D 6.1 – Case studies planning and evaluation strategy

Submission date: 30 April 2025

Due date: M16 (April 2025)

DOCUMENT SUMMARY INFORMATION

Grant Agreement No	101136583		
Full Title	AN INTEGRATED APPROACH TO ENHANCE FOOD SYSTEMS RESILIENCE, ADVOCATING FOR FOOD SECURITY AND UNINTERRUPTED FOOD SUPPLY		
Start Date	01/01/2024	Duration	42 months
Deliverable	D 6.1 – Case studies planning and evaluation strategy		
Work Package	WP6 – Co-creation, testing, scaling-up and evaluation of project's innovations		
Type	R	Dissemination Level	PU
Lead Beneficiary	EMP		
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This project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No. 101136583

DOCUMENT HISTORY

Version	Date	Changes	Contributor(s)
0.1	24/02/2025	Table of contents, chapter 1	EMP
0.2	14/03/2025	First draft of chapters 2, 4	EMP
0.3	09/04/2025	First draft of chapters 3, 5, 7	EMP
0.35	15/04/2025	Scenarios' update based on partners' feedback Refinement of the evaluation strategy Deliverable polishing	EMP
0.4	23/04/2025	Deliverable sent for review	EMP, GL, LAUR
0.5	29/04/2025	Consolidation of review comments	EMP
0.6	30/04/2025	Sent to the coordinator for submission	EMP
1.0	30/04/2025	Submission Version	ED

About SecureFood

The European Union's (EU) Farm to Fork strategy, the Biodiversity strategy, and the European Green Deal lay down necessary actions that set a long-term vision for how to change how we produce, distribute, and consume food.

In response to these ambitious aims, SecureFood adopts an integrated systems-thinking approach that acknowledges and embraces the complexity of the food supply chain, including all the actors, elements, processes, activities, infrastructure, and essential services of importance in the production, distribution, and consumption of food to maximize the food supply chain resilience.

SecureFood aims to create an ecosystem of scientific knowledge, collaborative processes, and digital tools that will provide evidence-based indications of the risks and vulnerabilities of the different food value categories in other geographies to safeguard food security and ensure that a secure and resilient food supply chain is assured.

The two crucial pillars of the program are the Food Systems Resilience Management Framework with connected resilience and sustainability orientations, as well as a Resilience Governance Framework that draws upon all of the collaborative principles and guidelines of the successful cooperation between the food supply chain stakeholders, which will be created, tested and demonstrated in real life case studies. These two frameworks will function as applicability and sustainability mechanisms for organizing and adopting the project's results by applying the developed scientific knowledge and enhancing the food system's resilience at different levels.

The ambition of the program consists of four critical dimensions, which are: 1) the evolution of scientific knowledge and development of the exploratory approach, combining research approach methods that facilitate the risk identification process; 2) the successful safeguarding of the food supply by framing the system resilience and broadening its lens, as well as by assessing and measuring it through a holistic approach which goes beyond national borders and strategies; 3) the acceleration of the transformation of the food systems network, which can be achieved by applying a systematic agency driven collaborative governance approach; 4) and finally, the application of innovative scientific knowledge with the use of advanced digital tools, which will contribute to the successful collection and processing of data sets from several platforms to reshape and redesign the food system trajectory.

The methodology employed in this program is based on three foundational and interconnected pillars: the scientific knowledge (existing and developing), the collaborative principles which are dynamically integrated into the methodology, and the development of digital solutions that will cover all parts of the project (forecasting, statistical analysis, etc.)

PROJECT PARTNERS

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List of Abbreviations and Acronyms

Acronym	Meaning
AI	Artificial Intelligence
D	Deliverable
DoA	Description of Action
DT	Digital Twin
EDRPOU	Unified State Register of Enterprises and Organizations of Ukraine
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
EWS	Early Warning System
FLW	Food Loss and Waste
FSRM	Food System Resilience Management
ID	Identification
IEP	Information Exchange Platform
IT	Information Technology
KPI	Key Performance Indicator
M	Month
OD	Observatory Dashboard
RASFF	Rapid Alert System for Food and Feed
T	Task
UC	Use Case
WP	Work Package

Executive Summary

The SecureFood project aims to demonstrate, test and validate its frameworks, models and digital tools (hereinafter referred to as the SecureFood solutions) through 4 case studies, each focusing on distinct food value chains and geographical areas: the grain supply chain in Ukraine, the fruits and vegetables in Portugal, the fish and aquaculture in Greece and Belgium, and the milk and dairy in Greece and Finland. Considering that, the ultimate goal of the present deliverable D6.1 is to define a concrete plan for organizing the pilot activities and establish a detailed evaluation and validation strategy for assessing the effectiveness of the SecureFood solutions.

Anchored in SecureFood's overarching objective of fostering innovation through an incremental, co-creation approach, 4 distinct pilots were scheduled to facilitate the iterative co-development cycle. The first 3 pilots will be conducted remotely, while the final will be held in person, fostering deeper interaction and enabling external stakeholder involvement. Each pilot iteration includes end-users' training, SecureFood solutions' demonstration and testing through realistic scenarios, and structured evaluation and validation from end-users and technical partners. The resulting feedback will inform technical partners in refining and adapting their solutions prior to subsequent pilot testing rounds. This cyclical approach supports continuous improvement and ensures that the solutions remain closely aligned with food supply chain realities and user expectations.

Realistic scenarios, designed to address both short- and long-term food security challenges, will guide the demonstration and testing activities. These scenarios reflect the unique characteristics, vulnerabilities, and specificities of each pilot case study. Through questionnaires, detailed consultations and workshops with both end-users and technical partners, the main characteristics and challenges of the pilot case studies were defined and the most suitable solutions for enhancing food security and strengthen food systems resilience were specified. The consultation phase resulted in 6 realistic pilot scenarios that will steer the testing and demonstration activities.

Moreover, D6.1 defines the steps to assess the technical performance of SecureFood and evaluate its acceptance among stakeholders in the food sector throughout each pilot iteration. To evaluate the SecureFood solutions, end-users will complete a detailed evaluation form designed to capture their perspectives on the solutions' effectiveness. In parallel, technical partners will use a dedicated evaluation matrix to assess how well the developed solutions address each user requirement. The validation activities will be based on the Key Performance Indicators (KPIs) previously defined in other project tasks, and will offer a clear assessment of the performance and overall effectiveness of the SecureFood ecosystem from a technical perspective.

To support meaningful stakeholder engagement in the pilot activities, tailored training sessions will be delivered in advance of each demonstration. Combining remote and on-site formats, these sessions will familiarize participants with the SecureFood solutions, enabling more effective use and richer, experience-based feedback during evaluation.

The pilot activities will be implemented under Tasks 6.2, 6.3, 6.4, and 6.5, with their outcomes comprehensively documented and analysed in D6.2 and D6.3.

1 Introduction

1.1 WP6 Objectives and Tasks

This deliverable is part of SecureFood Work Package (WP) 6, titled "Co-creation, testing, scaling-up and evaluation of project's innovations". WP6 focuses on the practical implementation, testing and validation of the SecureFood ecosystem in different case studies, through realistic scenarios that reflect the unique challenges of each case study. Additionally, WP6 aims to train end-users, equipping them with the necessary knowledge to effectively engage with the SecureFood solutions. By following structured planning and evaluation guidelines, WP6 will assess the performance and efficiency of the SecureFood solutions, ensuring their reliability and effectiveness in enhancing food security and supply chain resilience.

- **T6.1. Case studies planning and evaluation strategy:** This task focuses on planning the implementation, evaluation, and validation of the SecureFood ecosystem. Realistic scenarios that reflect the unique aspects of each case study are defined, while the most suitable methodologies, models, and tools that will be demonstrated in the 4 pilot cases are specified. The SecureFood user and system requirements, along with the KPIs developed during the WP2 activities, are core components of the evaluation strategy enabling the assessment of solutions' technical performance, user acceptance, and impact on food security and system resilience. Additionally, training sessions are organized to support stakeholders in executing their test cases effectively.
- **T6.2. Case study 1 – Grain, T6.3. Case study 2 – Fruits and Vegetables, T6.4. Case study 3 – Fish and aquaculture products, T6.5. Case-study 4 – Milk and dairy products:** These tasks focus on the grain value chain in Ukraine (T6.2), the fruits and vegetables value chain in Portugal (T6.3), the fish value chain in Greece and the aquaculture value chain in Belgium (T6.4), as well as the milk and dairy value chain in Greece and Finland (T6.5). The tasks aim to facilitate the co-development, customization, testing, and validation of the SecureFood solutions for the different value chains, while defining case studies' details and ensuring the successful execution of the evaluation process developed in T6.1. Additionally, they coordinate the required actions for the effective implementation of the pilot scenarios.
- **T6.6. Monitoring, evaluation, and validation of project's results – Lessons learned:** This task focuses on analysing and reporting the improvements made by the project in enhancing food security and food system resilience, compared to the baseline situation of the case studies. It is also responsible for reporting the evaluation outcomes, including performance results, feedback, conclusions, lessons learned, and identifying cross-cutting priorities across all case studies.

1.2 Purpose of the Document

D6.1, titled "Case studies planning and evaluation strategy", is the main outcome of T6.1. Its primary objective is to clearly and comprehensively plan the pilot activities and establish a concrete strategy for evaluating and validating the SecureFood solutions. The deliverable establishes the timeline of the co-creation approach, defining when piloting activities, iterative feedback loops, and solutions' refinements will take place, allowing for continuous adjustments and improvements as the project progresses. It also defines the most appropriate solutions to be tested and evaluated in each case study through realistic pilot scenarios that address the unique challenges and requirements of each food supply chain. This deliverable also details the steps for validating the technical performance of SecureFood, its acceptance by food actors as well as its efficiency in safeguarding food security and reinforcing food systems resilience.

Finally, D6.1 outlines a training plan designed to help end-users become familiar with the SecureFood solutions.

1.3 Intended Readership and Connection to Other Deliverables

This document is intended for the SecureFood consortium members, including case study leaders, technical partners and end-users who are directly responsible for evaluating the solutions. It is also relevant to external stakeholders including food supply chain actors, regulatory authorities, policymakers, IT professionals and researchers, who are interested in learning how innovative frameworks, models and tools could be applied to improve food security and food systems resilience across different value chains.

D6.1 builds upon the outcomes of WP2 activities, drawing on D2.1 (main drivers of food security per case study), D2.2 (user requirements, use cases, and KPIs), D2.3 (system requirements and architecture), and D3.1 (foresight analysis). In turn, this deliverable serves as a foundation for the development of individual SecureFood solutions, including frameworks, models, and digital tools, in WP3, WP4, and WP5. It also provides crucial guidance for D6.2 and D6.3, which will report the outcomes of the case study-related pilot activities, evaluation results, and lessons learned.

2 General Methodological Approach

The methodological approach followed for developing D6.1 aligns with the approach adopted to design the core elements of the evaluation strategy for the planning, implementation, monitoring, and evaluation of the SecureFood case studies (Figure 2.1). This approach includes the following key elements:

1. Pilots' timeline

An incremental timeline for the piloting activities was established, reinforcing the co-creation approach of SecureFood. This approach allows for ongoing refinement of the solutions through repeated testing, demonstration and evaluation. By leveraging user feedback at each stage, the solutions will be iteratively co-developed and improved, effectively addressing users' needs. The evaluation will be carried out in 4 rounds of pilot activities, with each round including end-users' training, solutions' testing and demonstration through predefined pilot scenarios, and structured evaluation and validation. Detailed information on the pilots' timeline is presented in Section 3.

2. Information collection and analysis

The definition of the evaluation strategy drew on the collection and synthesis of essential insights from the key outcomes of WP2 and T3.1. The main food security drivers impacting the SecureFood food supply chains, together with other information obtained through the ad-hoc questionnaire (reported in D2.1), provided a comprehensive understanding of the current and emerging challenges of the SecureFood case studies. Insights from the user requirements and use cases (D2.2) further enriched this understanding by highlighting the specific needs, gaps, and challenges faced by the end-users. Furthermore, the KPIs (D2.2), along with the system requirements and the architecture of SecureFood (D2.3), established a basis for comprehending the technical capabilities of the SecureFood solutions and how these could be leveraged to address the identified challenges. Finally, the outcomes of the foresight analysis performed in T3.1 (D3.1), shed light on the potential impact of future scenarios on the supply chain, identifying which aspects are most impactful to the end-users.

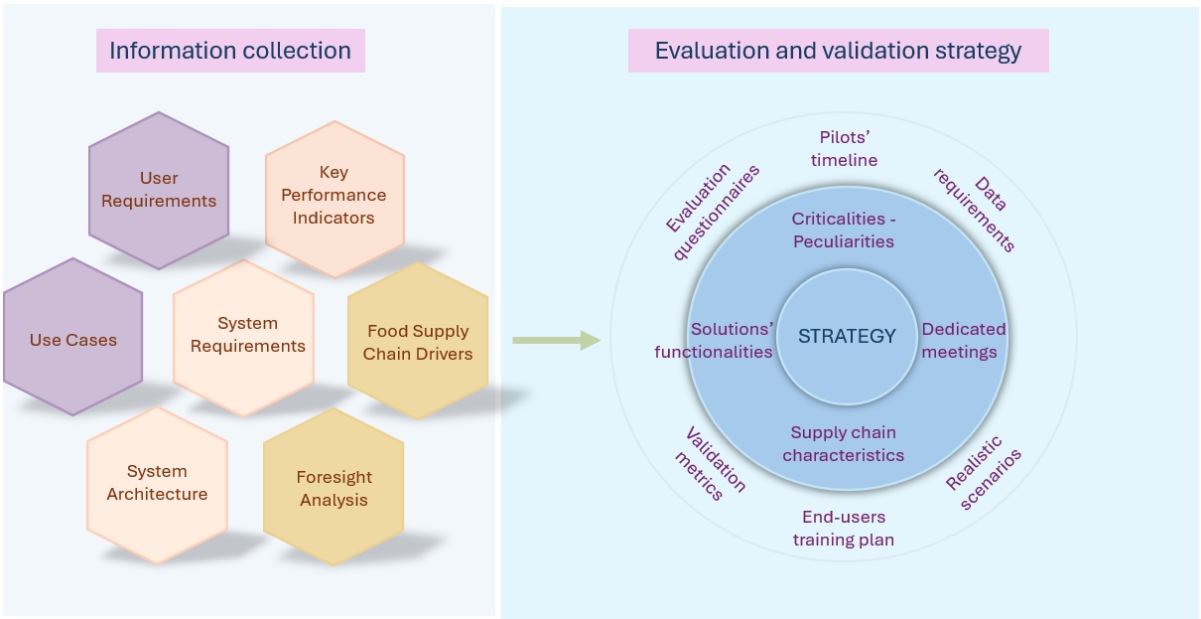

Figure 2.1 – Definition of the evaluation and validation strategy

3. End-users and technical partners consultation for scenarios co-development

Following the initial information consolidation, the next step included consultation with the end-users to prioritize their needs and capture the distinct characteristics of each case study. This process aimed at extracting valuable insights for developing realistic scenarios that will guide the pilot tests and demonstrations. Through a combination of questionnaires, targeted discussions and a physical workshop performed during the 2nd plenary meeting, the priorities, peculiarities and criticalities of each supply chain were thoroughly delineated. This approach also helped identify the most suitable methodologies, frameworks, and tools capable of addressing the specific needs of each case study, and enabled the definition of the initial pilot scenarios. Detailed information on the end-user's consultation activities is presented in Section 4.1. As a next step, co-creation sessions with both the end-users and technical partners were organized (see Section 4.2) to refine and finalize the pilot scenarios, ensuring they accurately reflect the capabilities of the SecureFood solutions while remaining as realistic as possible. Emphasis was given on capturing (through the pilot scenarios) all the functionalities offered by the SecureFood solutions and aligning the scenarios with the KPIs reported in D2.2, to enable a smooth validation process during the piloting activities. 6 pilot scenarios were developed in total.

