



D4.1 - Organization of Observatories – Draft 1

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	FOODSCALE HUB GREECE ASSOCIATION FOR ENTREPREUNERSHIP AND INNOVATION ASTIKI MI KERDOSKOPIKI ETAIREIA	FSH	EL
5	LE EUROPE LIMITED	LEE	IE
6	DAHEIM CORNELIA	FI	DE
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8	EIGEN VERMOGEN VAN HET INSTITUUT VOOR LANDBOUW- EN VISSERIJONDERZOEK	EV ILVO	BE
9	INSTITUTO NAVARRO DE TECNOLOGIAS E INFRAESTRUCTURAS AGROALIMENTARIAS SA	INTIA	ES
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11	TEKNOLOGIAN TUTKIMUSKESKUS VTT OY	VTT	FI
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Glossary of terms and abbreviations

List of Abbreviations and Acronyms	
AI	Artificial Intelligence
AR	Augmented Reality
APIs	Application Programming Interfaces
DIHs	Digital Innovation Hubs
DTDDs	Digital technologies and data-driven solutions (DTDDs)
EU	European Union
GIS	Geographic Information System
GPS	Global Positioning System
IoT	Internet of Things
LLMs	Large language models
ML	Machine Learning
MMFT	Market Monitoring & Forecasting Tool
SMEs	Small and Medium-sized Enterprises
UAV	Unmanned Aerial Vehicles
WP	Work Package

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Executive Summary

This document represents the first deliverable (D4.1) of Work Package 4 (WP4) within the 4Growth project. It describes the conceptualization of the 4Growth observatory ecosystem, presents the initial portfolio of stakeholders and delineates the planning for the first wave of data collection. This sets the groundwork for subsequent data collection and analysis.

The conceptual framework of 4Growth is illustrated in Figure S1, depicting markets for digital technologies and data-driven solutions (DTDDs) as dynamic arenas shaped by supply and demand interactions that are influenced by institutional frameworks. Digital observatories serve to observe, interpret, and act upon market dynamics, guided by a defined data grid facilitating data collection and dissemination. In alignment with 4Growth goals, observatories extend beyond end-user adoption observation, engaging key value chain actors such as digital infrastructure operators and data providers.

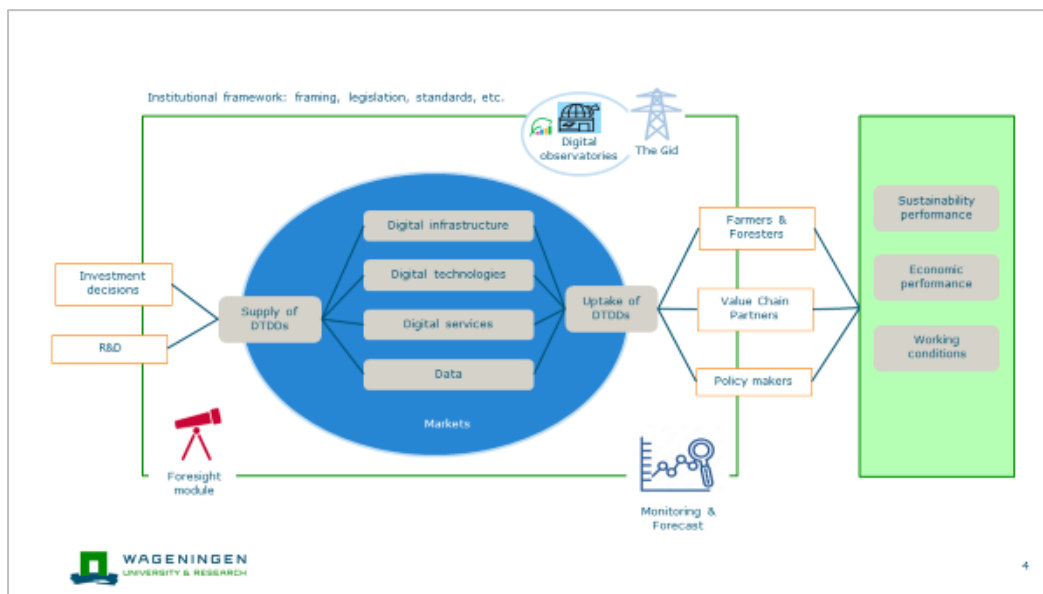


Figure S1: Conceptual framework and positioning of 4Growth observatory

The current observatory ecosystem comprises eight observatories, each dedicated to monitoring specific business ecosystem, digital innovation ecosystem, and data ecosystems. These observatories function as central hubs for planned surveys and other data collection methods to generate data and information, which is then utilized in forecast and foresight modules. Together, these interconnected components form a dynamic ecosystem essential for understanding and managing digital agriculture and forestry. Observatories play a pivotal role in gathering comprehensive data on digital technology adoption and its impact, informing strategic decisions and policy formulation in the agriculture and forestry sectors.

This document is the first deliverable of the task “Organizing 4Growth Observatory”. The organization and planning activities of this task will then be reported in two subsequent versions of D4.1 in M13 (D4.2) and M22 (D4.3), outlining the planning for waves 2 and 3 respectively.

1. Introduction

This section provides an overview of the 4Growth project, focusing on its background and objectives. The aim of this section is to highlight the project's key points for the reader to understand how the task of organizing the 4Growth observatory fits within the overall project's objectives.

1.1. Background

In the contemporary landscape of agriculture and forestry, the promise of digital technologies and data-driven solutions (DTDDs) stands as a beacon of potential transformation. Digital innovations offer the promise of enhanced sustainability, economic performance, and working conditions within these critical sectors. Although the potential and promises of DTDDs are widely acknowledged, policymakers and other stakeholders frequently lack comprehensive and timely insights into their adoption and impact in agriculture and forestry. Currently, there is no established 'observatory' capable of providing instant status updates as desired. This dearth of insight may impede the uptake and scaling of promising digital solutions.

1.2. Objectives

The project 4Growth 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).

The objectives of WP4 are to:

- organize an array of distributed observatories across technologies, subsectors, and regions
- analyze the framework conditions, technical aspects, governance models, socio-economic benefits and data sharing practices associated with the adoption of digital agriculture & forestry
- build synergies with other key European initiatives through which further data can be analysed and outcomes of the project can be sustained
- produce policy recommendations for governance actors and best practice guides for value chain actors to encourage the adoption of digital technologies.

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 observatories will be mobilised in three distinct "investigation waves", each lasting 9 months (1 month preparation, 6 months data collection, and 2 months data analysis). In addition to maintaining the portfolio of entities/individuals and all associated metadata, this task will set out the planning of observatory data collection activities. It will also seek to facilitate the expansion and incorporation of new stakeholders into each observatory ecosystems.

The establishment of observatories is necessary for the work in task 4.2 to begin. The observatories are necessary for the continual "ground truth" data collection to analyse innovative approaches to market monitoring in task 2.4.

This deliverable (D4.1) documents the first consolidated portfolio of stakeholders and data collection planning for Wave 1. The organization and planning activities of this task will then be reported in two subsequent versions of D4.1 in M13 (D4.2) and M22 (D4.3), outlining the planning for waves 2 and 3 respectively.

2. Organization of the observatories

2.1 Conceptual framework & positioning of 4Growth observatories

The conceptual framework for understanding 4Growth is visualized in Figure 1. Markets for digital technologies and data-driven solutions (DTDDs) can be seen as the dynamic playing field of the supply and demand of DTDDs by various actors, influenced and influencing the institutional framework in which the actors operate. The digital observatories serve to observe, interpret and act upon the state of play of the markets. The observatories are guided and supported by the 'grid' (Task 2.1) that defines the data and information to be collected and passed on to other modules that monitor, forecast and provide foresight.

