D 2.2 – Identification of use case scenarios and user requirements

Submission date: 31 December 2024

Due date: M12 (Dec. 2024)

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 2.2 – Identification of use case scenarios and user requirements		
Work Package	WP2 – Background analysis, food security drivers, requirements and high-level reference architecture		
Type	R	Dissemination Level	PU
Lead Beneficiary	EMP		
Authors	Anna Vetsou, Anastasia Chalkidou, Evita Agrafioti (EMP)		
Co-authors	ED: V. Sakas, S.Kordouli, A. Kapetanios, K. Touloumis; GL: C. Galanakis, C. Galanaki, M. Daskalakis, I. Galanakis; ZLC: T. de la Cruz, L. Urciuoli; DNV: A. Gallo, E. Marino; IRIS: M. del Mar Blanes Martínez, M.P. Jimenez; IAMO: I. Đurić, Franziska Appel; ICCS: I. Kanellopoulos, S.Kokonezi; EXUS: G. Kolionis, S. Bura; INNOV: M. Spanou, D. Drakoulis, M.E. Dimitrakopoulou; NULES: M. Nehrey; LUKE: P. Rikkonen, K. Rimhanen		
Reviewers	ZLC, IRIS		

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)
V0.1	01/10/2024	Introduction, User Requirements elicitation	EMP
V0.2	01/11/2024	Use Cases and KPIs methodology description	EMP
V0.3	05/11/2024	Internal review	EMP
V0.4	07/11/2024	Uses Cases initial template and descriptions	EMP
V0.5	04/12/2024	Use Cases and KPIs development	All technical partners
V0.6	12/12/2024	Internal review	EMP
V0.7	18/12/2024	Review of the updated Use Cases and KPIs	All technical partners
V0.8	27/12/2024	Review by peer reviewers	ZLC, IRIS
V1.0	30/12/2024	Final version for submission	EMP, 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 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

Partner	Country	Short name
EUROPEAN DYNAMICS LUXEMBOURG SA	LU	**ED**
EUROPEAN DYNAMICS ADVANCED INFORMATION TECHNOLOGY AND TELECOMMUNICATION SYSTEMS SA	*EL*	***EDAT***
ERGASTIRIA GALANAKIS E E	EL	**GL**
FUNDACION ZARAGOZA LOGISTICS CENTER	ES	**ZLC**
EMPRACTIS E.E. SYMVOULOI MICHANIKOI	EL	**EMP**
DNV BUSINESS ASSURANCE ITALY SRL	IT	**DNV**
IRIS TECHNOLOGY SOLUTIONS, SOCIEDAD LIMITADA	ES	**IRIS**
LEIBNIZ-INSTITUT FUER AGRARENTWICKLUNG IN TRANSFORMATIONSOEKONOMIEN (IAMO)	DE	**IAMO**
EREVNITIKO PANEPISTIMIAKO INSTITOUTO SYSTIMATON EPIKOINONION KAI YPOLOGISTON	EL	**ICCS**
LAUREA-AMMATTIKORKEAKOULU OY	FI	**LAU**
EXUS SOFTWARE MONOPROSOPI ETAIRIA PERIORISMENIS EVTHINIS	EL	**EXUS**
INNOV-ACTS LIMITED	CY	**INNOV**
CARR COMMUNICATIONS LIMITED	IE	**CARR**
COSMOSHIP MARITIME LIMITED	CY	**COSMO**
NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE	UA	**NULES**
MINISTRY OF AGRARIAN POLICY AND FOOD OF UKRAINE	UA	**MINAG**
ALL-UKRAINIAN PUBLIC ORGANISATION UKRAINIAN AGRARIAN CONFEDERATION	UA	**UAC**
ASSOCIATION UKRAINIAN AGRIBUSINESSCLUB	UA	**UCAB**
ELLINIKOS GEORGIKOS ORGANISMOS - DIMITRA	EL	**ELGO**
LUONNONVARAKESKUS	FI	**LUKE**
ENOSI KATANALOTON POIOTITA TIS ZOIS	EL	**EKP**
ROUSSAS ANONYMI ETAIREIA	EL	**ROUS**
SPREAD EUROPEAN SAFETY AND SUSTAINABILITY GEIE	IT	**SPES**
FEDERAZIONE ITALIANA DELL INDUSTRIAALIMENTARE ASSOCIAZIONE	*IT*	***FEDAL***
ASSOCIATION NATIONALE DES INDUSTRIES ALIMENTAIRES	*FR*	***ANIA***
FEDERACAO DAS INDUSTRIAS PORTUGUESAS AGRO-ALIMENTARES	*PT*	***FIPA***
FEDERACION ESPANOLA DE INDUSTRIAS DE LA ALIMENTACION Y BEBIDAS	*ES*	***FIAB***
SYNDESMOS ELLINIKON VIOMICHANION TROFIMON SOMATEIO	*EL*	***SEVT***
TUERKIYE SUET ET GIDA SANAYICILERI VE UERETICILERI BIRLIGI DERNEGI	*TR*	***SETBIR***
GOSPODARSKA ZBORNICA SLOVENIJE	*SI*	***CCIS***
LEBENSMITTELVERSUCHSANSTALT	*AT*	***LVA***
POTRAVINARSKA KOMORA CESKE REPUBLIKY	*CZ*	***FFDI***
BIGH SA	BE	**BIGH**
MC SHARED SERVICES SA	PT	**MC**
MODELO CONTINENTE HIPERMERCADOS S.A.	*PT*	***MCH***
ELAFINA ANONYMI ETAIREIA	EL	**ELAF**

Table of Contents

LIST OF FIGURES

LIST OF TABLES

List of Abbreviations and Acronyms

Acronym	Meaning
ABM	Agent-Based Model
AI	Artificial Intelligent
API	Application Programming Interface
B2B	Business-to-Business
COM	Communication (EU)
CS	Case Study
DoA	Description of Actions
DSRA	Dairy System Resilience assessment
EC	European Commission
EU	European Union
FLW	Food Loss and Waste
FS	Food Security
GA	Grand Agreement
GUI	Graphical User Interface
ID	Identification
IFS	International Featured Standards
ISO	International Organization for Standardization
IWT	Inland waterway transport
KPIs	Key Performance Indicators
NGO	Non-Governmental Organization
OAuth2	Open Authorization 2
PAG	Project Advisory Group
PDCA	Plan-Do-Check-Act
TAT	Turn-Around-Time
UC	Use Case
UR	User Requirements
URL	Uniform Resource Locator
WP	Work Package

Executive Summary

This deliverable provides a comprehensive summary of the key outcomes of Task 2.3 (T2.3), which focuses on eliciting the user requirements for the SecureFood ecosystem, detailing relevant use cases and defining Key Performance Indicators (KPIs). The user requirements capture the expectations and needs of end users regarding the SecureFood solutions and form the backbone for the development of the project's models, frameworks and tools. Use cases provide a detailed description of the tasks users can perform using the SecureFood solutions, illustrating a step-by-step interaction between the user and the system, as well as the system's response. Finally, the KPIs reflect the key functionalities and characteristics that need to be offered by the SecureFood solutions and enable the assessment of the development progress, at critical stages.