4. Evaluation and validation of the SecureFood solutions

Each pilot iteration of solutions' testing and demonstration will be followed by the evaluation of the SecureFood ecosystem by both the end-users and technical partners. The evaluation and validation process are described in Section 6. In brief, the SecureFood end-users, as well as the external stakeholders that will be invited to attend the final pilot demonstrations, will receive a detailed evaluation form, through which they will assess the performance and effectiveness of the overall SecureFood system, as well as the individual solutions it offers. In parallel, technical partners will evaluate their respective solutions using an evaluation matrix developed based on the user and system requirements traceability matrix outlined in D2.3. In addition to the evaluation, technical partners will also validate the performance of the SecureFood ecosystem by measuring the KPIs defined in D2.2.

5. Stakeholders' training

Finally, a comprehensive training plan was created to equip both the SecureFood end-users and external stakeholders with the necessary knowledge of the SecureFood solutions prior to the pilot tests and demonstration. This preparation also ensures their active participation in the evaluation process, empowering them to provide valuable insights throughout the piloting activities. More details on the end-users' training are provided in Section 7.

3 Timeline of pilot activities

The definition of the pilot activities' schedule was grounded on the incremental, co-creation approach that underpins the SecureFood development approach. It also took into consideration the timeline of key milestones of the project (mainly milestones 3, 4, 5 and 6), the deliverables from the technical WPs (i.e., WP3, WP4, WP5), the remaining deliverables under WP6, and the integration plan defined in T5.5. As outlined in the Description of Action (DoA), the development of the solutions is divided into short increments, each one involving requirements analysis, design, testing and review. This incremental approach aims to enhance collaboration between the technical partners and end-users by allowing for continuous exchange of feedback, thereby ensuring that the SecureFood solutions evolve in direct response to the end-users' needs and experiences.

In line with this approach, after each development phase, a pilot activity will be conducted, comprising the following core elements:

- End-users training on the latest solution version,
- Solutions' testing and demonstration through the pilot scenarios,
- Evaluation and validation.

The feedback collected during each pilot activity, will serve as a key co-creation driver, guiding the ongoing customization and refinement of the SecureFood solutions and potentially leading to the identification of additional user requirements. The updated solutions will be then tested in the subsequent pilot activity, continuing this iterative, 'development-testing-review' cycle.

The timeline of the SecureFood pilot activities is presented in Figure 3.1. In total, 4 successive pilot rounds will be conducted, in M25, M28, M31 and M36, respectively. The first 3 rounds will be carried out remotely and will involve only the members of the consortium. The 4th and final round will be conducted physically and will include also external stakeholders, allowing the SecureFood ecosystem to be demonstrated to a wider community and evaluated within a broader context.

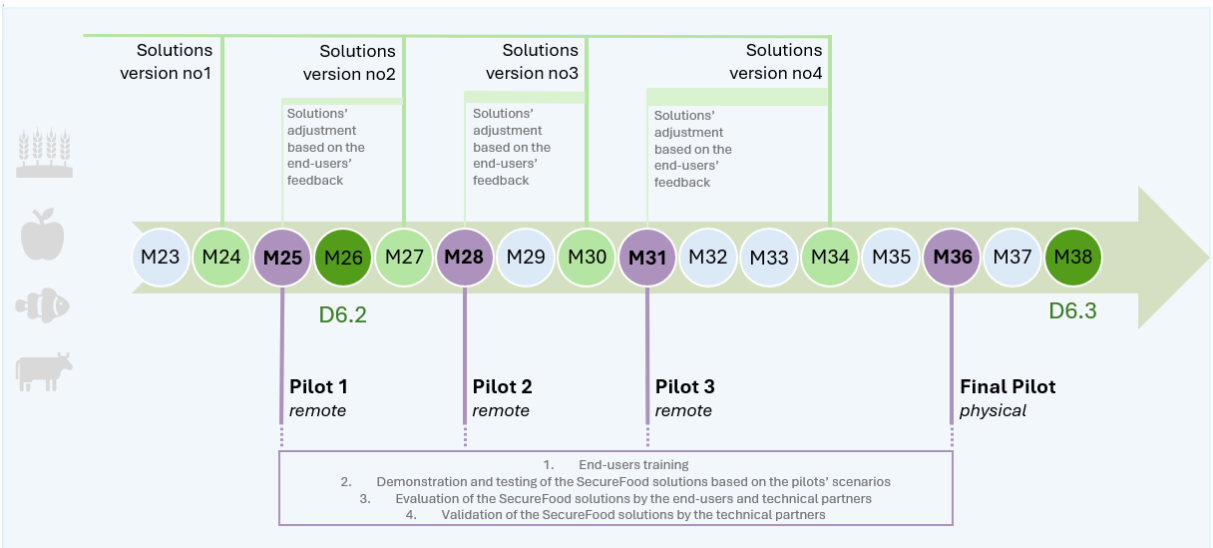

Figure 1.3.1 – Timeline of the SecureFood pilot activities

4 Consultation process for pilot scenarios development

4.1 Consultation with the end-users

As SecureFood aims to develop innovative solutions that comprehensively address the real needs of actors across the food supply chain, the active engagement of end-users was fundamental from the outset. The involvement of all relevant stakeholders, through dedicated meetings, workshops, and collaborative documentation, formed the backbone of the evaluation strategy. This stakeholder-centred approach ensured continuous feedback, the identification of critical needs, and alignment with real-world conditions.

Building on the insights gathered from the case study descriptions available in the DoA, WP2 outcomes and the initial input provided by the end-users during the 1st plenary meeting, the groundwork for shaping the SecureFood evaluation strategy was laid. These inputs helped guide the direction that the SecureFood solutions should follow, ensuring that their development remains aligned with real-world challenges, user priorities and operational conditions across diverse supply chains. All the collected information was used to design a dedicated questionnaire, which was shared with the end-users. This questionnaire outlined the primary areas of interest identified by the end-users, providing crucial guidance for the technical partners. It captured key elements such as the most relevant products within each supply chain, the specific stages where the end-users recommend focusing efforts based on available data, major food production areas, and the main vulnerabilities identified. Additionally, it provided a detailed mapping of supply chain diagrams, encompassing the various stages, modes of product transportation, and the primary stakeholders involved. Selected sections of the questionnaire are presented in Figure 4.1.1.

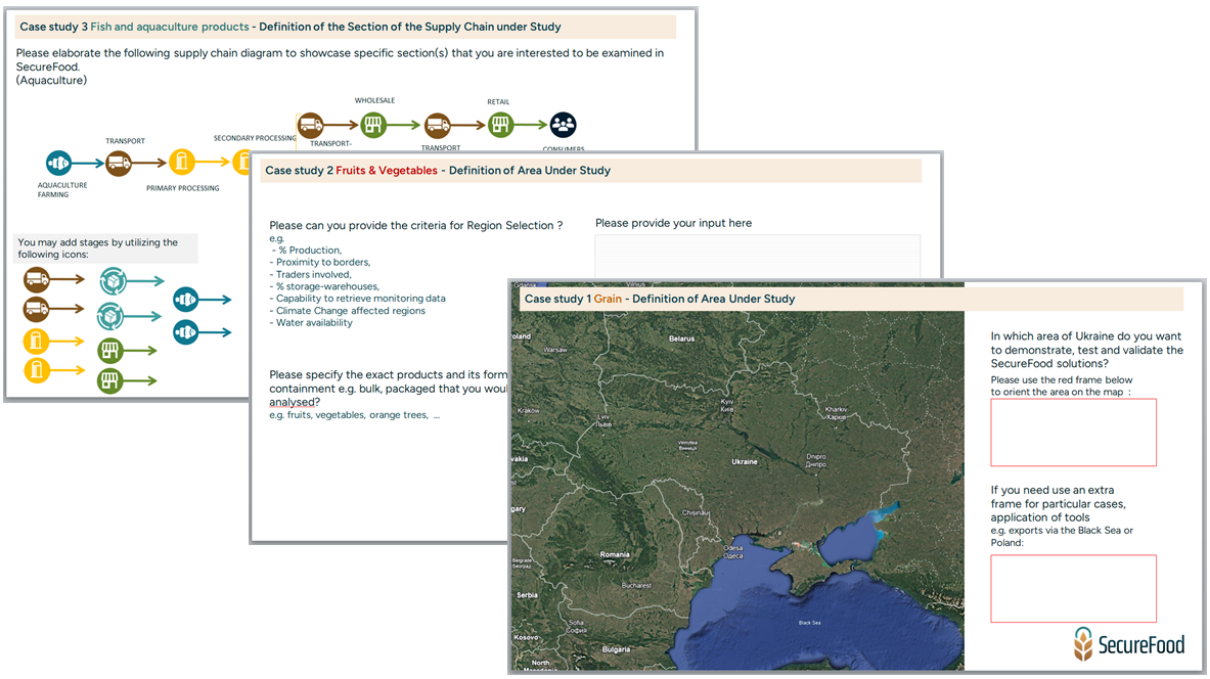

Figure 4.1.1 – Indicative sections of end-users questionnaires

The responses provided an overview of the operational context and challenges faced by each food supply chain, which were further explored through follow-up one-on-one interviews with the end-users. These interviews allowed for deeper insights into specific food supply chain characteristics, helping shape a targeted evaluation approach. As a next step, a physical workshop was held during the 2nd plenary meeting, with active participation from the end-users. This meeting focused on strengthening the connection between the peculiarities and criticalities of various food supply chains and the relevant SecureFood use cases. By providing an in-depth explanation of the solutions' functionalities and how they can be applied within different supply chains, the workshop enabled the end-users to evaluate the relevance of each solution with their case study. It also helped them articulate how these technologies could best support and enhance their operations, facilitating a shared understanding of their priorities.

Following this process, the initial version of the pilot scenarios was developed, effectively linking the real-world characteristics of the food supply chain with the capabilities of the SecureFood ecosystem. These pilot scenarios serve as a practical framework to test, demonstrate and validate how the proposed solutions can enhance food systems' resilience and food security across diverse supply chains.

4.2 Co-creation sessions with end-users and technical partners

To ensure that the SecureFood solutions are targeted and aligned with the real-world food supply chain needs, and have a future upscale and adoption potential, the initial version of the pilot scenarios was collaboratively refined through an iterative process involving both the technical partners and end-users. To do so, as a first step, the initial pilot scenarios were shared with all partners to gather comprehensive feedback. Then, remote co-creation sessions were organized for each case study, bringing together the technical partners and the specific end-users involved in that food supply chain. These collaborative sessions aimed to explore in depth how the proposed solutions could address the identified end-user needs, establish a foundational dialogue on data requirements for solutions' customization and refine the scenarios accordingly.

Based on the input collected during this phase, the pilot scenarios were revised to incorporate essential updates in both the narrative (storytelling) and the specific technical functionalities to be included in each scenario. To further support this effort, technical partners conducted follow-up one-on-one meetings with the end-users to identify the data required for customizing their solutions, as well as other key elements to be considered during the development phase. This close cooperation was instrumental in ensuring that each technical solution can be appropriately validated within the context of the pilot activities. The insights gathered from this collaborative refinement process led to the clear definition of 6 final pilot scenarios, thoroughly presented in Section 5.

Table 4.2.1 summarizes which SecureFood solutions will be applied in each pilot case study. Information on the use cases that will be tested in each case study is also provided. Although some SecureFood solutions are applied in multiple case studies, they are customized to fit the distinct characteristics and priorities of each supply chain. For instance, while the Early Warning System (EWS) is deployed in both the grain and fish pilots, it addresses different risks, draws from different data sources, and responds to diverse user needs. Moreover, it is important to note that, due to their specific nature, the SecureFood Governance and Resilience Management frameworks, as well as the Economic Modelling, will not be tested directly through the pilot scenarios. Instead, dedicated sessions will be held prior to each pilot

to demonstrate their relevance and applicability within the food supply chain, thereby supporting their subsequent evaluation.