In alignment with the goals 4Growth, the observatories extend beyond the observation of end-user adoption. Recognizing the integral role of digital infrastructure in facilitating the flow of data and the operational efficiency of digital technologies, this approach encompasses a comprehensive engagement strategy. This strategy not only targets end-users but also embraces other key value chain actors, including data infrastructure operators and data providers. Digital infrastructure operators play a pivotal role in enabling the connectivity and interoperability essential for the effective functioning of digital solutions within agriculture and forestry sectors. By engaging with these stakeholders, the observatories aim to gain insights into the existing infrastructure landscape, identify areas for improvement, and foster collaborations to enhance data accessibility and reliability. Furthermore, collaboration with data providers enriches the observatory ecosystem by expanding the breadth and depth of available data sources. Leveraging partnerships with data providers enables access to diverse datasets, ranging from environmental sensors to market transactions, thereby enriching the analytical capabilities of the observatories. Incorporating digital infrastructure within the organizational framework of the observatories underscores the commitment to holistic data-driven insights. By fostering synergies with infrastructure operators and data providers, the aim is to fortify the foundation upon which the observatory ecosystem thrives, ensuring robust data collection, analysis, and dissemination mechanisms.

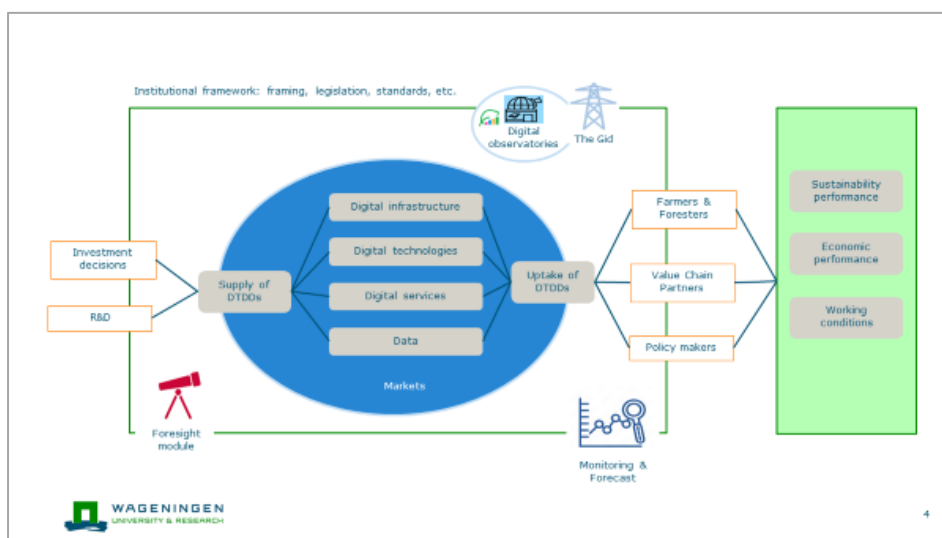


Figure 1: Conceptual framework and positioning of 4Growth observatory

Following this conceptual framework, the observatory ecosystem, together with the grid, plays a key role in the web of interactions between the physical environment of agriculture and forestry and the monitoring and forecasting systems. Figure 2 illustrates the interactions.

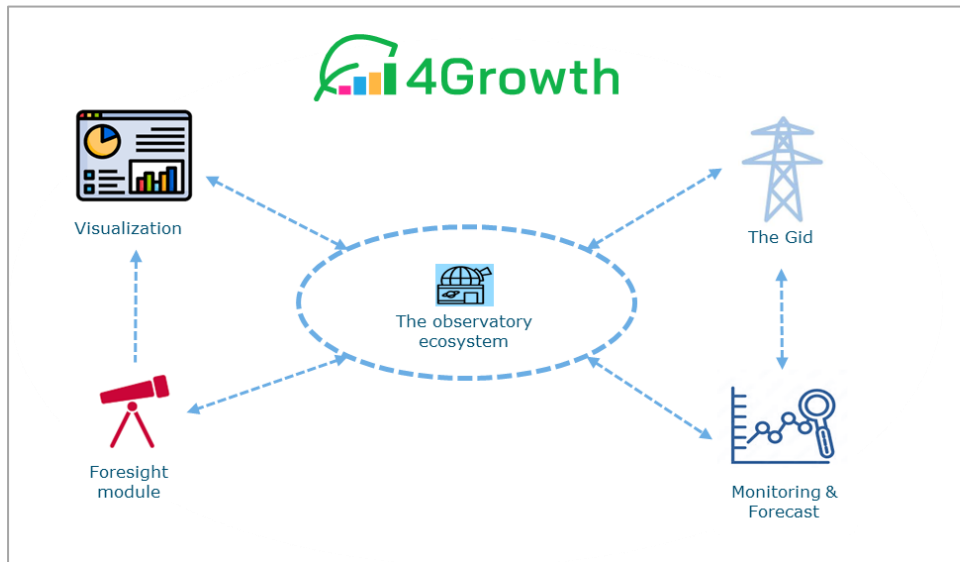


Figure 2: Interactions between different 4Growth modules

2.2 Functionality of observatories and the observatory ecosystem

Currently, the observatory ecosystem consists of 8 observatories, each with its own business ecosystem, digital innovation ecosystem and data ecosystems. The observatories serve as the primary data collection hub through planned surveys and other data-gathering methods to generate data. This data is then fed into forecast modules to generate predictive models, offering insights into future market conditions. These modules, in turn, provide valuable feedback to both the observatory and the grid, enabling continuous refinement and optimisation of the entire system. Together, these interconnected components form a dynamic ecosystem that plays a crucial role in understanding and managing markets for digital agriculture and forestry.

Observatories serve as pivotal hubs for gathering, analysing, and disseminating data on the adoption and impact of digital technologies within the agriculture and forestry sectors. They are designed to capture a comprehensive view of current states and emerging trends, thereby informing strategic decisions and policy formulations.

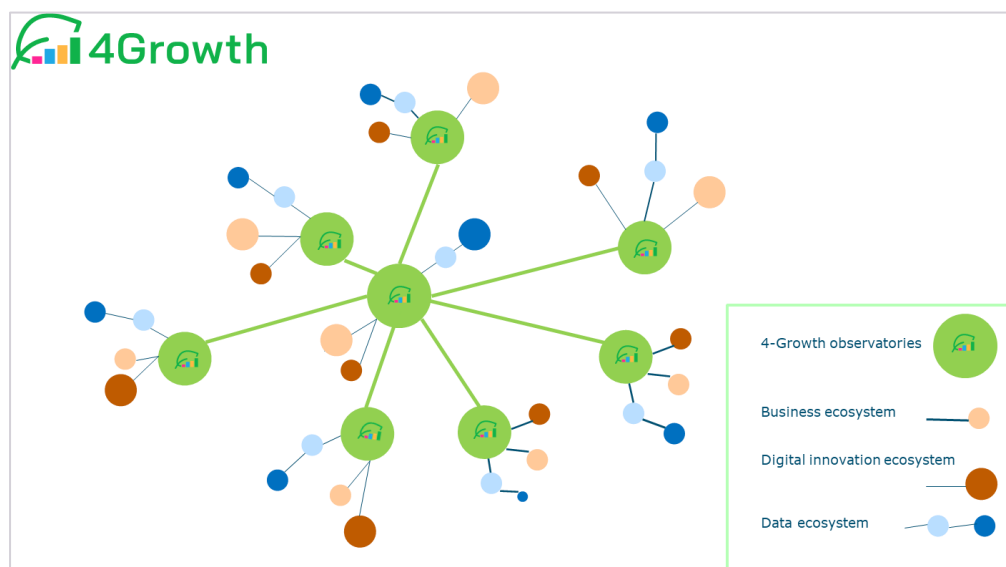


Figure 3: The 4-Growth observatory ecosystem

2.3 The observatory ecosystem

The premise of 4Growth observatory is based on existing experiences in organizing data hubs, data spaces and other data sharing initiatives as illustrated in Figure 4 for the Netherlands. This figure is developed to show the diversity and connectedness of different communities around digital technologies and data-driven solutions. The ambition is to develop or organize similar ‘observatories’ in different EU regions (e.g., Benelux, Mediterranean, Scandinavian.), see the list of potential networks in Annex D. The 4Growth observatory ecosystem in the EU is visualized in Figure 5.

