D4.9 – Synthesis of Observatory Findings – Draft 2

Work Package 4 - Observatory Data Collection and Analysis

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4Growth Consortium

	Participant organisation name	Short name	Country
1	STICHTING WAGENINGEN RESEARCH	WR	NL
2	EVENFLOW	EVF	BE
3	GEOPONIKO PANEPISTIMION ATHINON	AUA	EL
4	REFRAME FOOD ASTIKI MI KERDOSKOPIKI ETAIREIA	RFF	EL
5	LE EUROPE LIMITED	LEE	IE
6	FUTURE IMPACT - DAHEIM CORNELIA	FI	DE
7	SIMBIOTICA SL	VIZ	ES
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Glossary of terms and abbreviations

List of Abbreviations and Acronyms	
AI	Artificial Intelligence
CAP	Common Agricultural Policy
CDP	Consumer Data Platform
DIHs	Digital Innovation Hub
EU	European Union
FADN	Farm Accountancy Data Network
GDPR	General Data Protection Regulation
LLM	Large Language Models
MMFT	Market Monitoring & Forecasting Tool
NACE	Nomenclature of Economic Activities
QR-code	Quick Response (code)
RAG	Retrieval Augmented Generation
UAV	Unmanned Aerial Vehicle
WP	Work Package

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Executive Summary

This document represents Deliverable D4.9 of Task T4.2 in Work Package 4 (WP4) for the 4Growth project. It summarizes findings from the 4Growth observatory ecosystem and the first two waves of data collection, setting the stage for further analysis and Wave 3 activities.

The observatory ecosystem currently includes eight observatories monitoring business, digital innovation, and data ecosystems. Acting as hubs for surveys and data gathering, they supply forecast and foresight modules in WP3 with information critical to managing digital agriculture and forestry. Their role is central to tracking technology adoption and informing strategies and policy decisions.

Wave 1 vs. Wave 2 Performance

The first wave yielded 271 responses, of which 200 were complete enough for analysis. Engagement challenges included survey length and overly technical language. In contrast, Wave 2 delivered 1006 responses with 854 valid entries, thanks to a streamlined questionnaire and observatory support. Finland (231), Lithuania (221), and Poland (218) led participation, while Hungary returned just one response. Stakeholders were 653 agriculture, 297 forestry, and 68 mixed, but NGOs, cooperatives, and network organizations were underrepresented. Improving Wave 3 will require targeted outreach through local and national partners.

The dataset is still being cleaned, so current country-level findings are preliminary: among agriculture producers, Spain shows the highest confirmed integration (66.4%, n=104), with mixed adoption in Poland (41.9% Yes) and Lithuania (40.2% Yes), while several other countries have small samples and missing/unclear records that limit interpretation. Early technology signals point to strong uptake of farm management software (32%) and guidance/controlled vehicles (11%), with a large “Other” (≈49%) bucket indicating the need for targeted recoding and taxonomy refinement before final reporting.

Methodological Improvements

Post–Wave 1 reviews identified several survey design issues as major barriers. Adjustments for Wave 2—shorter, clearer questions and simplified language—boosted engagement. In-person methods again proved the most effective, delivering better quality and participation. Although scalability remains a concern, combining face-to-face interaction with digital newsletters and automated outreach offers a balanced approach for Wave 3.

Emerging Approaches

Beyond surveys, AI-driven web scraping extracted insights on digital transformation trends, technology integration, and data-sharing practices directly from company websites. The automated website analysis found explicit evidence that 41% of companies have integrated digital technologies into their workflow, while 59% were classified as “Don’t know” because their sites provided insufficient information. Importantly, this 59% is not a ‘No’—it reflects a lack of explicit mention rather than confirmed non-integration. While not a complete substitute for surveys, this method significantly reduces manual effort and provides near real-time insights, demonstrating strong potential as a complementary tool.

Next Steps

Planned Wave 3 adjustments include:

- Further refining survey clarity and length.
- Expanding in-person engagement strategies proven effective in Wave 2.

- Broader collaboration with partners to reach underrepresented groups.
- Scaling AI-based data collection to enrich the data visualization platform and support modelling tasks.

The final deliverable (D4.10, Month 30) will report on Wave 3 outcomes and synthesize lessons learned across all data collection waves.

Key Findings

- **Wave 2 Growth**: +854 valid responses vs. 200 in Wave 1; Average completion time improved to 10.4 minutes.
- **Most Effective Method for distributing survey**: In-person engagement consistently produced higher-quality responses despite scalability concerns.
- **Representation Gaps**: Forestry stakeholders and certain operator/NGO groups remain underrepresented; Hungary contributed only 1 response.
- **Automated Analysis**: Web scraping + AI identified 41 % of companies showing explicit digital adoption, complementing surveys.

1 Introduction

This section provides an overview of the 4Growth project, focusing on its background and objectives. This section aims to highlight the project's key rationale for the reader to understand how the findings of the 4Growth observatory ecosystem fit within the overall project's objectives. The term 'ecosystem' refers to a dynamic network of interconnected actors, institutions, and data infrastructures that collectively generate, share, and apply knowledge to support decision-making and learning. The conceptualisation of the '4Growth observatory ecosystem' is described in D4.1 (Figure 5) as a networked system of observatory nodes, each consisting of its own business ecosystem, data ecosystem and digital innovation ecosystem. Together, they collect, analyze, interpret, and share information on digital agriculture and forestry to inform activities in WP2 and WP3.

1.1 Background

This section reiterates the rationale of 4Growth project, which is also described in other 4Growth deliverables. Digital technologies and data-driven solutions constitute a critical driver for transformative change in agricultural and forestry sectors. Literature suggests that digital innovations offer the promise of enhanced sustainability, economic performance, and working conditions within these critical sectors (Kamilaris et al., 2017; Wolfert et al., 2017). Although the potential and promises of digital transformation are widely acknowledged, policymakers and other stakeholders frequently lack comprehensive and timely insights into their adoption and impact in agriculture and forestry. While initiatives like the FAO's AgriTech Observatory and the Digital Agri Hub (Digital Agri Hub, 2024; FAO, 2024) provide valuable platforms for advancing digital agriculture and fostering transparency in digital ecosystems, their focus primarily lies in regional development and aggregating innovations in low- and middle-income countries, respectively, which differ from the broader, real-time monitoring and adoption insights envisioned for 4Growth for EU agriculture and forestry.

1.2 Objectives

The 4Growth project aims to contribute to the uptake of digital solutions by (i) documenting the current state-of-play and projecting the future evolution (forecasting and foresight) of the sector; (ii) making insights available to the wider community of decision makers and value chain actors – through the 4Growth Visualisation Platform; (iii) collecting a wide range of ground truth data and identifying key factors or constraints for uptake; and (iv) producing sets of key policy recommendations and best practices to encourage/facilitate further uptake.

WP4 of 4Growth is focused on (iii) and (iv) in close collaboration with other WPs that work on (i) and (ii) (WP2 and WP3).

The objectives of WP4 are to:

(i) establish distributed observatories;
(ii) analyse framework conditions, governance, and socio-economic aspects of digital adoption;
(iii) build synergies with European initiatives; and
(iv) provide policy recommendations and best practice guides.

WP4 consists of 5 tasks. Task 4.1 aims to develop and maintain a portfolio/catalogue of various agricultural and forestry stakeholders who will be contacted to gather data on the adoption and use of digital technologies. The establishment of observatories is fundamental to initiating

Task 4.2, which encompasses all outreach and data gathering activities conducted by 4Growth observatory partners within their respective ecosystems. The overview of the observatories can be found in Table 1. Data collection is scheduled to occur over three dedicated waves, during which observatory partners will engage with users and stakeholders to understand their needs and preferences. These interactions will involve multiple touchpoints, including surveys, interviews, workshops and events.

Table 1: Organisation of observatories. Adapted from D4.1: Organization of observatories

Observatory node	Node type	Location and region coverage
1	Agriculture	Netherlands (Western Europe)
2	Agriculture	Greece (AUA) (Eastern Europe)
3	Forestry	Greece (AUTH) (Eastern Europe)
4	Agriculture	France (Western Europe)
5	Agriculture	Belgium (Western Europe)
6	Agriculture	Spain (Southern Europe)
7	Agriculture	Lithuania (Eastern Europe)
8	Forestry	Finland (Northern Europe)

Insights gathered during these waves will inform the content presented on the 4Growth Visualisation Platform, such as uptake figures and potential impact of digitalisation. They will also shape policy recommendations and best practices for value chain actors. Data collection activities rely on the Digital Agriculture and Forestry Uptake Grid (hereafter referred to as 'the grid'), developed under Task 2.2, to ensure consistency and objectivity in addressing all relevant topics. Each wave concludes with a report synthesizing the outreach conducted and the data collected, documented in deliverables D4.8, D4.9, and D4.10, corresponding to M12, M21, and M30. The current deliverable D4.9 updates D4.8 with experiences and findings during Wave 2.

This deliverable is structured as follows: Section 2 outlines the technical features of the survey and details its distribution methods and data quality. Section 3 discusses the experiences of data collection, including best practices, challenges, and suggestions for future improvements. Section 4 presents the preliminary analysis of the survey results and additional data collection and analysis using automated methods. The planning for Wave 3 is described in Section 5, including strategies for targeted surveys, interviews, and the potential integration of automated data collection methods. Finally, the report concludes with a synthesis of findings.

2 Outreach of data collection

This chapter presents the outreach activities carried out to support data collection through a carefully designed survey, with the aim of ensuring broad stakeholder participation and high-quality responses. The survey aimed to gather insights into the adoption and impact of digital technologies in agriculture and forestry across Europe. By targeting various stakeholders through a combination of digital and in-person methods, the survey sought to capture a wide range of perspectives and data. In this chapter, we discuss the technical features of the survey, the methods employed for its distribution, and an evaluation of the responses received, including their quality and relevance to the 4Growth project's objectives. The technical features of the survey is described in Annex 2.

2.1 Survey distribution

Each observatory was responsible for data collection within – but not limited to - specific geographical regions. For example, Wageningen Research focused on agriculture in the Netherlands, ILVO on agriculture in Belgium, the Agricultural University of Athens on agriculture in Greece, and the Aristotle University of Thessaloniki on forestry in Greece. INTIA covered agriculture in Spain, CTIFL focused on agriculture in France, VTT handled forestry in Finland, and Agri-Food Lithuania DIH was responsible for agriculture in Lithuania, Hungary, and Poland. This allocation ensured representation from diverse regions in the European Union, capturing insights into digital technology adoption.

A variety of outreach methods were employed across the observatories to distribute the survey, with approaches evolving between waves 1 and 2. The observatories acknowledge that response rates to general surveys tend to be low, reflecting increasing 'survey fatigue' among respondents (see e.g. Avemegah et al., 2021 and Ghafourifard et al., 2024). While email marketing and social media formed the backbone of dissemination, targeted and in-person engagement proved most effective in securing higher response rates and better-quality data. A QR code was generated for the survey, allowing stakeholders to easily access the questionnaire via smartphones. The table below summarises the different methods known in literature and their applications by observatories (i.e., which observatories used them), and the relative effectiveness reported.

Table 2: Summary of survey outreach methods, observatories, and reported effectiveness

Outreach method (Based on literature)	Observatory / Example use	Reported effectiveness
Email marketing	All observatories (Wave 1)	Most widely used; baseline method across all observatories.
Social media	Five observatories (general, Wave 1)	Useful for broad reach; less targeted than other methods.
Direct calls / personal outreach	Lithuania	Highly effective: increased quantity and quality of responses through personalised follow-up.
In-person events	Spain, France, Greece (Wave 2)	Reported as most successful method for gathering responses in these countries.
Local / professional networks	Finland (forestry management associations, Wave 2)	Very successful: leveraging associations with established customer contacts boosted outreach.
Farmer Accountancy Data Networks (FADN)	Netherlands, Belgium, France (Wave 2, mid-point initiation)	Engagement initiated but limited impact so far; further efforts encouraged in Wave 3.

Newsletters / direct connections	Two observatories (Wave 1)	Niche method; added value through sector-specific focus.
QR code to survey	All observatories (Wave 2)	Improved accessibility via smartphones; streamlined participation.
Translations of survey	All observatories	Ensured consistency and accessibility across languages.
4Growth channels (LinkedIn, website)	All observatories via project-level promotion	Broadened reach to general audience; useful for visibility but less targeted.
Generic events (e.g. Synergy Days)	4Growth representatives, Barcelona (Wave 2)	Effective for visibility and cross-initiative engagement with diverse stakeholders.
Advertisements / sponsored posts	None	Not used by any observatory.

Overall, the evidence indicates that outreach methods grounded in personal interaction and trusted networks—such as in-person events, direct follow-up, and collaboration with sectoral associations—were markedly more effective than broad, generic channels in securing stakeholder engagement and high-quality responses. The project has deliberately chosen not to use paid advertisements or sponsored posts as paid promotions could create a perception of bias or commercial intent and offer limited value for evidence-based, policy-oriented communication. Instead, the observatories prioritise organic, network-based outreach through institutional channels, stakeholder networks, and open-access EU platforms, which provide credible visibility while maintaining inclusivity, cost-effectiveness, and trust in the observatory's independence

2.2 Responses and data quality

Table 2 below represents a summary of the survey responses from the first and second wave combined in all metrics except for the average response time which only features the figures from the Wave 2 survey as this was drastically shortened and the average time would not be accurately represented if wave 1 times were merged, as they were significantly longer. Notably due to the outliers in the response times of Hungary and Sweden, they were also excluded from the total average to more accurately reflect the average time of completion per respondent. During wave 1 there was an overall large gap in the number of unique responses who have started the survey and the amount that have answered enough questions to provide enough data, that is useful for the 4Growth project. In Wave 2 this gap has been significantly reduced thanks to the efforts of observatories notably Spain who filled in the questionnaire on behalf of respondent to ensure the quality of responses. The surveys marked as not providing enough data usually only provided their name and the farm type or stakeholder type.

The distribution of stakeholder types overall is relatively even, but the responses are skewed towards each observatory which is expected as they focus on either the forestry or agricultural sector. There are notable disparities between collection rates of the different country surveys which is explained in the next section on experiences on data collection. The average response time is not overly long, but the figures are skewed by the significant amount of people who opened the survey and answered one or two questions and exited. The response time in wave 1 was recorded as 14 minutes on average but was closer to **20** minutes for respondent who completed the survey. In wave 2 thanks to the significant reduction in questions of the survey and the faster pace of responses due to observatory partners filling in the information on behalf of respondents, the response time has been lowered to **10** minutes.

Table 3: Statistics of survey respondent measures of wave 1 & 2 combined

Survey	Average response time - seconds	Unique responses	Completed responses	Agriculture stakeholder	Forestry stakeholder	Agriculture & Forestry Stakeholder
English	496	105	79	26	36	7
Dutch	512	47	36	22	0	2
French	340	71	38	33	0	2
Spanish	1254	193	178	170	2	4
Finnish	497	231	176	2	153	29
Swedish	2104*	1	1	0	1	0
Hungarian	332591*	1	0	0	0	0
Lithuanian	741	221	202	181	5	13
Polish	603	218	205	196	4	2
Greek	528	192	128	19	98	10
Total	**10.4 minutes**	**1277**	**1043**	**653**	**297**	**68**

** Outlier response times excluded from total average (We flagged observations whose log-time exceeded median ± 3×MAD (median absolute deviation) within each language and excluded them from the average. The MAD is recommended over SD for outlier detection because it is not distorted by the outliers it is meant to detect (see Leys et al., 2024).*

In Figure 1 we can also see that there is a new distribution of responses for wave 2. Spain, Greece, Finland, Lithuania, and Poland now make up the majority of responses, with a large cohort of respondents choosing not to identify their origin country. The (other) label includes the following countries: Albania, Andorra, Austria, Estonia, Germany, Italy, Portugal, Romania, and Sweden. While at least there is representation from Western, Southern, Eastern a,nd Northern Europe, more can be done to ensure a more equal distribution of country responses and involving multiple countries from each region, especially Hungary in wave 3 as it is one of the three focus countries for Agrifood Lithuania. Another important thing to note is that although we have Swedish as a language to assess response metrics, the justification for having it is due to Finland having Swedish as a second official language, therefore, it is not expected to have a very high response rate from Sweden, as the observatories do not have the desired networks to effectively distribute the survey there. It is important to note that we could not directly match the selected countries of the survey respondents with the observatories. This is due to several factors, such as having two observatories in Greece. Additionally, the survey did not explicitly ask respondents which observatory had invited them, and we were unable to trace responses back to a specific observatory via the survey link or other tracking mechanisms. In wave 2 this challenge has not been resolved, as we have combined the Qualtrics surveys into one for ease of data management; however it will be recommended for wave 3 to add a question identifying which observatory partner provided access to the survey.

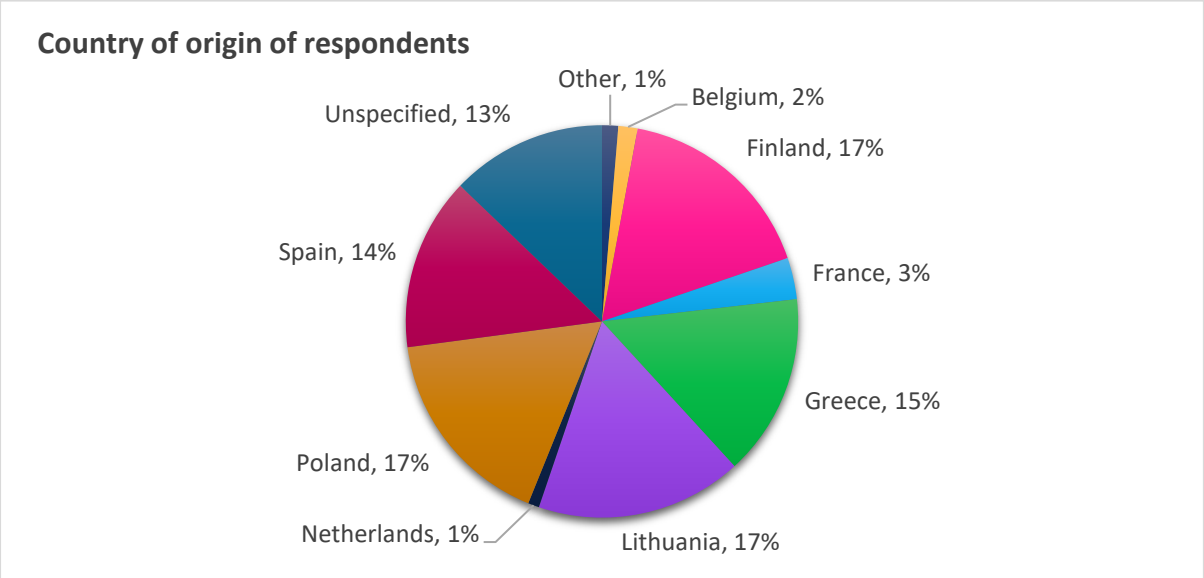

Figure 1: Selected country of survey respondents as a % of all responses from wave 1 & 2.

In Figure 2 we can see the breakdown of responses by stakeholder type which gives further insight into how representative wave 2 has been. Similarly to wave 1, we can see observatories have been successful in getting responses from primary stakeholder in the agriculture and forestry value chains and advisory groups. While in wave 1 we saw low response rates from data, technology, and service providers they now make up the second largest cohort of respondents, thanks to the efforts of the observatories to target these stakeholders in the second wave. Similarly to wave 2 the 4Growth partners will have to mobilise their networks to reach more processors and network organisations in wave 3, which may require a similar strategy of targeted survey distribution and mobilising national networks.