Table 4.2.1 – Overview of the SecureFood solutions application in the case studies

No	SecureFood solution	Partner	Use case*	Grain case study	Fruits and vegetables case study	Fish case study	Aquaculture case study	Milk and dairy case study
1	Interdependencies assessment	ZLC		X	X	X	X	X
2	Risk and vulnerability assessment	DNV		X	X	X	X	X
3	Resilience assessment	LUKE	UC14					X
4	Economic modelling	NULES		X				
5	Food loss and waste modelling	GL			X		X	X
6	Supply chain modelling	ZLC		X	X	X	X	X
7	Resilience governance framework	DNV		X	X	X	X	X
8	Resilience management framework	EMP		X	X	X	X	X
9	WASTE-SEC	GL	UC15		X		X	X
10	FSRM tool	EMP	UC16		X		X	X
11	Digital Twin (DT)	IRIS	UC12	X	X	X	X	X
			UC13	X	X	X		X
12	AgriPoliS	IAMO	UC5	X				
13	3D XR-based simulator	IAMO	UC6		X		X	
			UC7		X		X	X
14	Observatory dashboard (OD)	EXUS	UC2	X	X	X	X	X
15	Early warning system (EWS)	ED	UC11	X	X	X	X	X
16	RESILOG	ICCS	UC3	X		X		X
			UC4			X		X
17	Information exchange platform (IEP)	INNOV	UC8	X	X	X	X	X
			UC9	X		X		
			UC10		X	X		X

** The use cases titles are listed in Annex D, while their content is detailed in D2.2.*

5 Pilot scenarios

5.1 Grain case study

5.1.1 Scenario background

The end-users' consultation phase (see Section 4.1) shed light on several threats and vulnerabilities that critically affect the Ukrainian grain sector. Among others, the Ukrainian grain supply chain is currently facing a range of critical challenges, primarily stemming from the ongoing war with Russia. One of the most significant disruptions is the instability in grain production and export logistics, particularly at Black Sea ports, where increased safety and quality control protocols are causing major delays. Moreover, grain prices are under pressure from volatile energy markets and rising fertilizer costs, both of which are essential inputs in agricultural production. These fluctuations directly affect farming operations and threaten the economic viability of producers. Additionally, there is a lack of real-time visibility into available grain stocks and potential shortages, which complicates decision-making for both producers and policymakers. The broader supply chain is also impacted by these disruptions, with interdependent actors, including transport operators and industrial processors, facing cascading effects that compromise efficiency and stability. These interconnected challenges pose a serious risk not only to Ukraine's food system but also to the resilience of grain supply chains across Europe and globally. The aforementioned challenges formed the foundation upon which 2 pilot scenarios (see Section 5.1.2) were built, guiding the development, testing, and validation of the SecureFood solutions.

The grain pilot activities bring together key stakeholders across the food supply chain, from agricultural producers to industrial processors and consumers. Within the consortium, UAC and UCAB represent the agricultural producers and farming enterprises, providing critical insights into primary production practices and challenges. COSMO plays a central role in the logistics segment, managing the bulk sea transportation of grain and ensuring traceability and efficiency in cross-border movement. SPES, together with its affiliated entities SETBIR, LVA, and FFDI, contributes expert knowledge from the food processing and industries, linking raw grain inputs to food products. EKP represents the consumer perspective, helping to align pilot outcomes with public expectations. In addition to these core partners, external stakeholders will also participate in the final pilot demonstration activities, offering additional expertise and ensuring that the SecureFood solution is evaluated under broader, multi-actor conditions. The invitees to the final demonstration events will be specified at a later stage.

5.1.2 Scenario unfolding

Table 5.1.1 presents the SecureFood solutions that will be applied and tested in the grain case study, while Table 5.1.2. presents the 2 pilot scenarios.

Table 5.1.1 – The SecureFood solutions applied in the grain pilot scenarios

No	SecureFood solution	Partner	Use case*	Grain case study
1	Interdependencies assessment	ZLC		X
2	Risk and vulnerability assessment	DNV		X
3	Resilience assessment	LUKE	UC14	
4	Economic modelling	NULES		X
5	Food loss and waste modelling	GL		
6	Supply chain modelling	ZLC		X
7	Resilience governance framework	DNV		X
8	Resilience management framework	EMP		X
9	WASTE-SEC	GL	UC15	
10	FSRM tool	EMP	UC16	
11	Digital Twin (DT)	IRIS	UC12	X
			UC13	X
12	AgriPoliS	IAMO	UC5	X
13	3D XR-based simulator	IAMO	UC6	
			UC7	
14	Observatory dashboard (OD)	EXUS	UC2	X
15	Early warning system (EWS)	ED	UC11	X
16	RESILOG	ICCS	UC3	X
			UC4	
17	Information exchange platform (IEP)	INNOV	UC8	X
			UC9	X
			UC10	

** The use cases titles are listed in Annex D, while their content is detailed in D2.2.*

Table 5.1.2 – The pilot scenarios of the grain supply chain in Ukraine

Pilot Scenario 1			
Steps	**Description**	**SecureFood solution**	**System response**
1	Grain prices are highly influenced by energy market trends and fertilizer costs, as both are essential inputs in agricultural production. The OD is continuously informing stakeholders on grain international market, highlighting prices and	OD	The OD presents the information in a dashboard layout and provides interactive visualizations that respond to user interactions.

	import/export trends based on data availability. Energy market trends (e.g. for oil, lubricants etc.) are also provided based on data availability.		
2	The EWS predicts an increase in energy and fertilizer prices on European markets and notifies stakeholders accordingly.	EWS	The EWS generates an alert/notification tailored to the user profile and displays it along with its criticality level and relevant details. The alert/notification also appears on the OD.
3	As a major grain producer, Ukraine will be significantly impacted by these price fluctuations. Grain prices might also be affected. The DT informs stakeholders about the interdependent actors likely to be affected by the entire situation and the ripple effects across the grain supply chain. Additionally, stakeholders receive recommendations on how to respond effectively to the situation.	DT	The DT performs the simulation and presents the results.
4	Farming businesses are impacted by the increase in prices and are seeking strategies to strengthen their resilience. They (farmers) access AgriPoliS, select relevant variables, and utilize simulation results to explore different response strategies.	AgriPoliS	AgriPoliS provides on the OD information on simulation results for the selected scenarios and indicators.
5	Additionally, they consult the IEP to ask and review best practices from other users or competent authorities.	IEP	The IEP displays the request/question submitted by the user. Another user reviews the request/question and submits their own response.

6	Grain stakeholders use the DT to assess the impact and the ripple effects of the grain price trends alongside the supply chain. They also estimate the risk level of the upcoming event, evaluate its impact on food security, and explore short- and long-term interventions to mitigate its effects.	DT Supply chain modelling Interdependencies assessment Risk and vulnerability assessment	The DT performs the simulation according to the user's input parameters and presents the results.

Pilot Scenario 2			
Steps	**Description**	**SecureFood solution**	**System response**
1	Russia's war against Ukraine is disrupting the grain supply chain, causing severe implications for global food security and market stability. To gain a clear overview of available stocks and potential shortages, the Ukrainian grain producers have been asked to report their grain stock data (e.g. region, territorial community, producer, EDRPOU code, product type, type of grain storage, class, harvest year, physical weight) using the IEP.	IEP	The IEP presents the commodity stocks reported by the grain producers, along with relevant information (e.g. region, territorial community, producer, EDRPOU code, product type, type of grain storage, class, harvest year, physical weight).
2	The EWS generates an alert/notification informing the supply chain actors about detected low grain stocks.	EWS	The EWS generates an alert/notification tailored to the user profile and displays it along with its criticality level and relevant details. The alert/notification also appears on the OD.
3	Competent authorities responsible for food security matters receive the alert, review the pre-run AgriPoliS scenarios simulations, and adopt relevant, long-term policy	AgriPoliS	AgriPoliS provides on the OD information on simulation results for the selected scenarios and indicators.

	measures for tackling the upcoming event.		
4	Using AgriPoliS, producers are informed on the simulation results (changes in the farming sector) of selected political measures and scenarios. They might use that information to adjust their strategies.	AgriPoliS	AgriPoliS provides on the OD information on simulation results for the selected scenarios and indicators.
5	The implementation of Ukraine's policy measures further strengthens safety and quality control protocols, resulting in increased delays at the country's Black Sea ports. Producers coordinate with transport operators to redirect grain shipments. The users (shippers) submit to RESILOG a request for transfer, declaring origin, destination, quantity to be transferred, ETD and ETA.	IEP RESILOG	The IEP displays the request submitted by the user. Another user reviews the request and submits their own response. Bulk vessel operators review the requests. (Vessel brokerage and booking is done offline.)
6	Industrial processors around Europe, who rely on Ukrainian grain as a key raw material, consult the DT to assess how the situation affects their operations.	DT Supply chain modelling Interdependencies assessment	The DT performs the simulation according to the user's input parameters and presents the results.

5.2 Fruits and vegetables case study

5.2.1 Scenario background

Insights gathered during the end-user consultation phase (see Section 4.1) revealed several critical challenges that could undermine the resilience and long-term sustainability of the fruits and vegetables supply chain in Portugal. The growing intensity and frequency of climate extremes, particularly prolonged droughts and heatwaves, have a profound impact on agricultural production. Persistent water stress has emerged as a key constraint, driving down productivity over time and threatening the viability of cultivation in certain regions. This environmental instability may, sometimes lead to sharp price fluctuations. Compounding these pressures is the sector's increasing susceptibility to pests and diseases, prompting a more intensive use of pesticides. Meanwhile, managing food loss and waste throughout the fruit and vegetable supply chain remains a significant concern. These challenges pose a particularly acute threat to crops of national importance, such as oranges, which are essential both for

economic output and for sustainability goals. For this reason, the pilot scenario developed for the Portuguese case study places, among others, a strong emphasis on safeguarding orange production in the face of these mounting pressures.

The pilot activities of the Portuguese fruits and vegetables case study engage nearly all key actors across the supply chain. Within the consortium, MC and MCH represent the retail sector, offering a clear and comprehensive view of retailer needs and expectations, while also providing valuable insights into the challenges and requirements faced by producers. SPES, along with its affiliated entities FIPA, FIAB, and CCIS, contributes specialized knowledge from the food processing and manufacturing industries, while EKP plays a crucial role in capturing and reflecting consumer expectations, helping to align the solution with market and societal demands. In addition to consortium members, external stakeholders will actively participate in the final pilot demonstration activities, contributing sector-specific expertise and ensuring the SecureFood solutions are tested and validated by the wider stakeholder community.

5.2.2 Scenario unfolding

Table 5.2.1 presents the SecureFood solutions that will be applied and tested in the fruits and vegetables case study, while Table 5.2.2. presents the pilot scenario.

Table 5.2.1 – The SecureFood solutions applied in the fruits and vegetables pilot scenario

No	SecureFood solution	Partner	Use case*	Fruits and vegetables case study
1	Interdependencies assessment	ZLC		X
2	Risk and vulnerability assessment	DNV		X
3	Resilience assessment	LUKE	UC14	
4	Economic modelling	NULES		
5	Food loss and waste modelling	GL		X
6	Supply chain modelling	ZLC		X
7	Resilience governance framework	DNV		X
8	Resilience management framework	EMP		X
9	WASTE-SEC	GL	UC15	X
10	FSRM tool	EMP	UC16	X
11	Digital Twin (DT)	IRIS	UC12	X
			UC13	X
12	AgriPoliS	IAMO	UC5	
13	3D XR-based simulator	IAMO	UC6	X
			UC7	X
14	Observatory dashboard (OD)	EXUS	UC2	X
15	Early warning system(EWS)	ED	UC11	X
16	RESILOG	ICCS	UC3	
			UC4	
17	Information exchange platform (IEP)	INNOV	UC8	X
			UC9	
			UC10	X

** The use cases titles are listed in Annex D, while their content is detailed in D2.2.*

Table 5.2.2 – The pilot scenarios of the fruits and vegetables supply chain in Portugal

Pilot Scenario 3			
Steps	Description	SecureFood solution	System response
1	The orange supply chain is highly vulnerable to climate extremes, as the meteorological conditions and access to water have a major impact on orange production, affecting yield, quality, and overall supply chain stability. For this reason, the OD is continuously providing orange supply chain stakeholders with updates on precipitation, temperature, and other meteorological data based on data availability. Other information (e.g. crop status, water availability, information from RASFF, etc.) relevant to the orange supply chain is displayed based on data availability.	OD	The OD presents the information in a dashboard layout and provides interactive visualizations that respond to user interactions.
2	The EWS forecasts an upcoming prolonged drought and heatwave and notifies stakeholders accordingly.	EWS	The EWS generates an alert/notification tailored to the user profile and displays it along with its criticality level and relevant details. The alert/notification also appears on the OD.
3	Through the DT stakeholders get informed about potential quality issues in the orange yield and/or quality, as the forecasted event, is expected to cause water scarcity, resulting in oranges with quality parameters different than expected (e.g. smaller caliber, lower juice	DT Supply chain modelling Interdependencies assessment	The DT performs the simulation and presents the results.

	content, and reduced sugar levels).		
4	Moreover, the DT informs stakeholders that the repeated severe droughts in the latest years are expected to impact the production and sustainability of the crop, by inducing stress in the trees and leading to strong quality changes or lower yields in the long-run, disrupting the orange supply chain. This will, among others, affect oranges imports and exports balance, and lead to prices spikes.	DT Supply chain modelling Interdependencies assessment	The DT performs the simulation and presents the results.
5	Orange producers, orange juice industries and retailers, consult the DT to assess their vulnerabilities, evaluate the impact of the upcoming incidents and identify the application of the most effective risk-reduction measures. They also get informed on the interdependent actors that may be affected and the ripple effects along the orange supply chain.	DT Supply chain modelling Risk and vulnerability assessment Interdependencies assessment	The DT performs the simulation according to the user's input parameters and presents the results.
6	Moreover, the stakeholders use the FSRM tool to estimate their resilience management maturity level and get insights into appropriate resilience-enhancement interventions.	FSRM tool	The FSRM tool provides the weaknesses and strengths with regard to resilience management and reports the assessment results to the user.