For the elicitation of the user requirements, the entire consortium was actively engaged. Firstly, a questionnaire was shared with the technical partners asking for non-technical descriptions of the functionalities offered by their solutions. The collected information provided the end-uses with an overview of the scope and characteristics of each proposed solution and facilitated the upcoming discussions. Then, some crucial questions were included to the ad-hoc questionnaire of T2.1 to capture the key needs and difficulties the end users deal with, in their supply chain. The input collected through the two questionnaires, as well as the information provided by the Description of Action (DoA), guided the development of an indicative list of requirements. This list steered the conversation between the SecureFood partners (both end users and technical partners) during two focus group meetings. The purpose of these meetings was to facilitate a collaborative discussion among the SecureFood partners, fostering a shared understanding of the SecureFood baseline, and to define the user requirements. Following the focus group discussions, the first version of the user requirements was drafted and validated by the consortium. To incorporate diverse perspectives, this list was subsequently evaluated and validated by a broader target group from the food sector during a workshop that took place in M12. The workshop included members of the Project Advisory Group (PAG) and the extended stakeholder group. This step aimed to facilitate the reporting and sharing of ideas, needs and requirements, ensuring that the development of the SecureFood solutions aligns with the broader community's needs and expectations. During the workshop, an interactive process was followed, allowing the evaluation and validation of the user requirements, as well as their update and refinement. The finalized list comprises 66 user requirements in total. These requirements will be translated into system requirements in T2.4. The definition of the system requirements, together with the incremental development and customization of the SecureFood solutions, may result to the identification of additional user requirements, supporting the idea of solutions' co-design and co-development. User requirements are meant to serve as reference for evaluating the SecureFood solutions in WP6.

The user requirements elicitation process offered also valuable insights into defining the SecureFood use cases and KPIs. These insights were further enhanced through the knowledge gained from T2.4 and T6.1. T2.4 focuses on the technical specifications of the system components, including the overall architecture of SecureFood, while T6.1 addresses the planning of the four case studies. As a result, 17 use cases were developed, providing a comprehensive description of the core tasks users can perform with the solutions designed for the SecureFood system.

Additionally, two sets of KPIs were defined: the first set pertains to the performance characteristics of each individual SecureFood solution, and the second addresses the most critical performance features of the SecureFood ecosystem. The KPI inventory includes 58 solution-specific KPIs, and 7 cross-KPIs, providing tangible and measurable metrics crucial for validating the project's success. These KPIs will be measured during the four piloting activities in WP6.

1 Introduction

1.1 WP2 objectives and tasks

This deliverable comes under the scope of SecureFood Work Package 2 (WP2), titled "Background analysis, food security drivers, requirements and high-level reference architecture". WP2 conducts an in-depth analysis of food security gaps and vulnerabilities, identifies its main drivers, and defines user requirements and reference architecture to support the project's ecosystem. These efforts are structured around four main tasks, each contributing to a robust foundation for the project's strategic goals:

- **T2.1. Background analysis, state of play, and identification of gaps:** It undertakes a comprehensive literature review and regulatory analysis to map the current food security landscape in the EU, identifying vulnerabilities and areas for improvement. This task includes gathering perspectives from diverse stakeholders through surveys, helping to clarify specific needs and challenges across the food supply chain, which will inform the work of WP6.
- **T2.2. Food security drivers and targeted interventions:** Building on the findings from T2.1, this task examines the primary drivers influencing food security by looking at the extended food security pillars. The analysis integrates end user insights with literature-based findings, creating a framework to understand both immediate and long-term factors that impact food security, thus contributing directly to WP3 by supporting the development of scenarios for food system resilience.
- **T2.3. User requirements, use cases, and KPIs definition:** This task engages end users across the food supply chain to gather and refine a detailed set of requirements, capturing user expectations, capabilities, and needs within the SecureFood ecosystem. These requirements ensure that the developed models, frameworks, and digital tools are user-centered and effective in addressing real-world challenges, laying the groundwork for the system requirements and WP6 activities. Use cases outline specific tasks that users can accomplish with SecureFood solutions, while KPIs determine what will be tested, measured, and validated during the case studies.
- **T2.4. System requirements and high-level reference architecture:** It synthesizes insights from previous tasks to design a reference architecture that supports SecureFood's digital, collaborative, and governance solutions. This architecture will guide subsequent project phases, particularly tool development, scenario planning, and policy recommendations, ensuring that each component aligns with the overall goals of building a resilient, adaptive food system.

1.2 Purpose of the document

This deliverable D2.2, titled "Identification of Use Case Scenarios and User Requirements," is the main outcome of T2.3 (User Requirements, Use Cases, and KPIs Definition). Its main purpose is to present the user requirements and the use cases of the SecureFood ecosystem, as well as the KPIs that will be used for validating the SecureFood solutions.

This deliverable primarily focuses on eliciting the SecureFood user requirements, which reflect the end users' expectations and needs from the SecureFood solutions. These user requirements serve as the foundation of the SecureFood project, proving a critical reference framework for the design, development, deployment, and successful implementation of the solutions.

In addition to the user requirements, the deliverable presents a comprehensive inventory of use cases and KPIs. The use cases provide an overview of the tasks users can perform with the SecureFood system and the processes required to interact with the system and its solutions. The KPIs define the system's critical performance attributes, forming the basis for evaluating the quality and effectiveness of the SecureFood solutions.

1.3 Intended readership and connection to other deliverables

This document is primary intended for the SecureFood project consortium, including the end users and technical partners. It also targets external stakeholders such as food actors across the supply chain, competent authorities responsible for food security, policymakers, IT specialists and R&D experts. The deliverable aims to provide insights into end-user expectations for solutions that enhance food system resilience and security, as well as to outline how SecureFood solutions will function.

Deliverable 2.1, which detailed the state of play and gaps in food security and the food security drivers, provided essential input to T2.3 activities reported in the present deliverable. Conversely, the current deliverable serves as a foundation for developing the system requirements in T2.4 (Deliverable 2.3) while it will offer guidance for creating the SecureFood individual solutions, including frameworks, models, and digital tools, in WP3, WP4, and WP5, as outlined in Table 1.3.1. Moreover, the work presented in Deliverable 2.2 serves as reference for Deliverables 6.1. 6.2 and 6.3 forming the basis for designing realistic scenarios in the four case studies, and for evaluating and validating the SecureFood solutions.