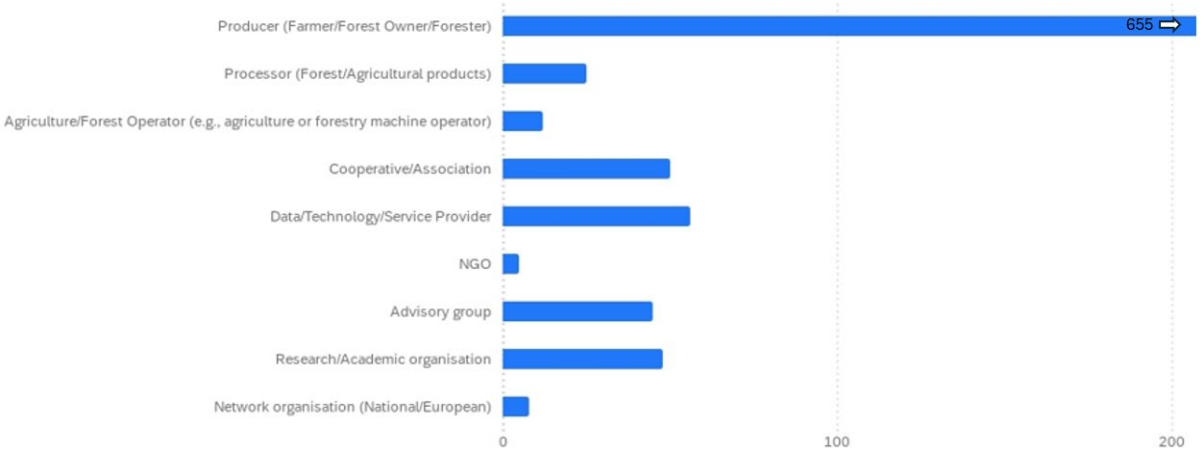

Figure 2 : Distribution of stakeholder types of survey respondents

2.3 Experiences with data collection

To gain insights into the experiences of data collection, we decided to survey the surveyors themselves. After all, who better to understand the challenges of collecting responses than those who do it regularly? All seven observatories participated in this meta-survey, providing valuable reflections on what worked, what did not, and what could be improved in future waves. The information below combines the most valuable and relevant information gathered from this survey after the completion of wave 1 & 2.

Effectiveness of Data Collection Methods

After wave 1 observatories were asked to identify the most and least effective data collection methods. In-person events emerged as the most effective approach, with four observatories selecting this option. Direct calls or personal outreach followed, with two observatories identifying it as their preferred method. Email marketing and other methods, such as utilizing direct connections, were less frequently mentioned. These results highlight the importance of direct and personal engagement in achieving successful data collection efforts. Wave 2 had some similarities as in-person events were once again the most favoured outreach method, but also some differences as email marketing was more favourable than personal outreach. Newsletter were particularly effective for one observatory as they distributed the survey as part of the newsletter to forest owners by the Central Union of Agricultural Producers and Forest Owners. Another observatory identified using Mentimeter an interactive online tool to gather data in real time at in-person events as a novel approach which made the activity more interactive and informative for participants.

When asked about the least effective methods in wave 1, email marketing was identified as the least effective by five observatories, followed closely by social media, cited by four observatories. In wave 1, one observatory also mentioned newsletters as a less effective option. These findings suggest that less personalized approaches, particularly those relying on broad, impersonal outreach, may yield lower engagement levels compared to direct and interpersonal strategies. In wave 2 these assumptions held for social media but were less clear for email marketing as 2 observatories found it effective but 3 found it not effective. Also Direct calls and personal outreach were stated as not effective by 3 observatory respondents in wave 2.

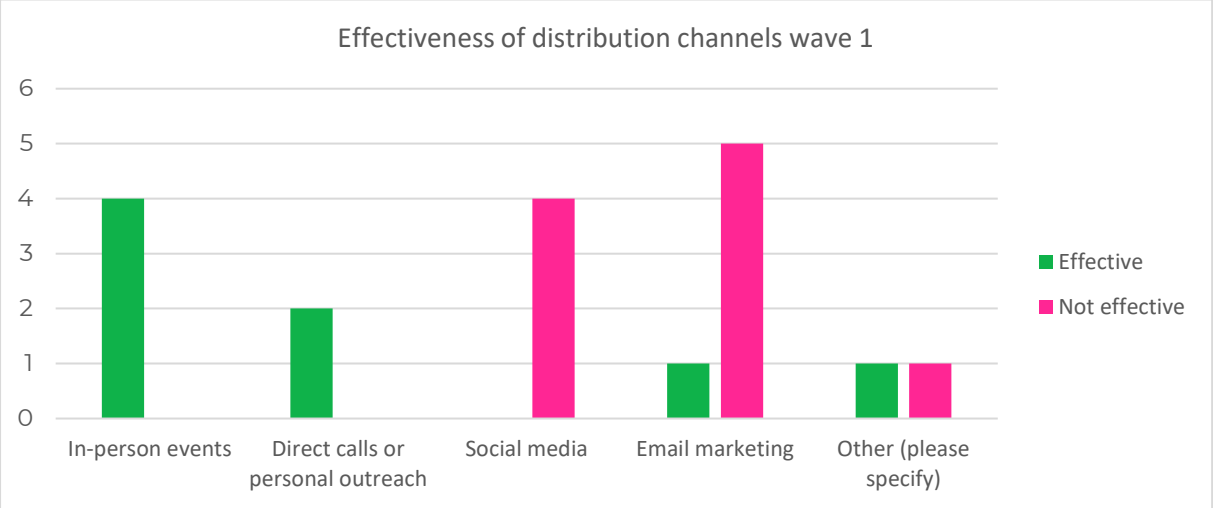

Figure 3: Effectiveness of survey distribution according to observatories in wave 1 (n=7)

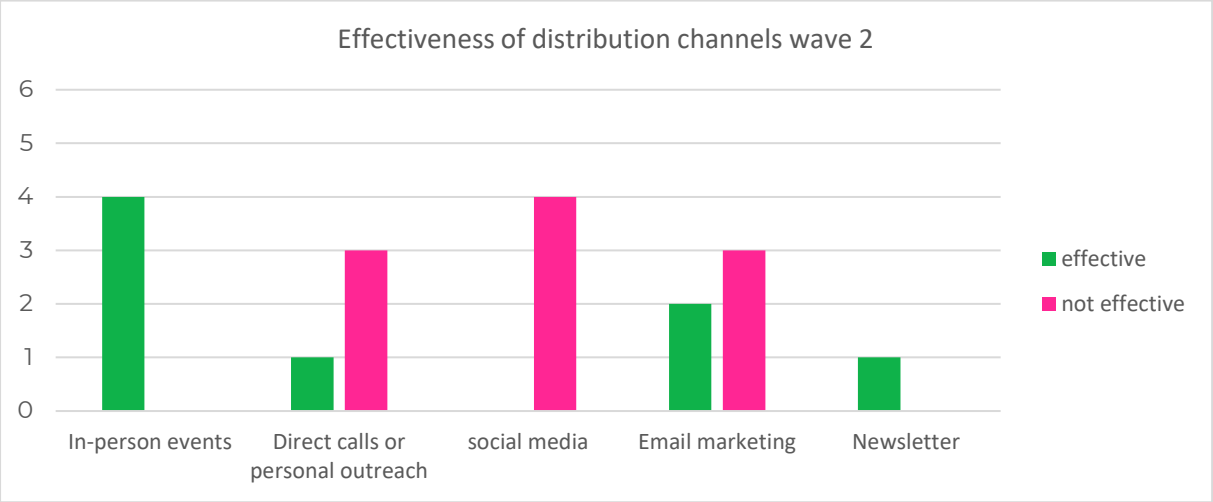

Figure 4: Effectiveness of survey distribution according to observatories in wave 2 (n=6)

Strategies to Prevent Response Bias

In wave 1 & 2 observatories employed various strategies to minimise response bias in their surveys. Conducting random sampling and providing explanations to clarify complex questions were the most commonly used approaches in both waves, with three observatories implementing each. In wave 2 including outreach to less digitally engaged stakeholders also became a method used by 2 observatories. These methods aimed to enhance the reliability of responses by reducing potential misunderstandings and ensuring diverse representation.

Other strategies included targeting diverse demographics. Additionally, observatories explored customized approaches such as targeting individuals with varying levels of digitalization, compiling comprehensive lists of companies and organizations across different stakeholder groups, and leveraging professional networks to pass along survey invitations. Some observatories also provided opportunities for stakeholders to respond during in-person events, further diversifying the respondent pool.

Challenges in Reaching Certain Groups

In wave 2 several (5) observatories reported encountering challenges in reaching specific groups, while two others indicated no significant difficulties. Among those facing challenges, lack of knowledge about or access to certain stakeholders was an issue in places such as Greece and France. Farmer survey fatigue was again tagged as an issue with gathering data, and small-scale farmers were difficult to reach due to falling outside of the established network. Building on the challenges identified in wave 1, the most pressing challenges include:

1. **Survey Saturation and Complexity:** The abundance of surveys in the sector and the use of technical vocabulary in lengthy questionnaires were cited as barriers. Farmers, often with limited time and education levels, found these factors overwhelming.
2. **Timing Constraints:** Contacting professionals, especially farmers, during their busiest seasons (e.g., harvest or sowing periods) led to low response rates. The ideal time for engagement was identified as the winter months.
3. **Remote Engagement Barriers:** Observatories noted difficulties in engaging stakeholders through email or newsletters, with limited visibility on which channels were effective.
4. **Regional Challenges:** In Poland and Hungary, reliance on local partners was critical due to limited capacity for in-person engagement.
5. **Hard-to-reach groups**: Forest stakeholders remain difficult to contact due to small population sizes or weak local networks.

6. **Lack of contact databases**: Several partners noted insufficient contact information, especially for forestry actors.

Challenges During Survey Distribution

In wave 1 and 2 survey distribution faced several challenges, particularly in ensuring broad participation and effective communication with stakeholders. One observatory had an issue with outdated contact information when relying on social media and websites to gather emails and phone numbers, leading to a high number of undelivered email notifications. This posed barriers to reaching intended respondents and required additional efforts to update contact lists and explore alternative channels.

In the Netherlands there has been significant challenges in reaching the desired number of respondents due to stakeholder survey fatigue so much so that direct calls and personal outreach was yielding less than expected results.

Willingness and Barriers for Stakeholder Participation

Observatories reported various barriers that impacted stakeholder willingness to participate in the survey (see Figure 5). The saturation of farmer surveys or 'survey fatigue' was mentioned as major challenge for data collection via surveys. Time constraints were the most frequently mentioned issue, highlighted by six observatories, as stakeholders often struggled to find time to complete the survey amidst competing priorities. Five observatories noted that the survey length posed a significant challenge, with lengthy questionnaires frequently resulting in unfinished responses. Four observatories identified issues with survey quality, such as overly technical or unclear questions, which discouraged participation, especially among stakeholders with less familiarity with digital topics.

A lack of interest in digitalization and related survey topics was cited by three observatories, reflecting limited stakeholder motivation to engage. Two observatories mentioned other barriers, including general disinterest in survey participation or fear of clicking on unfamiliar links. One observatory reported concerns about data privacy and usage, which deterred some stakeholders, while another observed that variations in digital literacy affected stakeholders' ability to complete the survey. These findings emphasize the need for shorter, simpler surveys, tailored outreach strategies, and reassurance about data security to improve participation in future waves.

After wave 2 it was observed that challenges remained in reaching respondents in Hungary despite the outreach efforts of the observatory. An opinion was expressed that the political climate and the general outlook on the EU can influence the willingness of stakeholders to participate in EU-funded research.

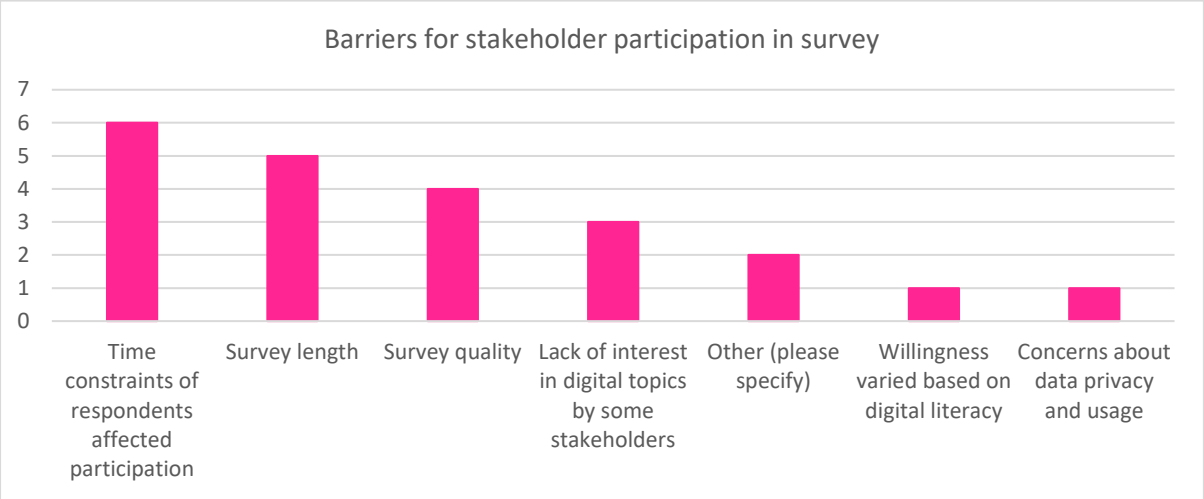

Figure 5: Barriers for participation according to the observatories (n=7)

2.4 Lessons learned

Our observations largely confirm established benchmarks on data outreach and evidence communication (e.g., Dillman et al., 2014, Contri et al., 2025). After the first wave an extensive analysis of the observatories' experiences with the first wave of data collection revealed key insights for improvement. Survey design issues, such as excessive length and overly technical language, significantly contributed to participant drop-out and engagement challenges. This was successfully addressed in the second wave by streamlining the survey and making the questions simpler and more targeted. In-person engagement emerged as the most effective data collection method, yielding higher response rates in the first wave. Despite concerns this was not scalable observatories demonstrated how efficient they can be and how it is possible to generate more engagement and better response quality with in person gathering during wave 2. These challenges are expected to persist in Wave 3, but will be addressed through a mixed-method approach that balances the effectiveness of direct interaction with the scalability of newsletters, digital channels, and automated tools, in order to ensure broader and more inclusive participation in the final wave.

Both literature and observatory experiences show that mass mailings, static web pages, generic social posts, and one-way webinars are simple to deploy and low-risk, but they suffer from declining reach (algorithmic throttling and channel fragmentation), low conversion, limited feedback loops, and selection bias. New methods such as audience segmentation with tested messaging, community partnerships, opt-in panels can raise engagement and traceability and speed learning cycles. However, they require more governance and resources, careful GDPR compliance, and proactive bias monitoring to preserve representativeness and reproducibility.

Besides traditional methods for measuring the adoption of digital technologies, such as the survey outlined above, emerging approaches like automated data collection offer promising alternatives. We leveraged web scraping and AI-driven analysis to, efficiently extracted insights from company websites, identifying trends in digital transformation, technology integration, and data-sharing practices. By streamlining data collection, these techniques can significantly reduce manual workload and provide scalable, real-time insights, addressing gaps in traditional methods. While limitations remain in capturing nuanced or sensitive data, this approach demonstrates strong potential to complement surveys, enhancing the efficiency and depth of data collection efforts in the second wave.

Adjustments for the third wave include further optimisation of the survey by finetuning question clarity and length, Increased stakeholder engagement strategies by replicating the successful in-person data gathering employed in wave 2, and exploring innovative techniques such as AI-driven web scraping to streamline data collection. These findings will inform updates to the data visualization platform and support modelling tasks in future project phases.

Good practices

Building on the lessons learned from the first two waves, several practices have proven especially effective in improving survey participation and response quality. These approaches show how observatories adapted their methods to different contexts and audiences, leading to more reliable results.

After the first survey round, observatories stressed the need to match distribution methods to the audience. At first, in-person collection was seen as resource-intensive and difficult to scale, but experiences in Lithuania and Spain during the second wave showed it produced higher response rates and richer data. Having observatory staff present allowed stakeholders to ask questions and receive guidance, which improved both accuracy and engagement.

The timing and setting of outreach also proved decisive. Reaching out during quieter periods—such as the off-season for farmers—significantly raised participation. Direct, face-to-face formats were especially effective for more complex topics and for including stakeholders with limited digital access.

In Greece, collaboration with trusted partners and established networks ensured the survey was handled responsibly and completed with greater care.

Observatories also emphasized survey design. Between the first and second waves, the questionnaire was shortened, simplified, and stripped of redundant options. This lighter format was easier to complete, more respectful of participants' time, and resulted in higher-quality responses. For time-constrained groups like farmers, reducing the burden was essential to securing participation.

2.5 Suggestions for future iterations

For the third wave there were limited requests for further adjusting the survey structure as wave 2 already demonstrated a large improvement. However, further fine-tuning of some questions and answer options were suggested and implemented. In addition, it was decided to remove sections on economic outlook and environmental outlook as they were quite short and contained limited information in the current form. These questions might benefit from engaging in specific interviews to gather info in the area of economic and environmental benefits of technology adoption to targeted stakeholders.

The main objective of the third wave will be to further utilise personalised emails and targeted approaches to reach the underrepresented stakeholders in the data. More emphasis will be placed on engaging participants effectively and emphasizing the importance of the survey and their input. Extra attention will be required and continued engagement to reach the right individuals, especially within smaller or harder-to-reach stakeholders. The third wave should have a focus on building quality connections such as trusting and engaging local intermediaries early in the process, such as, cooperatives advisors, or community organisations, in order to help build trust and encourage participation.

3 Preliminary analysis of survey results and findings from automated data collection

3.1 Preliminary findings from survey data

At the time of writing, the dataset is still being cleaned and curated to ensure consistency, accuracy, and comparability across waves and stakeholder groups. The findings shared here (e.g., Table 4) should therefore be regarded as preliminary and explorative. The statistical approach and findings will be described in the next iteration of the deliverable (i.e. D4.10). Across agriculture producers, integration of digital technologies shows clear cross-country variation. Among countries with substantive samples, Spain (66.4% “Yes”, n=104) leads, followed by Greece (58.1%, n=26). France also shows a high share (67.9%), though the base is small (n=19), so that estimate should be treated with caution. Mid-tier results appear in Poland (41.9% “Yes”, 48.5% “No”, n=179) and Lithuania (40.2% “Yes”, 38.5% “No”, n=137), where responses are more evenly split. Very small samples drive the extremes elsewhere—Netherlands (50.0% “Yes”, n=4), Finland (33.3% “Yes”, n=2), and Belgium (0% “Yes”, n=1)—so these should not be over-interpreted. A small Unspecified group also appears (42.9% “Yes”, n=5), reflecting incomplete location data.

Taken together, the pattern suggests higher integration in Spain (with robust sample size) and mixed adoption in Poland and Lithuania, with several other countries requiring larger samples before drawing conclusions. Note that some records are missing/unclear (neither “Yes” nor “No”), which will be addressed during data curation to firm up country comparisons.

Preliminary analysis of responses on the adoption of digital technologies among agriculture producers (n=565) shows three clear patterns. First, Farm management software features prominently, representing 32% of entries, indicating widespread uptake of platforms that support planning, record-keeping, and operations. Second, Guidance & controlled vehicles (autosteer/RTK) account for 11%, reflecting continued investment in in-cab guidance and precision steering. Third, nearly 49% of answers fall into “Other”, suggesting a broad mix of tools and free-text descriptions that do not neatly map to the current taxonomy. Smaller but visible shares include Sensors & IoT (2%), Precision application/variable rate (2%), and Drones/UAV (1%). Taken together, the data point to strong adoption of core, management-centric software and guidance systems, while more specialised technologies appear in lower, niche proportions. Given the size of the “Other” category, a targeted recoding pass (e.g., expanding categories and harmonising synonyms) is recommended before final reporting.