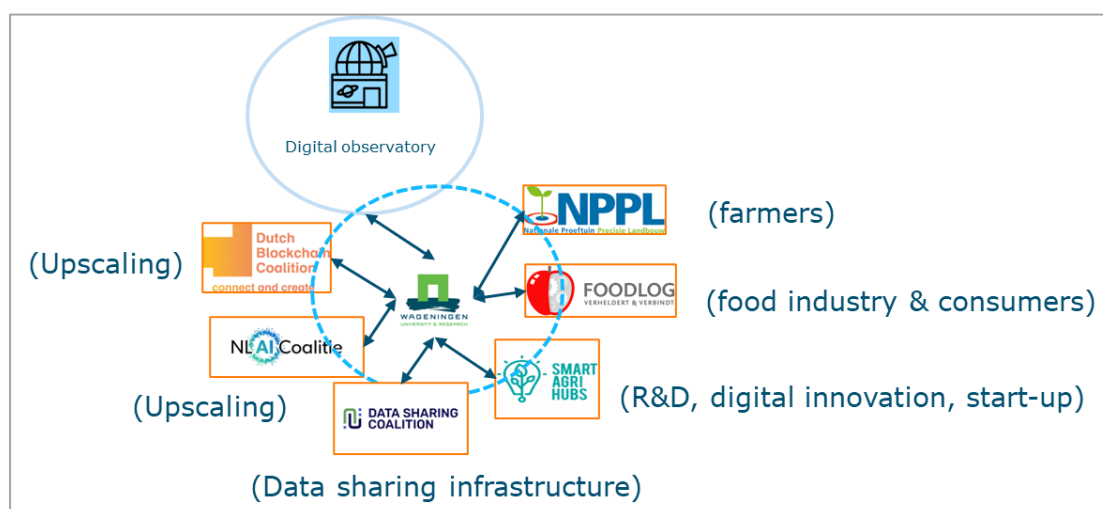


Figure 4: Illustration of the 4-Growth observatory in the Netherlands

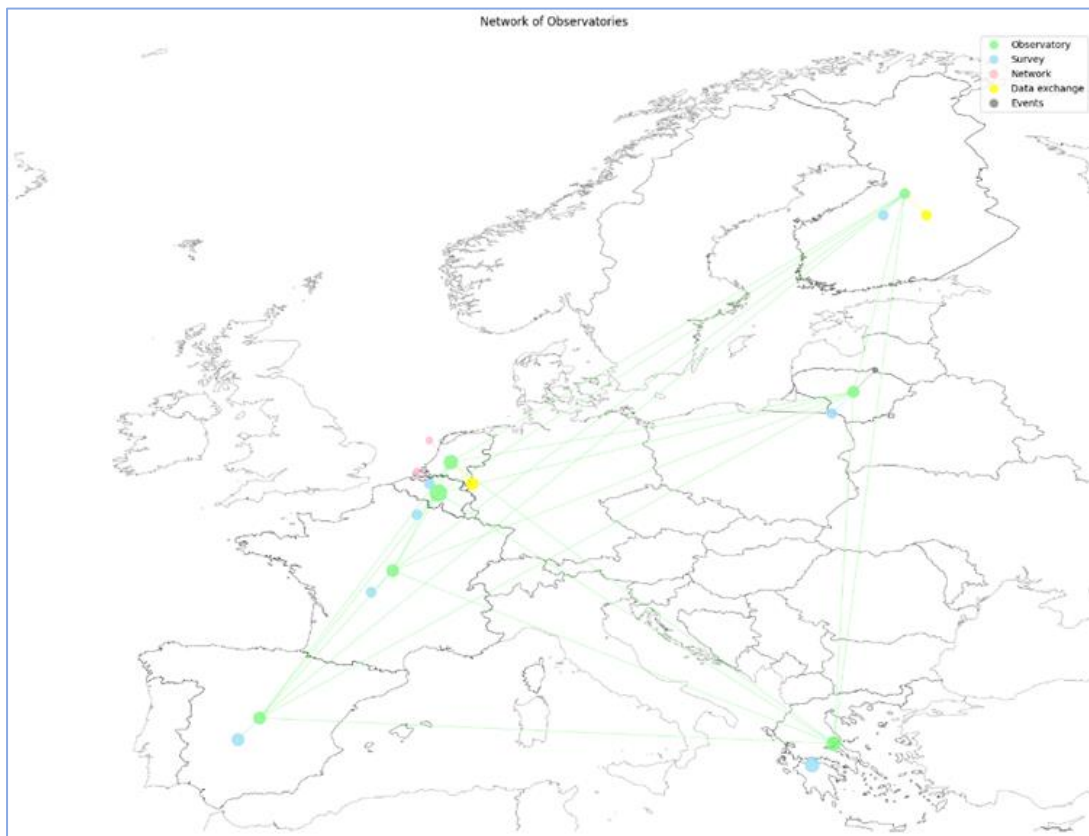


Figure 5: *The 4Growth observatory ecosystem in the EU*

2.3.1 The business ecosystem

A business ecosystem of the observatory refers to the interconnected network of organizations, suppliers, customers, competitors, and other stakeholders within a specific industry or market segment covered by the observatory. It encompasses the relationships and interactions among these entities, as well as the broader economic, social, and technological factors shaping their environment.

In the business ecosystem, organizations collaborate, compete, and co-evolve to create value for customers, drive innovation, and sustain their competitive advantage. This ecosystem extends beyond individual farms or foresters to include policy makers, industry associations, educational institutions, and other entities that influence the dynamics of the DTTDs market. Successful business ecosystems foster trust, transparency, and collaboration among participants, enabling them to adapt to changing market conditions, exploit new opportunities, and collectively address industry challenges.

2.3.2 The digital innovation ecosystem

A digital innovation ecosystem is a dynamic network comprising individuals, organizations, and institutions collaborating to develop, adopt, and leverage digital technologies to drive innovation and create value within a particular industry or region. It encompasses a range of actors, including entrepreneurs, researchers, investors, policymakers, and users, who interact through various channels such as research collaborations, funding mechanisms, and knowledge sharing platforms. This ecosystem fosters a culture of experimentation, agility, and

collaboration, facilitating the rapid ideation, development, and deployment of digital solutions to address emerging challenges and opportunities.

Key features of a successful digital innovation ecosystem include supportive regulatory frameworks, access to funding and resources, vibrant entrepreneurial communities, and robust infrastructure for digital connectivity and skills development.

2.3.3 The data ecosystem

The data ecosystem of an observatory refers to the interconnected network of entities, processes, technologies, and regulations involved in the generation, collection, storage, analysis, and sharing of data within a specific domain or industry. It encompasses various stakeholders such as individuals, organizations, and institutions, as well as the infrastructure and mechanisms facilitating data flow and utilization.

Within this ecosystem, data is created, transformed, and utilized for various purposes, often contributing to decision-making, innovation, and value creation. Effective data ecosystems often prioritize interoperability, security, and ethical considerations to ensure the reliable and responsible use of data across the ecosystem's components.