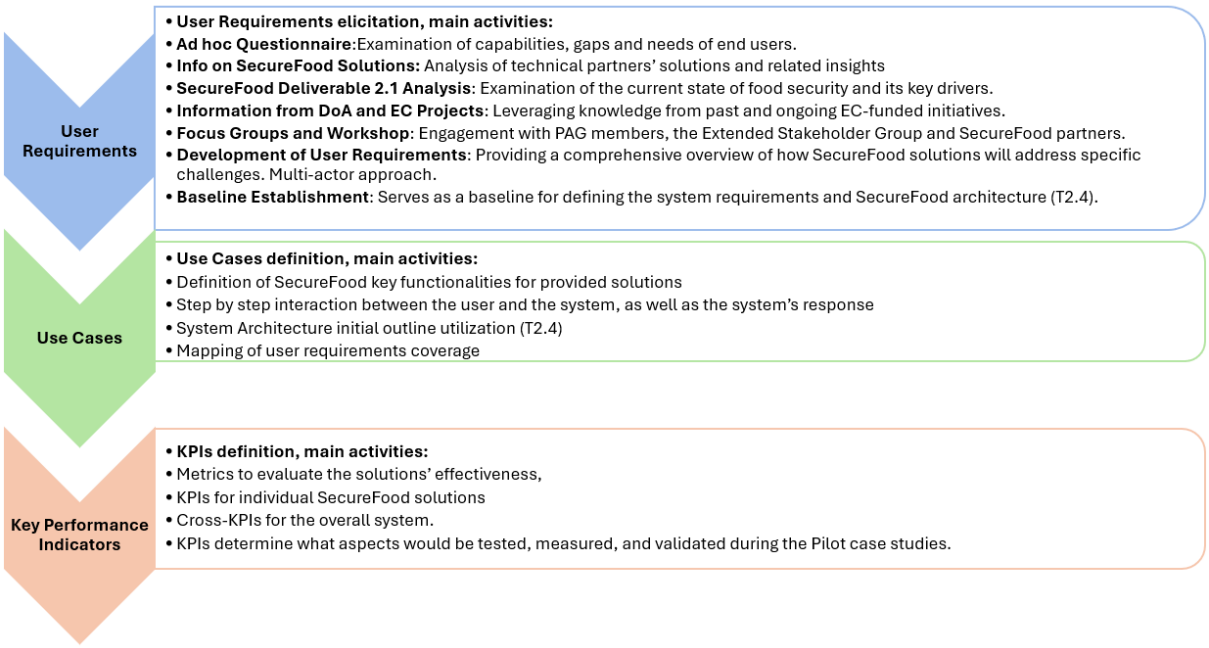
Table 1.3.1 – The SecureFood solutions

	No	SecureFood Solution	Responsible partner	WP	Task
Frameworks & Models	1	Interdependencies assessment	ZLC	3	3.2.1
	2	Risk and vulnerability assessment	DNV	3	3.2.2
	3	Resilience assessment	LUKE	3	3.2.3
	4	Economic modelling	NULES	3	3.2.4
	5	Food loss and waste modelling	GL	3	3.3
	6	Supply chain modelling	ZLC	4	4.1
	7	Resilience governance framework	DNV	3	3.4
	8	Resilience management framework	EMP	3	3.5
Digital Solutions	9	WASTE-SEC	GL	3	3.3
	10	FSRM	EMP	3	3.5
	11	Digital Twin	IRIS	4	4.2
	12	AgriPolis	IAMO	4	4.3
	13	3D XR-based simulator	IAMO	4	4.4
	14	Observatory dashboard	EXUS	5	5.1
	15	Early warning mechanism	ED	5	5.2
	16	RESILOG	ICCS	5	5.3
	17	Information exchange platform	INNOV	5	5.4

2 General methodological approach

The present deliverable has a threefold scope: i) eliciting the SecureFood user requirements, ii) defining the SecureFood use cases and iii) developing the SecureFood KPIs. An outline of the general methodological approach and key procedural steps followed to address this scope are presented in Figure 1.

Figure 1 – Main procedural steps applied for D2.2 development



The detailed description of the adopted methodological steps applied for each phase is presented in Chapters 3, 4 and 5.

3 User requirement elicitation

3.1 Methodology for the definition of the user requirements

SecureFood adopts the principles of the multi-actor approach, aiming at developing solutions that result from the cross-fertilization of knowledge and experience of both technical partners and the food system stakeholders. The active involvement of the end users, including all relevant stakeholders across the food supply chain such as producers, processors, transporters, wholesalers, retailers, consumers, and regulatory authorities- ensures that the resulting solutions deliver tangible value and facilitate future market uptake. The co-development process begins with defining the user requirements, allowing the end user to articulate their expectations and needs for the solutions provided by the technical partners. A user requirement is a statement specifying a necessary attribute, capability, characteristic, or quality of the solutions, ensuring they are valuable and practical for the intended users. These user requirements serve as a starting point for the development phase and may be further refined and enriched during the incremental development and customization of the solutions in the upcoming WPs.

To facilitate the definition of the user requirements, it was first deemed essential to familiarize end users with the SecureFood solutions. To achieve this, a dedicated questionnaire was developed and distributed to the technical partners to gather detailed, non-technical information about the key functionalities and characteristics of their proposed solutions. The responses enabled the creation of a comprehensive catalogue summarizing all SecureFood solutions, providing end users with valuable insights into their capabilities. The key questions posed to the technical partners were as follows:

- What is the purpose of the model? What information does it provide?
- What is the purpose of the framework? What does it offer to the end users?
- What is the purpose of the digital solution? What does it do? What does it offer to the user?
- Which stages of the food supply chain does your model/framework/digital solution address?
- Who is the target audience for the model results? Who is the user of the digital solution?
- Which resilience phase(s) does your model/framework/digital solution address?
- What advantages does it offer over existing technology? What makes your digital solution innovative?
- What kind of data would you need from the end users for customizing and training your model/framework? What kind of data would you need from the end users for developing and customizing your digital solution?
- What metrics would you use to evaluate your model's/ framework's/digital solution's performance?
- Does your digital solution require specialized training to operate?
- What infrastructure is needed for deploying and operating your digital solution?

Initial feedback from the end users was obtained through the ad-hoc questionnaire created under T2.1. This questionnaire included targeted questions designed to gather valuable insights relevant to T2.3. The questions aimed to assess user needs, current work practices, and identify gaps in their existing systems. Below is a representative set of these questions:

- Do you adhere to any national and/or international guidelines/best practices regarding food supply and food security matters?

- Do you use a dedicated digital communication mechanism allowing information sharing before and during crises, and the timely reporting of food security-related incidents to competent authorities and other stakeholders?
- What specific functionalities would you like to see in the digital twin to address your challenges?
- Are there aspects of confidentiality or commercial competition that technical partners should consider while developing their solutions?
- Based on your perception, which are the most important characteristics that need to be offered by the SecureFood technologies (*multiple choice:* reliability, interoperability, usability, modularity, scalability, autonomy)?

Based on the feedback gathered from the end users through the ad-hoc questionnaire, the solutions information catalogue, the information provided in the DoA, and the extensive knowledge from past and ongoing EC funded projects addressing food supply and security, an indicative list of potential user requirements was developed.

The next step in the user requirements elicitation process involved scheduling focus group meetings. These meetings fostered creative discussions among SecureFood partners to establish a shared understanding of the project objectives and refine the user requirements. Two remote focus groups meetings took place in M5, with participation of both end users and technical partners. During the meetings, the indicative list of user requirements was shared with all participants. Technical partners presented the initial functionalities of their solutions, explaining how these could address the identified needs. Then the end users had the opportunity not only to evaluate if these requirements meet the challenges they face, but also to express their additional needs and expectations from the SecureFood ecosystem. In addition, the SecureFood end users indicated a priority level for each requirement, considering how important the fulfillment of this requirement is for the enhancement of food systems resilience.

Following the completion of the focus groups, the end users and technical partners engaged in a cross-checking validation activity, providing feedback on the requirements' content. This iterative process aimed at finalizing the first version of the SecureFood user requirements list and ensure alignment among all consortium partners. This consensus established a clear set of priorities and goals to guide the development of the SecureFood system.

3.2 Requirements' validation during the stakeholders' workshop

As a follow-up activity, the user requirements elicitation process included the validation of the first version of the user requirements through a dedicated workshop with the PAG and the extended stakeholders group. The purpose of this workshop was to gather input from users with diverse knowledge backgrounds and ensure that the SecureFood system's development will be also underpinned by broader community needs.

The workshop was conducted remotely on December 13th (M12), with active engagement of a total of 36 participants. This included 2 members of the PAG, 6 members of the extended stakeholder group, along with SecureFood end users and technical partners. The agenda of the workshop is presented in Table 3.2.1.

The session began with an overview of the SecureFood project delivered by the project coordinator, outlining the project's vision and scope. This was followed by a presentation from the technical coordinator, introducing the innovative technical solutions and offering a clear description of the cutting-edge solutions being developed. These presentations were

essential in establishing a shared understanding of SecureFood objectives, thereby facilitating an effective evaluation and validation process.

Table 3.2.1 - Schedule of User Requirements validation workshop

SecureFood Workshop – User Requirements validation		
Time Schedule (CET)	Topic	Presenter
08:00-08:10	People joining, welcome, greetings	
08:10-08:30	The SecureFood Project – Scope and objectives	ED
08:30-08:45	The SecureFood innovation technical solutions	ICCS
08:45-08:55	Overview of the Workshop	EMP
08:55-09:25	The SecureFood User Requirements review and validation: ▪ Legislation, policies and standards ▪ Frameworks for food systems resilience ▪ Models for food systems resilience	EMP
09:25-09:40	Break	
09:40-11:00	The SecureFood User Requirements review and validation: ▪ Digital tools for situational awareness and decision support ▪ Usability ▪ Reliability ▪ Confidentiality and data protection ▪ Cost ▪ Societal	EMP

The first version of the user requirements was then presented as a basis for the evaluation and feedback collection process. To guide discussions, a series of critical questions were introduced focusing on identifying key issues and gathering actionable recommendations. Participants were asked to assign a priority level (high, medium or low) to each user requirement, as well as to provide relevant, non-functional specifications and additional insights. Feedback was collected via Slido application, which enables the participants to submit their responses digitally. Real-time sharing of responses through Slido allowed for collaborative discussions and deeper exploration of each user requirement. Figure 1 provides indicative screenshots of the polling results displayed during the workshop.