7	The prolonged water stress has already started making fruits and vegetables more vulnerable to pest attacks and diseases. To retain crops optimal growth and yield, many agricultural producers around Europe have intensified pesticide's application. Given the increased number of alert notifications on RASFF about increased pesticides in fruits and vegetables, and the subsequent products' recall, the EWS informs Portuguese industries and retailers that they should be alerted about the potential of using/selling oranges with pesticide residues above the legal limits.	EWS	The EWS generates an alert/notification tailored to the user profile and displays it along with its criticality level and relevant details. The alert/notification also appears on the OD.
8	3D XR-based simulator indicates a potential shift in consumer behaviour with individuals increasingly favouring locally produced or bio/organic products from regions unaffected by the disruption.	3D XR-based simulator	The 3D XR-based simulation results, inform the user about the potential effects on consumers' behaviour.
9	In parallel, the DT indicates that the entire situation may result in reduced product availability. 3D XR-based simulator informs stakeholders about the impact of such an incident on consumer behaviour.	DT 3D XR-based simulator	The DT informs users about the incident's impact on the supply chain. 3D XR-based simulation results, inform the user about the potential effects on consumers' behaviour.
10	Sample tests performed by industries indicate that, in some cases, pesticide residues exceed legal limits. Using the IEP they report these incidents.	IEP EWS	The IEP displays the incidents reported by industries. The information is sent to the EWS and the EWS generates an alert/notification.

	The EWS notifies stakeholders accordingly.		
11	They also ask suppliers (orange producers) to implement more rigorous and frequent testing of their produce for pesticide residues.	IEP	The IEP displays the request submitted by the user. Another user reviews the request and submits their own response.
12	Stakeholders are increasingly concerned about the escalating levels of food loss and waste. As part of their broader food waste management strategies, they employ the WASTE-SEC tool to analyse the key factors contributing to this issue.	WASTE-SEC	WASTE-SEC shows projected food security and Food Loss and Waste (FLW) levels. A list of tailored recommendations is also displayed.

5.3 Fish case study

5.3.1 Scenario background

Insights gathered during the end-user consultation phase (see Section 4.1) revealed several critical challenges that could undermine the resilience and long-term sustainability of the fish supply chain in Greece. The fish supply chain in Greece plays a crucial role in the nation's food system, supporting the economy, coastal livelihoods, and the cultural heritage of Mediterranean cuisine. However, as noted during the end-users' consultation, the sector is grappling with a growing array of challenges that threaten its stability, efficiency and long-term viability. Among others, environmental factors, including rising sea temperatures and algae blooms, are disrupting marine ecosystems, severely impacting fishing activities. These disturbances have made fishing operations more erratic, leading to unpredictable supply levels and heightened production risks. Additionally, pollution incidents, such as oil spills, sometimes lead to fish contamination, raising significant food safety concerns. The contamination risks demand more stringent monitoring and rapid response mechanisms to safeguard product integrity throughout the supply chain. Moreover, the fish supply chain is prone to logistical challenges that could disrupt the flow of goods, creating inefficiencies and jeopardizing food security. These challenges provided the groundwork for the definition of the Greek fish supply chain pilot scenario presented in Section 5.3.2.

The pilot activities of the Greek fish case study engage a broad and diverse set of stakeholders across the entire food supply chain, from primary producers and logistics providers to consumers and competent authorities. Within the SecureFood consortium, ELGO contributes essential insights from the perspective of competent authorities, while also voicing the needs and experiences of the fisheries sector. ELAF, representing the cold-chain logistics domain, brings valuable expertise in the handling and transportation of highly perishable fish products, which is critical for ensuring freshness and traceability. SPES, in collaboration with its affiliated entities FEDAL, ANIA, and SEVT, provides in-depth knowledge from the food processing and

manufacturing sectors, particularly in relation to fish and seafood products. EKP plays an essential role in representing the consumer perspective, helping to align the pilot outcomes with public expectations for food security. In addition to consortium partners, external stakeholders will also contribute to the final pilot activities, bringing domain-specific knowledge and ensuring that the SecureFood solution is validated in a wider context.

5.3.2 Scenario unfolding

Table 5.3.1 presents the SecureFood solutions that will be applied and tested in the fish case study in Greece, while Table 5.3.2. presents the pilot scenario.

Table 5.3.1 – The SecureFood solutions applied in the fish pilot scenario

No	SecureFood solution	Partner	Use case*	Fish case study
1	Interdependencies assessment	ZLC		X
2	Risk and vulnerability assessment	DNV		X
3	Resilience assessment	LUKE	UC14	
4	Economic modelling	NULES		
5	Food loss and waste modelling	GL		
6	Supply chain modelling	ZLC		X
7	Resilience governance framework	DNV		X
8	Resilience management framework	EMP		X
9	WASTE-SEC	GL	UC15	
10	FSRM tool	EMP	UC16	
11	Digital Twin (DT)	IRIS	UC12	X
			UC13	X
12	AgriPoliS	IAMO	UC5	
13	3D XR-based simulator	IAMO	UC6	
			UC7	
14	Observatory dashboard (OD)	EXUS	UC2	X
15	Early warning system (EWS)	ED	UC11	X
16	RESILOG	ICCS	UC3	X
			UC4	X
17	Information exchange platform (IEP)	INNOV	UC8	X
			UC9	X
			UC10	X

** The use cases titles are listed in Annex D, while their content is detailed in D2.2.*

Table 5.3.2 – The pilot scenario of the fish supply chain in Greece

Pilot Scenario 4			
Steps	**Description**	**SecureFood solution**	**System response**
1	Greece's fish supply chain faces significant challenges due to climate change. Concerns are rising that the increasing Mediterranean Sea temperatures will disrupt fisheries operation, since it facilitates the frequent occurrence of algae/phytoplankton blooms, especially at the most important fishing ground of Aegean Sea, the Northern Aegean Sea. The EWS leverages AI-driven satellite monitoring, detects sea temperature fluctuations, as well as important shifts in coloured dissolved organic matter, dissolved oxygen, chlorophyll and phytoplankton levels, and notifies fish supply chain stakeholders. The alerting messages are accompanied by a criticality level and suggested actions for handling the situation.	EWS	The EWS generates an alert/notification tailored to the user profile and displays it along with its criticality level and relevant details. The alert/notification also appears on the OD.
2	At early spring, many fishermen spot the initiation of algae blooms in specific areas, and report them through the IEP, enabling authorities to gain a comprehensive overview of the situation.	IEP	The IEP displays the incidents reported by fishermen. The information is sent to the EWS.
3	The EWS sends alerting messages to the fish supply chain actors about the initiation of algae bloom incident.	EWS	The EWS generates an alert/notification tailored to the user profile and displays it along with its criticality level and relevant details. The alert/notification also appears on the OD.

4	Fish supply chain actors use the DT to assess the impact of such an incident to their operations and study the implementation of countermeasures.	DT Supply chain modelling Risk and vulnerability assessment Interdependencies assessment	The DT performs the simulation according to the user's input parameters and presents the results.
5	In parallel, an oil transport accident at sea has caused a spill, posing significant pollution and fish contamination risks. The Ministry uses the IEP to inform fish supply chain actors about the incident. The EWS issues an alert/notification about the potential risk of fish contamination, and displays high-risk areas on a geographical map, helping fishermen identify the polluted zones they need to avoid.	IEP EWS	The IEP displays the information submitted by the user. Another user reviews the information and submits their own response (if needed). The EWS generates an alert/notification tailored to the user profile and displays it along with its criticality level and relevant details. The alert/notification also appears on the OD.
6	The entire situation has caused instability in the fish market and driven up fish prices. The OD continuously informs stakeholders about fish prices based on data availability.	OD	The OD presents the information in a dashboard layout and provides interactive visualizations that respond to user interactions.
7	Increased prices create a ripple effect throughout the supply chain. Food supply chain actors and the responsible authorities use the DT to study how the crisis affects interdependent fish supply chain actors, the resilience of the fish supply chain, and food security, and to make informed decisions on the countermeasures they need to implement.	DT Supply chain modelling Interdependencies assessment Risk and vulnerability assessment	The DT performs the simulation according to the user's input parameters and presents the results.
8	Advocating for fish food supply chain resilience, they ask fish supply chain	IEP	The IEP displays the request submitted by the user. Another user reviews the

	actors (via the IEP) to record fish traceability logs.		request and submits their own response (if needed).
9	Using the IEP, fishermen record details about catch location, species, time, fishing method, while cold chain transporters report shipment ID, batch number, origin/destination etc. Traceability logs are also provided by the large industries that turn raw fish into market-ready products.	IEP	The IEP presents the traceability logs reported by the fish supply chain actors, along with a reference ID and relevant information.
10	This information is available in the DT, enabling stakeholders to get dynamic view of the fish supply chain, and monitor, manage and respond to any issues.	DT	The DT represent the current state of the fish supply chain.
11	A quality check in an industry that turns raw fish into market-ready products, indicates that a batch of fish is contaminated. Using the IEP, they report the incident, and the fish supply chain actors are informed about the contaminated fish incident promptly.	IEP	The IEP displays the incident reported by the user. The information is sent to the EWS.
12	The EWS generates an alert to the food supply actors, ensuring that contaminated fish are removed from the supply chain before reaching consumers. Consumers are also informed about the contaminated batch to ensure they avoid consumption.	EWS	The EWS generates an alert/notification tailored to the user profile and displays it along with its criticality level and relevant details. The alert/notification also appears on the OD.
13	A transport operator realizes that contaminated fish is already being transported and there is a need to halt shipments and reroute deliveries, leading to delays and	RESILOG	RESILOG provides the transport operator with matchmaking route alternatives.

	logistical inefficiencies. To optimize the alternative routing schedule, they consult the RESILOG tool. Among others, the tool provides forecasted route performance for each of the alternative routes.		

5.4 Aquaculture case study

5.4.1 Scenario background

The end-users' consultation phase revealed that the aquaculture supply chain in Belgium is increasingly vulnerable to the effects of climate change, with rising temperatures and prolonged heatwaves posing major risks. Elevated water temperatures create favourable conditions for pathogen outbreaks, potentially compromising fish health, leading to contamination, and increasing mortality rates. In addition to environmental risks, the sector is highly sensitive to fluctuations in energy prices, particularly for electricity and gas, which are essential for maintaining critical systems like cooling and water circulation. As energy costs rise, the price of aquaculture products also increases, putting additional pressure on producers and further destabilizing the supply chain. Moreover, the absence of efficient waste management strategies complicates efforts to reduce food waste during crises, contributing to greater losses. The shifting dynamics in consumer behaviour (e.g. triggered by higher products' prices) could further disrupt the market, creating uncertainty about long-term demand and complicating strategic decision-making within the sector. The aforementioned challenges served as input for the development of the Belgian aquaculture supply chain pilot scenario.

The aquaculture pilot activities bring together key stakeholders from across the food supply chain, reflecting the SecureFood consortium's broad expertise and integrated approach. Within the consortium, BIGH represents the aquaculture producers, contributing essential insights into production practices, operational challenges and sector-specific needs. SPES, along with its affiliated entities FEDAL, ANIA, and SEVT, offers specialized expertise in food processing and manufacturing, ensuring that the downstream stages of the aquaculture value chain are well-represented. EKP plays a central role in capturing and addressing consumer expectations, providing valuable input on societal expectations related to quality, accessibility, and sustainability. In addition to these core consortium partners, external stakeholders will also engage in the pilot activities, contributing domain-specific knowledge and ensuring that the SecureFood solution is tested and validated in real-world, multi-actor aquaculture environments.

5.4.2 Scenario unfolding

Table 5.4.1 presents the SecureFood solutions that will be applied and tested in the aquaculture case study in Belgium, while Table 5.4.2. presents the pilot scenario.

Table 5.4.1 – The SecureFood solutions applied in the aquaculture pilot scenario

No	SecureFood solution	Partner	Use case*	Aquaculture case study
1	Interdependencies assessment	ZLC		X
2	Risk and vulnerability assessment	DNV		X
3	Resilience assessment	LUKE	UC14	
4	Economic modelling	NULES		
5	Food loss and waste modelling	GL		X
6	Supply chain modelling	ZLC		X
7	Resilience governance framework	DNV		X
8	Resilience management framework	EMP		X
9	WASTE-SEC	GL	UC15	X
10	FSRM tool	EMP	UC16	X
11	Digital Twin (DT)	IRIS	UC12	X
			UC13	
12	AgriPoliS	IAMO	UC5	
13	3D XR-based simulator	IAMO	UC6	X
			UC7	X
14	Observatory dashboard (OD)	EXUS	UC2	X
15	Early warning system (EWS)	ED	UC11	X
16	RESILOG	ICCS	UC3	
			UC4	
17	Information exchange platform (IEP)	INNOV	UC8	X
			UC9	
			UC10	

** The use cases titles are listed in Annex D, while their content is detailed in D2.2.*

Table 5.4.2 – The pilot scenario of the aquaculture supply chain in Belgium

Pilot Scenario 5			
Steps	Description	SecureFood solution	System response
1	The aquaculture supply chain is prone to climate change as it depends on stable environmental conditions for optimal fish growth and health. The OD continuously informs the supply chain actors on meteorological conditions, fish (e.g. salmon trout) price and stock availability, fish market trends, and	OD	The OD presents the information in a dashboard layout and provides interactive visualizations that respond to user interactions.

	energy (electricity, gas) market fluctuations based on data availability.		
2	The EWS notifies stakeholders about an important increase in electricity and gas prices as well as an increase in European salmon trout prices.	EWS	The EWS generates an alert/notification tailored to the user profile and displays it along with its criticality level and relevant details. The alert/notification also appears on the OD.
3	In parallel, the EWS notifies stakeholders about an upcoming, prolonged heatwave that has an increased risk of rising water temperature, favour pathogens outbreak and disrupt the operations of the aquaculture supply chain. It might also rise up aquaculture products' prices due to the increased energy demand.	EWS	The EWS generates an alert/notification tailored to the user profile and displays it along with its criticality level and relevant details. The alert/notification also appears on the OD.
4	Producers are concerned about the upcoming event and they use the DT to run simulations, estimate risks and vulnerabilities and study the most appropriate interventions.	DT Supply chain modelling Risk and vulnerability assessment Interdependencies assessment	The DT performs the simulation according to the user's input parameters and presents the results.
5	They also consult the FSRM tool to get information on how resilient they are for the upcoming heatwave.	FSRM tool	The FSRM tool provides the weaknesses and strengths with regard to resilience management and reports the assessment results to the user.
6	Their concerns and insights are shared with processors through the IEP, enabling better coordination and proactive decision-making.	IEP	The IEP displays the request submitted by the user. Another user reviews the request and submits their own response.
7	In parallel, concerned that the prolonged heatwave could, among others, disrupt cooling systems and lead to widespread	WASTE-SEC	WASTE-SEC shows projected food security and FLW levels. A list of tailored recommendations is also displayed.

	fish contamination and loss, aquaculture producers consult the WASTE-SEC tool, seeking insights into projected food waste levels and strategies for efficient waste management that minimize losses while maintaining food security.		
8	They also turn to the 3D XR-based simulator tool to get information on how a potential pathogen outbreak and prices increase in the aquaculture sector might impact the consumer behaviour in the long run, driving shifts in demand and purchasing patterns.	3D XR-based simulator	3D XR-based simulator displays the simulation results of the selected scenario to the user.
9	As a long-term solution to address both the current outbreak and future climate-related crises, producers are considering transitioning to a closed, recirculating aquaculture system. Before proceeding, they consult the 3D XR-based simulator tool to assess how consumers might respond to and accept this change, and how it could influence their purchasing behaviour.	3D XR-based simulator	3D XR-based simulator displays the simulation results of the selected scenario to the user.