3. Interaction with observatories

3.1 Mapping to the grid based on key attributes

The observatory ecosystem offers a wide range of possibilities for gathering data as required by the grid and other modules. In each observatory within the observatory ecosystem, stakeholders bring a diverse set of capabilities and sources of information that can be tapped into. This means that the questions in the grid should be mapped to different stakeholders, tailored to their roles and interests in the ecosystem of digital agriculture and forestry. Table 1 illustrates the potential mapping between the questions, the targeted groups, and potential sources or means for gathering the answers.

Table 1: Illustrative mapping of the grid and the observatory ecosystem.

Sample of question category	Category			
	General	Adoption of digital technologies and technology integration	Associated costs and prerequisites	Environmental and Sustainability Impact
Sample of questions in grid	Question			
	Type of stakeholder	What type of digital technology has been used for agriculture/forestry	What are the most significant costs associated with the adoption of digital technologies in your organisation	Do you use digital technologies to track and ensure adherence to sustainable farming practices and forestry activities
	Answer			

Sample of answers in grid (multiple choice, yes/no, open answer)	Farmer/Agricultural producer	Robots, sensors, GPS	Investments, running costs	Yes/no/don't know
	Farming association	ERPs, platforms	Subscription costs, wages	Yes/no/don't know
	Forestry association	Platforms, apps	Subscription costs, wages	Yes/no/don't know
	Value chain partners	Platforms, apps	Investments, wages	Yes/no/don't know
	AgTech Investors		Investments	Yes/no/don't know
Methods/Sources for gathering information	Survey, interviews	Survey, websites, interviews	Survey, interviews	Survey, websites

3.2 Data collection methods

In gathering the data and information as envisaged by the 4Growth project through the observatory, various methods can be employed, each tailored to specific needs and contexts. More specifically, WP4 foresees three types of data collection:

- Targeted surveys
- Interviews & events
- Automatic data collections.

Targeted surveys stand as a structured approach, allowing researchers to gather insights from a predetermined audience, ensuring data relevance and specificity to the research objectives. Multiple-choice questions will incorporate well-known classifications of digital technologies listed in the References and Annex C. Interviews and events provide a more interactive platform, enabling direct engagement with stakeholders to delve deeper into perspectives, experiences, and nuances that may not surface through surveys alone.

Automatic data collections leverage technological advancements to passively collect information, offering a continuous stream of data without the need for active participation from respondents. Each method contributes uniquely to the data collection process, combining breadth, depth, and efficiency to paint a holistic picture of the subject matter.

3.3 Engaging stakeholders in observatories

3.3.1 Current engagement

The current engagement of the observatory ecosystem with different stakeholders is detailed in Annex B and summarised in Table 2.

Table 2: Current engagement with stakeholders

Observatory node	Node type	Location and region coverage	Current Interactions
1	Agriculture	Netherlands (Western Europe)	Survey, network, data exchange
2	Agriculture	Greece (AUA) (Eastern Europe)	Survey, interviews, educational initiatives, joint research
3	Forestry	Greece (AUTH) (Eastern Europe)	Survey, websites, events, data exchange
4	Agriculture	France (Western Europe)	Survey, interviews, events, networking
5	Agriculture	Belgium (Western Europe)	Survey, network, data exchange
6	Agriculture	Spain (Southern Europe)	Survey, interviews, data exchange
7	Agriculture	Lithuania (Eastern Europe)	Survey, websites, events, seminars, data exchange
8	Forestry	Finland (Northern Europe)	Survey, websites, data exchange, interviews

3.3.2 Envisaged engagement

To ensure the active and sustained engagement of all stakeholders in the data collection waves of the observatories, it's crucial to adopt a multifaceted approach tailored to the diverse needs and preferences of each participant. For stakeholders who may find surveys or questionnaires unsuitable, alternative methods such as interviews, focus groups, or participatory workshops could be employed to gather insights effectively. Additionally, providing flexibility in data collection methods, such as offering online platforms, mobile applications, or even traditional paper-based forms, can accommodate varying levels of digital literacy and accessibility among stakeholders. Moreover, establishing clear communication channels and fostering a collaborative environment through regular updates, training sessions, and feedback mechanisms can promote active participation and commitment. Furthermore, the provision of necessary facilities, tools, and systems, such as user-friendly data collection interfaces, access to relevant resources and expertise, and technical support for troubleshooting, is essential to facilitate seamless engagement and collaboration with stakeholders across the observatory ecosystem.

By addressing the specific needs and preferences of stakeholders and providing the requisite infrastructure and support, the observatories can ensure a motivated and active participation throughout the data collection process.

4. Planning for data collection

This deliverable is related to several other deliverables and tasks through the grid. Under Task 4.2 there will be deliverables submitted at the end of each data collection wave that will synthesize the findings of the data collection i.e., D4.8, D4.9 and D4.10 in M12, M21 and M30.

4.1 Distributing targeted surveys

In the coming months the project team will inform relevant target groups about the surveys or interviews to gather the required information, allowing them time to prepare for either the surveys or interviews. The targeted stakeholders are identified via the grid. The grid will be finalized and then there will be two more months to distribute the survey. The waves will each last 8 months each (6 months of distribution/data collection and 2 months on synthesizing findings). The survey will be shared digitally and/or physically and will all be standardized by the grid. The final step for the respondents digitally will be an online link to the survey. For those stakeholders who cannot access the survey online, physical options will be available.

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's 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.

4.3 Automated data collection (through web-scraping)

One of the main challenges facing 4Growth is defining what exactly constitutes "digital technologies" in the context of the forestry sector. This ambiguity complicates the process of identifying relevant stakeholder groups. To address this issue, the project team proposes an extensive web scraping and knowledge retrieval exercise. This will involve analyzing information from firms active in the forestry sector to ascertain the extent, manner, and ways in which they disclose the use of digital technologies in their operations and services. The preliminary assessment done by VTT has identified a target sample of 100,000 firms in the EU, classified under the relevant NACE codes, as being pertinent to the forestry sector. VTT and other partners possess the necessary technology and expertise to scale up scraping and identification processes, enabling the consortium to access these companies' websites and determine the digital technologies they report using in their operations. This endeavour will enhance our understanding of digitalization's scope and penetration in the industry, complementing other metadata that VTT has collected or plans to collect.

Among the partners of WP4, VTT had previously conducted large-scale studies on similar themes for EU projects. For instance, one of the [published studies](#)¹ involved scraping data

¹ Ashouri, Sajad, et al. "Indicators on firm level innovation activities from web scraped data." Data in brief 42 (2022): 108246.
<https://www.sciencedirect.com/science/article/pii/S2352340922004486>

from over 200,000 firms in the EU and UK, focusing on high-tech and medium-tech industries, specifically their product announcements and innovations.

5. Conclusion and next steps

This deliverable outlines the key features of the 4Growth observatory ecosystem and the portfolio of stakeholders. Overall, the observatory ecosystem represents a dynamic and collaborative network for leveraging data-driven insights to understand, manage, and optimize digital agriculture and forestry markets, with the potential to drive innovation and sustainable growth in these sectors.

For the observatory ecosystem to deliver the data and information envisaged by 4Growth, it is important to align the activities in different WPs, especially, the definitions and classifications developed by the grid. In addition to surveys and interviews, it is important to incorporate innovative data collection methods such as web-scraping. In that regards, close collaboration with Task 2.4 and Task 4.2 is essential. This aspect will be elaborated in the next version of the deliverable (D4.2).