The insights gathered during the workshop were instrumental in refining the user requirements and adjusting their priority level for implementation. After analyzing the collected feedback, the final version of the user requirements was formulated.

Figure 2 - Polling results presentation in the Slido application during the workshop

3.3 The SecureFood user requirements

The elicitation process resulted in the development of a final list of 66 SecureFood user requirements. These requirements were organized into nine thematic categories, each reflecting specific contexts of expectations identified during the process. To ensure clarity and traceability, each requirement was assigned a unique code that incorporates its corresponding category, followed by a numerical identifier to distinguish between requirements within the same category. Table 3.3.1 presents an overview of the requirements' categories along with the adopted coding scheme.

Table 3.3.1 - User requirements' grouping

Category	Code
Legislation, policies and standards	UR-LPS-#
Frameworks for food systems resilience	UR-FR-#
Models for food systems resilience	UR-MOD-#
Digital tools for situational awareness and decision support	UR-DGT-#
Usability	UR-USB-#
Reliability	UR-REL-#
Confidentiality and data protection	UR-CONF-#
Cost	UR-COST-#
Societal	UR-SOC-#

Each requirement was further assigned a unique title along with a comprehensive description, providing sound information on the exact expectations it addresses. Additionally, every requirement was categorized according to a priority level (high, medium, or low), indicating its importance to the end users and the alignment with the capabilities of the proposed solutions.

The priority levels were defined as follows:

- High priority – This prioritization is assigned to the requirements that form the core set of SecureFood functionalities and characteristics that are desired by the end users and must be delivered by the SecureFood solutions. Those high-priority requirements draw mainly on the information available in the DoA, updated by the feedback received by the end users.
- Medium priority – This prioritization is assigned to important requirements that add the necessary functionalities to ensure that SecureFood will deliver added technical and business value above the mandatory (high priority) requirements. The SecureFood project will strive to meet those important requirements.
- Low priority – This prioritization is assigned to interesting requirements that have the potential to add value to the SecureFood solutions, though if they are not met they do not hamper the core value of the offered solutions. The project may be able to fulfill some of these requirements, however, will not commit to their completion. In many cases they are out of the scope of the project, as outlined in the DoA, or exceed available resources. In the event they are not achieved within the project, they could be considered for future adaptations or follow-up projects.

The final version of the SecureFood user requirements is summarized in Tables 3.3.2 – 3.3.67.

Table 3.3.2 - Directive (EU) 2022/2557 (UR-LPS-01)

Title: Directive (EU) 2022/2557			
Code	UR-LPS-01	**Category**	Legislation, policies and standards
Description	The SecureFood solutions (frameworks, models, digital tools) should comply with the requirements of the Directive (EU) 2022/2557 on the resilience of critical entities.		
Priority level	High		

Table 3.3.3 - Regulation (EC) No 178/2002 (UR-LPS-02)

Title: Regulation (EC) No 178/2002			
Code	UR-LPS-02	**Category**	Legislation, policies and standards
Description	The SecureFood solutions should comply with the Regulation (EC) No 178/2002 which lays down the general principles and requirements of food law.		
Priority level	High		

Table 3.3.4 - Regulation (EC) No 679/2016 (UR-LPS-03)

Title: Regulation (EC) No 679/2016			
Code	UR-LPS-03	**Category**	Legislation, policies and standards
Description	The SecureFood solutions should comply with the requirements of the EU Regulation 2016/679 on the protection of natural persons with regard to processing of personal data and on the free movement of such data.		
Priority level	High		

Table 3.3.5 - COM(2020)381 (UR-LPS-04)

Title: COM(2020)381			
Code	UR-LPS-04	Category	Legislation, policies and standards
Description	The SecureFood solutions should follow the principles of the COM(2020)381 "A Farm to Fork strategy".		
Priority level	High		

Table 3.3.6 - COM(2019)640 (UR-LPS-05)

Title: COM(2019)640			
Code	UR-LPS-05	Category	Legislation, policies and standards
Description	The SecureFood solutions should follow the principles of the COM(2019)640 "The European Green Deal".		
Priority level	High		

Table 3.3.7 - COM(2022)133 (UR-LPS-06)

Title: COM(2022)133			
Code	UR-LPS-06	Category	Legislation, policies and standards
Description	The SecureFood solutions should follow the principles of the COM(2022)133 "Safeguarding food security and reinforcing the resilience of food systems".		
Priority level	High		

Table 3.3.8 - COM(2021)689 (UR-LPS-07)

Title: COM(2021)689			
Code	UR-LPS-07	Category	Legislation, policies and standards
Description	The SecureFood solutions should follow the principles of the COM (2021)689 "Contingency plan for ensuring food supply and food security in times of crises".		
Priority level	High		

Table 3.3.9 - COM(2020)380 (UR-LPS-08)

Title: COM(2020)380			
Code	UR-LPS-08	Category	Legislation, policies and standards
Description	The SecureFood solutions should follow the principles of the COM(2020)380 "EU Biodiversity strategy for 2030".		
Priority level	High		

Table 3.3.10 - CAP (UR-LPS-09)

Title: CAP			
Code	UR-LPS-09	Category	Legislation, policies and standards
Description	The SecureFood solutions should comply with the requirements of the Common Agricultural Policy (CAP).		
Priority level	High		

Table 3.3.11 - CFP (UR-LPS-10)

Title: CFP			
Code	UR-LPS-10	Category	Legislation, policies and standards
Description	The SecureFood solutions should comply with the requirements of the Common Fisheries Policy (CFP).		
Priority level	High		

Table 3.3.12 - International Standards (UR-LPS-11)

Title: International Standards			
Code	UR-LPS-11	Category	Legislation, policies and standards
Description	The SecureFood solutions should comply with the requirements of the ISO 22000 "Food Safety Management System", ISO 9001 "Quality Management System", BRCGS "Global Food Safety Standard" 9th edition, IFS Food Standard version 8.		
Priority level	High		

Table 3.3.13 - Stakeholders collaboration (UR-FR-01)

Title: Stakeholders collaboration			
Code	UR-FR-01	Category	Frameworks for food systems resilience
Description	SecureFood should reinforce the collaboration among public and private stakeholders, at national and international level. It should allow the establishment of a common understanding on food security aspects and set commonly agreed priorities and interventions. It should empower stakeholders to be actively engaged in the resilience-building activities, while it should define their roles and responsibilities before and during crises.		
Priority level	High		

Table 3.3.14 - National plans (UR-FR-02)

Title: National plans			
Code	UR-FR-02	Category	Frameworks for food systems resilience
Description	SecureFood should provide guidance to competent authorities regarding the development of national strategies/plans on the resilience of food systems, following the requirements of the Directive (EU) 2022/2557.		
Priority level	High		

Table 3.3.15 - Resilience plans (UR-FR-03)

Title: Resilience plans			
Code	UR-FR-03	Category	Frameworks for food systems resilience
Description	SecureFood should provide guidance to food system stakeholders on the development of their resilience plans, based on the requirements of the Directive (EU) 2022/2557. Those plans should		

	address all potential short and long-term hazards and threats and provide recommendations on the necessary preparedness, prevention, response and mitigation measures, considering also sustainability and reorientation dimensions.
Priority level	High

Table 3.3.16 - Interdependencies assessment (UR-MOD-01)

Title: Interdependencies assessment			
Code	UR-MOD-01	**Category**	Models for food systems resilience
Description	SecureFood should enable the analysis of interdependencies and interactions (e.g. economic, political and geographic) among the multi-sectoral network of actors, elements, activities, processes, infrastructure and essential services along the food supply chain.		
Priority level	High		

Table 3.3.17 - Risk and vulnerability assessment (UR-MOD-02)