5.5 Milk and dairy case study

5.5.1 Scenario background

The milk and dairy supply chain focus is placed on two distinct yet complementary production contexts, Greece and Finland, each representing a unique set of environmental, operational and regulatory conditions. Together, they offer a comprehensive perspective on the challenges for sustainable milk and dairy supply chains in diverse geographic contexts. This dual-country approach provides a valuable opportunity to assess the shared vulnerabilities and region-specific complexities within the milk and dairy supply chain, laying the groundwork for targeted strategies that enhance its efficiency, security and resilience.

Based on the feedback collected during the end-user consultation phase, the milk and dairy supply chain faces significant challenges due to climate change, which is exacerbating extreme

weather events and disrupting operations. The increased frequency of heatwaves, droughts, and snowstorms presents major risks to the availability of feed, the stability of transport systems, and the overall supply chain. This could drive up prices for consumers and potentially alter purchasing behaviour. Additionally, the disruption of road transport infrastructure caused by environmental factors sometimes makes it difficult for carriers to reach farms, processing plants, and retailers, exacerbating stock shortages and complicating logistics. Furthermore, the need to address milk and dairy products loss and waste management is a critical concern alongside the supply chain. Those challenges provided the backbone for the development of the Greek and Finnish milk and dairy supply chain pilot scenario (see Section 5.5.2)

The pilot activities in the milk and dairy sector engage a broad range of stakeholders across the food supply chain, reflecting the SecureFood consortium's extensive expertise and holistic approach. Within the consortium, ELGO and LUKE provide critical insights from competent authority perspectives, while also voicing the needs and priorities of dairy farmers. ROUS, as a key dairy producer and supplier, plays a central role in representing the production and primary distribution stages. SPES, in collaboration with its affiliated entities ANIA, SEVT, LVA, and FFDI, contributes specialized knowledge in food processing, manufacturing, and packaging, ensuring that downstream activities are effectively addressed. EKP complements these efforts by bringing forward the consumer perspective, ensuring that end-user expectations around quality, safety, and accessibility are considered. External stakeholders, alongside the core consortium, will join the final pilot demonstration, adding expertise and aiding in broader validation of the SecureFood solutions.

5.5.2 Scenario unfolding

Table 5.5.1 presents the SecureFood solutions that will be applied and tested in the milk and dairy case study in Greece and Finland, while Table 5.5.2 presents the pilot scenario.

Table 5.5.1 – The SecureFood solutions applied in the milk and dairy pilot scenario

No	SecureFood solution	Partner	Use case*	Milk and dairy case study
1	Interdependencies assessment	ZLC		X
2	Risk and vulnerability assessment	DNV		X
3	Resilience assessment	LUKE	UC14	X
4	Economic modelling	NULES		
5	Food loss and waste modelling	GL		X
6	Supply chain modelling	ZLC		X
7	Resilience governance framework	DNV		X
8	Resilience management framework	EMP		X
9	WASTE-SEC	GL	UC15	X
10	FSRM tool	EMP	UC16	X
11	Digital Twin (DT)	IRIS	UC12	X
			UC13	X
12	AgriPoliS	IAMO	UC5	
13	3D XR-based simulator	IAMO	UC6	
			UC7	X
14	Observatory dashboard (OD)	EXUS	UC2	X

15	Early warning system (EWS)	ED	UC11	X
16	RESILOG	ICCS	UC3	X
			UC4	X
17	Information exchange platform (IEP)	INNOV	UC8	X
			UC9	
			UC10	X

** The use cases titles are listed in Annex D, while their content is detailed in D2.2.*

Table 5.5.2 – The pilot scenario of the milk and dairy supply chain in Greece and Finland

Pilot Scenario 6			
Steps	**Description**	**SecureFood solution**	**System response**
1	Climate change has led to more frequent and intense weather events that have the potential to disrupt the milk and dairy supply chain. The OD is continuously monitoring and sharing meteorological data (e.g. daily weather forecasts, heat stress, droughts and snow) with the milk supply chain stakeholders, helping them be prepared for and respond to weather-related disruptions effectively based on data availability. It also presents market fluctuations, as well as other information relevant to the milk and dairy supply chain based on data availability.	OD	The OD presents the information in a dashboard layout and provides interactive visualizations that respond to user interactions.
2	The EWS predicts that a prolonged drought combined with an extreme heatwave will hit the country and might impact feed availability. It sends a notification/alert to stakeholders, providing them with recommendations to enhance resilience.	EWS	The EWS generates an alert/notification tailored to the user profile and displays it along with its criticality level and relevant details. The alert/notification also appears on the OD.

3	Many stakeholders consult the FSRM tool to study the appropriate resilience -building interventions, ensuring they are well-prepared and equipped to mitigate risks, sustain operations, and adapt to the upcoming challenges.	FSRM tool	The FSRM tool provides the weaknesses and strengths with regard to resilience management and reports the assessment results to the user.
4	Milk producers and processors utilize the DT to study the risk the upcoming events might induce to their operations and the effectiveness of short and long-term countermeasures. The competent authorities run simulations to investigate food security and milk supply chain resilience aspects. Information on the affected, interdependent actors, is also available in the DT.	DT Supply chain modelling Risk and vulnerability assessment Interdependencies assessment	The DT performs the simulation according to the user's input parameters and presents the results.
5	Competent authorities use the IEP to communicate with the milk and dairy supply chain actors and share instructions for preparedness and response to the upcoming event.	IEP	The IEP displays the information submitted by the user. Another user reviews the information and submits their own response.
6	As highlighted by the DT simulations (in step 4), the disruption of feed production is expected to drive up feed cost affecting milk and dairy products' prices. The 3D XR-based simulator informs stakeholders on the effects of the increase milk and dairy products' prices on consumers' behaviour, including purchasing patterns and demand shifts.	3D XR-based simulator	3D XR-based simulation results, inform the user about the potential effects on consumers' behaviour.

7	In the meanwhile, the EWS informs stakeholders about an upcoming snowstorm event.	EWS	The EWS generates an alert/notification tailored to the user profile and displays it along with its criticality level and relevant details. The alert/notification also appears on the OD.
8	Road transport infrastructure is disrupted, making it difficult and in some cases impossible for carriers to reach farms, processing plants, and retailers. Road transport disruption is reported through the IEP by many stakeholders. An alert/notification about the disruption is sent to relevant stakeholders.	IEP EWS	The IEP displays the incidents reported by the users. The information is sent to the EWS The EWS generates an alert/notification tailored to the user profile and displays it along with its criticality level and relevant details. The alert/notification also appears on the OD.
9	In parallel, the DT informs stakeholders that the disruption might lead to milk and dairy products low stock availability.	DT Supply chain modelling Interdependencies assessment	The DT performs the simulation and presents the results.
10	These reports help authorities coordinate response measures, considering also the expected consumers behaviour to the low milk and dairy products' availability as reported by the 3D XR-based simulator tool on the OD.	3D XR-based Simulator	3D XR-based simulation results, inform the user about the expected consumers behaviour.
11	Dairy chain actors also consult the Resilience assessment results to get comprehensive recommendations on enhancing Finnish resilience for the dairy supply chain.	Resilience assessment	The OD displays the resilience assessment results.
12	Transport stakeholders use RESILOG to identify alternative routes, ensuring timely milk delivery and minimizing disruptions.	RESILOG	RESILOG provides the user with matchmaking route alternatives, along with forecasted route performance for each of the alternative routes.
13	In parallel, considering the risk of milk loss and waste due to spoilage, storage	WASTE-SEC	WASTE-SEC shows projected food security and FLW levels. A list of tailored

	limitations, and supply chain bottlenecks, the stakeholders consult the WASTE-SEC tool, to get recommendations on loss and waste prevention.		recommendations is also displayed.

6 Evaluation and validation

This chapter presents the framework for evaluating and validating the SecureFood solutions. The primary objective of this process is to ensure that each solution performs effectively within the context of the case studies and aligns with user needs. However, the evaluation and validation plan is not only designed to assess the performance of the SecureFood ecosystem. It also aims to gather essential input from the end-users for solutions' customization, fostering continuous improvement through co-creation. By actively involving end-users in the feedback process, this approach ensures that SecureFood solutions are grounded on the tacit knowledge of the end-users and address the food supply chain realities. Their insights will support the refinement of the existing solutions and may also lead to the identification of new user requirements.

The evaluation and validation plan is twofold, involving both the end-users, who assess the usability and relevance of the solutions, and the technical partners, who verify the systems' performance. This combined approach ensures a holistic understanding of the solutions' effectiveness, integrating user feedback and technical validation into a coherent assessment strategy. Together, the end-user evaluation and technical validation will offer a comprehensive understanding of the SecureFood solutions' capabilities and limitations. The feedback and findings gathered through this evaluation and validation process will serve as the foundation for refining the solutions and enhancing their readiness for future, wider customization and deployment.

Both the evaluation and validation will be carried out during each pilot iteration, after the pilot testing and demonstration activities, with a total of 4 planned rounds (see Section 3). More information on the evaluation and validation process is provided in Sections 6.1 and 6.2, respectively. The results from the evaluation and validation activities will be presented and analysed in D6.2 "Case study monitoring and evaluation reports (v1)" and D6.3 "Case study monitoring and evaluation reports (v2)".

6.1 Evaluation

The evaluation is designed to be user-centric and impact-driven, aligning with real-world needs by capturing detailed feedback from both the end-users and technical partners.

The end-user evaluation will be based on a structured questionnaire designed to collect qualitative feedback on both the general impact of the entire SecureFood ecosystem and the specific solutions' capabilities. The end-user evaluation form intended for this purpose is presented in Annex A. The SecureFood end-users will be engaged in the evaluation process, and during the final pilot demonstrations, external stakeholders will also be invited to assess the solutions.

The technical evaluation will be led by the SecureFood technical partners and will be grounded on the user requirements - system requirements traceability matrix reported in D2.3. This matrix links the SecureFood user requirements to system functionalities, ensuring that all specified needs are properly addressed by the developed solutions. During the technical evaluation, the technical partners will apply a color-coded system to the technical evaluation matrix (see Annex B) to evaluate the level of implementation of the various system requirements. The outcome of this evaluation process will indicate how well each user requirement has been integrated into the developed solutions.

6.2 Validation

The validation process is a key component of assessing the performance and overall effectiveness of the SecureFood ecosystem from a technical standpoint. While the evaluation activities primarily gather insights from end-users (or at least at a user-centric perspective), the validation phase ensures that the SecureFood solutions function as intended and meet the defined technical objectives.

The validation will be carried out by measuring the KPIs previously defined in D2.2, based on the pilot scenarios outlined in Section 5. More specifically, the technical validation encompasses 2 streams: a) Solution-level validation, in which each individual SecureFood solution will be assessed against the predefined set of the solution-specific KPIs. The assessment will be performed by each solution provider; and b) System-level validation, in which SecureFood will be validated as an integrated ecosystem, through the measurement of the SecureFood Cross-KPIs. The assessment will be jointly performed by all the technical partners. The validation matrix to be used for this purpose is presented in Annex C.

7 Training plan

The training was designed to equip end-users with the knowledge and practical experience necessary for effectively engaging with the SecureFood solutions during the pilot activities. As the pilot phase includes the testing, demonstration and evaluation of the SecureFood solutions within the pre-defined pilot scenarios, it is essential that all participating end-users are well-prepared to utilize the solutions they will be evaluating. The training plan is divided into 2 main approaches, tailored to the nature of the pilot activities, whether remote or physical, and will be implemented ahead of each pilot demonstration.

For the pilot activities conducted remotely, dedicated online training workshops will be organized for each SecureFood solution. These workshops will be interactive and supported by a range of training materials, including presentations that explain the solutions' functionality and context, as well as user manuals (for the digital tools). During the workshops, participants (i.e. the SecureFood end-users) will be shown live demonstrations of the digital tools and, where possible, will have the opportunity to access and navigate them remotely. To support continuous learning, recorded versions of the training workshops will be made available to the end-users. This ensures that participants can revisit the library of training materials at their convenience and reinforce their understanding at their own pace.

For the physical pilot demonstrations, the primary method of training will be an on-site, interactive approach using rotation hubs. During these sessions, each SecureFood solution will have its own dedicated station. The end-users will be divided into groups and each group will rotate through the various stations. Each rotation is expected to last approximately 20 minutes, offering a focused and immersive training experience. At each hub, the solutions will be presented by the technical partner, while the live version of the digital tools will be showcased. Moreover, the end-users will have the opportunity to use the digital tools and explore their capabilities. These hands-on rotation hubs are designed to foster dialogue between technical partners and end-users, encouraging questions, feedback and active engagement, while facilitating the evaluation of each SecureFood solution. The on-site training will be delivered to the SecureFood end-users as well as to external stakeholders attending the final pilot demonstrations.

8 Conclusion

This deliverable defines the SecureFood evaluation and validation strategy, by establishing a comprehensive plan for organizing the case studies and implementing, demonstrating, testing, evaluating and validating the SecureFood solutions. Following SecureFood's commitment to a co-creation approach, 4 rounds of pilot activities will be conducted following an incremental timeline. After the development of each solution version, each pilot iteration will involve end-users' training, solutions' demonstration and testing through realistic pilot scenarios, as well as evaluation and validation by both the end-users and technical partners. The feedback gathered through this process will inform the ongoing customization and refinement of the solutions, ensuring that the SecureFood ecosystem evolves in alignment with real-world needs and expectations. The first 3 pilots will be conducted remotely engaging only consortium partners, while the final pilot round will be held physically, expanding participation to include external stakeholders.