6. References

On (distributed) ‘observatories’

Digital Observatory: <https://digitalobservatory.com/>

On AgTech types:

Tech types and tools | AgTech (daf.qld.gov.au)

On classification of digital tools in agriculture:

- Moreno, José C., et al. "A pending task for the digitalisation of agriculture: A general framework for technologies classification in agriculture." *Agricultural Systems* 213 (2024): 103794.
- A white paper to classify digital tools in agriculture
<https://www.aspexit.com/wp-content/uploads/2023/01/WhiteBook-OCT2023.pdf>

On AgTech/ICT Surveys:

ATIO from FAO: <https://www.fao.org/documents/card/en/c/cc2506en>

EU ICT Survey: https://ec.europa.eu/eurostat/cache/metadata/en/isoc_e_esms.htm

On Earth Observation (EO):

EARSC Industry survey 2024

EUSPA market report 2024

On Web scraping

Ashouri, Sajad, et al. "Indicators on firm level innovation activities from web scraped data." *Data in brief* 42 (2022): 108246. <https://doi.org/10.1016/j.dib.2022.108246>

ANNEX

Annex A: Templates for observatories

General features of the observatory (node)			
Name of the observatory			
Location			
Website			
Geographic focus			
Potential coverage			
Focus sector (agriculture/forestry)			
Potential coverage			
Business ecosystem			
Key actor groups involved	Actor Group	Relation to digital agriculture/forestry	Potential Interactions
Digital innovation ecosystem (aligned with the Grid)			
Farm/forest tech			

Data exchange in value chains	
Digital providers solution	
Data infrastructure	
Data ecosystem (existing data system)	
Own data system	
Official statistics/public data provider	
Access to proprietary data sources	
Open data sources	
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Annex B: Key features of existing nodes of the 4-Growth observatory

General features of the observatory (node) – 1	
Name of the observatory	Wageningen Research
Location	The Netherlands
Website	www.wur.nl
Geographic focus	NL

Potential coverage	EU/Global		
Focus sector (agriculture/forestry)	Agriculture, Horticulture, Forestry		
Potential coverage	Environmental aspects		
Business ecosystem			
Key actor groups involved	Actor Group	Relation to digital agriculture/forestry	Potential Interactions
	Policy makers	Institutional framework	Interview
	Research institutes		Data exchange
	Farmers associations		Surveys
	Value chain partners	Requesting data/information	Surveys
	Digital technology providers	Providing smart machinery	Website
	Data service providers	Providing tech	Website
	Investors	Investment	Surveys, interviews
Digital innovation ecosystem (aligned with the Grid)			
Farm/forest tech	(Aligned with grid and Task 2.1) Precision agriculture;		
Data exchange in value chains	Data spaces, Data4Food, FoodDataQuest		
Digital solution providers	Farm Management Information System (such as AgroVision)		

Data infrastructure	
Data ecosystem (existing data system)	
Own data system	WEcR data warehouse/ innovation monitor
Official statistics/public data provider	CBS
Access to proprietary data sources	Orbis
Open data sources	
<i>Filled in by: Lan van Wassenæer</i> <i>Filled in date: 19/4/2024</i>	

General features of the observatory (node) - 2	
Name of the observatory	Geoniko Panepistimion Athinon (Agricultural University of Athens - AUA)
Location	Athens, Greece
Website	https://www2.aua.gr/en
Geographic focus	Greece
Potential coverage	Southeast Europe
Focus sector (agriculture/forestry)	Agriculture (with possible extensions to related fields like agrotechnology, sustainable farming practices, and precision agriculture)
Potential coverage	AUA might focus on a range of topics within the agriculture sector, including sustainable farming, digital agriculture, precision farming, and climate-smart agriculture practices.
Business ecosystem	

Key actor groups involved	Actor Group	Relation to digital agriculture/forestry	Potential Interactions
	Farmers and Agricultural Cooperatives	Primary stakeholders in digital agriculture, likely to engage through workshops, surveys, and field trials.	Engagements through educational initiatives, feedback mechanisms on technology effectiveness, and participatory design of digital solutions.
	Agri-Tech Companies	Providers of digital solutions and smart farming technology. Interactions could include technology demonstrations, joint research projects, and innovation forums.	Collaborative development of technologies, field testing of innovative solutions, and participation in agricultural tech expos and fairs.
	Policy Makers	Influence and shape the regulatory and support frameworks for digital agriculture through policy advisory, roundtable discussions, and dissemination of research findings.	Consultations with stakeholders, development of supportive policies and regulations, funding and incentives for digital transformation initiatives.
	Research Institutes and Universities	Engage in foundational and applied research, contributing to the advancement of digital agriculture and forestry technologies.	Joint studies, research dissemination events, workshops for knowledge transfer, and collaborative grant applications.
	NGOs and Environmental Organisations	Advocate for sustainable agricultural practices and the integration of digital solutions to address environmental challenges.	Partnership on projects aimed at sustainable development goals, awareness campaigns, and development of best practice guides.
Digital innovation ecosystem (aligned with the Grid)			
Farm/forest tech	AUA's initiatives span a wide array of smart farming technologies aimed at enhancing precision agriculture. Deployment of IoT devices for soil moisture monitoring, the use		

	of drones for crop health assessment, the application of artificial intelligence for predictive analytics on crop yields and pest management and remote sensing technologies and Geographic Information Systems (GIS).
Data exchange in value chains	AUA plays a pivotal role in projects like ROBS4CROPS, SMATAKIS, SUPPORT, QuantiFarm, CODECS, ICAERUS and DiVine, which focus on leveraging digital technologies for optimised data flow in agricultural supply chains.
Digital solution providers	In collaboration with SMEs in Greece, AUA evaluates and promotes a range of digital tools tailored for the agriculture sector. This includes comprehensive farm management software, remote sensing technologies for soil and crop health insights, and mobile applications offering agricultural advice.
Data infrastructure	Focused on building a robust infrastructure for agricultural data, AUA's efforts ensure interoperability and adherence to open standards. This involves developing centralised data platforms that aggregate information from sensors, drones, and satellites, and creating APIs and data exchange protocols to facilitate compatibility and data sharing among diverse digital tools and platforms.
Data ecosystem (existing data system)	
Own data system	Maintains a comprehensive repository of agricultural research, including studies, experiments, and findings relevant to the sector's digital transformation. Responsible for the development of project platforms.
Official statistics/public data provider	Works in collaboration with national and European statistical offices, such as ELSTAT and Eurostat, for access to agricultural data.
Access to proprietary data sources	Engages with technology providers and companies for access to specialised data, enhancing research and development efforts.
Open data sources	Utilises open data platforms extensively for agricultural research purposes, including satellite imagery, weather data, and open agricultural research databases.
Filled in by: Aikaterini Kasimati (AUA) Filled in date: 05/04/2024	

General features of the observatory (node) - 3	
Name of the observatory	Aristotelio Panepistimio Thessalonikis (AUTH)
Location	Greece

Website	https://fmrs.web.auth.gr/ , https://www.auth.gr/en/		
Geographic focus	National/Mediterranean		
Potential coverage	Southern EU		
Focus sector (agriculture/forestry)	Forestry		
Potential coverage			
Business ecosystem			
Key actor groups involved	Actor Group	Relation to digital agriculture/forestry	Potential Interactions
	Policy makers	Institutional framework	Interview, Surveys
	Research institutes		Website, Interview, Surveys
	Forest industry	Providing data, products & services	Website, Interview, Surveys
	Digital technology providers	Providing technology	Website, Surveys
	Data providers		Website
	Forestry Associations	Providing data/information	Website, Surveys
	Mediterranean Networks	Requesting data/information	Surveys
Digital innovation ecosystem (aligned with the Grid)			