Table 4 Overview of adoption of digital technologies

Type of digital technologies	Count	Percent of agri producers (%)
Other/unmapped	294	52,0
Farm management software	179	31,7
Guidance & controlled vehicles (autosteer/rtk)	62	11
Sensors & IoT (on-farm)	12	2,1
Precision application (variable rate)	10	1,8
Drones / UAV	8	1,4

The analysis focuses on identifying emerging patterns and indicative trends rather than definitive conclusions. Further validation will be carried out as part of the data curation process, and subsequent reporting will integrate these refinements. To support interpretation, a selection of the results is visualised in charts and figures on the visualisation platform, offering a clear and accessible representation of the survey outcomes to date.

In the next draft of this deliverable, the consolidated results will be presented based on the fully cleaned and validated dataset. That version will include detailed breakdowns by observatory and stakeholder group, comparative analyses across waves, and an expanded set of figures and tables to aid interpretation. Any methodological updates made during curation (e.g., harmonisation rules, handling of missing data) will be documented to ensure transparency and reproducibility.

3.2 Automated data collection and analysis

Besides traditional methods for measuring the adoption of digital technologies, such as the survey outlined above, emerging approaches like automated data collection offer promising alternatives. This subsection explores how automated techniques, including web scraping and AI-driven analysis, can streamline data collection efforts, potentially reducing the workload for the third wave while providing valuable insights into digital technology adoption.

3.2.1 Introduction

The aim of this automated data collection is to get more information about the use of digital technologies in the context of the forestry sector to complement the information collected by the survey. In this study we tested how well we could automatically find answers to the selected questions in the survey (Wave 1) by using information on companies' websites.

The data and results reported in this deliverable build on the previous work, which tested automated data collection from forestry companies' websites to complement survey data on the use of digital technologies. The approach, based on Large Language Models (LLMs) and retrieval-augmented generation (RAG), demonstrated the potential to efficiently extract relevant information about companies' digital transformation activities. The selection of companies, data collection and analysis methods have been described in more detailed in the deliverable D4.8 - Synthesis of Observatory Findings. In this phase, dataset was extended to include information analysed from technology companies in forestry and forest machinery companies.

In this deliverable, we provide general information on the current datasets collected and analysed, and provide initial results on the adoption of digital technologies and technology integration. These results demonstrate the opportunities of automated data collection and analysis. The technical set-up is described in detail in Appendix D.

3.2.2 Results

Distribution of different types of stakeholders

Most companies in the dataset are service/information providers (28%) and forest product processors (25%), together accounting for over half of all stakeholders. Forest operators (13%) and those classified as other (12%) represent the next largest groups. Smaller shares are seen for farmers/agricultural producers (7%), foresters (3%), and forestry associations (2%). The remaining categories, including digital technology providers, infrastructure providers, data and platform providers, each account for less than 2% of the total, reflecting

that the number of technology companies analysed is much lower than that of forestry and forestry machinery companies. (See and Table 5)

Table 5: Distribution of companies by stakeholder type, including counts and percentages.

Stakeholder type	Stakeholder type count	% stakeholder type
Service/Information provider	828	27,7
Forest product processor	751	25,1
Forest operator	385	12,9
Other	363	12,1
Farmer/agricultural producers	224	7,5
Forester	92	3,1
No information	66	2,2
Forestry association	57	1,9
Digital technology provider	43	1,4
Farming cooperative	39	1,3
Trade association	30	1,0
Forest owner	25	0,8
Infrastructure provider	17	0,6
NGO/Advisory Group	17	0,6
Data provider	14	0,5
Platform provider	12	0,4
Farming association	11	0,4
Forest industry association	8	0,3
Research institutes and research networks	8	0,3
Data association/organisation/coalition	3	0,1
Farming technology provider	1	0,0
Total	**2994**	**100**

* In some cases, a company was classified to more than one stakeholder type.

Primary area of operation in forestry

The survey question and how it was designed as a prompt for the AI analysis are shown below.

Survey question: Primary area of operation in forestry
Prompt: *Identify the organization's primary area of operation in forestry. Classify the organization's primary area as one of the following categories: "Reforestation", "Forest conservation - thinning, pruning, weed & pest control," "Felling," "Transportation of logs", "Non-Timber Forest Products (NTFPs)", "Forest Fire Management," "Forestry inventory and mapping", "Wildlife management" or "Other." Provide both the selected primary area and a detailed explanation of why this area was chosen. If the primary area is "Other," provide a detailed description of what this organization's primary area of operation in forestry entails. If no relevant information is available regarding the query, respond with "No information". Return the information in the following format:* *{* *"prim.forest": "The selected primary area",* *"prim.forest.description": "Detailed explanation of why this area was chosen"*

```
}
If there is no relevant information, respond with:
{
   "prim.forest": "No information"
}
```

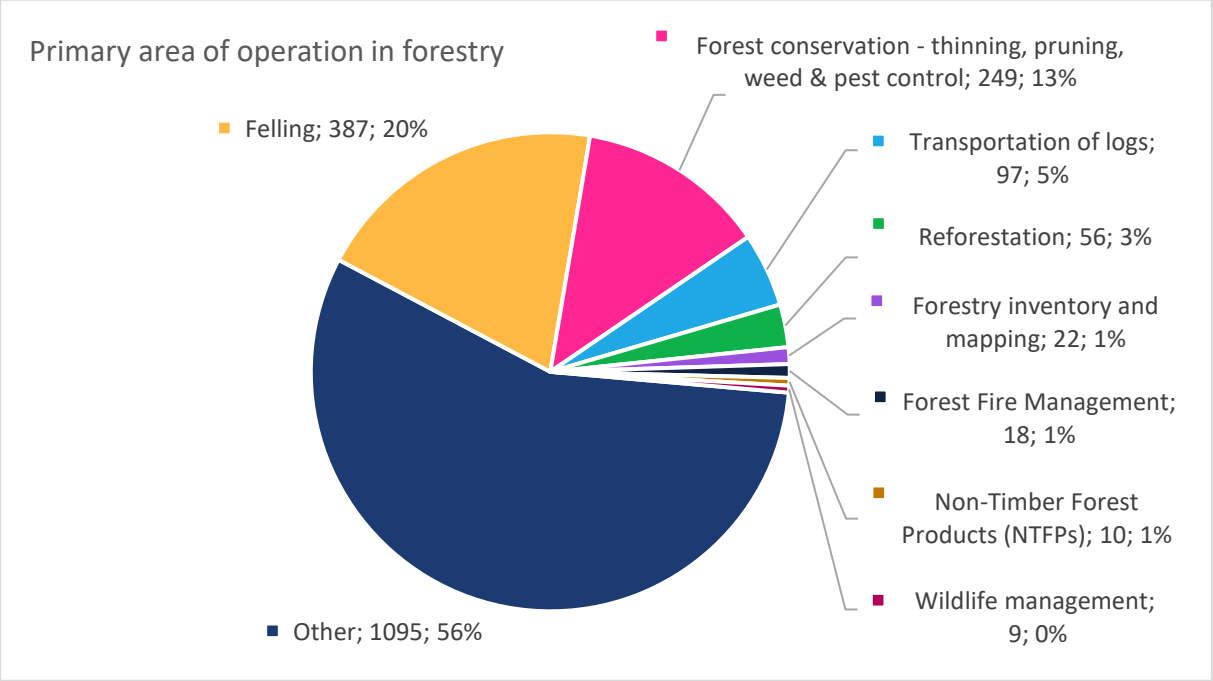

Figure 6 : Distribution of companies by primary area of operation in forestry in the analysis results (N= 1868 companies).

A total of 1868 companies provide information about the primary area of operation in forestry. The remaining 884 companies had no relevant information on their websites. In some cases, a company was classified to more than one primary area. The results are visualised in Figure 6. Most companies fall under 'Other' (56%) regarding their primary area of operation in forestry. Analysing the descriptions within the 'Other' category may reveal more information. Among the specified activities, felling (20%) and forest conservation tasks such as thinning, pruning, and pest control (13%) are the most common. Smaller shares are involved in log transportation (5%), reforestation (3%), and specialised areas like forestry inventory, fire management, non-timber forest products, and wildlife management (each under 1%).

Adoption of digital technologies and technology integration

In this section, we present examples of the results to illustrate both the opportunities and challenges of the dataset, providing a clearer idea of how it could be utilised in the project.

Integrated digital technologies

The survey question and how it was designed as a prompt for the AI analysis are shown below.

Survey question: Has your organisation integrated digital technologies into its workflows?

Prompt:
Identify if the organization has integrated digital technologies into its workflows. Respond with "Yes" or "Don't know". If the response is "Yes," provide a detailed description of how digital technologies are integrated into its workflow. If no relevant information is available regarding the query, respond with "Don't know" and provide "No information" as the description. Return the information in the following format:
If the response is "Yes":
{
"itegrated.digi.tech": "Yes",
"itegrated.digi.tech.description": "Detailed explanation of the digital technologies integrated into the organization's workflow"
}
If the response is "Don't know":
{
"itegrated.digi.tech": "Don't know",
"itegrated.digi.tech.description": "No information"
}

Analysis results are visualised in Figure 7 showing 41% Yes, company has integrated digital technologies into organisation's workflow and 59% Don't know. Note that in the automated analysis, the response options are limited to 'Yes' or 'Don't know'. A classification of 'Don't know' indicates that the website did not provide any information regarding the integration of digital technologies into its workflow. This category is not interpreted as 'No', since the absence of such information does not necessarily imply that digital technologies are not being integrated; it may simply reflect that the website did not explicitly mention it.

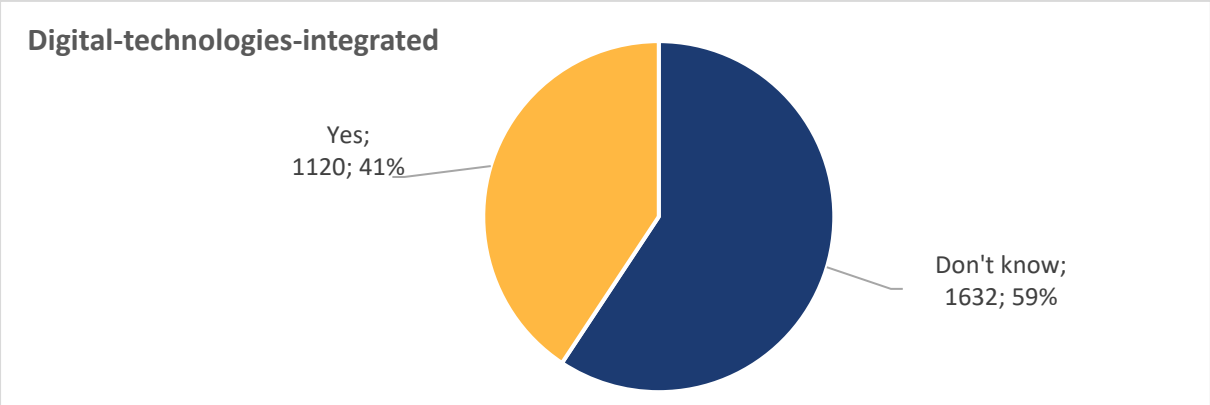

Figure 7 : Digital-technologies-integrated in total dataset.

Integrated digital technologies by stakeholder types

The results can be analysed by stakeholder types. Table 6 shows as an example how much digital technologies have been integrated by stakeholder types.

The highest levels of 'Yes' responses are found among digital technology providers (88%), research institutes (88%), and platform and infrastructure providers (82–83%), indicating strong engagement in digitalisation, which is not surprising since these are technology-oriented and supporting organisations. In forestry stakeholders, 39% of forest product processors and 21% of forest operators indicated 'Yes'.

Table 6 Digital technologies integrated by stakeholder types calculated from the total dataset and sorted by Yes %.

Type	Don't know	Yes	Total	Yes %	Don't know %
Digital technology provider	5	38	43	88,4	11,6
Research institutes and research networks	1	7	8	87,5	12,5
Platform provider	2	10	12	83,3	16,7
Infrastructure provider	3	14	17	82,4	17,6
Data provider	3	11	14	78,6	21,4
Trade association	8	22	30	73,3	26,7
Data association/organisation/coalition	1	2	3	66,7	33,3
Forest industry association	3	5	8	62,5	37,5
Farmer/agricultural producers	100	124	224	55,4	44,6
Farming association	5	6	11	54,5	45,5
Service/Information provider	395	433	828	52,3	47,7
Farming cooperative	19	20	39	51,3	48,7
Farming technology provider	1	1	2	50,0	50,0
Other	185	178	363	49,0	51,0
NGO/Advisory Group	9	8	17	47,1	52,9
Forestry association	31	26	57	45,6	54,4
Forest product processor	457	294	751	39,1	60,9
Forest owner	18	7	25	28,0	72,0
Forester	71	21	92	22,8	77,2
Forest operator	304	81	385	21,0	79,0
No information	64	2	66	3,0	97,0
Total	**1685**	**1310**	**2994**	**43,8**	**56,3**

Type of digital technology used for forestry

The survey question and how it was designed as a prompt for the AI analysis are shown below, and the results can be found in Figure 8.

Survey question: What type of digital technology has been used for forestry?
Prompt: *Identify the type of digital technologies used by the organization for forestry. Classify the digital technologies under one or more of the following categories: "Forest Inventory Management Software", "Drones for Forest Monitoring", "Automated machinery and robotics", "Forest Fire Prediction and Monitoring Systems" or "Other". Provide the relevant technology types or, if no relevant information is available, respond with "No information". For each identified technology type, provide a detailed explanation of why the technology was chosen. If the technology type is "Other", describe what the relevant technology entails. Return the information in the following format:* *{* *"digitaltech.forestry": [* *{* *"type": "Relevant technology type (e.g., Forest Inventory Management Software)",* *"description": "Detailed explanation of why this technology was chosen"*

```
    },
    {
        "type": "Relevant technology type (e.g., Drones for Forest Monitoring)",
        "description": "Detailed explanation of why this technology was chosen"
    }
  ]
}
If no relevant technologies are found, return the following:
{
   "digitaltech.forestry": "No information"
}
```

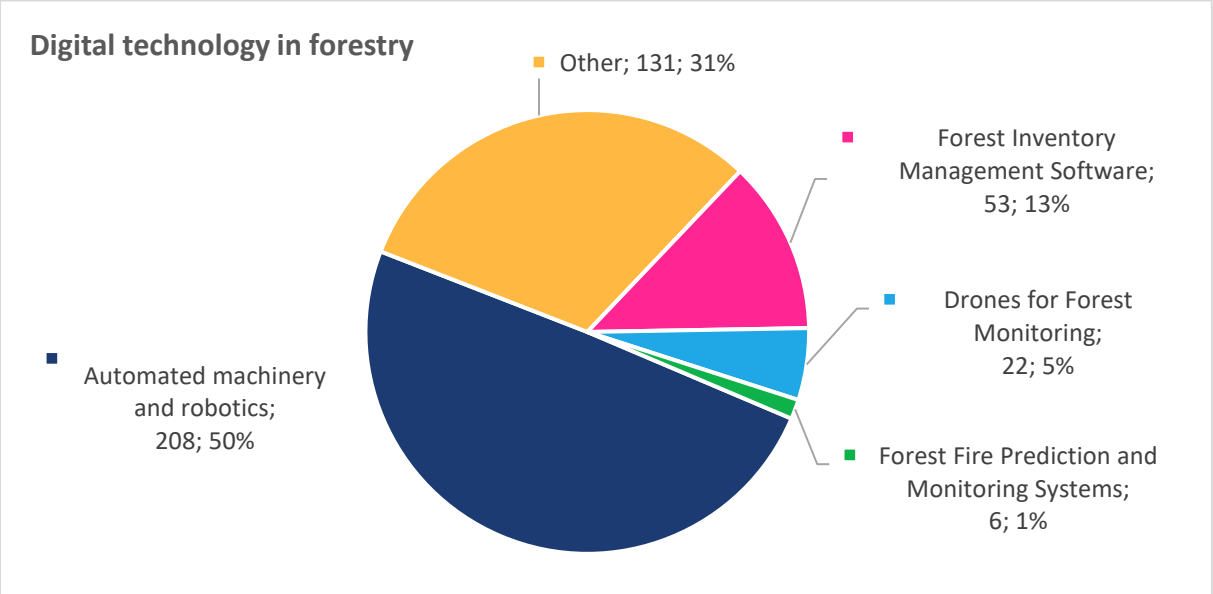

Figure 8 Digital technology in forestry (N=315 companies)

A total of 315 companies provide information about one or more digital technology categories. The remaining 2,437 companies had no relevant information on their websites. When identified, the most common types are automated machinery and robotics, forest inventory management software, and other technologies. The results also show that the AI analysis created some additional categories, such as 'GIS and Databases', 'Statistical Analysis Software', 'GIS Data Management', 'Data Analysis', 'Digital Mapping', 'GPS Technology', and 'Data Analysis and GIS Technology', which are classified under 'Other' in the figure. This indicates that the results still require some additional cleaning.

Primary functions of technologies

The survey question and how it was designed as a prompt for the AI analysis are shown below, and results are presented in Figure .

Survey question: What are the primary functions of these technologies in the agriculture or forestry value chain?
Prompt:

Identify the primary functions of digital technologies used by the organization in the agriculture or forestry value chain. Classify each primary function under one or more of the following categories: "On-farm activities", "Production phase", "Monitoring", "Supply chain optimization", "Decision-making", "Planning and management", "Crop health and disease detection", "Harvesting and distribution", "Data management" or "Other". For each identified primary function, provide a detailed explanation of why this function was chosen. If the function is classified as "Other", include a description of what it entails.
Return the information in the following format:

```
{
   "prim.function.tech": [
      {
         "type": "Primary function type (e.g., Decision-making)",
         "description": "Detailed explanation of why this primary function of digital technologies was chosen"
      },
      {
         "type": "Primary function type (e.g., Planning and management)",
         "description": "Detailed explanation of why this primary function of digital technologies was chosen"
      }
   ]
}
```

If there is no relevant information, respond with:

```
{
   "prim.function.tech": "No information"
}
```

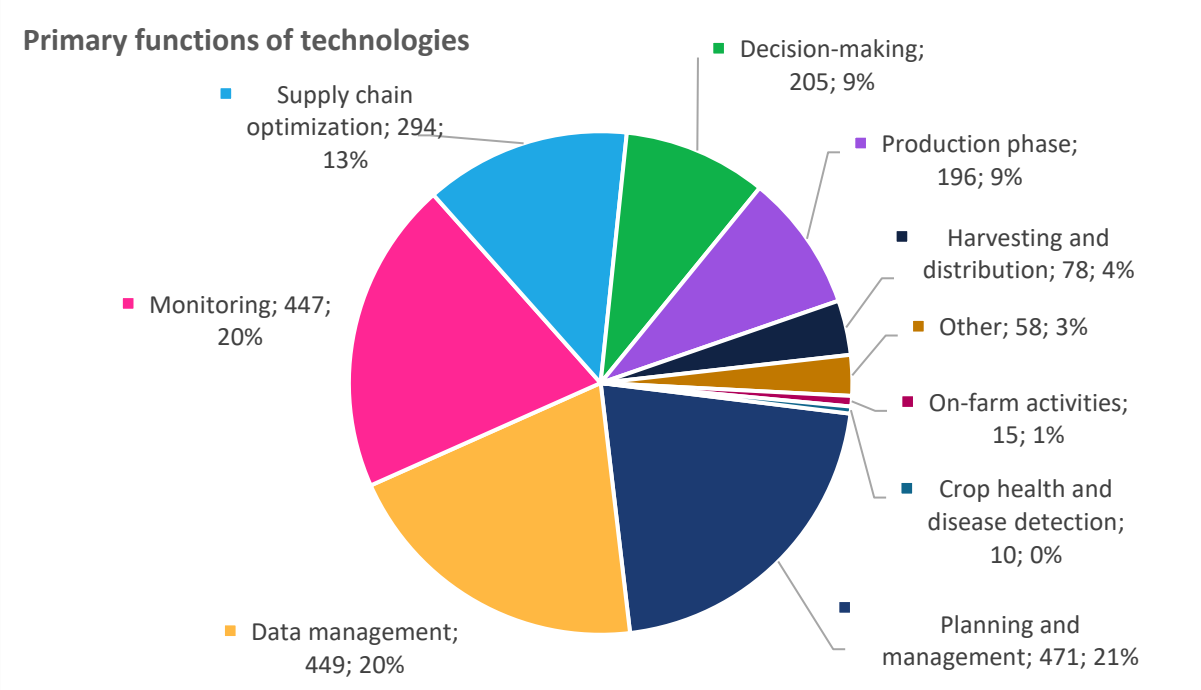

Figure 9 Primary functions of technologies in forestry (N=612 companies)

A total of 612 companies provide information about the primary functions of technologies. The remaining 2,140 companies had no relevant information on their websites. Among the identified functions, the most common are planning and management (21%), data management (20%), and monitoring (20%), followed by supply chain optimization (13%) and decision-making (9%) and production phase (9%). Other categories are less frequent. The results also show that the AI analysis created some additional categories, such as 'Quality control', 'Communication', 'Research and Development', which have been classified under 'Other' in the figure.