Title: Risk and vulnerability assessment			
Code	UR-MOD-02	**Category**	Models for food systems resilience
Description	SecureFood should enable the identification and analysis of the risks that are induced by the different drivers on the SecureFood food value chains and their impact on the key pillars of food security.		
Priority level	High		

Table 3.3.18 - Risk treatment (UR-MOD-03)

Title: Risk treatment			
Code	UR-MOD-03	**Category**	Models for food systems resilience
Description	SecureFood should enable the analysis of risk reduction and mitigation practices' effectiveness, highlighting the most appropriate measures/actions/mechanisms that minimize risks and improve resilience.		
Priority level	High		

Table 3.3.19 - Resilience assessment (UR-MOD-04)

Title: Resilience assessment			
Code	UR-MOD-04	**Category**	Models for food systems resilience
Description	SecureFood should enable the assessment of food systems resilience to shocks, disturbances and changes, considering agronomic, economic and social dimensions that capture the capacities to confront both short- and long-term changes.		
Priority level	High		

Table 3.3.20 - Economic modelling (UR-MOD-05)

Title: Economic modelling			
Code	UR-MOD-05	Category	Models for food systems resilience
Description	SecureFood should enable the potential impact assessment of different policies and shocks on agricultural commodity markets.		
Priority level	High		

Table 3.3.21 - Food loss and waste modelling (UR-MOD-06)

Title: Food loss and waste modelling			
Code	UR-MOD-06	Category	Models for food systems resilience
Description	SecureFood should enable the optimization of food loss and food waste reduction efforts, while ensuring food systems resilience and food security.		
Priority level	High		

Table 3.3.22 - Forecast future supply chain disruptions (UR-MOD-07)

Title: Forecast future supply chain disruptions			
Code	UR-MOD-07	Category	Models for food systems resilience
Description	SecureFood should enable the forecasting of future supply chain disruptions and the identification of optimal recovery strategies for counteracting those disruptions.		
Priority level	High		

Table 3.3.23 - Resilience management (UR-DGT-01)

Title: Resilience management			
Code	UR-DGT-01	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should allow food system stakeholders to assess the maturity level of their existing resilience management procedures and identify relevant strengths and weaknesses.		
Priority level	High		

Table 3.3.24 - Food loss and waste tool (UR-DGT-02)

Title: Food loss and waste tool			
Code	UR-DGT-02	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should enable food system stakeholders to optimize their food loss and waste while ensuring food security. It should provide insights to stakeholders on where and how much food is wasted in the supply chain, and what they can do to minimize this waste.		
Priority level	High		

Table 3.3.25 - Agricultural structures simulation (UR-DGT-03)

Title: Agricultural structures simulation			
Code	UR-DGT-03	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should observe and analyze how policies and unexpected events impact changes in farm structures.		
Priority level	High		

Table 3.3.26 - Consumer behavior analysis (UR-DGT-04)

Title: Consumer behavior analysis			
Code	UR-DGT-04	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should enable the analysis of consumer behaviour in different scenarios, through the simulation of real-world conditions.		
Priority level	High		

Table 3.3.27 - Food actors behavior analysis (UR-DGT-05)

Title: Food actors behavior analysis			
Code	UR-DGT-05	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should also enable the analysis of food actors behaviour in different scenarios, through the simulation of real-world conditions.		
Priority level	Medium		

Table 3.3.28 - Digital communication among stakeholders (UR-DGT-06)

Title: Digital communication among stakeholders			
Code	UR-DGT-06	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should provide a digital mechanism for advancing the communication among food system stakeholders. Through this digital communication mechanism, food system stakeholders can share knowledge and good practices on food security matters.		
Priority level	High		

Table 3.3.29 - Reporting of commodities stocks (UR-DGT-07)

Title: Reporting of commodities stocks			
Code	UR-DGT-07	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should enable food actors to report data on commodities stocks. Those data will be available to other, interdependent actors, governmental entities and competent authorities.		
Priority level	High		

Table 3.3.30 - Incident reporting (UR-DGT-08)

Title: Incident reporting			
Code	UR-DGT-08	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should provide incident reporting capabilities, so as to enable food actors to notify, in a consistent manner, public authorities and other stakeholders on food-security related incidents that take place on their business environment.		
Priority level	High		

Table 3.3.31 - Optimization of food transportation (UR-DGT-09)

Title: Optimization of food transportation			
Code	UR-DGT-09	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should optimize the transportation of food supplies and dynamically provide feasible alternative routes in case of events that affect the availability of transport networks.		
Priority level	High		

Table 3.3.32 - Prediction of route performance (UR-DGT-10)

Title: Prediction of route performance			
Code	UR-DGT-10	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should enable the prediction of route performance, providing a more accurate estimation of the reliability of each route.		
Priority level	High		

Table 3.3.33 - Drivers' analytics (UR-DGT-11)

Title: Drivers' analytics			
Code	UR-DGT-11	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should inform food system stakeholders on the status and trends of food security drivers. Those drivers should be pertinent to the challenges and peculiarities of the SecureFood food value chains, e.g. drivers related to climate change, energy market speculation and global trade dynamics.		
Priority level	High		

Table 3.3.34 - Detection of various kinds of hazards and threats (UR-DGT-12)

Title: Detection of various kinds of hazards and threats			
Code	UR-DGT-12	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should be versatile and adaptable to predict and detect various kinds of hazards, threats and risks.		
Priority level	High		

Table 3.3.35 - Timely prediction of long-term stresses (UR-DGT-13)

Title: Timely prediction of long-term stresses			
Code	UR-DGT-13	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should enable the timely prediction of long-term stresses. The prediction of long-term stresses should be performed at least 6 months ahead.		
Priority level	High		

Table 3.3.36 - Timely detection of short-term shocks (UR-DGT-14)

Title: Timely detection of short-term shocks			
Code	UR-DGT-14	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should enable the timely detection of short-term shocks. The detection of short-term shocks should take place at least 6 hours before their occurrence.		
Priority level	High		

Table 3.3.37 - Warning notification/Alert (UR-DGT-15)

Title: Warning notification/Alert			
Code	UR-DGT-15	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should provide warning notifications/alerts to food system stakeholders every time a potential, upcoming stress/shock/disruption is predicted or detected.		
Priority level	High		

Table 3.3.38 - Criticality of warning notification/alert (UR-DGT-16)

Title: Criticality of warning notification/alert			
Code	UR-DGT-16	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should assign a criticality level to each warning notification/alert based on the risk level of the predicted/detected event. Relevant information should be available to the end users.		
Priority level	High		

Table 3.3.39 - Support action / Recommendation action (UR-DGT-17)

Title: Support action / Recommendation action			
Code	UR-DGT-17	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should provide recommendation actions and decision support to the end users for the efficient handling of the predicted/detected events.		
Priority level	High		

Table 3.3.40 - Confirmation of threat elimination (UR-DGT-18)

Title: Confirmation of threat elimination			
Code	UR-DGT-18	Category	Digital tools for situational awareness and decision support
Description	When a warning notification/alert goes off, the SecureFood system should provide a means to confirm that the event has been closed.		
Priority level	Medium		

Table 3.3.41 - Real-time monitoring of the food supply chain (UR-DGT-19)

Title: Real-time monitoring of the food supply chain			
Code	UR-DGT-19	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should enable the real-time monitoring, analysis and optimization of the supply chains operations, through their virtual replica (digital twin).		
Priority level	High		

Table 3.3.42 - Systems representation (UR-DGT-20)

Title: Systems representation			
Code	UR-DGT-20	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should combine information from the SecureFood subsystems and selected user's legacy systems, supporting the supervision of those systems.		
Priority level	Medium		

Table 3.3.43 - Simulation and what-if scenarios (UR-DGT-21)

Title: Simulation and what-if scenarios			
Code	UR-DGT-21	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should enable end users to run simulations and what-if scenarios in the digital replica of their food supply chain. By these means they can evaluate the potential impact of disruptions and adaptations in the supply chain before making direct applications in the real food supply chains.		
Priority level	High		

Table 3.3.44 - Information filtering (UR-DGT-22)