Farm/forest tech	GPS, UAVs, sensors, remote sensing, satellite imagery, GIS, web portals, Decision Support Systems (DSS)
Data exchange in value chains	
Digital solution providers	
Data infrastructure	
Data ecosystem (existing data system)	
Own data system	Operational Burned Area Mapping Service (NOFFI-OBAM) – Burned area viewing service (http://fmrsvm.for.auth.gr/)
Official statistics/public data provider	<p>Eurostat: https://ec.europa.eu/eurostat</p> <p>European Forest Fire Information System – EFFIS: supports the services in charge of the protection of forests against fires in the EU and neighbour countries and provides the European Commission services and the European Parliament with updated and reliable information on wildfires in Europe. https://effis.jrc.ec.europa.eu/</p> <p>Global Wildfire Information System – GWIS: GWIS aims at bringing together existing information sources at regional and national levels to provide a comprehensive view and evaluation of fire regimes and fire effects at global level. https://gwis.jrc.ec.europa.eu/</p> <p>Earth Explorer (USGS): Online search, discovery, and ordering tool of satellite, aircraft, and other remote sensing inventories through interactive and textual-based query capabilities. https://earthexplorer.usgs.gov/</p> <p>Copernicus Data Space Ecosystem: an open ecosystem that provides free instant access to a wide range of data and services from the Copernicus services https://dataspace.copernicus.eu</p>
Access to proprietary data sources	
Open data sources	GEODATA.gov.gr (open national geospatial data & services)

General features of the observatory (node) -4	
Name of the observatory	Centre Technique Interprofessionnel des Fruits et Legumes (CTIFL)

Location	France		
Website	www.ctifl.fr		
Geographic focus	France		
Potential coverage	Europe (research networks such as Eufrin or Euvrin)		
Focus sector (agriculture/forestry)	Fruits and vegetables		
Potential coverage	Fruits and vegetables Contacts in arable crops and vineyards		
Business ecosystem			
Key actor groups involved	Actor Group	Relation to digital agriculture/forestry	Potential Interactions
	Policy makers	Institutional framework	networking, interview, surveys
	Farmers associations	Requesting data/information	Events, networking, interview, Surveys
	Value chain partners	National network	Events, networking, interview, Surveys
	Digital technology providers	National network, in some cases European providers	Interview, survey, events
	Data service providers	National network	Interview, survey, events
	Research institutes	National network European networks: Euvrin and Eufrin	Partner, surveys

	Cooperatives	Requesting data/ information	Interview, Surveys, Data exchange
Digital innovation ecosystem (aligned with the Grid)			
Farm/forest tech	GPS, Precision agriculture (Variable Rate Application, precision spraying), Crop diseases and pest detection, Productive indicators, Robotics, Innovative weeding (laser, electric, thermal), UAVs, remote sensing, disease models, mapping, innovative application techniques		
Data exchange in value chains			
Digital solution providers	CTIFL is in contact with various providers (from start-ups to agroequipment manufacturers). It is involved or in contact with interprofessional commissions or associations (CIETAP, AXEMA, Robagri.)		
Data infrastructure			
Data ecosystem (existing data system)			
Own data system			
Official statistics/public data provider	National: <ul style="list-style-type: none">- Agreste, Agreste, la statistique agricole (agriculture.gouv.fr)- Insee: Accueil - Insee - Institut national de la statistique et des études économiques EU: Eurostat, https://ec.europa.eu/eurostat/data/database		
Access to proprietary data sources			
Open data sources			

General features of the observatory (node) -5

Name of the observatory	Flanders Research Institute for Agriculture, Fisheries and Food Technology and Food Science – Agrifood technology		
Location	Burg. Van Gansberghelaan 115 bus 1 - 9820 Merelbeke - Belgium		
Website	http://www.ilvo.vlaanderen.be		
Geographic focus	Flanders in NW-Europe		
Potential coverage	EU – Global		
Focus sector (agriculture/forestry)	Agriculture, Food and Fisheries		
Potential coverage			
Business ecosystem			
Key actor groups involved	Actor Group	Relation to digital agriculture/forestry	Potential Interactions
	Policy makers	Institutional framework	Interviews, Surveys, Networking
	Research Institutes	R&D	Cooperations
	Farmers associations	End users	Events, networking, interview, Surveys
	Value chain partners	Requesting /providing information	Events, networking, interview, Surveys
	Advisors	Requesting information/ tacit knowledge exchange	Events, networking, interview, Surveys
	Digital technology providers	Providing technology, implementing innovations	Events, networking, interview, Surveys

	Investors	Investment	Events, networking, interview, Surveys
	DIHs	DIH services	Using services
	Start-up community		Events, networking, interview, Surveys
	Technology organizations		Events, networking, interview, Surveys
	Universities		
	Living Labs		
	Consumers		
	Food chain actors organisations		Data exchange
Digital innovation ecosystem (aligned with the Grid)			
Farm/forest tech	Agri and food technology		
Data exchange in value chains			
Digital solution providers			
Data infrastructure	DjustConnect/ Common European Agricultural Data Spaces (CEADS)		
Data ecosystem (existing data system)			
Own data system	DjustConnect		

Official statistics/public data provider	www.vlaanderen.be/landbouwcijfers
Access to proprietary data sources	Yes
Open data sources	https://www.vlaanderen.be/datavindplaats

General features of the observatory (node) -6			
Name of the observatory	Instituto Navarro de Tecnologías e Infraestructuras Agroalimentarias (INTIA)		
Location	Navarra, Spain		
Website	https://www.intiasa.es/web/es		
Geographic focus	Regional		
Potential coverage	Regional, National (only public data)		
Focus sector (agriculture/ forestry)	Agriculture, Horticulture, Livestock		
Potential coverage			
Business ecosystem			
Key actor groups involved	Actor Group	Relation to digital agriculture/forestry	Potential Interactions
	Cooperatives	Requesting data/ information	Interview, Surveys, Data exchange

	Farms associations	Requesting data/ information	Interview, Surveys, Data exchange
	Farmers	Requesting data/information	Interview/ Survey
	Digital technology providers	Providing smart technology	Data exchange, interview
	Policy makers	Institutional framework	Data exchange, interview
	Advisors	Requesting data/ information	Interview, Survey
	IRIS (regional Hub that belongs to the European Digital Innovation Hub)	Requesting data/ information	Data exchange
	Irrigation Communities	Requesting data/information	Data exchange
Digital innovation ecosystem (aligned with the Grid)			
Farm/forest tech	<p>Precision agriculture: GPS, VRT (variable rate technology), precision seed drill, IoT, Remote sensing, UAVS, Sentinel satellite imagery, Sensors</p> <p>Precision livestock farming: GPS, IoT, virtual fences.</p>		
Data exchange in value chains	<p>Agricultural Farm Information System (SIEX): The SIEX will be a set of interconnected databases and administrative records, with information on agricultural farms in Spain (private data, no access). SIEX will be technically and systematically interoperable with the Agricultural Farm Registers of the Autonomous Regions, the Digital Farm Notebooks and other public registers. https://www.fega.gob.es/es/content/siex</p> <p>SOA: The Agroindustrial Offer Service aims to create a greater connection between irrigated areas (farmers) and agribusiness. https://www.intiasa.es/web/es/regadios/servicio-de-oferta-agroindustrial</p> <p>Website with current information on markets by sector, events and tools to make a personalized fertilization and irrigation plan. https://www.plataformatierra.es/</p> <p>Irrigation Data: https://www.intiasa.es/web/es/regadios/recomendaciones-riego</p> <p>Early warning system platform: Web Advisory service on pests and diseases to farmers and technicians. https://estacionavisos.agrointegra.intiasa.es/portallntia.html</p> <p>A European early-warning system for wheat rust diseases (user required).). GRRC (global rust referent center) is responsible for the development and improvements of the Wheat Rust</p>		