3.2.3 Discussion and Conclusion

Company websites provide a valuable source of information for identifying the integration and application of digital technologies within organizations. Automated collection and analysis of website content allow us to gain a better understanding of how companies present their adoption of technological tools, highlight innovation, and communicate their engagement in digital transformation.

In this study, we expanded the dataset from the previous phase to include forestry companies, technology providers, and forestry machinery manufacturers, resulting in a total of 2,752 analysed companies across 24 European countries. This broader scope provides a more complete picture of the forestry value chain. The data collection and analysis methods have been described in more detailed in the deliverable D4.8 - Synthesis of Observatory Findings. This deliverable presents an overview of the datasets and example analyses of results concerning the adoption of digital technologies and their integration. Incorporating these results into the visualisation platform would allow further visualisations, covering other survey topics such as data management and data sharing practices.

The results show both the strengths and limitations of automated analysis. The method enables efficient data collection on a scale, offering cross-country and cross-sector comparisons that would be challenging to achieve solely through surveys. On the other hand, not all company websites have detailed descriptions of digital technology use, leading to "Don't know" or "No information" classifications. In addition, the automated classification sometimes produced additional categories, requiring post-processing to ensure consistent results. The implemented automated analysis not only classifies data into categories but also provides description for the category selections. These extracted descriptions serve as a possible data source for further analysis. They enable the creation of summaries, offering an overview of topics related to the adoption of digital technologies in forestry. Automated website analysis effectively complements survey data by giving a broader picture of stakeholders' positioning in digitalisation across European countries. However, compared to survey-based approaches, which explore challenges such as costs, barriers, and implementation difficulties in more detail, such information is typically absent from company websites.

Future work includes defining how the analysis results can be integrated into the Wageningen data pipeline to enable their use in the visualisation platform. In addition, further analysis of the results could support other project tasks, such as state-of-the-art assessments, market analysis and the monitoring of digital technology uptake.

4 Planning for data collection in Wave 3

This section outlines the planned adjustments for Wave 3 of data collection, incorporating the findings and suggestions from Wave 1 and 2. It highlights the steps to address the low response rate from certain stakeholders and countries. The results of these adjustments aim to enhance data quality and increase participation in the next wave.

4.1 Distributing targeted surveys

In Q4 2025, the suggestions made in Chapter 3 will be implemented to further refine the survey and data collecting method for Wave 3. These improvements focus on finetuning the survey, simplifying language, and ensuring questions align with the primary objectives. Adjustments will be developed through a feedback survey and discussions within the consortium. This collaborative approach ensures that the survey design benefits from diverse perspectives and addresses the challenges identified in Waves 1 and 2.

The updated survey will aim to engage a broader range of stakeholders while maintaining the consistency and focus provided by the Digital Agriculture and Forestry Uptake Assessment Grid. Distribution strategies will also be reviewed to incorporate a mix of methods, including digital outreach, in-person engagement, and automated approaches where feasible, as detailed in subsequent sections.

4.2 Interviews & Events

For the entire project, the goal is to utilize the Assessment Grid in over 5000 cases, encompassing various actors, entities, and sectors such as agriculture, horticulture, and livestock. Regardless of the method of data collection, whether it is through interviews or surveys, the final dataset will be standardized for each observatory. Using the WR meta-data platform “Adagio”, the consortium will be able to collect and aggregate questions from different formats into a standardized form, which can then be used for further data analysis purposes.

5 Conclusion

Waves 1 and 2 of data collection have generated essential insights into the adoption of digital agriculture and forestry technologies within the EU and strategies to collect data on the adoption. The evidence is clear: shorter, simplified surveys improve data quality; in-person engagement yields the highest response rates; and representation gaps across stakeholder groups persist. These findings underscore the importance of survey design and targeted outreach for robust evidence gathering.

Wave 3 will build on these lessons by actively targeting underrepresented groups and incorporating AI-driven web-scraping to streamline indicators and reduce respondent burden. A mixed-methods approach—combining the proven effectiveness of in-person engagement with the scalability of digital channels—will ensure broader participation and improved data reliability.

These refinements are directly relevant to EU policy priorities. The results will inform updates to the 4Growth data visualisation platform and modelling tasks in WP2 and WP3, strengthen evidence for the Common Agricultural Policy (CAP) digitalisation agenda, and contribute to the European Green Deal's objectives. By closing these evidence gaps, the project supports more targeted, future-oriented strategies for digital technology adoption in European agriculture and forestry.

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7 ANNEXES

Annex A: Survey informed consent form

Consent Form for the Survey

Project details

Project name	Project number	Start and end date
4Growth	2282300621	01-02-2024 – 01-02-2028

Please take some time to read this information and ask questions if anything is unclear. Contact details can be found in this document.

Brief project information

Wageningen Economic Research is coordinating the 4Growth Horizon Europe project and the research for this study is being undertaken by consortium partners. This survey is part of the activity *Observatory Data Collection and Analysis,* undertaken by *all partners except EVF,* This project is funded through the Horizon Europe funding program of the EU Commission (grant agreement No. 101016807). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or Research Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

The 4Growth Horizon Europe project, aiming to advance digital solutions in agriculture and forestry, involves the collection and processing of certain data from stakeholders in the agriculture and forestry sectors. To ensure compliance with the General Data Protection Regulation (GDPR), we seek your explicit and informed consent before proceeding.

Purpose of Data Collection

The collected data will be used for the development and implementation of the Digital Agriculture & Forestry Uptake Assessment Grid. This tool aims to document various aspects of technology adoption, integration, costs, prerequisites, governance models, socio-economic benefits, and more. The insights gathered will contribute to advancing digital solutions in the agriculture and forestry sector. Aggregated data will be used for reporting and visualizations.

Deliverables

■ Paper ■Report ■ International research ■Other: Visualization dashboard.

Data Handling and Security Measures

We assure you that your data will be handled with the utmost care and confidentiality. Security measures, including encryption and access controls, will be implemented to safeguard the information collected. Personal data will be anonymized in any reports, infographics or publications.

The information will be retained by *Wageningen Research* and will only be used for the purpose of research. The security of personal data and by the processors takes place on the basis of generally accepted standards and best practices. Please refer to *the organization information security policy: e.g.:* *WUR information security policy* and the *organization data policy: e.g.:* *WUR data policy* for more details.

Which data is collected, where is it processed and for how long

Data category (you can add and delete)	Location/ country of processing	Storage period
Company Name	Netherlands	10yrs
Country of residence	Netherlands	10yrs
Survey/interview responses	Netherlands	10yrs

Organizations, institutions, and countries with which the data is shared

After conducting the activity personal data are pseudonymized as soon as possible. Access to the 'key' file is restricted to researchers analyzing the data. Analyses are conducted only on the basis of pseudonymized data. The pseudonymized data are only accessible to the researchers analyzing these data within the framework of the 4Growth Horizon Europe project, composed of the following organisations:

Organization/institutions which are part of the 4Growth Consortium	Countries within the EU (incl. NL)
EVENFLOW	BE
GEOPONIKO PANEPISTIMION ATHINON	EL
FOODSCALE HUB GREECE ASSOCIATION FOR ENTREPREUNERSHIP AND INNOVATION ASTIKI MI KERDOSKOPIKI ETAIREIA	EL
LE EUROPE LIMITED	IE
DAHEIM CORNELIA	DE
SIMBIOTICA SL	ES
EIGEN VERMOGEN VAN HET INSTITUUT VOOR LANDBOUW- EN VISSERIJONDERZOEK	BE
INSTITUTO NAVARRO DE TECNOLOGIAS E INFRAESTRUCTURAS AGROALIMENTARIAS SA	ES
CENTRE TECHNIQUE INTERPROFESSIONNEL DES FRUITS ET LEGUMES	FR
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Research results

You may request a summary of the research findings by contacting the task leader, Lan van Wassenaar of the Wageningen Economic Research Lan.vanwassenaar@wur.nl. At any time, you are free to withdraw consent by contacting the task leader.

Concerns or complaints

If you have any concerns about the project, your involvement in it or this consent form, please discuss this with the researcher undertaking the *survey* to find out how your concern will be addressed. If your concern is not addressed you can contact the Data Protection Officer -DPO- who supervises the application of and compliance with the GDPR via: *privacy@wur.nl*

Annex B: 4Growth English Survey – Technical aspects and Wave 1 Survey

Technical features of the survey

The survey was based on the Grid developed in WP2 as described in *Deliverable D2.1: Development of the Digital Agriculture and Forestry Uptake Assessment Grid.* After the first wave, the grid was further improved in the second iteration as described in Deliverable D2.2. This grid served as a standardized framework for capturing key data points from various stakeholders in agriculture and forestry.

Survey Implementation

The survey was created using the *Consumer Data Platform (CDP) (Wageningen Economic Research, 2024b),* a tool developed by Wageningen Economic Research to facilitate consumer science reports in various national and EU projects. While originally designed for consumer research purposes, the CDP tool proved versatile and was easily adapted to meet the specific needs of the 4Growth project. It enabled the construction of reusable question components aligned with the thematic blocks of the grid (e.g., governance model, technology adoption, economic impact) (see Figure B1).

Although the CDP supports survey creation, it requires an external platform, such as Qualtrics, for distribution to respondents. Its multilingual support ensured accessibility, offering surveys in an English version and translations into Greek, Spanish, French, Dutch, Finnish, Lithuanian, Swedish, Hungarian, and Polish. The integration of the CDP with the project's needs allowed for efficient and consistent data modelling, which was essential for collecting and analyzing stakeholder insights effectively. ,By using the CDP tool, a data model could be exported to Wageningen Economic Research's Adagio platform (Wageningen Economic Research, 2024a), which supports the OData protocol. OData (Open Data Protocol) is a standardized data access protocol designed to enable seamless integration with external systems (Chappell, 2011). This export capability facilitated efficient data sharing with WP2's dashboard visualization from *T2.3 Visualisation Platform of Digital Agriculture & Forestry Uptake* by providing structured datasets for direct integration into the project's visualization tools.

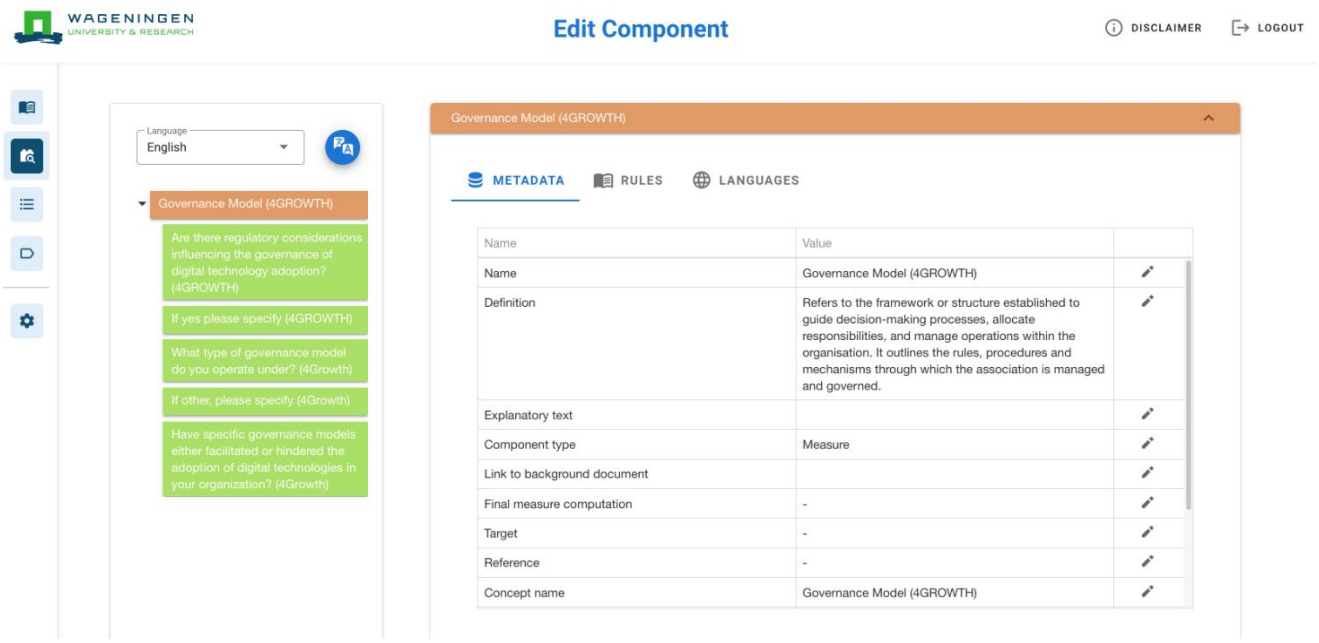


Figure B1: Screenshot of the Governance model survey component in the CDP tool

Survey Interface

The actual survey interface was implemented in Qualtrics (Qualtrics, 2020), which allowed the creation of language-specific surveys. Each survey began with a consent form in the respondent's native language. The consent form can be found in Appendix A. These consent forms were developed in collaboration with WP1: Coordination and management.

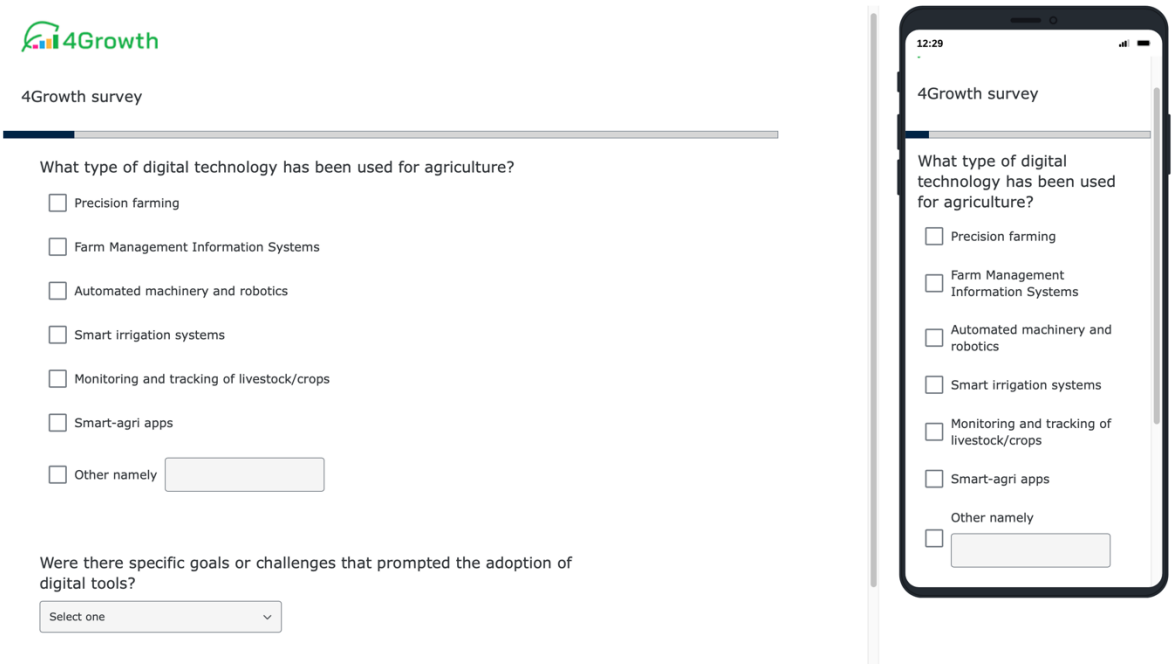


Figure B2: Preview of the 4Growth Survey

Following consent, respondents were guided through a tailored set of questions based on the sector that are active in; Agriculture, forestry, or both, and their role, which were grouped to:

Tech operators, tech providers, or data sharers. An example of a survey page can be found in Figure B2.

This routing logic minimized respondent's burden while maximizing data relevance. The survey routing (see Figure B3: Survey Routing) ensured that only the applicable questions were displayed, improving response accuracy and engagement. The survey iterations are available in Appendix B for wave 1 and Appendix C for wave 2.

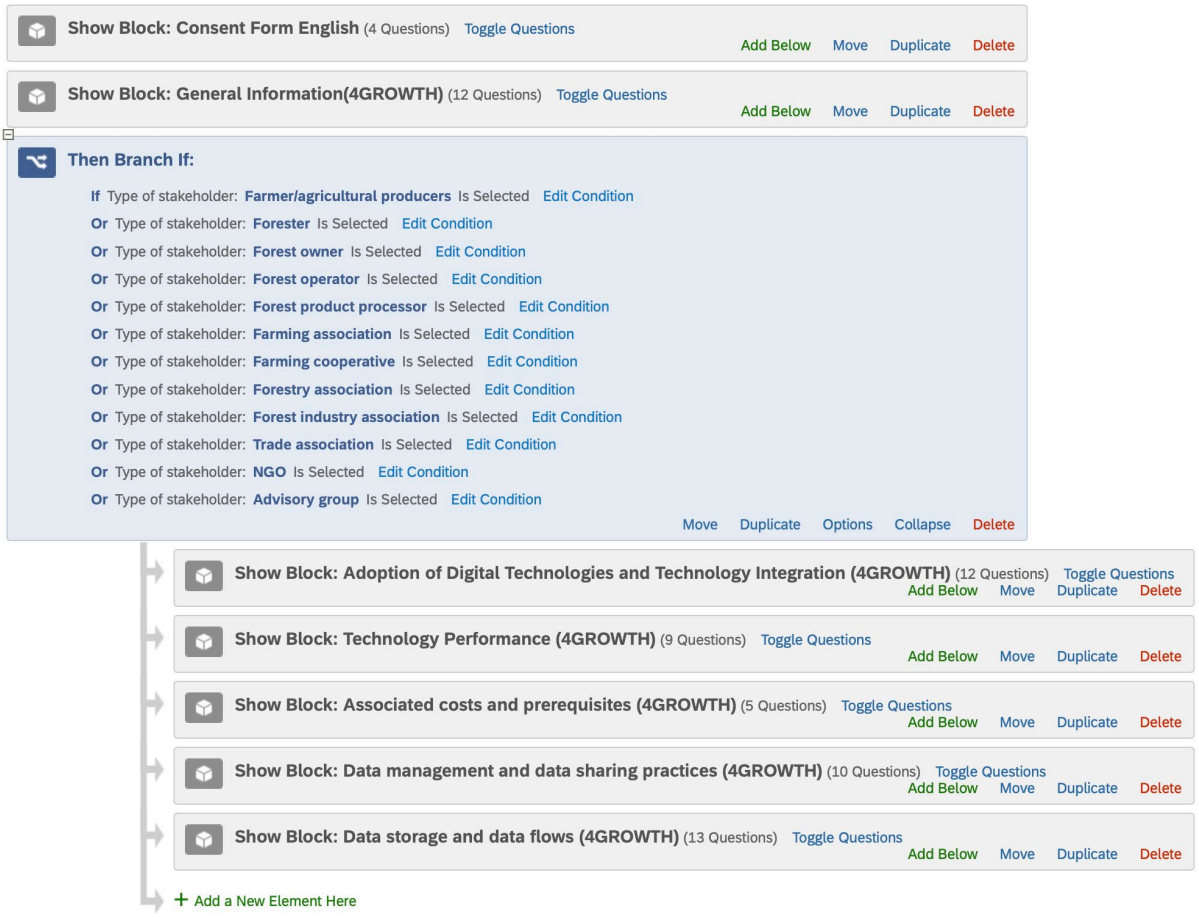


Figure B3 : Part of survey routing for the English survey

The combined capabilities of the CDP and Qualtrics platforms ensured the survey was both robust and adaptable, meeting the multilingual, multi-stakeholder demands of the 4Growth project.