Title: Information filtering			
Code	UR-DGT-22	Category	Digital tools for situational awareness and decision support
Description	The information displayed on the SecureFood system should be categorized/classified based on the role of the person who accesses the system.		
Priority level	Medium		

Table 3.3.45 - Report generation (UR-DGT-23)

Title: Report generation			
Code	UR-DGT-23	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should generate a situation report (in Word, pdf or any other file format) once an incident has occurred.		
Priority level	Medium		

Table 3.3.46 - Mobile devices (UR-DGT-24)

Title: Mobile devices			
Code	UR-DGT-24	Category	Digital tools for situational awareness and decision support
Description	The SecureFood system should be available for mobile devices (tablets and smartphones).		
Priority level	Medium		

Table 3.3.47 - User-friendly interface (UR-USB-01)

Title: User-friendly interface			
Code	UR-USB-01	Category	Usability
Description	The SecureFood system should provide a user-friendly environment that is easily understandable and all presented information should be clear.		
Priority level	High		

Table 3.3.48 - Multilingual interface (UR-USB-02)

Title: Multilingual interface			
Code	UR-USB-02	Category	Usability
Description	The SecureFood system should provide a multilingual user interface. Apart from English, it should be available in the official language of the end users leading the project case studies (i.e., Ukrainian, Portuguese, Greek).		
Priority level	Medium		

Table 3.3.49 - Modularity (UR-USB-03)

Title: Modularity			
Code	UR-USB-03	Category	Usability
Description	Users should be able to use either parts of or the whole SecureFood system depending on their needs.		
Priority level	High		

Table 3.3.50 - Autonomy (UR-USB-04)

Title: Autonomy			
Code	UR-USB-04	Category	Usability
Description	The SecureFood system should be able to operate without human intervention.		
Priority level	Medium		

Table 3.3.51 - Event register (UR-USB-05)

Title: Event register			
Code	UR-USB-05	Category	Usability
Description	The SecureFood system should allow the setup of an event register that will record and trace all SecureFood related actions that are carried out during an (upcoming) incident/crisis and the SecureFood system is aware of.		
Priority level	High		

Table 3.3.52 - Interoperability (UR-USB-06)

Title: Interoperability			
Code	UR-USB-06	Category	Usability
Description	The SecureFood system has to be interoperable with selected existing monitoring tools and systems of end users.		
Priority level	High		

Table 3.3.53 - Data storage (UR-USB-07)

Title: Data storage			
Code	UR-USB-07	Category	Usability
Description	The SecureFood system should be able to store historical data, which can be made available for further processing.		
Priority level	High		

Table 3.3.54 - Accurate information (UR-REL-01)

Title: Accurate information			
Code	UR-REL-01	Category	Reliability
Description	The SecureFood system should provide accurate information to the stakeholders. The false alert rate should be within the boundaries of 0 to 10%.		
Priority level	High		

Table 3.3.55 - Event correlation (UR-REL-02)

Title: Event correlation			
Code	UR-REL-02	Category	Reliability
Description	The SecureFood system should be able to correlate two or more events in order to exhibit increased situational awareness and/or improve its detection capabilities by increasing the reliability of the predictions/detections.		
Priority level	Medium		

Table 3.3.56 - Alert location (UR-REL-03)

Title: Alert location			
Code	UR-REL-03	Category	Reliability
Description	The SecureFood system should provide positional information on the warning notification/alert (when applicable).		
Priority level	Medium		

Table 3.3.57 - Close to real time notification (UR-REL-04)

Title: Close to real time notification			
Code	UR-REL-04	Category	Reliability
Description	The SecureFood system should provide close to real time notifications to the stakeholders about food security related incidents.		
Priority level	High		

Table 3.3.58 - Information on non-available subsystems (UR-REL-05)

Title: Information on non-available subsystems			
Code	UR-REL-05	Category	Reliability
Description	The SecureFood system should notify the user when the source of information for the subsystems is no longer available/accessible (system health check).		
Priority level	Medium		

Table 3.3.59 - Replaceability (back-up) (UR-REL-06)

Title: Replaceability (back-up)			
Code	UR-REL-06	Category	Reliability
Description	The SecureFood system should provide the possibility to store/back-up the gathered data.		
Priority level	High		

Table 3.3.60 - Availability (UR-REL-07)

Title: Availability			
Code	UR-REL-07	Category	Reliability
Description	Taking into consideration the time for maintenance and the mean time to repair, the SecureFood system should be fully available at all times.		
Priority level	High		

Table 3.3.61 - Scalability (UR-REL-08)

Title: Scalability			
Code	UR-REL-08	Category	Reliability
Description	The SecureFood system should be able to maintain its performance and efficiency even in operational demands that exceed everyday use.		
Priority level	High		

Table 3.3.62 - Digitally secure, safe and resilient (UR-CONF-01)

Title: Digitally secure, safe and resilient			
Code	UR-CONF-01	Category	Confidentiality and data protection
Description	The SecureFood system should be digitally secure and safe (protected against hackers and malware), as well as resilient to easily recover fast from potential adverse events.		
Priority level	High		

Table 3.3.63 - Authentication and authorization (UR-CONF-02)

Title: Authentication and authorization			
Code	UR-CONF-02	Category	Confidentiality and data protection
Description	The SecureFood system should allow for secure authentication and authorization for different types of users.		
Priority level	High		

Table 3.3.64 - Data anonymization (UR-CONF-03)

Title: Personal Data Handling			
Code	UR-CONF-03	Category	Confidentiality and data protection
Description	All personal data gathered by the SecureFood system has to be anonymized.		
Priority level	High		

Table 3.3.65 - Data protection (UR-CONF-04)

Title: Data protection			
Code	UR-CONF-04	Category	Confidentiality and data protection
Description	All data gathered by SecureFood need to be secured.		
Priority level	High		

Table 3.3.66 - Cost-efficiency (UR-COST-01)

Title: Cost-efficiency			
Code	UR-COST-01	Category	Cost
Description	The SecureFood system should be cost-efficient (taking into account commercial prices of equivalent available systems).		
Priority level	High		

Table 3.3.67 - Accessibility (UR-SOC-01)

Title: Accessibility			
Code	UR-SOC-01	Category	Societal
Description	The SecureFood system should be accessible to everyone, acknowledging population diversity such as ageism, poverty and minorities.		
Priority level	High		

4 Use Cases

4.1 Methodology for the definition of the use cases

A use case is a detailed, structured description of a specific scenario in which a system, process, or solution is applied to achieve a defined objective. It outlines the interactions between users (or "actors") and the system, focusing on the functional requirements, goals and outcomes within a particular context. Use cases give detailed realistic examples of how users may carry out their tasks in a specified context with the system. It provides a structured representation of user's actions and system behaviour by outlining a sequence of steps the actors and the system perform in a defined order, while adhering to specified preconditions and postconditions.

In the context of the SecureFood project, use cases play a pivotal role in elaborating the user requirements, and are designed to address two key audiences: end users and technical partners. For the end users, the use cases demonstrate the primary objectives and outline the steps necessary to achieve these objectives using the SecureFood solutions. For technical partners, the use cases specify the functionalities that must be integrated into their solutions to enable users to complete their tasks effectively.

The development of the SecureFood use cases began with the identification of key actors and their goals. Within the context of SecureFood, the relevant actors identified include:

- Policy Makers/Competent Authorities. Includes governmental and regulatory bodies such as food safety authorities, and policy research institutes focused on compliance and public welfare.
- Producers and Processors. Encompasses agricultural producers (e.g., cooperatives and farmers), food processing companies, industry associations, crisis management professionals, quality control specialists, and R&D experts dedicated to sustainable production.
- Transport and Logistics Operators. Includes fleet and cold chain service providers, transport associations, logistics organizations and IoT/technology solution providers specializing in tracking systems.
- Retailers and Wholesalers. Covers large retail chains, wholesaler networks, trade organizations, and providers of supply chain software.
- Consumers (Public). Represents consumer protection agencies, NGOs focused on food security, mobile app developers, educational institutions promoting consumer awareness, and media platforms driving public campaigns.