	<p>Toolbox - together with many BGRI partners and via the RustWatch project. https://web15.agro.au.dk/WheatRustToolbox/Menu/01_Home/Home.aspx</p> <p>Advisory network for the optimal use of fertilization using precision farming: Network that belongs to the STRATUS project (Horizon Europe project coordinated by INTIA).</p>
Digital solution providers	Farm Management Information System
Data infrastructure	
Data ecosystem (existing data system)	
Own data system	<p>GEXPER (Platform to manage our trials data)</p> <p>Irrigation Database</p> <p>Early warning system platform (Web Advisory service on pests and diseases to farmers and technicians). https://estacionavisos.agrointegra.intiasa.es/portallntia.html</p>
Official statistics/public data provider	Ministry data: https://www.mapa.gob.es/es/
Access to proprietary data sources	
Open data sources	<p>Regional data:</p> <p>Agricultural price observatory (weekly updated): https://www.navarra.es/home_es/Temas/Ambito+rural/Indicadores/Observatorio.htm#header1</p> <p>Coyuntura Agraria (monthly updated): detailed information on agricultural and livestock land and production, prices, machinery, weather, crop situation and foreign trade of agricultural products: https://www.navarra.es/home_es/Temas/Ambito+rural/Publicaciones/Revistas/Coyuntura_Agraria.htm</p> <p>Early warning system platform (Web Advisory service on pests and diseases to farmers and technicians). https://estacionavisos.agrointegra.intiasa.es/portallntia.html</p>

General features of the observatory (node) - 7	
Name of the observatory	AgriFood Lithuania (LITH)
Location	Lithuania

Website	www.agrifood.lt		
Geographic focus	LT, PL, HU		
Potential coverage	Agriculture and forestry		
Focus sector (agriculture/forestry)	Agriculture		
Potential coverage	AgriFood Lithuania is a Digital Innovation Hub and Cluster that brings together major research, business and public stakeholders in Lithuania for the common pursuit of digital transformations in the agriculture, food and associated sectors. AgriFood Lithuania is active in both national and EU-level.		
Business ecosystem			
Key actor groups involved	Actor Group	Relation to digital agriculture/forestry	Potential Interactions
	Farmers associations	end users	Surveys, interviews, seminars, website
	Agri-industry leaders	technology providers	Surveys, interviews, seminars, website
	Digital technology providers	technology providers	Surveys, interviews, seminars
	Policy makers	institutional framework	Interviews
	National Clusters (same country, neighbouring areas of interest)	collaborators	Surveys, interviews, seminars, data exchange, website
	National Clusters (neighbouring countries, such as PL and HU, similar areas of interest)	collaborators	Surveys, interviews, seminars, data exchange, website
	Public institutions	enablers	Surveys, data exchange
	R&D institutions	technology developers	

	Data service providers	service providers	Surveys, website
Digital innovation ecosystem (aligned with the Grid)			
Farm/forest tech	AgriFood Lithuania has more experience as a facilitator of farm-tech, but also participates in projects dedicated to forestry tech, is a member of consortium of Forest 4.0 excellence centre.		
Data exchange in value chains	AgriFood Lithuania is facilitating international technology, competence and know-how transfer, and works in numerous (10+) Horizon Europe agrifood project consortiums in similar roles		
Digital solution providers	The role of hub and digital innovation center means that AgriFood Lithuania has current data on digital solution providers and actively promotes agrifood startups		
Data infrastructure	Not formalised, customised for client/project needs		
Data ecosystem (existing data system)			
Own data system	AgriFood Lithuania links stakeholders with local, international and cross-sector initiatives to provide all-round support in the research, development and deployment of AgriFood Tech innovations.		
Official statistics/public data provider	LT: https://osp.stat.gov.lt/ (national statistical office), https://www.vic.lt/statistine-informacija/ (aggregated information on agriculture, food, rural development and fisheries) PL: https://stat.gov.pl/en/ (national statistical office), HU: https://www.ksh.hu/?lang=en , https://www.ksh.hu/agriculture (national statistical office).		
Access to proprietary data sources	AgriFood Lithuania DIH is an important player in Lithuania's agrifood sector and can gain access to various datasets and specialised analysis of major research, business and public stakeholders in Lithuania. AgriFood Lithuania DIH gains access to similar data of other EU countries using its local (EDIH Lithuania) and EU- scale memberships s (ECCP, DIH.NET, SS4AF, EIT Food).		
Open data sources			

General features of the observatory (node) - 8

Name of the observatory	VTT Technical Research Centre of Finland (VTT)		
Location	Finland		
Website	https://www.vttresearch.com/en		
Geographic focus	Finland		
Potential coverage	Nordic		
Focus sector (agriculture/forestry)	Forestry		
Potential coverage			
Business ecosystem			
Key actor groups involved	Actor Group	Relation to digital agriculture/forestry	Potential Interactions
	Forest owners	Requesting data/information	Interview (big forest owners), survey, web site, statistics
	Associations for forest owners and other actors in value chain.	Requesting data/information	Survey, website
	Forest industry	Requesting data/information, providing smart technology	Survey, website, statistics
	Digital technology providers	Providing smart technology, machinery, mobility	Survey, website, statistics
	Online service providers (e.g.. for forest owners, forest operators)	Requesting data/information	Survey

	Forestry consultants	Requesting data/ information, providing smart technology (e.g. AFRY Smart Forestry)	Interview, survey, website
	Forestry publishers or Forestry communication networks	Requesting data/ information (e.g., Tapio Oy)	Media archive, website
	Policy makers	Institutional framework	Interview
	Environmental agencies		Data exchange
	Research institutes and research networks		Data exchange
	National and European Networks	Requesting data/ information	Data exchange, survey
	European confederations for actors in value chain		Survey, web site
Digital innovation ecosystem (aligned with the Grid)			
Farm/forest tech	SEEDForest is the business-driven open collaboration platform that marries the whole value chain of Finnish forest and chemical industry, process technology, automation, engineering and services companies together and with IT industries. https://seedforest.fi/		
Data exchange in value chains	OmaMetsä (Association for forest owners);, online service for forest owners & forest professionals, https://omametsa.mhy.fi/ eMetsä (StoraEnso)– online service for forest owners, https://emetsa.fi/ Metsään.fi , forest.fi (Suomen Metsäkeskus))– online service for forest owners and service providers. Information about your own forest, maps, information about service providers.		

Digital solution providers	Platform provider; Forestry TEP, https://f-tep.com/ , Forestry TEP is an online solution for commercial, research and public sector users to improve forest management while ensuring sustainability and carbon sequestration.
Data infrastructure	
Data ecosystem (existing data system)	
Own data system	
Official statistics/public data provider	Finland: Statistics of Finland, https://www.stat.fi/index_en.html Natural Resources Institute Finland (Luonnonvarakeskus), https://www.luke.fi/en/statistics/directory-of-statistics EU: Eurostat, https://ec.europa.eu/eurostat/data/database
Access to proprietary data sources	Statista, https://www.statista.com/ Orbis, Company data, https://login.bvdinfo.com/R0/Orbis
Open data sources	Forest Centre: Open Forest and nature information, https://www.metsakeskus.fi/en/open-forest-and-nature-information Other: European: Forest based sector technology platform, forestplatform.org Google Earth Engine Data Catalog: https://developers.google.com/earth-engine/datasets

Annex C: Digital technologies/meta-data/definitions

The classifications of digital technologies in agriculture and forestry will be aligned with the grid as defined in WP2. The following digital technologies are considered²:

- **Internet of Things (IoT):** This is a system of interrelated devices, computing, and digital means to transfer data independently over networks. For example, applications that record data and provide you with reports about what has been achieved.
- **Virtual reality:** An interactive computer-generated experience within a simulated environment using visuals and sound. In many cases users wear goggles in a three-dimensional, computer-generated environment.