4Growth English Wave 1 Survey Flow

Standard: Consent Form English (4 Questions)
Block: General Information(4GROWTH) (12 Questions)

Branch: New Branch
If
If Type of stakeholder: Farmer/agricultural producers Is Selected
Or Type of stakeholder: Forester Is Selected
Or Type of stakeholder: Forest owner Is Selected
Or Type of stakeholder: Forest operator Is Selected
Or Type of stakeholder: Forest product processor Is Selected
Or Type of stakeholder: Farming association Is Selected
Or Type of stakeholder: Farming cooperative Is Selected
Or Type of stakeholder: Forestry association Is Selected
Or Type of stakeholder: Forest industry association Is Selected
Or Type of stakeholder: Trade association Is Selected
Or Type of stakeholder: NGO Is Selected
Or Type of stakeholder: Advisory group Is Selected

Block: Adoption of Digital Technologies and Technology Integration (4GROWTH) (12 Questions)
Block: Technology Performance (4GROWTH) (9 Questions)
Block: Associated costs and prerequisites (4GROWTH) (5 Questions)
Block: Data management and data sharing practices (4GROWTH) (10 Questions)
Block: Data storage and data flows (4GROWTH) (13 Questions)

Branch: New Branch
If
If Type of stakeholder: Data provider Is Selected
Or Type of stakeholder: Research institutes and research networks Is Selected
Or Type of stakeholder: National and European networks Is Selected

Block: Governance Model (4GROWTH) (5 Questions)
Block: Data management and data sharing practices (4GROWTH) (10 Questions)
Block: Data storage and data flows (4GROWTH) (13 Questions)

Branch: New Branch
If
If Type of stakeholder: Infrastructure provider Is Selected

Block: Adoption of Digital Technologies and Technology Integration (4GROWTH) (12 Questions)
Block: Technology Performance (4GROWTH) (9 Questions)
Block: Associated costs and prerequisites (4GROWTH) (5 Questions)

Branch: New Branch
If
If Type of stakeholder: Data association/organisation/coalition Is Selected
Or Type of stakeholder: Platform provider Is Selected
Or Type of stakeholder: Service/information provider Is Selected
Or Type of stakeholder: Digital technology provider Is Selected

Block: Governance Model (4GROWTH) (5 Questions)
Block: Adoption of Digital Technologies and Technology Integration (4GROWTH) (12 Questions)
Block: Technology Performance (4GROWTH) (9 Questions)
Block: Associated costs and prerequisites (4GROWTH) (5 Questions)
Block: Data management and data sharing practices (4GROWTH) (10 Questions)
Block: Data storage and data flows (4GROWTH) (13 Questions)

Block: Social benefits and impact (4GROWTH) (3 Questions)
Block: Economic benefits and impact (4GROWTH) (3 Questions)
Block: Environmental and sustainability impact (4GROWTH) (5 Questions)
Block: Future outlook (4GROWTH) (3 Questions)
Block: Additional comments (4GROWTH) (1 Question)

Start of Block: Consent Form English

4Growth English Wave 1 Survey

Q1

4Growth- Consent Form

Enquête in het Nederlands Kysely suomeksi Enquête en français Undersökning på svenska Encuesta en español Ankieta w języku polskim Felmérés magyar nyelven Έρευνα στα ελληνικά Apklausa lietuvių kalba

The 4Growth Horizon Europe project, aiming to advance digital solutions in agriculture and forestry, involves the collection and processing of certain data from stakeholders in the agriculture and forestry sectors. To ensure compliance with the General Data Protection Regulation (GDPR), we seek your explicit and informed consent before proceeding. By giving your consent, you declare that: You have provided the data voluntarily The data you provide will only be used for the purpose for which you provided it You have the right to inspect, delete, correct, or limit the processing of personal data, as well as the right to object and the right to data portability Any use of the information beyond the scope or duration of this project will require the researchers to contact you for (renewed) consent. There are no known risks in taking part in this study. Read more about the consent form: Consent form English

*

Q2 If you agree, please confirm the following statements: I have read the information presented in this consent form. I have had the opportunity to ask any questions related to this research and received satisfactory answers to my questions. I understand that relevant sections of the data collected during the research may be accessed by individuals from the 4Growth project. With full knowledge of all the foregoing, I agree that my answers will be processed as part of the 4Growth project. I understand that relevant sections of the data collected during the research may be looked at by individuals from the 4Growth project. I give permission for these individuals to have access to my responses.

- ○ Yes (1)
- ○ No (2)

Q3 I agree to be contacted again by the researchers for clarification or elaboration on my input in the discussion (Optional)

- ○ Yes, e-mail: (1) _____
- ○ No (2)

Q4 Name:

_____

End of Block: Consent Form English

Start of Block: General Information(4GROWTH)

Q1.1 Organisation Name:

_____

Q1.2 Sector (Agri/Forestry/Both):

▾ Forestry (1) ... Both (3)

Q1.3 Type of stakeholder:

▾ Farmer/agricultural producers (1) ... Advisory group (20)

Q1.4 Location (Country/Region)

▾ Albania (28) ... Vatican City (city-state) (32)

Display This Question:
If Sector (Agri/Forestry/Both): = Agriculture
Or Sector (Agri/Forestry/Both): = Both

Q1.5 Primary Area of Operation in Agriculture

- [ ] Crop cultivation - grains (1)
- [ ] Crop cultivation - vegetables (2)
- [ ] Crop cultivation - legumes (3)
- [ ] Crop cultivation - fruits (4)
- [ ] Plant propagation (5)
- [ ] Livestock farming - meat (6)
- [ ] Livestock farming - dairy (7)
- [ ] Livestock farming - other (8)
- [ ] Mixed farming (crops and animal) (9)
- [ ] Agricultural machinery and equipment services (10)
- [ ] Crop services (monitoring) (11)
- [ ] Farm management services (12)
- [ ] Post-harvest handling services (13)
- [ ] Other namely (14)

Display This Question:
If Primary Area of Operation in Agriculture = Other namely

Q1.6 Other namely ...

_____

Display This Question:
If Sector (Agri/Forestry/Both): = Forestry
Or Sector (Agri/Forestry/Both): = Both

Q1.7 Primary Area of Operation in forestry

- ☐ Reforestation (1)
- ☐ Forest conservation - thinning, pruning, weed & pest control (2)
- ☐ Felling (3)
- ☐ Non-Timber Forest Products (NTFPs) (4)
- ☐ Transportation of logs (5)
- ☐ Forest Fire Management (6)
- ☐ Forestry inventory and mapping (7)
- ☐ Wildlife management (8)
- ☐ Other namely (9)

Display This Question:
If Primary Area of Operation in forestry = Other namely

Q1.8 Other namely ...

_____

Q1.9 Organic farming operation

▾ Yes (1) ... Don't know (3)

Q1.10 Agriculture/Forestry organisation size

▾ Small-scale/Local (1) ... Large-scale/National-International (3)

Q1.11 Specific regional or subsector considerations to take into account

▾ Yes (1) ... Don't know (3)

Display This Question:

If Specific regional or subsector considerations to take into account = Yes

Q1.12 Considerations to be taken into account

_____

End of Block: General Information(4GROWTH)

Start of Block: Adoption of Digital Technologies and Technology Integration (4GROWTH)

Q3.1 Has your organisation integrated digital technologies into its workflows?

▾ Yes (1) ... Don't know (3)

Skip To: End of Block If Has your organisation integrated digital technologies into its workflows? = No

Display This Question:

If Sector (Agri/Forestry/Both): = Agriculture

Or Sector (Agri/Forestry/Both): = Both

Q3.2 What type of digital technology has been used for agriculture?

- ☐ Precision farming (1)
- ☐ Farm Management Information Systems (2)
- ☐ Automated machinery and robotics (3)
- ☐ Smart irrigation systems (4)
- ☐ Monitoring and tracking of livestock/crops (5)
- ☐ Smart-agri apps (6)
- ☐ Other namely (7) _____

Display This Question:

If Sector (Agri/Forestry/Both): = Forestry

Or Sector (Agri/Forestry/Both): = Both

digitaltech.forestry What type of digital technology has been used for forestry?

- [ ] Forest Fire Prediction and Monitoring systems (1)
- [ ] Automated machinery and robotics (2)
- [ ] Drones for Forest Monitoring (3)
- [ ] Forest Inventory Management Software (4)
- [ ] Other namely (5) _____

goals.to.adopt Were there specific goals or challenges that prompted the adoption of digital tools?

▾ Yes (1) ... Don't know (3)

Display This Question:

If Were there specific goals or challenges that prompted the adoption of digital tools? = Yes

specify.challenges.tech.adopt If yes, please specify

_____

lvl.digitalisation How would you rate the level of digitalization in your farming/forestry practices on a scale of 1 to 5 (1 being low, 5 being high)

▾ 5 (1) ... 1 (5)

prim.function.tech What are the primary functions of these technologies in the agriculture or forestry value chain?

- [ ] Data management (1)
- [ ] Harvesting and distribution (2)
- [ ] Crop health and disease detection (3)
- [ ] Planning and Management (4)
- [ ] Decision-making (5)
- [ ] Supply chain optimisation (6)
- [ ] Monitoring (7)
- [ ] Production phase (8)
- [ ] On-farm activities (9)

---

adopt.level.tech What is the adoption level of these technologies?

▾ Preliminary (1) ... Fully integrated (3)

---

challenges.tech.adopt Have you encountered challenges in the adoption of digital technologies?

▾ Yes (1) ... Don't know (3)

Display This Question:

If Have you encountered challenges in the adoption of digital technologies? = Yes

specify.challenges If yes, please specify

_____

further.integration Are there specific barriers hindering further integration?

▾ Yes (1) ... Don't know (3)

Display This Question:

If Are there specific barriers hindering further integration? = Yes

specify.barriers If yes, please specify

_____

End of Block: Adoption of Digital Technologies and Technology Integration (4GROWTH)

Start of Block: Technology Performance (4GROWTH)

digitech.userneeds To what extent do digital technologies meet evolving user needs within your organization?

▾ Not at all (1) ... Completely (3)

adv.tech What are the advantages of the used technologies?

- ☐ Enhanced safety and monitoring (1)
- ☐ Improved management (2)
- ☐ Smart irrigation and water conservation (3)
- ☐ Economic benefits (4)
- ☐ Early detection of issues (5)
- ☐ Traceability and transparency (6)
- ☐ Efficient resource allocation (7)
- ☐ Improved decision-making (8)
- ☐ Increased efficiency and productivity (9)
- ☐ Other namely (10) _____

limitations.tech Have you encountered any perceived limitations or challenges in utilising these technologies?

▾ Yes (1) ... Don't know (3)

Display This Question:

If Have you encountered any perceived limitations or challenges in utilising these technologies? = Yes

specify.limitations If yes, please specify

_____

network.connect Do you have network connectivity?

▾ Yes (1) ... Don't know (3)

Skip To: End of Block If Do you have network connectivity? = No

network.connectivity What network connectivity do you use?

- ☐ Low-power Wide-area network (1)
- ☐ Private networks (2)
- ☐ Fiber optic networks (3)
- ☐ IoT networks (4)
- ☐ Satellite internet (5)
- ☐ Cellular networks (6)
- ☐ Wireless internet (7)
- ☐ Wired internet (8)

reliability.network How reliable is the current network connectivity? (1 being not reliable, 5 being very reliable)

▾ 5 (1) ... 1 (5)

barriers.connectivity Are there any specific barriers to accessing connectivity?

_____

devices.network What type of devices are commonly used to access the network?

- [ ] Agricultural machinery equipped with IoT (Internet of Things) sensors (1)
- [ ] GPS devices (2)
- [ ] Smartphones (3)
- [ ] Tablets (4)
- [ ] Laptop computers (5)
- [ ] Desktop computers (6)

End of Block: Technology Performance (4GROWTH)

Start of Block: Associated costs and prerequisites (4GROWTH)

ACP6.1 What are the most significant costs associated with the adoption of digital technologies in your organisation

- ☐ Initial investment (1)
- ☐ Connectivity infrastructure (2)
- ☐ Maintenance and upgrades (3)
- ☐ Energy (4)
- ☐ Integration with existing systems (5)
- ☐ Training and skill development (6)
- ☐ Data security and privacy measures (7)
- ☐ Other namely (8) _____

Acp6.2 What is the level of direct costs?

▾ High (1) ... Low (3)

Acp6.3 Unexpected or hidden costs?

▾ Yes (1) ... Don't know (3)

Acp6.4 Have you identified organisational prerequisites (skills, workforce, education) necessary for successful technology integration?

▾ Yes (1) ... Don't know (3)

Display This Question:

If Have you identified organisational prerequisites (skills, workforce, education) necessary for successful technology integration? = Yes

Acp6.4.1 If yes, please specify identified organisational prerequisites

_____

End of Block: Associated costs and prerequisites (4GROWTH)

Start of Block: Data management and data sharing practices (4GROWTH)

Dmdsp7.1 Is data collected from your farming/forestry activities?

▾ Yes (1) ... Don't know (3)

Dmdsp7.2 What type of data sharing practices related to digital technology does your organisation use?

▾ Open sharing (1) ... No sharing (3)

Dmdsp7.3 What type of data do you collect?

- [ ] Crop and yield data (1)
- [ ] Soil data (2)
- [ ] Weather and environmental data (3)
- [ ] Pest and disease data (4)
- [ ] Inventory and equipment data (5)
- [ ] Market and economic data (6)
- [ ] Remote sensing and geospatial data (7)
- [ ] Livestock data (8)
- [ ] Financial and operational data (9)

Dmdsp7.4 Do you pay for this data?

▾ Yes (1) ... Don't know (3)

Dmdsp7.5 What type of tools or platforms do you use to collect data?

- [ ] Field Data Collection Apps (1)
- [ ] Precision Agriculture Technology (2)
- [ ] IoT Devices (3)
- [ ] Remote sensing platforms (4)
- [ ] Farm Management Software (5)
- [ ] Forest Management Software (6)
- [ ] Forest Inventory Tools (7)
- [ ] Traceability systems (8)
- [ ] Research Databases (9)

Dmdsp7.6 Do you share this data?

▾ Yes (1) ... Don't know (3)

Dmdsp7.7 Do challenges exist in sharing and interoperability of agricultural and forestry data?

▾ Yes (1) ... Don't know (3)

Display This Question:

If Do challenges exist in sharing and interoperability of agricultural and forestry data? = Yes

Dmdsp7.8 If yes, please name the challenges associated with sharing and interoperability

_____

Dmdsp7.9 How do these practices contribute to or impede the overall effectiveness of technology adoption?

▾ Contribute (1) ... No impact (3)

Dmdsp7.10 Approximately what percentage of overall decisions made are based on data analytics in your organisation?

▾ 25% (1) ... 90% (4)

End of Block: Data management and data sharing practices (4GROWTH)

Start of Block: Data storage and data flows (4GROWTH)

DSDF8.2 Do you use cloud services/data centres?

▾ Yes (1) ... Don't know (3)

Display This Question:

If Do you use cloud services/data centres? = Yes

DSDF8.3 If yes, please name which cloud services/data centres

_____

DSDF8.4 Are there economic implications associated with data flows in these sectors?

▾ Yes (1) ... Don't know (3)

Display This Question:

If Are there economic implications associated with data flows in these sectors? = Yes

DSDF8.4.1 If yes, please name the main implications

_____

DSDF8.5 Do data flows enhance productivity and efficiency in agriculture and forestry?

▾ Yes (1) ... Don't know (3)

DSDF8.6 Do you use data analytics for decision-making?

▾ Yes (1) ... Don't know (3)

DSDF8.7 Where do you receive data from and how much?

_____

DSDF8.8 What type of data do you receive or provide?

- ☐ Farm-level data (1)
- ☐ Earth Observation (EO) data (2)
- ☐ Environmental data (3)
- ☐ Socio-economic data (4)
- ☐ Supply chain data (5)
- ☐ Research and Development data (6)

DSDF8.9 Do you pay for this data?

▾ Yes (1) ... Don't know (3)

Display This Question:

If Do you pay for this data? = Yes

DSDF8.9.1 If yes please specify (type/amount)

_____

DSDF8.10 Where and how do you store this data?

- [ ] On-premises servers/local storage facilities (1)
- [ ] Cloud-based platforms (2)
- [ ] Data warehouses (3)
- [ ] Agricultural information management systems (4)
- [ ] Geographic Information Systems (GIS) (5)
- [ ] Hybrid storage solutions (on-premises and cloud) (6)
- [ ] Secure data centres (advanced security measures) (7)

DSDF8.11 What do you do with this data?

_____

DSDF8.12 To who and where do you send derived information or data?

_____

End of Block: Data storage and data flows (4GROWTH)

Start of Block: Governance Model (4GROWTH)

Q2.1 Are there regulatory considerations influencing the governance of digital technology adoption?

▾ Yes (1) ... Don't know (3)

Display This Question:

If Are there regulatory considerations influencing the governance of digital technology adoption? = Yes

Q2.2 If yes please specify

_____

Q2.3 What type of governance model do you operate under?

▾ Traditional/Subsistence Agriculture or Forestry (1) ... Other namely (7)

Display This Question:

If What type of governance model do you operate under? = Other namely

Q2.4 Other namely ...

_____

Q2.5 Have specific governance models either facilitated or hindered the adoption of digital technologies in your organization?

▾ Facilitated (1) ... No impact (3)

End of Block: Governance Model (4GROWTH)

Start of Block: Social benefits and impact (4GROWTH)

social.benefits Have you experienced social benefits through the use of digital technologies?

▾ Yes (1) ... Don't know (3)

job.creation How have digital technologies impacted job creation?

▾ Substantial impact (1) ... Negligible impact (3)

social.impact What is the overall social impact of adopting digital technologies?

▾ Negative (1) ... Positive (3)

End of Block: Social benefits and impact (4GROWTH)

Start of Block: Economic benefits and impact (4GROWTH)

digitech.costsavings Have digital technologies resulted in cost savings or increased efficiency?