The definition of the pilot scenarios was performed in close collaboration with the end-users, ensuring that their perspectives, priorities and needs are at the core of SecureFood's development. The technical partners were also actively engaged to ensure that their solutions could be effectively applied across the various case studies. The consultation phase included targeted questionnaires, in-depth interviews, and participatory workshops with both the end-users and technical partners. This process resulted in the definition of 6 pilot scenarios, which form the foundation for testing the SecureFood solutions. These scenarios reflect the specific vulnerabilities and sectoral challenges within the different SecureFood case studies (i.e., grain, fruit and vegetable, aquaculture, fish, and milk and dairy supply chains), showcasing how the various SecureFood solutions can be applied to enhance food systems resilience and foster food security.

The evaluation and validation activities will be conducted at each pilot iteration by both the end-users and technical partners, through dedicated evaluation and validation matrices. The process will be guided by the user and system requirements, as well as the established KPIs. Moreover, to facilitate effective participation and ensure that stakeholders are adequately prepared, structured training sessions will be conducted in advance of each pilot demonstration. These include both remote and on-site engagements, supported by comprehensive presentation materials and interactive rotation hub stations.

The pilot activities will take place in T6.2, 6.3, 6.4, and 6.5 and their outcomes will be thoroughly documented and analysed in D6.2 and D6.3.

Annex A - End-user evaluation form

Pilot no: **Section A - General questions**									
A1. Which food supply chain are you providing feedback for?	Grain		Fruits and vegetables		Fish		Aquaculture		Milk and Dairy
	O		O		O		O		O
A2. Please indicate the name of your organisation:	[Free Text]								
A3. At which stage(s) of the food supply chain does your organisation operate?	Production	Processing	Packaging	Logistics	Wholesale	Retail	Consumption	Policy	Other
	O	O	O	O	O	O	O	O	[Free Text]
A4. What is your role within your organisation?	[Free Text]								

Section B - Questions for the overall SecureFood ecosystem					
B1. How would you rate the overall contribution of the SecureFood solutions to addressing current challenges in the food supply chain?	No contribution	Low contribution	Moderate contribution	High contribution	Very high contribution
	O	O	O	O	O
B2. How would you assess the potential impact of SecureFood on improving food supply chain resilience and enhancing food systems' ability to anticipate, withstand, respond to, and recover from crises?	Very low impact	Low impact	Moderate impact	High impact	Very high impact
	O	O	O	O	O
B3. To what extent do you believe SecureFood solutions have the potential to positively impact the dimensions of food security (availability, access, utilization, and stability)?	Not at all	To a small extent	To some extent	To a great extent	To a very great extent
	O	O	O	O	O
B4. Which aspects of SecureFood do you find most valuable?	[Free Text]				
B5. Are there any critical areas where SecureFood could be improved? (If yes, please specify.)	Yes	No	[Free Text]		
	O	O			
	Yes	No	[Free Text]		

B6. Would you recommend the adoption or further development of the SecureFood ecosystem within your sector?	O	O			
B7. Do you foresee any barriers to adopting SecureFood tools within your organization or sector? (If yes, please specify)	Yes	No	[Free Text]		
	O	O			
B8. Please assign a score to the overall SecureFood system:	Very Unsatisfactory	Unsatisfactory	Satisfactory	Good	Excellent
	O	O	O	O	O
B9. Please share any comments or observations you may have.	[Free Text]				

Section C - Solutions specific questions Early warning system					
C1. To what extent do the alerts provided by the Early Warning System support your timely notification on (upcoming) incidents and support informed decision-making for prevention and response?	Not at all	To a small extent	To some extent	To a great extent	To a very great extent
	O	O	O	O	O
C2. Is there any additional information that should accompany the alerts to better support your response and decision-making?	[Free Text]				
C3. What additional features or information should be integrated into the Early Warning System to allow for better customization to your needs?	[Free Text]				
C4. How would you rate the ease of use and overall user experience of the Early Warning System?	Very difficult	Somewhat difficult	Neutral	Very easy	Extremely easy
	O	O	O	O	O
C5. Have you encountered any technical or usability challenges while using the Early Warning System? If yes, please describe them.	Yes	No	[Free Text]		
	O	O			
Observatory Dashboard					

C6. How well does the Observatory Dashboard present a clear and easily interpretable overview of key factors affecting the food supply chain?	Very poorly	Poorly	Neutral	Well	Very well
	O	O	O	O	O
C7. What additional features or information should be integrated into the Observatory Dashboard to allow for better customization to your needs?	[Free Text]				
C8. How would you rate the ease of use and overall user experience of the Observatory Dashboard?	Very difficult	Somewhat difficult	Neutral	Very easy	Extremely easy
	O	O	O	O	O
C9. Have you encountered any technical or usability challenges while using the Observatory Dashboard? If yes, please describe them.	Yes	No	[Free Text]		
	O	O			
Information Exchange Platform					
C10. How well does the Information Exchange Platform facilitate communication and collaboration among stakeholders across the food supply chain?	Not at all	To a small extent	To some extent	To a great extent	To a very great extent
	O	O	O	O	O
C11. To what extent does the Information Exchange Platform support the secure exchange of relevant information?	Not at all	To a small extent	To some extent	To a great extent	To a very great extent
	O	O	O	O	O
C12. To what extent does the Information Exchange Platform support the timely	Not at all	To a small extent	To some extent	To a great extent	To a very great extent
	O	O	O	O	O

exchange of information among stakeholders?					
C13. What additional features or information should be integrated into the Information Exchange Platform to allow for better customization to your needs?	[Free Text]				
C14. How would you rate the ease of use and overall user experience of the Information Exchange Platform?	Very difficult	Somewhat difficult	Neutral	Very easy	Extremely easy
	O	O	O	O	O
C15. Have you encountered any technical or usability challenges while using the Information Exchange Platform? If yes, please describe them.	Yes	No	[Free Text]		
	O	O			
RESILOG					
C16. To what extent does RESILOG support informed decision-making in planning and optimizing transportation routes?	Not at all	To a small extent	To some extent	To a great extent	To a very great extent
	O	O	O	O	O
C17. How well does RESILOG support forecasting and recommending alternative routes during unexpected disruptions or critical events?	Very poorly	Poorly	Neutral	Well	Very well
	O	O	O	O	O
C18. What additional features or information should be integrated into	[Free Text]				

RESILOG to allow for better customization to your needs?					
C19. How would you rate the ease of use and overall user experience of RESILOG?	Very difficult	Somewhat difficult	Neutral	Very easy	Extremely easy
	O	O	O	O	O
C20. Have you encountered any technical or usability challenges while using RESILOG? If yes, please describe them.	Yes	No	[Free Text]		
	O	O			
Digital Twin					
C21. To what extent does the Digital Twin provide a realistic representation of your supply chain environment or operations?	Not at all	To a small extent	To some extent	To a great extent	To a very great extent
	O	O	O	O	O
C22. How well does the Digital Twin simulate scenarios and support strategic planning and decision-making?	Very poorly	Poorly	Neutral	Well	Very well
	O	O	O	O	O
C23. What additional features or information should be integrated into the Digital Twin to allow for better customization to your needs?	[Free Text]				
C24. How would you rate the ease of use and overall user experience of the Digital Twin?	Very difficult	Somewhat difficult	Neutral	Very easy	Extremely easy
	O	O	O	O	O

C25. Have you encountered any technical or usability challenges while using the Digital Twin? If yes, please describe them.	Yes	No	[Free Text]		
	O	O			
AgriPoliS					
C26. How well do the simulation outputs of AgriPoliS support strategic planning or policy assessment?	Very poorly	Poorly	Neutral	Well	Very well
	O	O	O	O	O
C27. What additional features or information should be integrated into AgriPoliS to allow for better customization to your needs?	[Free Text]				
C28. How would you rate the ease of use and overall user experience of AgriPoliS?	Very difficult	Somewhat difficult	Neutral	Very easy	Extremely easy
	O	O	O	O	O
C29. Have you encountered any technical or usability challenges while using AgriPoliS? If yes, please describe them.	Yes	No	[Free Text]		
	O	O			
3D XR-based simulator					
C30. How realistic did you find the 3D XR-based simulation environment for representing supply chain scenarios?	Not immersive at all	Slightly immersive	Moderately immersive	Very immersive	Extremely immersive
	O	O	O	O	O

C31. How well do the simulation results of the 3D XR-based simulator contribute to decision-making?	Not at all	To a small extent	To some extent	To a great extent	To a very great extent
	O	O	O	O	O
C32. What additional features or information should be integrated into the 3D XR-based simulator to allow for better customization to your needs?	[Free Text]				
C33. How would you rate the ease of use and overall user experience of the 3D XR-based simulator?	Very difficult	Somewhat difficult	Neutral	Very easy	Extremely easy
	O	O	O	O	O
C34. Have you encountered any technical or usability challenges while using the 3D XR-based simulator? If yes, please describe them.	Yes	No	[Free Text]		
	O	O			
WASTE-SEC					
C35. How accurately does WASTE-SEC simulate food waste across stages using driver-specific scenario modelling?	Very Inaccurate	Somewhat inaccurate	Neutral	Very accurate	Extremely accurate
	O	O	O	O	O
C36.How effectively does WASTE-SEC support scenario-based decisions reducing food waste while preserving food security?	Not effective at all	Somewhat effective	Moderately effective	Highly effective	Extremely effective
	O	O	O	O	O
	[Free Text]				

C37. What additional features or information should be integrated into WASTE-SEC to allow for better customization to your needs?					
C38. How would you rate the ease of use and overall user experience of WASTE-SEC?	Very difficult	Somewhat difficult	Neutral	Very easy	Extremely easy
	O	O	O	O	O
C39. Have you encountered any technical or usability challenges while using WASTE-SEC? If yes, please describe them.	Yes	No	[Free Text]		
	O	O			
FSRM					
C40. To what extent does FSRM support the assessment of your organization's technical, organizational and operational resilience measures?	Not at all	To a small extent	To some extent	To a great extent	To a very great extent
	O	O	O	O	O
C41. How well does FSRM facilitate informed decision-making regarding the actions needed to enhance resilience?	Very poorly	Poorly	Neutral	Well	Very well
	O	O	O	O	O
C42. What additional features or information should be integrated into FSRM to allow for better customization to your needs?	[Free Text]				
C43. How would you rate the ease of use and overall user experience of FSRM?	Very difficult	Somewhat difficult	Neutral	Very easy	Extremely easy
	O	O	O	O	O

C44. Have you encountered any technical or usability challenges while using FSRM? If yes, please describe them.	Yes	No	[Free Text]		
	O	O			
Interdependencies assessment					
C45. How would you rate the interdependencies assessment model overall?	Very poor	Poor	Neutral	Good	Very good
	O	O	O	O	O
C46. What improvements or additions would help customize the interdependencies assessment model to better meet your needs?	[Free Text]				
Risk and vulnerability assessment					
C47. How would you rate the risk and vulnerability assessment model overall?	Very poor	Poor	Neutral	Good	Very good
	O	O	O	O	O
C48. What improvements or additions would help customize the risk and vulnerability assessment model to better meet your needs?	[Free Text]				
Resilience assessment					
C49. How would you rate the resilience assessment model overall?	Very poor	Poor	Neutral	Good	Very good
	O	O	O	O	O

C50. What improvements or additions would help customize the resilience assessment model to better meet your needs?	[Free Text]				
Economic modelling					
C51. How would you rate the economic modelling overall?	Very poor	Poor	Neutral	Good	Very good
	O	O	O	O	O
C52. What improvements or additions would help customize the economic modelling to better meet your needs?	[Free Text]				
Supply chain modelling					
C53. How would you rate the supply chain modelling overall?	Very poor	Poor	Neutral	Good	Very good
	O	O	O	O	O
C54. What improvements or additions would help customize the supply chain modelling to better meet your needs?	[Free Text]				
Resilience governance framework					
C55. How well does the resilience governance framework support collaboration between public and private stakeholders on food security and food system resilience issues?	Very poor	Poor	Neutral	Good	Very good
	O	O	O	O	O

C56. To what extent does the resilience governance framework clearly define stakeholder roles, responsibilities and interactions in both preparedness and crisis response phases?	Not at all	To a small extent	To some extent	To a great extent	To a very great extent
	O	O	O	O	O
C57. To what extent does the resilience governance framework empower stakeholders to take an active role in resilience-building efforts?	Not at all	To a small extent	To some extent	To a great extent	To a very great extent
	O	O	O	O	O
C58. What improvements or additions would help customize the resilience governance framework to better meet your needs?	[Free Text]				
Resilience management framework					
C59. How well does the resilience management framework support the development of resilience plans by the food supply chain actors?	Not at all	To a small extent	To some extent	To a great extent	To a very great extent
	O	O	O	O	O
C60. To what extent does the resilience management framework provide support for the adoption of more sustainable practices, enhancing food security and food systems resilience in the long-run?	Not at all	To a small extent	To some extent	To a great extent	To a very great extent
	O	O	O	O	O
C61. To what extent does the resilience management framework provide useful guidance to competent authorities in developing national strategies for food systems resilience?	Not at all	To a small extent	To some extent	To a great extent	To a very great extent
	O	O	O	O	O

C62. What improvements or additions would help customize the resilience management framework to better meet your needs?	[Free Text]

Annex B - Technical evaluation of the SecureFood solutions

B1 - Technical evaluation matrix

The following technical evaluation matrix is built upon the user and system requirements traceability matrix documented in D2.3.