² Source: [Tech types and tools | AgTech \(daf.qld.gov.au\)](https://daf.qld.gov.au/tech-types-and-tools)

- **Augmented Reality (AR):** This technology superimposes a computer-generated image on a user's view of the real world in real time to provide a composite view.
- **Cloud Computing:** On demand computer resources, accessing real-time file sharing and collaboration via the cloud.
- **Intelligent apps:** Applications that learn from user inputs to improve the user's experience.
- **Big data:** Very large data sets that are too complex for traditional data analysis and processing, and can be used in modelling, such as weather predictive models.
- **Robotics:** Technologies using mechanical options to substitute for human actions. For example, automated robotic harvesters that seek out and pick fruit and vegetables.
- **Robots:** Robots are self-contained electronic, electric, or mechanical devices programmed to perform discreet tasks, often automatically and intelligently. For example, a palletising robot stacks cartons.
- **Autonomy:** Technology that can function without being told what to do. For example, driverless tractors, cultivators, sprayers and harvesters.
- **Artificial intelligence:** A range of technologies that allow machines to perform tasks and make decisions which normally require human intelligence. This includes robotics, machine learning (ML), speech recognition and other technologies like remote monitoring of crops.
- **Sensors:** A device that measures or detect changes in its environment to present data for decision making. This information can deliver benefits through improved crop and livestock yields; reduced wastage and livestock mortality; automation of farm operations; and maintenance or labour cost savings. Sensors may measure soil moisture/nutrition, weather data and water storage levels.
- **Blockchain:** A distributed secure database, a digital ledger that provides a way for value to be permanently recorded with the product or output. This 'value' also applies to an agricultural commodity, where the whole supply chain is transparent and interacts. Blocks store unique information on transactions in the supply chain to improve efficiencies and build confidence.
- **5G Technology:** Fifth-generation mobile technology, builds on the current 4G network, but increases connection speeds and lowers time delays.
- **Global Positioning Systems (GPS):** This is a satellite-based navigation system that utilises orbiting satellites to reference your position on earth. Used in precision agriculture for automated steering in tractors.
- **Geographical Information System (GIS):** A computer system that captures, stores, checks and displays data in relation to positions on earth's surface. It creates a visual representation of data and performs spatial analysis in order to make informed decision making. For example, to automate the application of fertilisers and seed in precision agriculture.

Annex D: List of stakeholders in the observatory ecosystem

Name	Type	Country	Relationship to 4Growth Observatory partner
AgriDataCube	Hub	The Netherlands	WR- host of the hub
SmartAgriHub	Network	The Netherlands	WR- coordinator of the hub

<u>NPPL</u>	Ecosystem	The Netherlands	WR- coordinator of the ecosystem
<u>Dutch Blockchain Coalition</u>	Association	The Netherlands	WR- strong contact with the association
<u>Farm Accountancy Data Network (FADN)</u>	Network	The Netherlands	WR- member of the network
<u>Ministry of Agriculture, Nature and Food Quality</u>	Ministry	The Netherlands	WR – has strong professional contacts
<u>Robagri</u>	Association	France	CTIFL - Member of the association
<u>UMT ECOTECH</u>	Network	France	CTIFL - has strong professional contacts
<u>FNPF - Fédération nationale des producteurs de fruits</u>	Association	France	CTIFL - FNPF contributes CTIFL research
<u>Légumes de France</u>	Association	France	CTIFL - contributes to CTIFL research
<u>Réseau DEPHY</u>	Network	France	CTIFL – lead of DEPHY vegetable network
<u>Pegasus</u>	Cooperative	Greece	AUA - Projects: ROBS4CROPS, SMATAKIS
<u>Nileas</u>	Cooperative	Greece	AUA - SUPPORT (Horizon) IOF2020
<u>ELGO-DIMITRA</u>	Research Inst.	Greece	AUA - National Projects: DiVine
<u>SEEDForest</u>	Network	Finland	VTT - Network is established and lead by VTT
<u>FinnCERES</u>	Ecosystem	Finland	VTT - The ecosystem is coordinated by VTT
<u>Finnish Forest Industries</u>	Association	Finland	VTT - has strong professional contacts
<u>Finnish Forest Association</u>	Association	Finland	VTT - has strong professional contacts
<u>FTP</u>	Ecosystem	Europe	VTT - has strong professional contacts
<u>Ministry of Agriculture and Forestry of Finland</u>	Ministry	Finland	VTT - has strong professional contacts
<u>International Association for Mediterranean Forests (AIFM)</u>	Association	Mediterranean	AUTH - Members of AUTH's FMRS laboratory
<u>EARSeL</u>	Network	Europe	AUTH - FMRS laboratory is a member
<u>European Forest Institute (EFI) / EFI's Mediterranean Facility</u>	Research Inst.	Mediterranean	AUTH - FMRS laboratory has collaborated with EFI in several European projects.
<u>MedRIN</u>	Network	Mediterranean	AUTH - Members of AUTH's FMRS laboratory

<u>CIHEAM</u>	Research Inst.	Mediterranean	AUTH - Members of AUTH's FMRS laboratory
<u>INRAE</u>	Research Inst.	France	AUTH - AUTH has liaison with units of INRAE
<u>General Directorate of Forests and Forest Environment</u>	Policy maker	Greece	AUTH - AUTH's FMRS laboratory is a permanent collaborator with the Greek Central Forest Service
<u>si-Cluster</u>	Cluster	Greece	AUTH - FMRS laboratory is a member
<u>DjustConnect</u>	Public/private cooperation	BE,NL, FR	ILVO - is part of the steering board/hosts platform
<u>WALLeSmart</u>	Project	Belgium	ILVO - Data exchange and networking partner
<u>ODYC</u>	SME	Belgium	ILVO - Close cooperation with the CC ILVO
<u>Wallonia Digital Farming</u>	Public org.	Belgium	ILVO - Close cooperation with the CC ILVO
<u>Smart Digital Farming</u>	Public org.	Belgium	ILVO - Close cooperation with the CC ILVO
<u>Boerenbond</u>	Non-profit	Belgium	ILVO - part of an ILVO project
<u>Agoria</u>	Non-profit	Belgium	ILVO - Close corporation in projects and advisory
<u>Agribusiness club</u>	Non-profit	Belgium	ILVO - Networking partner for Business project
<u>Experimental Poultry Center</u>	Research Inst.	Belgium	ILVO - Direct contact with farmers,
<u>Hooibeekhoeve</u>	Research Inst.	Belgium	ILVO - Direct contact with farmers
<u>Cooperativa Cerealista Valdorba</u>	Cooperative	Spain	INTIA - belongs to the INTIA advisory network
<u>Sociedad Cooperativa Agraria Orvalaiz</u>	Cooperative	Spain	INTIA - belongs to the INTIA advisory network
<u>AFNA</u>	Association	Spain	INTIA - belongs to the INTIA's Consultive Advice
<u>DIH IRIS</u>	Hub	Spain	INTIA - participates as research center
<u>Protected geographical indications</u>	Initiative	Spain	INTIA - carries out controls/inspection for PGIs
<u>LITMEA</u>	Association	Lithuania	LITH – Close collaboration between clusters
<u>National Paying Agency</u>	Governmental agency	Lithuania	LITH - Collaboration on the ongoing European project BEATLES

<u>Innoskart Cluster</u>	Cluster	Hungary	LITH - Collaboration on the SUAVE Eurocluster
<u>HPC4Poland EDIH</u>	Hub	Poland	LITH – Close collaboration between clusters
<u>Smart Food Cluster</u>	Cluster	Lithuania	LITH – Close collaboration between clusters