▾ Yes (1) ... Don't know (3)

digitech.savinginputs Have you seen savings in inputs due to digital technologies?

▾ Yes (1) ... Don't know (3)

impact.digitech What is the overall economic impact of implementing digital technologies?

▾ Negative (1) ... Positive (3)

End of Block: Economic benefits and impact (4GROWTH)

Start of Block: Environmental and sustainability impact (4GROWTH)

digitech sustainability Have digital technologies contributed to sustainability and environmental practices?

▾ Yes (1) ... Don't know (3)

digitech impacts footprint Have you observed positive impacts on resource conservation or environmental footprint?

▾ Yes (1) ... Don't know (3)

didgitech energy efficiency Have digital technologies contributed to energy efficiency?

▾ Yes (1) ... Don't know (3)

digitech biodiversity Have you observed any positive or negative effects on biodiversity in agricultural and forestry areas due to digital technology adoption?

▾ No impact (1) ... Positive (3)

digitech track sustainability Do you use digital technologies to track and ensure adherence to sustainable farming practices and forestry activities?

▾ Yes (1) ... Don't know (3)

End of Block: Environmental and sustainability impact (4GROWTH)

Start of Block: Future outlook (4GROWTH)

plan upgrade digitech Are there plans to expand or upgrade your current digital infrastructure?

▾ Yes (1) ... Don't know (3)

facilitate expansion/upgrade What would help facilitate the expansion/upgrade of digital infrastructure in the future?

- ☐ Better connectivity/Infrastructure (1)
- ☐ More income/Access to funding (2)
- ☐ Standardisation efforts/Regulatory support (3)
- ☐ Better training and education (4)

type of developments What type of developments do you anticipate in the near future?

▾ Emergence of new technologies (1) ... No significant changes anticipated (3)

End of Block: Future outlook (4GROWTH)

Start of Block: Additional comments (4GROWTH)

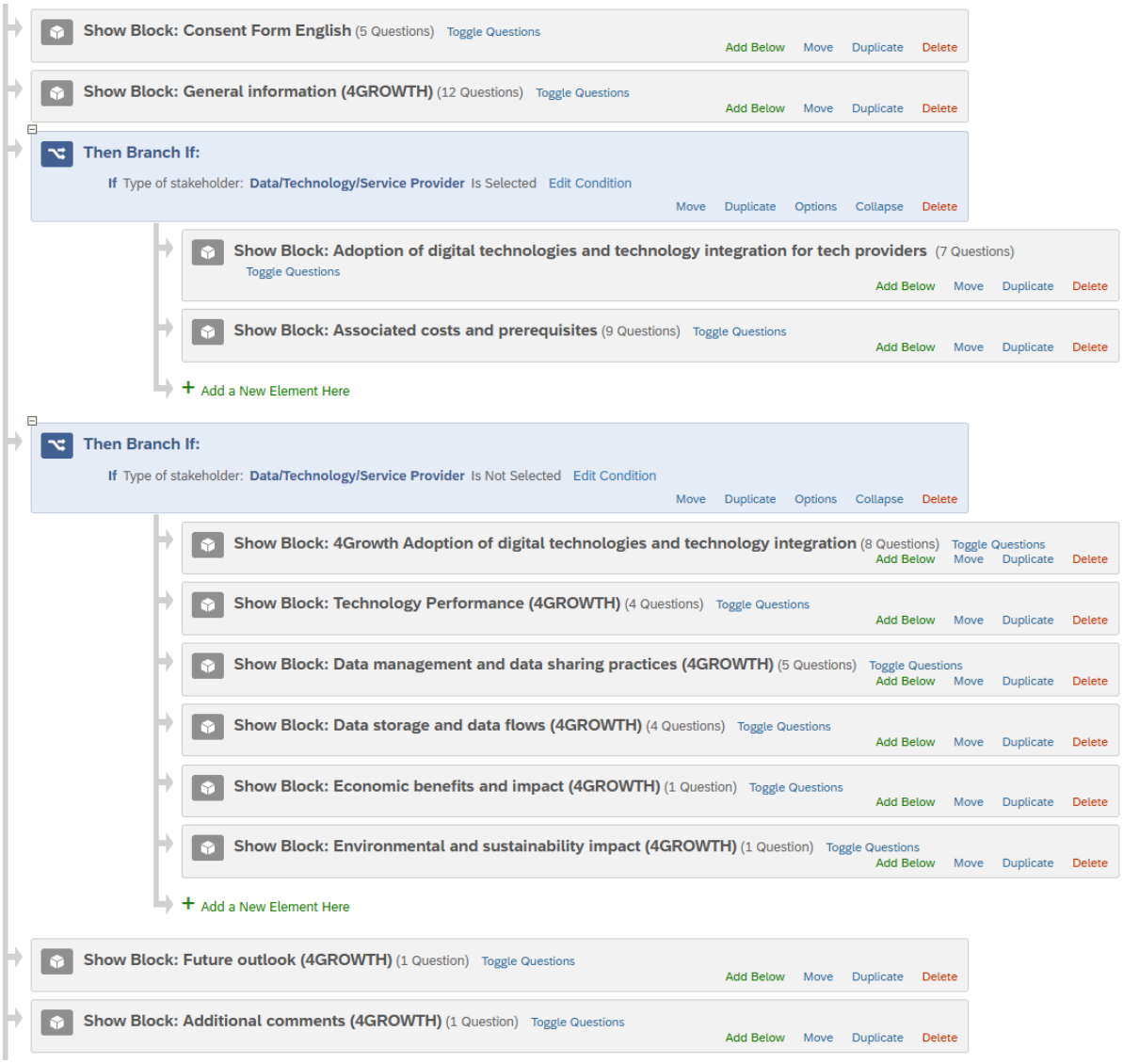
add.info Please share any other input that could be relevant to the questionnaire

_____

End of Block: Additional comments (4GROWTH)

Annex C: 4Growth English wave 2 survey

4Growth English Wave 2 - Survey Flow



4Growth English Wave 2 - Survey

Start of Block: Consent Form English

Q1

4Growth- Consent Form

The 4Growth Horizon Europe project, aiming to advance digital solutions in agriculture and forestry, involves the collection and processing of certain data from stakeholders in the agriculture and forestry sectors. To ensure compliance with the General Data Protection

Regulation (GDPR), we seek your explicit and informed consent before proceeding. By giving your consent, you declare that: You have provided the data voluntarily The data you provide will only be used for the purpose for which you provided it You have the right to inspect, delete, correct, or limit the processing of personal data, as well as the right to object and the right to data portability Any use of the information beyond the scope or duration of this project will require the researchers to contact you for (renewed) consent. There are no known risks in taking part in this study. Read more about the consent form: Consent form English

*

CFConfirm If you agree, please confirm the following statements: I have read the information presented in this consent form. I have had the opportunity to ask any questions related to this research and received satisfactory answers to my questions. I understand that relevant sections of the data collected during the research may be accessed by individuals from the 4Growth project. With full knowledge of all the foregoing, I agree that my answers will be processed as part of the 4Growth project. I understand that relevant sections of the data collected during the research may be looked at by individuals from the 4Growth project. I give permission for these individuals to have access to my responses.

- ○ Yes (1)
- ○ No (2)

CFContact I agree to be contacted again by the researchers for clarification or elaboration on my input in the discussion (Optional)

- ○ Yes (1)
- ○ No (2)

Display this question:

If I agree to be contacted again by the researchers for clarification or elaboration on my input in... = Yes

CFContactYes Please provide your email address:

_____

CFName Name:

_____

End of Block: Consent Form English

Start of Block: General information (4GROWTH)

GIName Organisation Name:

_____

GISector Sector (Agri/Forestry/Both):

▼ Forestry (1) ... Both (3)

GIType Type of stakeholder:

▼ Producer (Farmer/Forest Owner/Forester) (1) ... Network organisation (National/European) (9)

GILocation Location (Country/Region)

▼ Albania (28) ... Vatican City (city-state) (32)

Display this question:

If Sector (Agri/Forestry/Both): = Agriculture

Or Sector (Agri/Forestry/Both): = Both

GIPAOAgri Primary Area of Operation in Agriculture

- ☐ Arable farming (grains, vegetables, legumes, fruits, plant propagation, etc. (14)
- ☐ Perennial agriculture or permanent farming (almonds, olives, walnuts. hazelnuts, etc.) (15)
- ☐ Livestock farming (meat, dairy, other) (16)
- ☐ Mixed farming (crops and animals) (17)
- ☐ Service and support (farm management services, crop services, post-harvest handling services, etc.) (18)
- ☐ Other namely (19)

Display this question:

If Primary Area of Operation in Agriculture = Other namely

GIPAOAgriOther Other namely ...

_____

Display this question:

If Sector (Agri/Forestry/Both): = Forestry

Or Sector (Agri/Forestry/Both): = Both

GIPAOForest Primary Area of Operation in forestry

- [ ] Reforestation (1)
- [ ] Forest conservation - thinning, pruning, weed & pest control (2)
- [ ] Felling (3)
- [ ] Non-Timber Forest Products (NTFPs) (4)
- [ ] Transportation of logs (5)
- [ ] Forest Fire Management (6)
- [ ] Forestry inventory and mapping (7)
- [ ] Wildlife management (8)
- [ ] Other namely (9)

Display this question:

If Primary Area of Operation in forestry = Other namely

GIPAOForestOther Other namely ...

_____

GIOSize Agriculture/Forestry organisation size

▼ Micro (1-9 employees) (1) ... N/A (6)

Display this question:

If Type of stakeholder: = Data/Technology/Service Provider

GIOrgType What type of organisation are you?

- ○ Start-up (1)
- ○ SME (2)
- ○ Large enterprise (3)
- ○ Agri-Tech company (4)
- ○ Innovation Hub (5)
- ○ Other, namely (6)

Display this question:
If What type of organisation are you? = Other, namely

GIOrgTypeOther Other namely ...

_____

Display this question:
If Type of stakeholder: = Data/Technology/Service Provider

GIGeoReach What is the geographical reach of the services that you offer?

- ○ Local (services offered within a single city or region) (1)
- ○ National (services offered across one country) (2)
- ○ Regional (services offered across neighboring countries or within a specific geographical region, e.g., Mediterranean, Baltic) (3)
- ○ Continental (services offered across an entire continent, e.g., Europe, Africa) (4)
- ○ Global (services offered worldwide) (5)

End of Block: General information (4GROWTH)

Start of Block: Adoption of digital technologies and technology integration for tech providers

AdoptPerc What percentage of your products or services are specifically targeted at the agricultural and forestry sectors?

▼ (1) ... >90% (4)

AdoptUserType What type of users do you primarily provide your technology to?

- ○ Farmers (1)
- ○ Forestry Operators (2)
- ○ Agricultural researchers (3)
- ○ Governmental organisations (4)
- ○ Other, namely (5)

Display this question:
If What type of users do you primarily provide your technology to? = Other, namely

AdoptUserTypeOther Other namely...

_____

AdoptSalesModel What sales model do you primarily use for your products/services?

- ☐ Subscription-based (1)
- ☐ One-time lump sum payment (2)
- ☐ Usage-based (3)
- ☐ Freemium (4)
- ☐ Licensing (5)
- ☐ Other, namely (6)

Display this question:

If What sales model do you primarily use for your products/services? = Other, namely

AdoptSalesModelOther Other namely...

_____

AdoptDataType What types of data do your products or services generate or rely on?

- ☐ Soil health data (1)
- ☐ Climate/weather data (2)
- ☐ Crop yield data (3)
- ☐ Sensor-based data (4)
- ☐ Geospatial data (5)
- ☐ Other, namely (6)

Display this question:

If What types of data do your products or services generate or rely on? = Other, namely

AdoptDataTypeOther Other namely...

_____

End of Block: Adoption of digital technologies and technology integration for tech providers

Start of Block: Associated costs and prerequisites

ACPMarket Do you conduct market research or needs assessments before developing digital solutions for agriculture and forestry?

- Yes (1)
- No (2)
- Don't know (3)

ACPUserNeeds Do you prioritize user needs within the agricultural and forestry sectors during the development phase?

- Yes (1)
- No (2)
- Don't know (3)

ACPCostStr Can you provide insights into the cost structure associated with implementing and maintaining your technology?

- Yes (1)
- No (2)
- Don't know (3)

Display this question:

If Can you provide insights into the cost structure associated with implementing and maintaining you... = Yes

ACPCostStrSp If yes, please specify

_____

_____

_____

_____

_____

ACPPenetr Do you employ specific strategies to penetrate diverse markets within agriculture and forestry?

- ○ Yes (1)
- ○ No (2)
- ○ Don't know (3)

Display this question:

If Do you employ specific strategies to penetrate diverse markets within agriculture and forestry? = Yes

ACPPenetrSp If yes, please specify

_____

_____

_____

_____

_____

ACPAfterSales Do you offer any after-sales service, support, or warranty for your products or services?

- ☐ Yes, we offer after-sales service and support (please specify) (1)
- ☐ Yes, we offer warranty (please specify) (2)
- ☐ Yes, we offer both after-sales service/support and warranty (3)
- ☐ No, we do not offer after-sales service, support, or warranty (4)
- ☐ Other, namely (5)

Display this question:

If Do you offer any after-sales service, support, or warranty for your products or services? = Other, namely

ACPAfterSalesOther Other namely...

_____

ACPAfterSalesSp If needed, please specify

_____

_____

_____

_____

_____

End of Block: Associated costs and prerequisites

Start of Block: 4Growth Adoption of digital technologies and technology integration

ADTTIntegrated Has your organisation integrated digital technologies into its workflows?

▼ Yes (1) ... Don't know (3)

Skip To: End of Block If Has your organisation integrated digital technologies into its workflows? = No

Display this question:

If Sector (Agri/Forestry/Both): = Agriculture

Or Sector (Agri/Forestry/Both): = Both

ADTTAgriculture What type of digital technology has been used for agriculture?

- ☐ Farm Management Software (e.g., digital tools for holistic practical, operational or financial management of a farm etc.) (1)
- ☐ Guidance and Controlled Vehicle Technologies (e.g., vehicle guidance services or automatic steering etc.) (2)
- ☐ Map or Sensor-based Variable Rate Technologies (e.g., advice or automatic variable application of fertilizers, persiticides, or irrigation etc.) (3)
- ☐ Recording and Mapping Technologies (e.g., mapping or sensor-based monitoring of crops/soil/animals/weather conditions etc.) (4)
- ☐ Robotic Systems or Smart Machines (e.g., drones or harvesting/weeding/planting/milking robots etc.) (5)
- ☐ Data or Information Sharing Applications/Platforms (6)
- ☐ Other namely (7)

Display this question:

If What type of digital technology has been used for agriculture? = Other namely

ADTTAgricultureOther Other namely...

_____

Display this question:

If Sector (Agri/Forestry/Both): = Forestry

Or Sector (Agri/Forestry/Both): = Both

ADTTForestry What type of digital technology has been used for forestry?

- ☐ Mapping Technologies (e.g., satellite or aerial imagery to collect information about forest condition/health/biomass/inventory/environmental changes etc.) (1)
- ☐ Field Survey Technologies (e.g., drones, ground sensors for soil/weather/fire prediction, GPS devices, Geographic Information Systems (GIS) Software etc.) (2)
- ☐ Descision Support Technologies (e.g., advice or data-driven insights/reccomendations for forestry operations and management etc.) (3)
- ☐ Data or Information Sharing Applications/Platforms (4)
- ☐ Other namely (5)

Display this question:

If What type of digital technology has been used for forestry? = Other namely

ADTTForestryOther Other namely...

_____

ADTTFunctions What are the primary functions of these technologies in the agriculture or forestry value chain?

- ☐ Production phase enhancement (e.g. optimizing yields, resource efficiency) (1)
- ☐ Monitoring and surveillance (e.g. crop/forest health, pest detection, environmental conditions) (2)
- ☐ Supply chain optimisation (e.g. logistics, traceability, post-harvest handling) (3)
- ☐ Decision-making Support (e.g. AI/ML models for recommendations) (4)
- ☐ Planning and Management (e.g. Resource allocation, inventory management) (6)
- ☐ Crop/Forest Health and disease detection (e.g. early detection via sensors or drones) (7)
- ☐ Harvesting and distribution (e.g. automated machinery, tranportation tracking) (8)
- ☐ Data collection and Management (e.g. data storage, analytics, dashboards) (9)

ADTTBarriers Are there specific barriers hindering further integration?

▼ Yes (1) ... Don't know (3)

Display this question:

If Are there specific barriers hindering further integration? = Yes

ADTTFunctionsSpec If yes, please specify

_____

End of Block: 4Growth Adoption of digital technologies and technology integration

Start of Block: Technology Performance (4GROWTH)

NetworkYes Do you have network connectivity?

▼ Yes (1) ... Don't know (3)

Display this question:
If Do you have network connectivity? = Yes

NetworkConnect What network connectivity do you use?

- ☐ Wired internet (e.g. DSL, Ethernet) (1)
- ☐ Wireless internet (Wi-Fi) (2)
- ☐ Cullular networks (e.g. 3G, 4G, 5G) (3)
- ☐ Sattelite internet (4)
- ☐ IoT specific Networks (e.g. LPWAN, LoRaWan, Zigbee) (5)
- ☐ Fiber optic networks (6)
- ☐ Private networks (e.g. corporate or organizational networks) (7)

Display this question:
If Do you have network connectivity? = Yes

NetworkReliability How reliable is the current network connectivity? (1 being not reliable, 5 being very reliable)

▼ 5 (1) ... 1 (5)

NetworkDigital Would you further adopt digital technologies if you had better network connectivity?

▼ Strongly Disagree (1) ... Strongly Agree (5)

End of Block: Technology Performance (4GROWTH)

Start of Block: Data management and data sharing practices (4GROWTH)

DMDSTypes What type of data sharing practices related to digital technology does your organisation use?

▼ Open Sharing (Data is openly shared with the public or stakeholders without restrictions) (1) ... No Sharing (Data is not shared with anyone, internally or externally) (3)

DMDSDataTypes What type of data do you collect?

- ☐ Crop and Yield Data (e.g., production quantities, quality metrics) (1)
- ☐ Soil Data (e.g., pH levels, nutrient content, moisture) (2)
- ☐ Weather and Environmental Data (e.g., temperature, precipitation, air quality) (3)
- ☐ Pest and Disease Data (e.g., infestations, outbreaks, treatments) (4)
- ☐ Inventory and Equipment Data (e.g., machinery status, stock levels) (5)
- ☐ Market and Economic Data (e.g., prices, demand trends, cost analysis) (6)
- ☐ Remote Sensing and Geospatial Data (e.g., satellite imagery, GIS mapping) (7)
- ☐ Livestock Data (e.g., health, productivity, breeding) (8)
- ☐ Financial and Operational Data (e.g., expenses, profits, workflow efficiency) (9)

DMDSTools What type of tools or platforms do you use to collect data?

- ☐ Field Data Collection Tools (e.g., mobile apps, handheld devices) (1)
- ☐ Precision Agriculture and Forestry Technology (e.g., variable rate technology, GPS-guided equipment) (2)
- ☐ IoT Devices and Sensors (e.g., soil moisture sensors, weather stations, livestock trackers) (3)
- ☐ Remote Sensing Platforms (e.g., drones, satellites) (4)
- ☐ Farm and Forest Management Software (e.g., FMIS, forest management system) (5)
- ☐ Traceability and Supply Chain Systems (e.g., blockchain for tracking produce, timber certification systems) (6)
- ☐ Research Data platforms (e.g., academic databases) (7)

DMDSPay Do you pay for this data?

▼ Yes (1) ... Don't know (3)

DMDSDepend Would you be able to operate without this data?