User Requirements			System Requirements				PILOT __						
							M __						
Code	Title	Priority level	Code	Reference	Priority level	Partner	Pilot Scenario						Comments
							1	2	3	4	5	6	
UR-FR-03	Resilience plans	High	SF-FSRM-02	Graphical user interface	Must	EMP							
			SF-FSRM-04	Report generation	Must	EMP							
UR-MOD-01	Interdependencies assessment	High	SF-DT-01	Graphical user interface	Must	IRIS							
			SF-DT-02	API	Must	IRIS							
			SF-DT-03	Disruption prediction models	Must	IRIS							
			SF-DT-04	Risk assessment models	Must	IRIS							
UR-MOD-02	Risk and vulnerability assessment	High	SF-DT-01	Graphical user interface	Must	IRIS							
			SF-DT-02	API	Must	IRIS							
			SF-DT-03	Disruption prediction models	Must	IRIS							
			SF-DT-04	Risk assessment models	Must	IRIS							
UR-MOD-03	Risk treatment	High											
UR-MOD-04	Resilience assessment	High	SF-DT-01	Graphical user interface	Must	IRIS							
			SF-DT-02	API	Must	IRIS							
			SF-DT-03	Disruption prediction models	Must	IRIS							
			SF-DT-04	Risk assessment models	Must	IRIS							
			SF-XR-06	User Interface	Should	IAMO							
			SF-XR-07	ABM model specification	Must	IAMO							
			SF-XR-08	Simulation results report	Must	IAMO							

UR-MOD-05	Economic modelling	High	SF-OD-01	Authentication service	Must	EXUS							
			SF-OD-02	Visual dashboard	Must	EXUS							
			SF-OD-03	Crisis alert	Must	EXUS							
			SF-OD-04	Data visualizations filtering	Should	EXUS							
			SF-OD-05	Visual explainable AI features	Could	EXUS							
			SF-IEP-01	Authentication service	Must	INNOV							
			SF-IEP-10	Authentication service	Must	INNOV							
			SF-IEP-18	Authentication service	Must	INNOV							
UR-MOD-06	Food loss and waste modelling	High	SF-WS-01	Intuitive user interface	Must	GL							
			SF-WS-02	Reporting	Must	GL							
UR-MOD-07	Forecast future supply chain disruptions	High	SF-DT-01	Graphical user interface	Must	IRIS							
			SF-DT-02	API	Must	IRIS							
			SF-DT-03	Disruption prediction models	Must	IRIS							
			SF-DT-04	Risk assessment models	Must	IRIS							
UR-DGT-1	Resilience management	High	SF-FSRM-02	Graphical user interface	Must	EMP							
			SF-FSRM-04	Report generation	Must	EMP							
UR-DGT-2	Food loss and waste tool	High	SF-WS-01	Intuitive user interface	Must	GL							
			SF-WS-02	Reporting	Must	GL							
UR-DGT-3	Agricultural structures simulation	High	SF-AP-01	AgriPoliS	Should	IAMO							
UR-DGT-4	Consumer behaviour analysis	High	SF-XR-02	Scenario selection sub-module	Must	IAMO							
			SF-XR-03	Scenario-dependent 3D environment and assets	Must	IAMO							
			SF-XR-04	Data storage and handling	Must	IAMO							
			SF-XR-06	User interface	Should	IAMO							

			SF-XR-07	ABM model specification	Must	IAMO							
			SF-XR-08	Simulation results report	Must	IAMO							
UR-DGT-5	Food actors behaviour analysis	Medium	SF-XR-02	Scenario selection sub-module	Must	IAMO							
			SF-XR-03	Scenario-dependent 3D environment and assets	Must	IAMO							
			SF-XR-04	Data storage and handling	Must	IAMO							
			SF-XR-06	User Interface	Should	IAMO							
			SF-XR-07	ABM model specification	Must	IAMO							
			SF-XR-08	Simulation results report	Must	IAMO							
UR-DGT-6	Digital communication among stakeholders	High	SF-IEP-02	Correlation	Should	INNOV							
			SF-IEP-03	Information Exchange Data Model	Must	INNOV							
			SF-IEP-04	Blockchain Node Infrastructure	Must	INNOV							
			SF-IEP-05	Smart contract execution manager	Should	INNOV							
			SF-IEP-06	Information Exchange Platform Unified backend API	Should	INNOV							
			SF-IEP-07	Information Exchange Platform Frontend	Should	INNOV							
			SF-IEP-08	External Smart Wallet	Must	INNOV							
			SF-IEP-09	Data Harmonization Mechanism for Information Exchange Data Model	Should	INNOV							
UR-DGT-7	Reporting of commodities stocks	High	SF-IEP-11	Correlation between user-held distributed credentials (blockchain accounts) and centralized non-distributed user IDs	Should	INNOV							
			SF-IEP-12	Reporting stocks Data Model	Must	INNOV							

			SF-IEP-13	Blockchain Node Infrastructure	Must	INNOV							
			SF-IEP-14	Smart contract execution manager	Should	INNOV							
			SF-IEP-15	Reporting stocks commodities endpoint of Unified backend API	Should	INNOV							
			SF-IEP-16	External Smart Wallet	Must	INNOV							
UR-DGT-8	Incident reporting	High	SF-IEP-17	Harmonization Mechanism	Should	INNOV							
			SF-IEP-19	Correlation between user-held distributed credentials (blockchain accounts) and centralized non-distributed user IDs	Should	INNOV							
			SF-IEP-20	Reporting incidents Data Model	Must	INNOV							
			SF-IEP-21	Blockchain Node Infrastructure	Must	INNOV							
			SF-IEP-22	Smart contract execution manager	Should	INNOV							
			SF-IEP-23	Incident Reporting endpoints of the Unified backend API	Should	INNOV							
			SF-IEP-24	External Smart Wallet	Must	INNOV							
			SF-IEP-25	Masking Methods of real user Identity	Could	INNOV							
			SF-IEP-26	Harmonization Mechanism	Should	INNOV							
UR-DGT-9	Optimization of food transportation	High	SF-RS-01	Graphical user interface	Must	ICCS							
			SF-RS-02	API for B2B data sharing of transport schedule and transport orders	Must	ICCS							
			SF-RS-03	Route discovery graph	Must	ICCS							
UR-DGT-10		High	SF-RS-01	Graphical user interface	Must	ICCS							

	Prediction of route performance		SF-RS-02	API for B2B data sharing of transport schedule and transport orders	Must	ICCS							
			SF-RS-04	Route availability forecasting algorithm	Must	ICCS							
UR-DGT-11	Drivers' analytics	High	SF-OD-01	Authentication service	Must	EXUS							
			SF-OD-02	Visual dashboard	Must	EXUS							
			SF-OD-03	Crisis alert	Must	EXUS							
			SF-OD-04	Data visualizations filtering	Should	EXUS							
			SF-OD-05	Visual explainable AI features	Could	EXUS							
			SF-IEP-01	Authentication service	Must	INNOV							
			SF-IEP-10	Authentication service	Must	INNOV							
			SF-IEP-18	Authentication service	Must	INNOV							
UR-DGT-12	Detection of various kinds of hazards and threats	High	SF-EWS-01	Early Warning Prediction APIs	Must	ED							
UR-DGT-13	Timely prediction of long-term stresses	High	SF-EWS-01	Early Warning Prediction APIs	Must	ED							
UR-DGT-14	Timely detection of short-term shocks	High	SF-EWS-01	Early Warning Prediction APIs	Must	ED							
UR-DGT-15	Warning notification/Alert	High	SF-EWS-01	Early Warning Prediction APIs	Must	ED							
			SF-EWS-03	Graphical user interface	Should	ED							
UR-DGT-16	Criticality of warning notification/alert	High	SF-EWS-01	Early Warning Prediction APIs	Must	ED							
			SF-EWS-02	AI risk classification and prioritization	Must	ED							
			SF-EWS-03	Graphical user interface	Should	ED							
UR-DGT-17	Support action / Recommendation action	High											

UR-DGT-18	Confirmation of threat elimination	Medium											
UR-DGT-19	Real-time monitoring of the food supply chain	High	SF-DT-01	Graphical user interface	Must	IRIS							
			SF-DT-02	API	Must	IRIS							
			SF-DT-03	Disruption prediction models	Must	IRIS							
			SF-DT-04	Risk assessment models	Must	IRIS							
UR-DGT-20	Systems representation	Medium	SF-DT-01	Graphical user interface	Must	IRIS							
			SF-DT-02	API	Must	IRIS							
			SF-DT-03	Disruption prediction models	Must	IRIS							
			SF-DT-04	Risk assessment models	Must	IRIS							
UR-DGT-21	Simulation and what-if scenarios	High	SF-DT-01	Graphical user interface	Must	IRIS							
			SF-DT-02	API	Must	IRIS							
			SF-DT-03	Disruption prediction models	Must	IRIS							
			SF-DT-04	Risk assessment models	Must	IRIS							
			SF-XR-02	Scenario selection sub-module	Must	IAMO							
			SF-XR-03	Scenario-dependent 3D environment and assets	Must	IAMO							
			SF-XR-04	Data storage and handling	Must	IAMO							
			SF-XR-06	User Interface	Should	IAMO							
			SF-XR-07	ABM model specification	Must	IAMO							
			SF-XR-08	Simulation results report	Must	IAMO							
UR-DGT-22	Information filtering	Medium	SF-EWS-03	Graphical user interface	Should	ED							
			SF-EWS-04	Batch and real-time data ingestion processing pipelines	Must	ED							
UR-DGT-23	Report generation	Medium											
UR-DGT-24	Mobile devices	Medium	SF-FSRM-05	Access from different terminals	Must	EMP							
UR-USB-01		High	SF-WS-01	Intuitive user interface	Must	GL							

	User-friendly interface		SF-FSRM-02	Graphical user interface	Must	EMP							
			SF- FSRM-03	Color-coded design	Must	EMP							
UR-USB-02	Multilingual interface	Medium	SF-XR-01	GROCERYSIM application access (user authentication and data collection consent).	Should	IAMO							
			SF-XR-02	Scenario selection sub-module	Must	IAMO							
			SF-XR-03	Scenario-dependent 3D environment and assets	Must	IAMO							
			SF-XR-05	ABM application access	Should	IAMO							
			SF-XR-06	User Interface	Should	IAMO							
			SF-XR-08	Simulation results report	Must	IAMO							
UR-USB-03	Modularity	High											
UR-USB-04	Autonomy	Medium											
UR-USB-05	Event register	High											
UR-USB-06	Interoperability	High	SF-XR-06	User Interface	Should	IAMO							
			SF-XR-07	ABM model specification	Must	IAMO							
			SF-XR-08	Simulation results report	Must	IAMO							
UR-USB-07	Data storage	High	SF-WS-04	Data storage	Must	GL							
UR-REL-01	Accurate information	High	SF-EWS-04	Batch and real-time data ingestion processing pipelines	Must	ED							
UR-REL-02	Event correlation	Medium	SF-EWS-02	AI risk classification and prioritization	Must	ED							
UR-REL-03	Alert location	Medium											
UR-REL-04	Close to real time notification	High	SF-EWS-01	Early Warning Prediction APIs	Must	ED							
			SF-EWS-03	Graphical user interface	Should	ED							
UR-REL-05	Information on non-available subsystems	Medium											

UR-REL-06	Replaceability (back-up)	High											
UR-REL-07	Availability	High	SF-XR-01	GROCERYSIM application access (user authentication and data collection consent)	Should	IAMO							
			SF-XR-05	ABM application access	Should	IAMO							
			SF-XR-06	User Interface	Should	IAMO							
			SF-XR-07	ABM model specification	Must	IAMO							
			SF-XR-08	Simulation results report	Must	IAMO							
UR-REL-08	Scalability	High											
UR-CONF-01	Digitally secure, safe and resilient	High	SF-EWS-03	Graphical user interface	Should	ED							
UR-CONF-02	Authentication and authorization	High	SF-WS-03	Authentication and access control	Must	GL							
			SF-FSRM-01	Authentication service	Must	EMP							
UR-CONF-03	Data anonymization	High	SF-XR-01	GROCERYSIM application access (user authentication and data collection consent)	Should	IAMO							
UR-CONF-04	Data protection	High	SF-XR-01	GROCERYSIM application access (user authentication and data collection consent)	Should	IAMO							
			SF-XR-05	ABM application access	Should	IAMO							
UR-COST-01	Cost-efficiency	High											
UR-SOC-01	Accessibility	High	SF-XR-01	GROCERYSIM application access (user authentication and data collection consent)	Should	IAMO							
			SF-XR-05	ABM application access	Should	IAMO							
			SF-XR-06	User Interface	Should	IAMO							
			SF-XR-07	ABM model specification	Must	IAMO							
			SF-XR-08	Simulation results report	Must	IAMO							

B2 - Colour coding of requirement implementation status

The color-coding scheme outlined below will be used by the technical partners when completing the technical evaluation matrix of Annex B1.