Goals are articulated from the perspective of the actors and reflect the key tasks they aim to accomplish using the SecureFood system. Each identified goal was translated into a separate use case. Since use cases are designed to ensure that all user requirements are fulfilled through the technological development process, the adopted approach captured and incorporated all high priority user requirements in the formulation of the use cases. It is important to mention that certain user requirements are applicable to all use cases. These general requirements are listed in Table 4.1.1 and are not reiterated in the detailed descriptions of each individual use case.

Table 4.1.1 General User Requirements covered by all Use Cases

User requirements covered by all use cases		
Category	Code	Title
Legislation, policies and standards	UR-LPS-01	Directive (EU) 2022/2557
	UR-LPS-02	Regulation (EC) No 178/2002
	UR-LPS-03	Regulation (EC) No 679/2016
	UR-LPS-04	COM(2020)381
	UR-LPS-05	COM(2019)640
	UR-LPS-06	COM(2022)133
	UR-LPS-07	COM(2021)689
	UR-LPS-08	COM(2020)380
	UR-LPS-09	CAP
	UR-LPS-10	CFP
	UR-LPS-11	International Standards
Digital tools for situational awareness and decision support	UR-DGT-24	Mobile devices
Usability	UR-USB-01	User-friendly interface
	UR-USB-03	Modularity
	UR-USB-04	Autonomy
	UR-USB-06	Interoperability
	UR-USB-07	Data storage
Reliability	UR-REL-06	Replaceability (back-up)
Confidentiality and data protection	UR-CONF-02	Authentication and authorization
	UR-CONF-03	Personal Data Handling
	UR-CONF-04	Data protection
Cost	UR-COST-01	Cost-efficiency
Societal	UR-SOC-01	Accessibility

Each use case was assigned a unique identifier code, accompanied by a descriptive title outlining its scope, the primary actors involved and a diagram visually representing the interactions between the actors and the system. Additionally, a brief description was provided, along with pre-conditions, post-conditions, a basic flow detailing the actor's steps and corresponding system responses, alternative flows, and the user requirements addressed

by the use case. Further details regarding the aforementioned types of information are presented below.

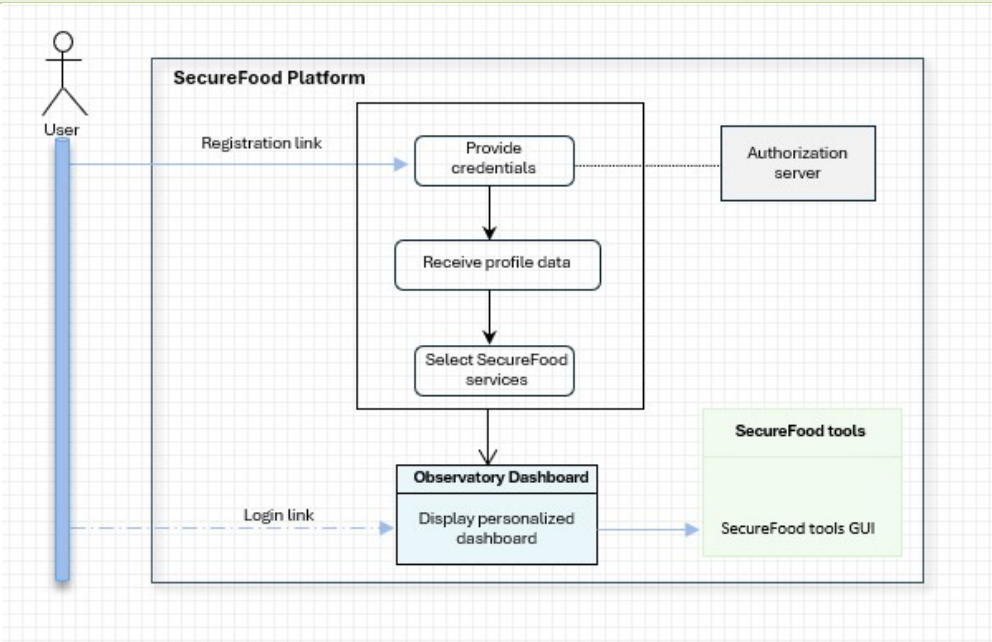
- ID: A unique code to facilitate cross-referencing.
- Name: A concise title that effectively communicates the scope and goal of the use case from the user's perspective.
- Main actor: The user interacting with the system to achieve the goal.
- Diagram: A visual representation illustrating the actors, subsystems, or tools involved in the use case.
- Brief description A short explanation providing an overview of the use case.
- Pre-conditions: The conditions or requirements that must be met for the use case to be executed.
- Post-conditions: The resulting state of the system once the use case has been completed.
- Basic flow:
    - Actor action: A detailed sequence of steps the actor performs to accomplish the goal.
    - System response: A clear description of the system's actions in response to each user interaction.
    - Notes: Clarifications or additional details on actor actions or system responses.
- Alternative flows: Descriptions of alternative sequences to those outlined in the basic flow.
  User requirements coverage: The IDs of the functionalities involved, as described in the user requirements.

The development of the use cases was achieved through the feedback gathered during the definition of the user requirements, while it was also supported by the preliminary version of the SecureFood architecture currently defined in T2.4. The detailed input by the consortium and the extensive elaboration was instrumental for defining meaningful and valuable use cases. These uses cases, 17 in total, are presented in section 4.2.

4.2 The SecureFood use cases

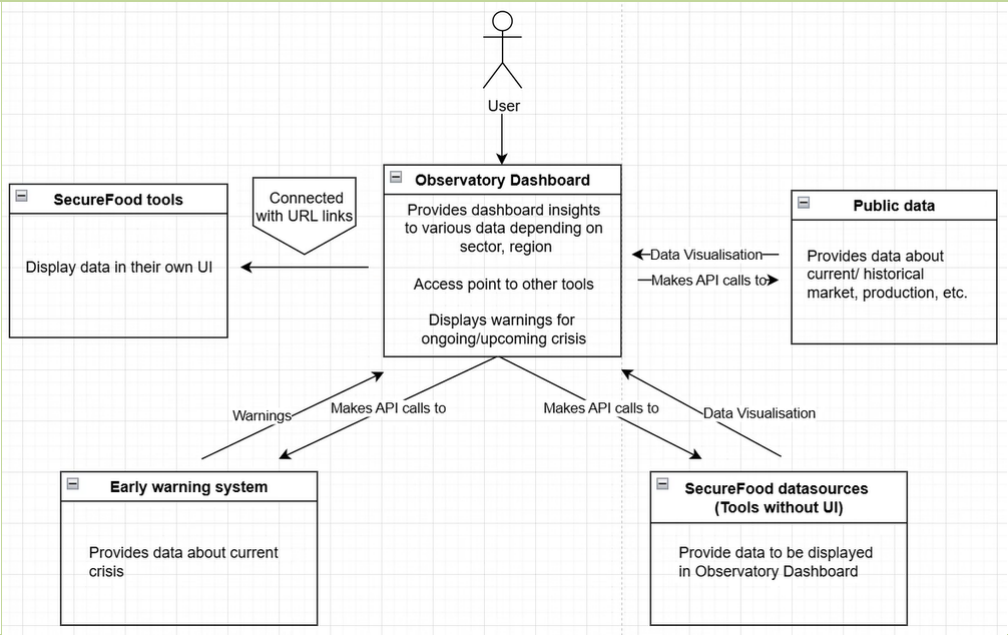
The SecureFood use cases are presented in Tables 4.2.1-4.2.17.