- ○ Strongly Disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly Agree (5)

End of Block: Data management and data sharing practices (4GROWTH)

Start of Block: Data storage and data flows (4GROWTH)

DSDFStorage Where and how do you store this data?

- ☐ On-premises servers/local storage facilities (1)
- ☐ Cloud-based platforms (2)
- ☐ Data warehouses (3)
- ☐ Agricultural information management systems (4)
- ☐ Geographic Information Systems (GIS) (5)
- ☐ Hybrid storage solutions (on-premises and cloud) (6)
- ☐ Other, namely (7)

Display this question:

If Where and how do you store this data? = Other, namely

DSDFStorageOther Other namely...

_____

Display this question:

If What type of data sharing practices related to digital technology does your organisation use? = Open Sharing (Data is openly shared with the public or stakeholders without restrictions)

Or What type of data sharing practices related to digital technology does your organisation use? = Restricted Sharing (Data is shared only with specific parties under controlled conditions, such as through agreements)

DSDFSharing Do you share the data you have collected with others?

- ○ Yes (1)
- ○ No (2)
- ○ Don't know (3)

Display this question:

If What type of data sharing practices related to digital technology does your organisation use? = Open Sharing (Data is openly shared with the public or stakeholders without restrictions)

Or What type of data sharing practices related to digital technology does your organisation use? = Restricted Sharing (Data is shared only with specific parties under controlled conditions, such as through agreements)

Or Do you share the data you have collected with others? = Yes

DSDFSending To who and where do you send this data?

- ○ Research organisations (4)
- ○ Industry partners (5)
- ○ Financial organisations (6)

End of Block: Data storage and data flows (4GROWTH)

Start of Block: Economic benefits and impact (4GROWTH)

Display this question:

If Has your organisation integrated digital technologies into its workflows? = Yes

EcoBenefitSavings Digital technologies have resulted in cost savings or increased efficiency in our operations.

▼ Strongly Disagree (1) ... Strongly Agree (6)

End of Block: Economic benefits and impact (4GROWTH)

Start of Block: Environmental and sustainability impact (4GROWTH)

Display this question:

If Has your organisation integrated digital technologies into its workflows? = Yes

EnvironContribute Digital technologies have positively contributed to sustainability and environmental practices in our organization.

▼ Strongly Disagree (1) ... Strongly Agree (5)

End of Block: Environmental and sustainability impact (4GROWTH)

Start of Block: Future outlook (4GROWTH)

FOUpgrade Our organization plans to expand or upgrade its current digital infrastructure in the near future.

▼ Strongly Disagree (2) ... Strongly Agree (6)

End of Block: Future outlook (4GROWTH)

Start of Block: Additional comments (4GROWTH)

ACInput Please share any other input that could be relevant to the questionnaire

End of Block: Additional comments (4GROWTH)

Annex D: Technical set-up of automated data collection and analysis of answer retrieval effectiveness for various queries

Overview of datasets

We implemented methodology to different type of companies selected based on NACE codes, which is an industrial classification system used in the European Union to categorise businesses based on their economic activities. We used Orbis database that provides detailed information on companies and entities worldwide. Selection of companies are described in detailed in D4.8.

Table D1 summarises currently collected and analysed datasets, showing the number of scraped websites, analysed websites which had some relevant information to survey questions and excluded websites that did not contain any information relevant to survey question. In the previous phase we implemented methodology to forestry companies containing 1549 analysed companies. Now we extended analysis to the list of selected technology companies containing 36 analysed companies and forest machinery containing 1167 analysed companies. The total number of analysed companies are 2752.

Table D1 Overview of datasets

Dataset	Scraped	Analysed	No information
Forestry group	3424	**1549**	1875
Technology companies	44	**36**	8
Forestry machinery	1657	**1167**	490
Total	5125	**2752**	2373

The following figures and tables summarise the companies analysed in each dataset, showing their distribution by country and classification according to NACE codes.

Companies by NACE codes in the datasets

The following tables and figures present an overview of how companies are classified by NACE codes in each dataset.

In the forestry group dataset (Table 6), the main categories were ‘1610 Sawmilling and planing of wood’ (46%), ‘0210 Silviculture and other forestry activities’ (17%), ‘0220 Logging’ (17%), and ‘0240 Support services to forestry’ (13%). Other categories were represented by a smaller number of companies.

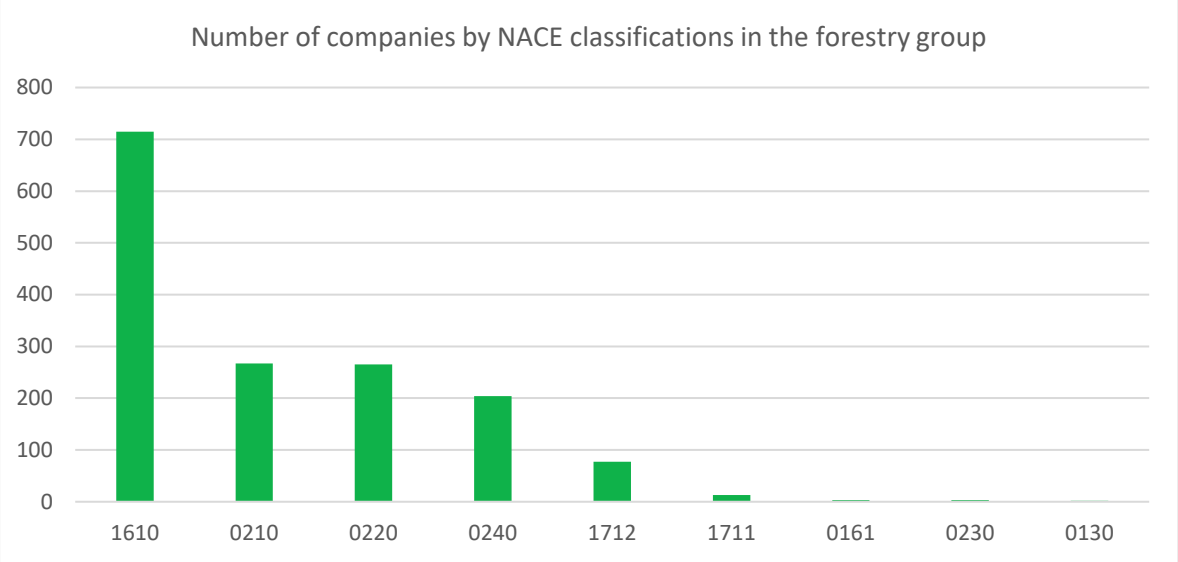
In the technology companies dataset (Table 7) the top main categories were ‘6201 Computer programming activities’ (17%), ‘7112 Engineering activities and related technical consultancy’ (11%) and ‘7219 Other research and experimental development on natural sciences and engineering’ (11%). The diversity of NACE code classifications shows that technology companies developing solutions for the forestry sector are spread across multiple categories, making it difficult to identify which companies are truly active in forestry.

In the forestry machinery dataset (Table 8), 64% of companies fall under ‘4661 Wholesale of agricultural machinery, equipment and supplies’ and 36% under ‘2830 Manufacture of agricultural and forestry machinery’.

The total distribution of NACE codes in total dataset are presented in Figure D1.

Table D2 Companies by NACE codes in forestry group dataset.

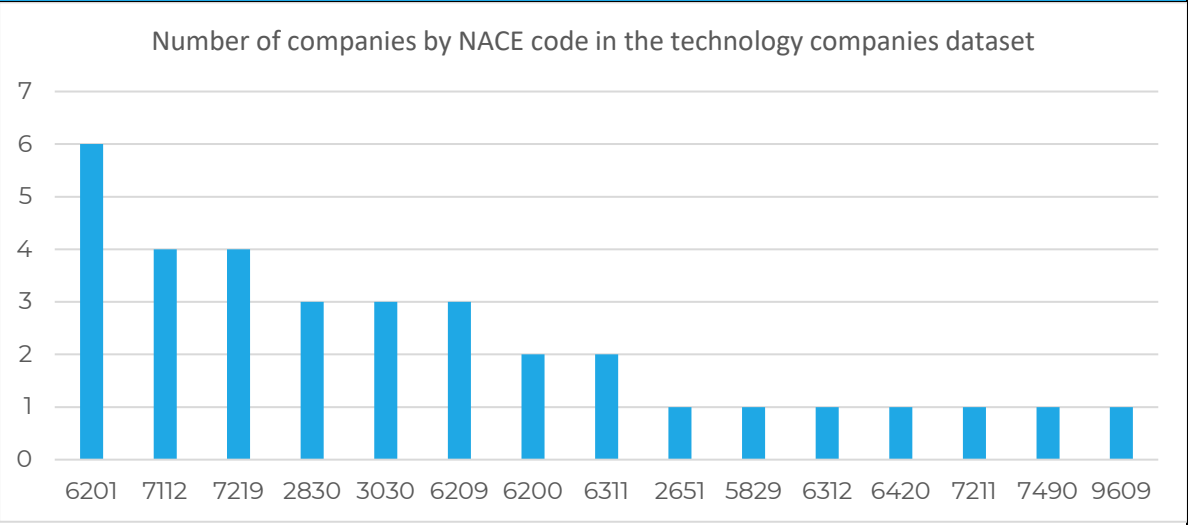
Forestry group



NACE code	NACE_label	NACE Count	Share of NACE codes %
1610	Sawmilling and planing of wood	715	46,2
0210	Silviculture and other forestry activities	267	17,2
0220	Logging	265	17,1
0240	Support services to forestry	204	13,2
1712	Manufacture of paper and paperboard	77	5,0
1711	Manufacture of pulp	13	0,8
0161	Support activities for crop production	3	0,2
0230	Gathering of wild growing non-wood products	3	0,2
0130	Plant propagation	2	0,1
	Total	**1549**	**100**

Table D3 Companies by NACE codes in the technology companies dataset

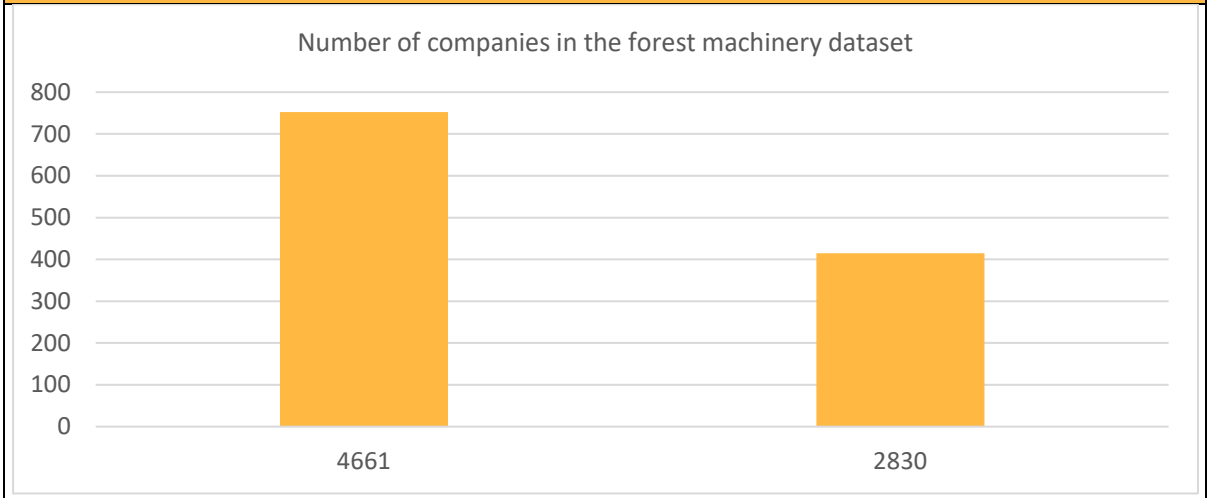
Technology companies



NACE code	NACE label	NACE Count	Share of NACE codes %
6201	Computer programming activities	6	16,7
7112	Engineering activities and related technical consultancy	4	11,1
7219	Other research and experimental development on natural sciences and engineering	4	11,1
2830	Manufacture of agricultural and forestry machinery	3	8,3
3030	Manufacture of air and spacecraft and related machinery	3	8,3
6209	Other information technology and computer service activities	3	8,3
6200	Computer programming, consultancy and related activities	2	5,6
6311	Data processing, hosting and related activities	2	5,6
2651	Manufacture of instruments and appliances for measuring, testing and navigation	1	2,8
5829	Other software publishing	1	2,8
6312	Web portals	1	2,8
6420	Activities of holding companies	1	2,8
7211	Research and experimental development on biotechnology	1	2,8
7490	Other professional, scientific and technical activities n.e.c.	1	2,8
9609	Other personal service activities n.e.c.	1	2,8
None	No NACE code for an organisation in Orbis	2	5,6
	Total	**36**	**100**

Table D4 Companies by NACE codes in the forest machinery dataset

Forestry machinery



NACE code	NACE label	NACE Count	Share of NACE codes %
4661	Wholesale of agricultural machinery, equipment and supplies	752	64,4
2830	Manufacture of agricultural and forestry machinery	415	35,6
	Total	**1167**	**100**

Figure D1 summarises distribution of NACE codes in total dataset. In the visualisation, smaller NACE groups are aggregated. The different NACE codes of technology companies are combined, as are Manufacture of paper and paperboard and Manufacture of pulp. The category 'Other forestry (combined)' includes 'Support activities for crop production', 'Gathering of wild-growing non-wood products' and 'Plant propagation'.

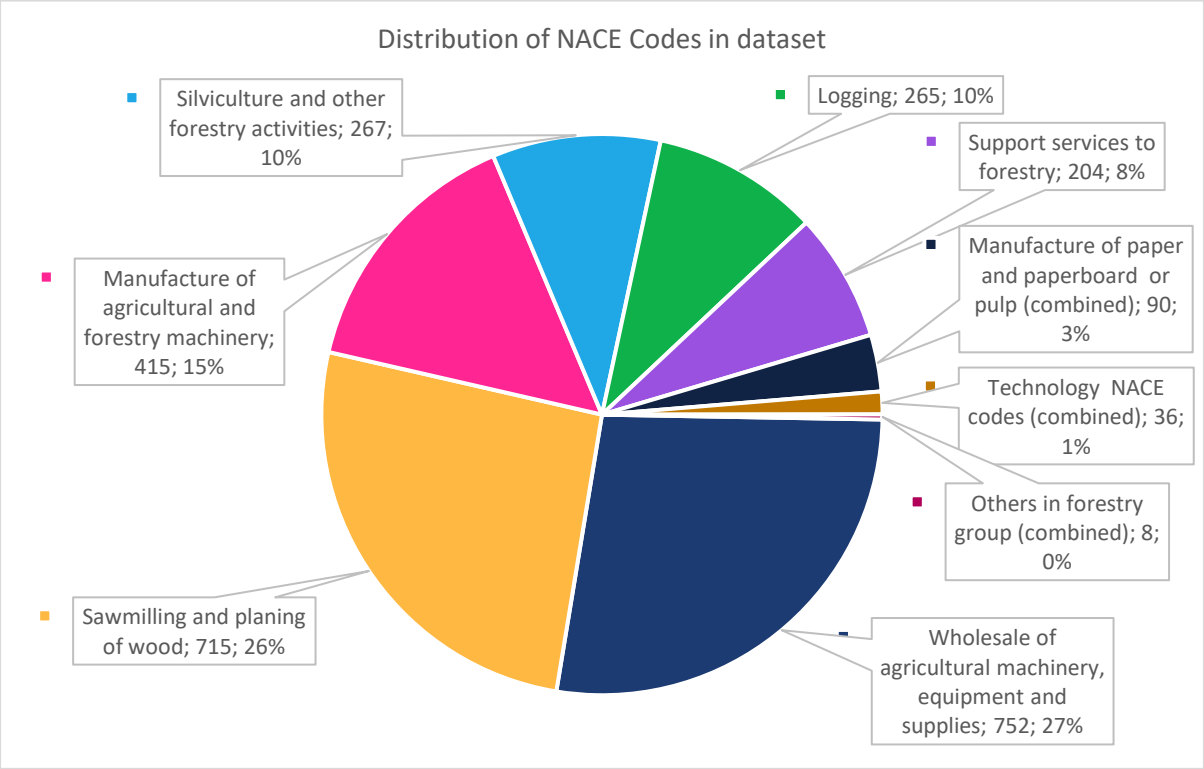


Figure D1 Distribution of NACE codes in the total dataset.

Number of companies by country in the datasets

The following figures present an overview of how companies are distributed in different countries by dataset.

In the forestry group dataset, 16% of companies are from Germany, 9% from Sweden, 8% from Poland and Finland, and 7% from Spain and Italy. A total of 23 countries is represented, with companies from other countries each accounting for 5% or less (Figure D2).

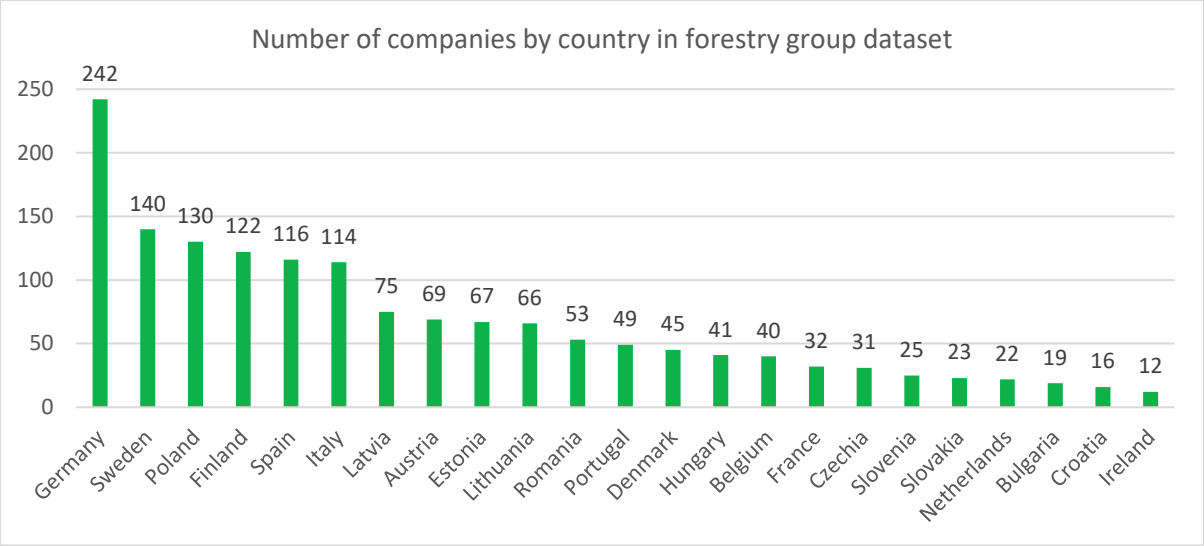


Figure D2 Distribution of companies by countries in the forestry group dataset.

The technology company dataset includes companies from 13 countries. Of these, 25% are from Germany, 17% from Finland, 14% from Belgium, and companies from the remaining countries each account for 8% or less (Figure D3).