Colour	Status description
(Green)	Requirement fully met
(Yellow)	Requirement partially met, close to full integration
(Orange)	Requirement partially met, yet far from full integration
(Red)	Not working at all / not implemented yet
(Grey)	Not seen or not tested

Annex C - Validation matrix

SecureFood cross KPIs				Value achieved						
				PILOT __ M __						
Indicator	Description	Method of measurement	Target value	Pilot Scenario						Comments
				1	2	3	4	5	6	
Timeliness of predictions	Timely prediction of long-term stresses.	Estimate time through system logs/database entries, comparing prediction and forecasted event timestamps. Using internal KPIs dashboard and PDCA life cycle	< 6 months ahead prediction							
Timeliness of detections	Timely detection of short-term shocks.	Estimate time through System logs/database entries, comparing prediction and forecasted event timestamps. Using internal KPIs dashboard and PDCA life cycle.	< 6 hours early detection							
Notification latency	Time elapsed from the moment an event/incident is detected/predicted to when the warning notification/alert is displayed to the user.	Comparing the time instances an alert reaches specific points in the system.	<2 minutes							
Timeliness of decision-making	Time needed by the users to get informed decisions on response and adaptation measures, upon receiving a warning notification/alert.	Measured through the connection of the early warning system to the digital twin and other SecureFood tools, considering users' actions	<10 min							
False alert rate	Percentage of false positive alerts raised by the SecureFood system.	Number of false alerts over total number of alerts	< 5%							

Data source diversity	Number of different data sources used to support decision making.	Measure the number of different external data sources that will feed the SecureFood system	>20							
Food security improvement	Average risk reduction and food security improvement after application of mitigation measures, averaged over at least 20 scenarios.	Measure the efficiency of the mitigation measures of the Resilience Management Framework through the risk assessment model, averaged over at least 20 scenarios.	>20%							

Solutions KPIs						Value achieved						
						PILOT __ M __						
SecureFood solution	Partner	Indicator	Description	Method of measurement	Target value	Pilot Scenario						Comments
						1	2	3	4	5	6	
Interdependencies assessment	ZLC	Networks	Develop risk networks and related analysis for each UC. Collect data and integrate with the analytical framework.	Number of use cases.	6							
Interdependencies assessment	ZLC	Cascade effects	By selecting individual risks, preview how these will affect supply chain actors.	Measure and visualize cascades and risk propagation for each UC.	≥6							
Supply chain modelling	ZLC	Supply chain models libraries	Develop model libraries for risk predictions in UC food supply chains.	Number of risks to be predicted per UC.	≥ 24							
Supply chain modelling	ZLC	Models' assessment	Provide accuracy and precision indicators for each model library.	Precision Recall F1 Score Confusion Matrix	≥ 4 indicators associated with the libraries							

Supply chain modelling	ZLC	Data Sources	Identify relevant data sources for each model library.	Number of databases available from observatory or tailor-made by UC.	≥ 8 per UC							
Supply chain modelling	ZLC	Recovery strategies	Identify and associate recovery strategies for each risk event considered in the models.	Number of recovery strategy per risk event.	≥ 4 per risk event							
Risk and vulnerability assessment	DNV	Risk assessment time	Time to assess the food security risk of the baseline scenario (i.e. no mitigation action implemented to respond to a disruption) after data ingestion through risk assessment models.	Measured through the elapsed time to execute the dedicated function within the tool (e.g., Digital Twin) incorporating the pseudo-code of the risk models.	< 1 min							
Risk and vulnerability assessment	DNV	Optimal intervention strategy time	Time to estimate the best intervention to mitigate food security risks based on the input data of a single scenario ingested through risk assessment models.	Measured through the elapsed time to execute the dedicated function within the tool (e.g., Digital Twin) incorporating the pseudo-code of the risk models.	< 10 min							
Resilience assessment	LUKE	Preparedness ratio	The proportion of disruptions that have a contingency plan in relation to all identified disruptions in dairy systems.	Measured through interviews and public sources data.	≥80%							

Resilience assessment	LUKE	Usability score	How well the DSRA framework adapts to evolving conditions and challenges and supports decision making in dairy systems.	Assessment by Likert scale.	≥4							
Economic modelling	NULES	Supply Chain Stages Covered	Number of stages of the food supply chain.	Modelling and analysis of food supply chain stages, linking production to consumption outcomes.	> 2 stages (primary production, consumption)							
Economic modelling	NULES	Time Horizon Achieved	Time horizon for analysis (medium term: 2-3 years).	Development and validation of scenarios aligned with the medium term timeframe.	2-3 years							
Economic modelling	NULES	Scenarios Modelled	Number of scenarios addressing risks, transport diversification, and practical real-world applications.	Modelling of scenarios, including risk assessments, transport, and optimization strategies.	> 2 scenarios							
Economic modelling	NULES	Data Sources Integrated	Number of data sources used for developing, testing, and validating the solution.	Inclusion of data from production and processing, distribution and logistics, retail and wholesale, technology.	> 3 data sources							
Resilience Governance Framework	DNV	Scenario coverage ratio	Percentage of food crises scenarios requiring the collaboration between the public and private sector measured on at	Evaluating the percentage of food crises scenarios requiring the collaboration between the public and private sector covered by the	≥ 70%							

			least 4 crises scenarios.	Resilience Governance Framework (measured on at least 4 crises scenarios).								
Resilience Governance Framework	DNV	Trust-building index	Trust -building index measured through the concern assessment.	Conduct at least two surveys to gather feedback on end users' specific concerns and suggestions for improvement.	> 50% of end users express satisfaction in the final survey.							
Resilience Governance Framework	DNV	Represented domains	Number of different domains/disciplines represented in the SecureFood Governance process.	Measure the number of stakeholders of different domains/disciplines involved in the participatory activities of the Resilience Governance Framework. The measurement will take into account combinations of geographies (countries, regions), sectors, product type, supply chain stages and organization type (e.g. Private entity, associations and NGOs, public authority, research institutions).	>20							

Resilience Management Framework	EMP	Resilience improvement	Average resilience index improvement after the application of mitigation measures.	Assessing the resilience improvement through the resilience management methodology applied over at least 20 scenarios.	>20%							
Resilience Management Framework	EMP	Resilience measures	Number of different categories of resilience measures captured by the framework (e.g. prevention, response etc).	Counting the different measures categories that will be included in the FSRM framework.	>4							
Resilience Management Framework	EMP	Resilience assessment dimensions	Number of different categories of indicators applied for assessing the maturity of the resilience management procedures.	Counting the different types of dimensions and topics that provide indicators pertinent to resilience management.	>5 dimensions >6 topics							
FSRM	EMP	Access from various terminals	Number of different types of terminals that the tool will be responsive.	Counting the number of different access terminals.	3 (desktop, tablet, mobile)							
FSRM	EMP	Food supply chain coverage	Number of different food supply chain actors that will be addressed by the FSRM tool.	Counting the number of different actors using the tool.	>4 actors							
FSRM	EMP	Food security drivers' coverage	Number of different food security drivers that will be addressed by the FSRM tool.	Counting the different food security drivers analysed by the tool.	>8 drivers							

Waste-SEC	GL	Driver and subcategory coverage	Number of driver categories and subcategories incorporated into scenario analysis.	Mapping included drivers in scenarios, calculating proportions, and identifying gaps.	≥5 unique drivers modelled across at least 2 subcategories per main category of drivers							
Waste-SEC	GL	Modelled scenarios	Total number of positive and negative scenarios configured and analysed by users during pilots.	Tracking the total count of positive and negative scenarios configured and analysed by users during pilot tests.	2-5 per case study; ≥10 overall							
Waste-SEC	GL	Simulation processing time	Average time to compute and present results for a selected scenario, including FS and FLW index projections.	The average duration taken to compute and present results for a selected scenario, including projections for Food Security and Food Loss and Waste indices.	≤3 minutes per scenario							
Waste-SEC	GL	Customization success rate	Percentage of successful user customized models (e.g., positive or negative driver scenarios) that generate error-free, actionable outputs aligned with historical data or expert-reviewed benchmarks.	The percentage of user-customized models (e.g., driver scenarios) that produce error-free, actionable outputs consistent with historical data or expert-reviewed benchmarks.	≥90% success rate across all tested scenarios							
Waste-SEC	GL	Optimized food security gain	Maximum food security improvement through food loss	Compare food security indexes before and after implementing FLW	>15%							

			and waste reduction.	reduction scenarios to calculate percentage improvements.								
Digital Twin	IRIS	Event detection and response time	Measure the elapsed time between data ingestion—capturing real-time inputs from internal and external sources—and the issuance of actionable results or insights.	Track and record timestamps in the system event logs at key stages of the process to accurately validate and measure the timeline from data ingestion to results issuance.	≤ 10 minutes							
Digital Twin	IRIS	Historical data archiving for scenario analysis and reporting	Validate the number of archived events created by the Digital Twin and stored in the platform database.	Ensure archived events include key attributes such as event type, criticality level, affected actors, mitigation measures, and resolution time. Use this data for generating historical trend analyses and improving future simulations.	≥ 100 historical events archived							
Digital Twin	IRIS	Timely prediction of short-term shocks and long-term stresses	Timely detection of short-term and long term shocks in specific supply chain.	Compare predictions generated by the Digital Twin for short-term shocks (e.g. supply bottlenecks) and long-term stresses (e.g. climate trends) against historical data or actual occurrences.	< 6 hours (short term) < 6 months (long term)							

				Assess prediction accuracy using precision recall metrics and error rates.								
AgriPoliS	IAMO	Number of agricultural practices covered	Number of CS specific agriculture practices whose impact on food security will be estimated.	Modelling of typical agricultural practices, simulating and assessing the changes in production.	>10 practices							
AgriPoliS	IAMO	Number of scenarios	Number political measures or external shocks to be modelled.	Modelling of different shocks and stresses to analyse their impact on agricultural production. Modelling of (hypothetical) political measures to analyse their impact on resilience of agricultural production in CS region.	> 3 scenarios with different combinations of shocks/stresses and political measures							
AgriPoliS	IAMO	User Engagement	Number of users using AgriPoliS	Number of users accessing AgriPoliS results Number of Downloads of AgriPoliS Software from GitHub	10 users per month accessing AgriPoliS results > 5 Downloads of the Software							

3D XR-based simulator	IAMO	User Engagement	Number of users actively using the GROCERYSIM and ABM simulators.	Number of users accessing GROCERYSIM and ABM applications through SecureFood platform.	At least 20 active users per month							
3D XR-based simulator	IAMO	Scenario Completion Rate	Percentage of users completing predefined scenarios in GROCERYSIM.	Final data report can't be generated if 100% of the tasks is not performed. The difference between number of users of the application through SecureFood dashboard and number of final data reports will show the scenario completion rate.	90% scenario completion rate							
3D XR-based simulator	IAMO	Simulation Processing Time	Average time to generate ABM results after a scenario trigger.	Monthly testing by the IAMO representatives (ABM programmers) to check if processing time is under 5 min.	<5 min per scenario simulation							
3D XR-based simulator	IAMO	System uptime	Percentage of the time the application is operational and available.	Server errors will be provided indicating downtime.	99% system uptime							
3D XR-based simulator	IAMO	Data Accuracy	Quality and relevance of consumer behaviour data collected from the GROCERYSIM application for the ABM.	IAMO representatives will analyse all the available data before conducting the simulations and make sure that quality meets the required standards.	95% accuracy and relevance in collected data							

Observatory Dashboard	EXUS	Data Ingestion Latency	Time taken to fetch and integrate data from external sources.	Estimate time needed through system logs.	≤ 6 secs							
Observatory Dashboard	EXUS	Time to recover after failure	Time needed so that the system becomes functional again after a system failure.	Estimate time needed through system logs.	≤1 min							
Observatory Dashboard	EXUS	System Uptime	Percentage of time the dashboard is operational and accessible to users.	Estimate time through system logs.	>99.5%							
Observatory Dashboard	EXUS	Visualization Load Time	Time taken for data visualizations (charts, graphs) to render after user interaction or data update.	Estimate time needed through system logs.	≤4 secs							
Observatory Dashboard	EXUS	Data Accuracy Rate	Percentage of accurate and reliable data presented on the dashboard (validated against source data).	Compare dashboard's data to source data through system logs.	>99%							
Early Warning	ED	Processing time	Average time to estimate risks and generate notifications/alerts after data ingestion.	Estimate time needed through system logs/ database entries timestamps, internal KPIs dashboard and PDCA cycle.	<1 hour							
Early Warning	ED	Critical event acknowledgement rate	Number of critical events acknowledged by user.	Estimated through System logs/ database entries, internal KPIs dashboard and PDCA cycle.	>65%							

Early Warning	ED	Notification delivery time	Average time from event detection/prediction to informing SecureFood components.	Estimate time needed through system logs/ database entries timestamps, internal KPIs dashboard and PDCA cycle.	<2 minutes for critical events							
RESILOG	ICCS	Transport operators	Total number of transport operators responsible for providing transportation services within a specified region or network.	Count the number of transport operators that have submitted schedules and capacities via the RESILOG API or by using the tools GUI.	>10							
RESILOG	ICCS	Cargo volume	Candidate cargo volume for matchmaking to optimize logistics and ensure efficient allocation of resources.	Count the number of transport order submitted via the RESILOG API or the GUI for which a matching option for consolidation has been identified.	>10% of the total cargo volume examined							
RESILOG	ICCS	Route planning time	Time required for the route planning algorithm to process and deliver a response based on the user's specified requirements.	Measure the difference between the timestamps of route planning request and the timestamp of the last leg of the last identified route.	<15 mins for a geographical area of 150.000 Km2							
RESILOG	ICCS	Forecasting deviation	The route performance forecasting deviation, based on the predicted and actual performance of a route to assess the accuracy of route planning.	Compare the actual route turn-around time with the forecasted for the same route.	<15% deviation forecasted vs actual availability							

RESILOG	ICCS	Time of Delivery	Reduction of delayed and/or cancelled deliveries considering the transport route optimization provided by RESILOG	Identify ad-hoc alternative routes for transport order request that have been cancelled or considerably delayed.	>10%							
Information Exchange Platform	INNOV	User Engagement	Number of users using the Information Exchange Platform for reporting purposes.	Measured through blockchain transaction monitoring.	≥ 8 users (≥2 per case study)							
Information Exchange Platform	INNOV	User Engagement	Number of users engaging in best practices and knowledge sharing.	Measured through blockchain transaction monitoring.	≥ 8 active users (≥2 per case study)							
Information Exchange Platform	INNOV	Accessibility	Successful and timely logins by users to the information exchange platform.	Measured through system logs (Keycloak).	> 95%							
Information Exchange Platform	INNOV	Trigger Time	Time needed for an incident report to trigger the early warning system through platforms' API.	Estimate time needed through system logs.	≤ 2 min							
Information Exchange Platform	INNOV	Trigger Time	Time needed for a stock report to trigger the other SecureFood tools through platforms' API.	Estimate time needed through system logs.	≤ 2 min							
Information Exchange Platform	INNOV	Report submissions approvement	Report submissions successfully approved by the Blockchain Smart Contract Execution Manager.	Measured through blockchain transaction monitoring.	> 95%							

Annex D - Use Cases as per D2.2

Use case	Title
UC1	Log in into the SecureFood platform and profile customization
UC2	Display of real time analysis and historical data for food security drivers
UC3	Calculation of optimal transport routes for goods transport purposes
UC4	Forecasting transportation routes' efficiency
UC5	Simulation of policies and unexpected events impacts on farm structures
UC6	Real-time simulation of consumer and food actors' behaviour in normal conditions (before crisis)
UC7	Real-time simulation of consumer and food actors' behaviour during the shock events
UC8	Information exchange and communication among trusted stakeholders
UC9	Reporting stock commodities
UC10	Incident reporting
UC11	Detection of potential critical events
UC12	Simulate supply chain operations in virtual environment
UC13	Monitoring of the food supply chain
UC14	Dairy chain resilience assessment
UC15	Optimizing food loss and waste for enhanced food security
UC16	Assessment of maturity of resilience management procedures
UC17	Representative compiled UC utilizing SecureFood tools for resilience planning