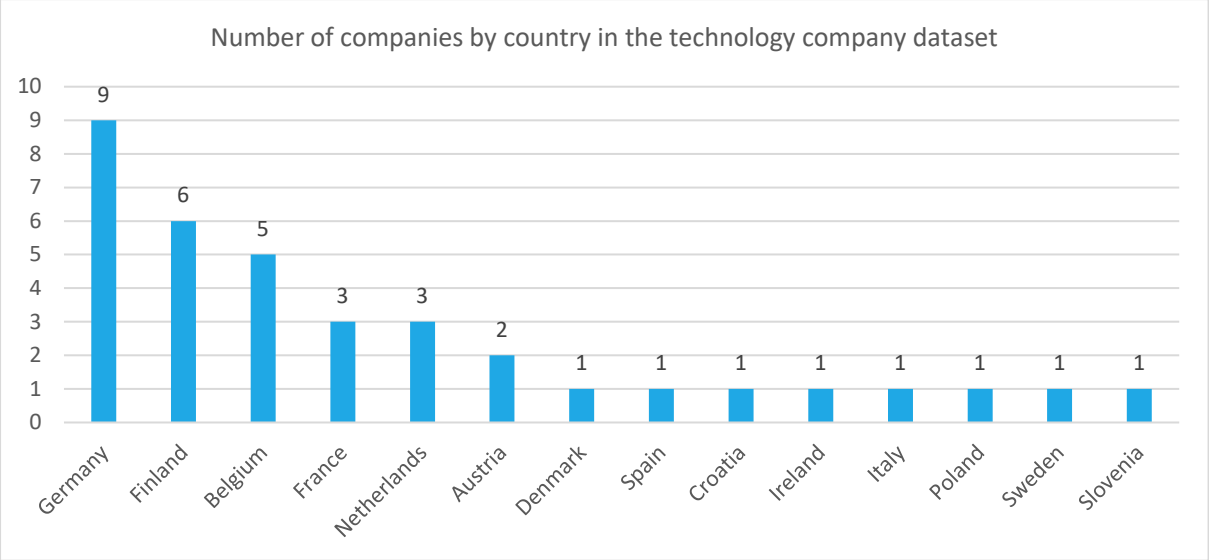


Figure D3 Number of companies by country in the technology company dataset.

The forestry machinery dataset includes companies from 24 countries. Of these, 26% are from Italy, 11% from Germany and 10% from Poland and Spain, and companies from the remaining countries each account for 6% or less (Figure D4).

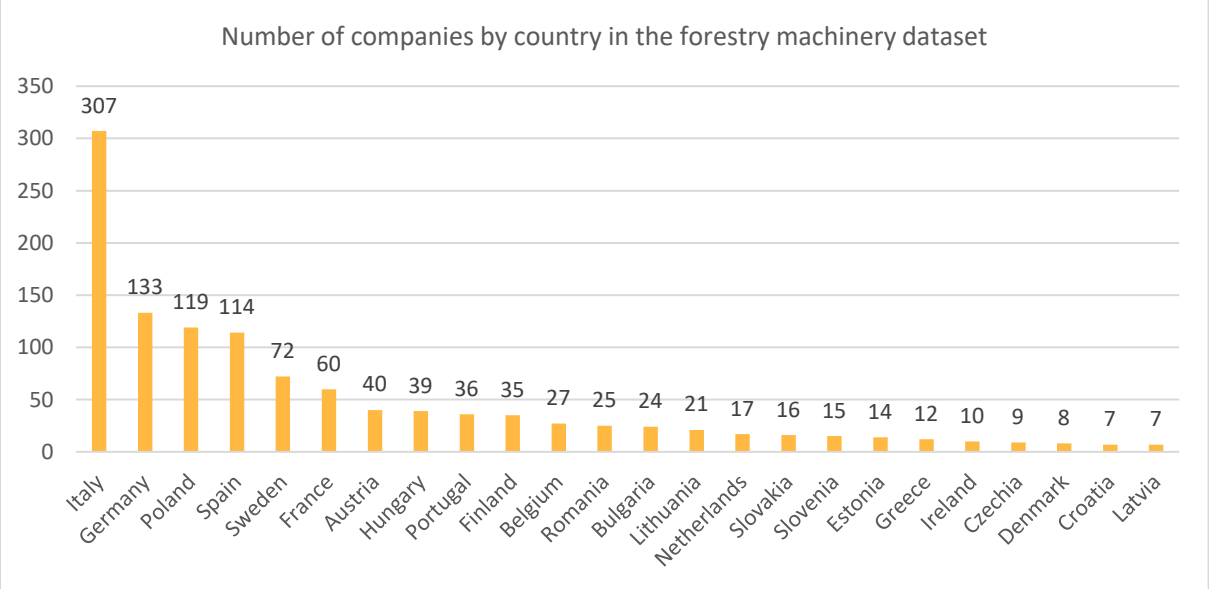


Figure D4 Number of companies by countries in the forest machinery dataset.

General information

Here, we present general information about the total dataset to provide an overview of the collected analysis results. The visualisations show the distribution of companies by country, different types of stakeholders, and their primary areas of operation in forestry. This provides an overall view, while the data can also be explored by country or stakeholder type.

% of companies by country and regions of Europe

The total dataset includes 2752 companies across Europe, number of different countries being 24. Southern Europe has the largest share, with 858 companies (31%), led by Italy and Spain. Northern Europe and Western Europe are nearly equal, with 703 companies (26%) and 704 companies (26%) respectively, dominated by Sweden, Finland, and Germany. Eastern Europe has the smallest representation, with 487 companies (18%), primarily from Poland and Hungary. Figure 10 shows the distribution of companies by country, while Figure presents their distribution European regions. Detailed data are provided in Table 9.

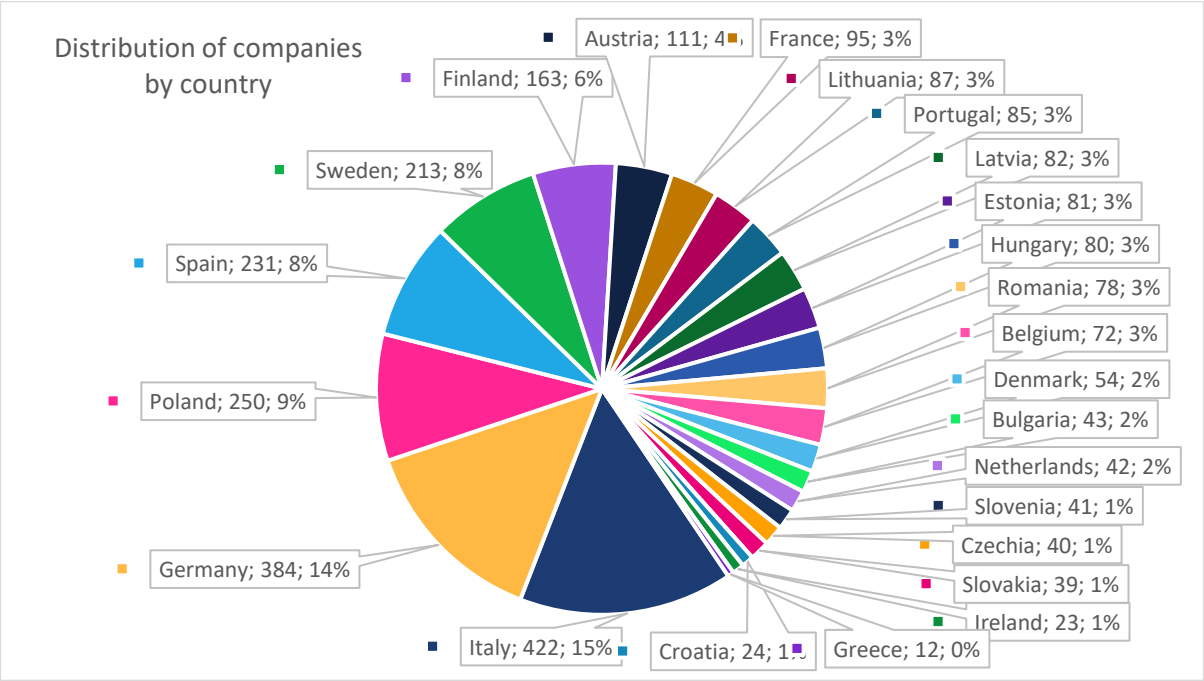


Figure D5 Distribution of companies by country in total dataset.

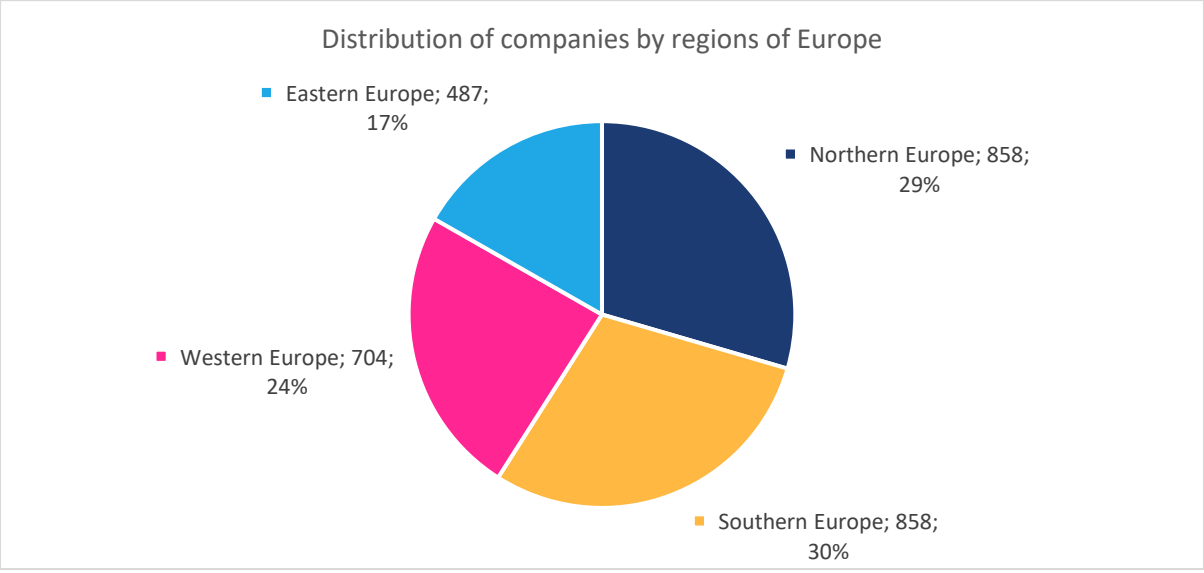


Figure D6 : Distribution of companies by regions of Europe

Table D5 Distribution of companies by country in total dataset and distribution by regions of Europe.

Northern Europe	Company count by country	% of companies
Sweden	213	7,7
Finland	163	5,9
Denmark	54	2,0
Estonia	81	2,9
Latvia	82	3,0
Lithuania	87	3,2
Ireland	23	0,8
Total	**703**	**26**
Southern Europe		
Italy	422	15,3
Spain	231	8,4
Portugal	85	3,1
Greece	12	0,4
Croatia	24	0,9
Slovenia	41	1,5
Bulgaria	43	1,6
Total	**858**	**31**
Western Europe		
Germany	384	14,0
France	95	3,5
Belgium	72	2,6
Netherlands	42	1,5
Austria	111	4,0
Total	**704**	**26**
Eastern Europe		
Poland	250	9,1
Hungary	80	2,9
Romania	78	2,8
Czechia	40	1,5
Slovakia	39	1,4
Total	**487**	**18**
Total all	**2752**	**100**

Primary area of operation in forestry

The survey question and how it was designed as a prompt for the AI analysis is shown below.

Survey question: Primary area of operation in forestry
Prompt: *Identify the organization's primary area of operation in forestry. Classify the organization's primary area as one of the following categories: "Reforestation", "Forest conservation - thinning, pruning, weed & pest control," "Felling," "Transportation of logs", "Non-Timber Forest Products (NTFPs)", "Forest Fire Management," "Forestry inventory and mapping", "Wildlife management" or "Other." Provide both the selected primary area and a detailed explanation of why this area was chosen. If the primary area is "Other," provide a detailed description of what this organization's primary area of operation in forestry entails. If no relevant information is available regarding the query, respond with "No information". Return the information in the following format:* *{* *"prim.forest": "The selected primary area",* *"prim.forest.description": "Detailed explanation of why this area was chosen"* *}* *If there is no relevant information, respond with:* *{* *"prim.forest": "No information"* *}*

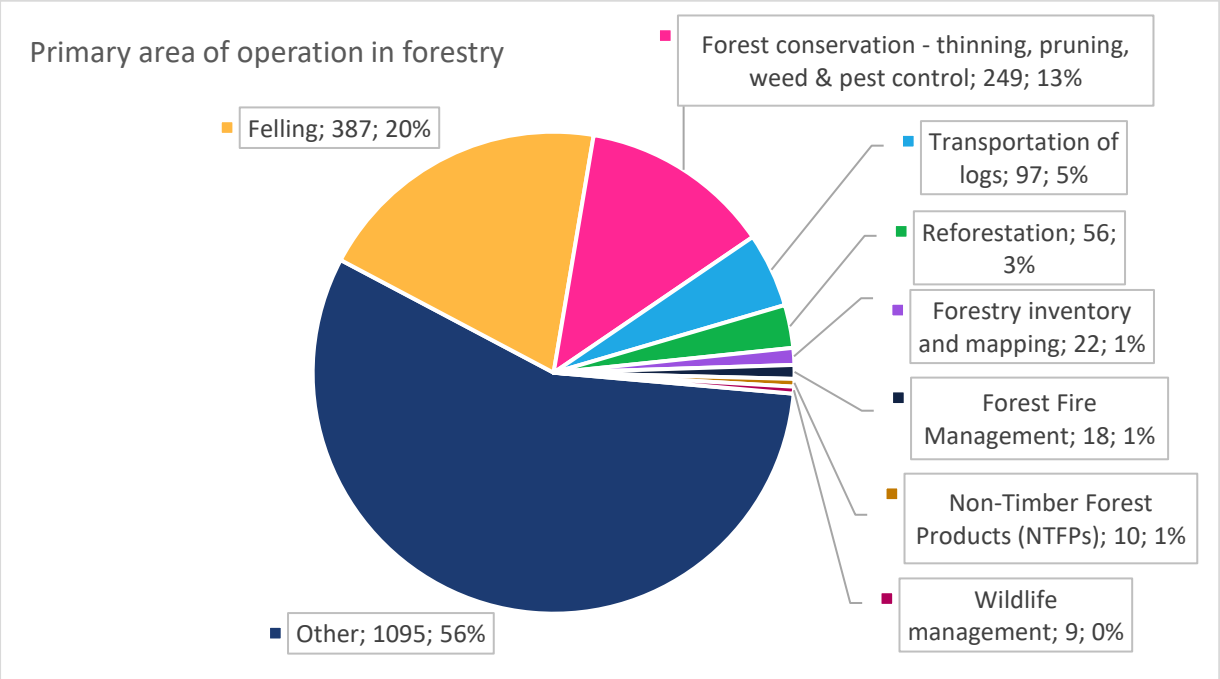


Figure D7 : Distribution of companies by primary area of operation in forestry in the analysis results (N= 1868 companies).

A total of 1868 companies provide information about primary area of operation in forestry. The remaining 884 companies had no relevant information on their websites. In some cases, a company was classified to more than one primary area. The results are visualised in Figure

16. Most companies fall under 'Other' (56%) regarding their primary area of operation in forestry. Analysing the descriptions within the 'Other' category may reveal more information. Among the specified activities, felling (20%) and forest conservation tasks such as thinning, pruning, and pest control (13%) are the most common. Smaller shares are involved in log transportation (5%), reforestation (3%), and specialised areas like forestry inventory, fire

The table below presents a detailed analysis of the effectiveness of answer retrieval across various queries in the analysed dataset.

code	query	Has information Count	No information Count	Has information %	No information %
type	Type of stakeholder:	2685	67	98	2
GM02	What type of governance model do you operate under?	2227	525	81	19
type.developments	What type of developments do you anticipate in the near future?	2056	696	75	25
prim.forest	Primary Area of Operation in forestry	1868	884	68	32
digitech.userneeds	To what extent do digital technologies meet evolving user needs within your organization?	1751	1001	64	36
DSDF8.11	What do you do with this data?	1670	1082	61	39
social.impact	What is the overall social impact of adopting digital technologies?	1578	1174	57	43
Dmdsp7.9	How do these practices contribute to or impede the overall effectiveness of technology adoption?	1535	1217	56	44
Dmdsp7.2	What type of data sharing practices related to digital technology does your organisation use?	1487	1265	54	46
adopt.level.tech	What is the adoption level of these technologies?	1403	1349	51	49
DSDF8.8	What type of data do you receive or provide?	1336	1416	49	51
GM04	Are there regulatory considerations influencing the governance of digital technology adoption?	1143	1609	42	58
Dmdsp7.3	What type of data do you collect?	1147	1605	42	58

code	query	Has information Count	No information Count	Has information %	No information %
itegrated.digi.tech	Has your organisation integrated digital technologies into its workflows?	1120	1632	41	59
DSDF8.7	Where do you receive data from and how much?	1126	1626	41	59
DSDF8.12	To who and where do you send derived information or data?	1068	1684	39	61
facilitate.expansion.upgrade	What would help facilitate the expansion/upgrade of digital infrastructure in the future?	1029	1723	37	63
lvl.digitalisation	How would you rate the level of digitalization in your farming/forestry practices on a scale of 1 to 5 (1 being low, 5 being high)	880	1872	32	68
DSDF8.6	Do you use data analytics for decision-making?	877	1875	32	68
Dmdsp7.6	Do you share this data?	805	1947	29	71
goals.to.adopt	Were there specific goals or challenges that prompted the adoption of digital tools?	727	2025	26	74
digitech.costsavings	Have digital technologies resulted in cost savings or increased efficiency?	675	2077	25	75
adv.tech	What are the advantages of the used technologies? - Selected Choice	660	2092	24	76
job.creation	How have digital technologies impacted job creation?	660	2092	24	76
prim.function.tech	What are the primary functions of these technologies in the agriculture or forestry value chain?	612	2140	22	78
digitech.sustainability	Have digital technologies contributed to sustainability and environmental practices?	596	2156	22	78
DSDF8.10	Where and how do you store this data?	452	2300	16	84
DSDF8.2	Do you use cloud services/data centres?	412	2340	15	85

code	query	Has information Count	No information Count	Has information %	No information %
DSDF8.4	Are there economic implications associated with data flows in these sectors?	402	2350	15	85
digitech.savinginputs	Have you seen savings in inputs due to digital technologies?	393	2359	14	86
plan.upgrade.digitech	Are there plans to expand or upgrade your current digital infrastructure?	357	2395	13	87
Dmdsp7.1	Is data collected from your farming/forestry activities?	319	2433	12	88
DSDF8.5	Do data flows enhance productivity and efficiency in agriculture and forestry?	343	2409	12	88
digitech.energy.efficiency	Have digital technologies contributed to energy efficiency?	333	2419	12	88
digitech.track.sustainability	Do you use digital technologies to track and ensure adherence to sustainable farming practices and forestry activities?	322	2430	12	88
digitaltech.forestry	What type of digital technology has been used for forestry? - Selected Choice	315	2437	11	89
digitech.impacts.footprint	Have you observed positive impacts on resource conservation or environmental footprint?	299	2453	11	89
Dmdsp7.5	What type of tools or platforms do you use to collect data?	244	2508	9	91
limitations.tech	Have you encountered any perceived limitations or challenges in utilising these technologies?	224	2528	8	92
digitech.biodiversity	Have you observed any positive or negative effects on biodiversity in agricultural and forestry areas due to digital technology adoption?	189	2563	7	93
social.benefits	Have you experienced social benefits through the use of digital technologies?	144	2608	5	95

code	query	Has information Count	No information Count	Has information %	No information %
challenges.tech.adopt	Have you encountered challenges in the adoption of digital technologies?	78	2674	3	97
further.integration	Are there specific barriers hindering further integration?	47	2705	2	98
impact.digitech	What is the overall economic impact of implementing digital technologies?	51	2701	2	98
Dmdsp7.7	Do challenges exist in sharing and interoperability of agricultural and forestry data?	22	2730	1	99
Dmdsp7.4	Do you pay for this data?	5	2747	0	100