Table 4.2.1 - UC1: Log in into the SecureFood platform and profile customization

UC1: Registration and log in into the SecureFood platform and profile customization			
Main actor	Policy Makers/Competent Authorities, Food Supply Chain actors (i.e. producers, processors, transport operators, wholesalers, retailers, consumers)		
Diagram			
Brief description	Users need to complete the registration process to gain access to the SecureFood platform. Once registered, they can log in using their username and password from their computer or portable devices. The platform will collect the following type of information: 1. Personal Profile Data: Includes first name, last name, email address and role. 2. Tool-Specific User Attributes: Profile parameters for the various SecureFood tools. 3. Usage Statistics: Includes data on users, website visits and usage frequency. Within the platform, users can update their personal information, select the SecureFood tools they wish to use, and navigate accordingly. To ensure secure communication across all services, the platform employs OAuth2 authentication.		
Pre-conditions	The SecureFood platform and its tools are functional.		
Post-conditions	Users have successfully logged into their SecureFood platform, gained access to selected tools and can view specific profile parameters.		
Basic flow			
Step	Actor Action	System Response	Additional Information
1	The user accesses the SecureFood platform (through the Observatory Dashboard) and selects	The SecureFood platform requests the user to provide personal profile data and to select specific tools from a predefined	

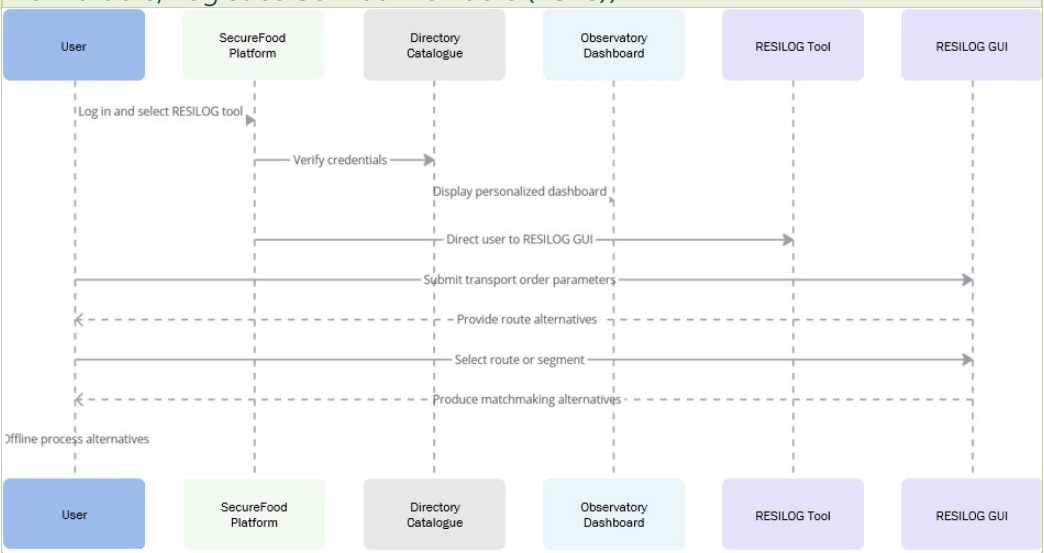
	the registration link.	list, to grant access.	
2	The user inputs personal profile data and selects their preferred SecureFood tools from the provided list.	The SecureFood platform saves the profile data in the directory catalogue, and an acknowledge is returned to the user.	
3	The user accesses the requested tools via dashboard hyperlinks and on the tool GUI, clicks on the user profile.	The SecureFood platform requests the user attributes necessary to configure its functionalities tailored to the user.	Applicable for the tools that require user attributes other than the personal data.
4	The user provides their preferred attributes per tool.	The SecureFood tool saves the user attributes in its own user profile.	
5	The user returns to the SecureFood dashboard and selects Login link.	The SecureFood system prompts the user to enter their username and password. If authentication is successful, the user is logged in, and their personal dashboard along with the list of registered tools is displayed.	
7	The user processes the dashboard information and selects a specific tool to use.	The user is redirected to the specific tool's GUI and proceeds with operations based on the tool's functionalities.	The system maintains a consistent web palette to enhance the user experience.
Alternative Flows			
Step 5. If authentication fails due to incorrect credentials, the user is redirected to the login page.			
User requirements coverage			
UR-CONF-02 Authentication and authorization UR-DGT-22 Information filtering UR-USB-02 Multilingual interface			

Table 4.2.2 - UC2: Display of real time analysis and historical data for food security drivers

UC2: Display of real time analytics and historical data for food security drivers			
Main actor	Policy Makers/Competent Authorities, Food Supply Chain actors (i.e. producers, processors, transport operators, wholesalers, retailers, consumers)		
Diagram			
Brief description	The system can continuously acquire a comprehensive range of dynamic data e.g. weather/climate data, food marker prices, food demand, commodities price evolution, crop production data, energy and other variables through the Observatory Dashboard. The user can view detailed information as through clear, concise, and analytical tables, along with an overview of multiple data sources. This functionality is meant to support informed decision-making process across the food actor's value chain.		
Pre-conditions	1. The user is successfully registered with the SecureFood platform. 2. Relevant data sources are operational and provide up-to-date or historical data as required. 3. Data integration pipelines are functioning correctly to ensure seamless data ingestion. 4. The Early Warning System, the Digital Twin and other tools that will display their outcomes on the Dashboard are operational and sharing relevant data with the dashboard.		
Post-conditions	1. The user has accessed and interpreted actionable insights through visualizations and analytics. 2. Any issues identified during user interactions are logged, and necessary updates or maintenance tasks are planned or executed. 3. The dashboard has effectively contributed to monitoring, analyzing, and addressing key drivers of change in the food value chain.		
Basic flow			
Step	Actor Action	System Response	Additional Information
1	The user logs into the SecureFood platform.	The system verifies credentials and displays the personalized dashboard.	
2	The user remains in the	The system displays key	Dashboard

	Observatory Dashboard interface.	metrics, summaries, and notifications/alerts (e.g., price volatility, delays, food deficiencies) in a dashboard layout.	communicates with other tools and displays notifications/alerts.
3	The user selects a data category (e.g., food prices, crop data) from a menu or dashboard.	The system fetches and loads data visualizations specific to the selected category.	
4	The user interacts with visualizations (e.g. zooming into charts, selecting trends).	The system displays interactive visualizations like, line charts or flow diagrams based on the selected data and scope.	
5	The user monitors live data updates for specific categories.	The system updates the dashboards from SecureFood internal sources and other external resources.	
Alternative Flows			
-			
User requirements coverage			
UR-DGT-22 Information filtering UR-DGT-11 Drivers' analytics			

Table 4.2.3 - UC3: Calculation of optimal transport routes for goods transport purposes

UC3: Discovery of route alternatives and matchmaking options for goods transport purposes	
Main actor	Food Supply Chain actors (i.e. transport operators, shippers, freight forwarders, Logistics Service Providers (LSPs))
Diagram	
Brief description	RESILOG builds upon the Logistics Matchmaking Platform algorithms for short-sea-shipping routes developed during the MOSES project to expand and include hinterland transport routes such as road, rail and inland waterways as well as cargo parameters pertinent to the food supply chain such as temperature, humidity and consolidation/stacking options. The system operates based on distinct user roles structured across two levels. The first level caters to service providers, encompassing a spectrum of transport operators such as trucking companies, rail operators and shipping lines. These entities leverage the platform to effortlessly upload their routing schedules both via B2B operations using an API or manually through a user-friendly API. The second level caters to end users and potential customers, such as shippers, freight forwarders and logistics service providers (LSPs). This segment of the platform is tailored to deliver tangible benefits through optimization and collaborative matchmaking for the reduction of the number of trips or even the identification of possibilities to shift cargo from road traffic to rail or IWT traffic. End users digitally submit on system level the transport orders via an API or manually set the parameters for their transport order via the RESILOG GUI and receive the relative route alternatives with their characteristics such as turn-around-time (TAT), total emissions and cost estimates per multimodal transport leg. Moreover, post processing of submitted orders can reveal opportunities for modal shift.
Pre-conditions	1. The user is successfully registered with the SecureFood platform. 2. Availability of transport schedules available in the designated geographical area. 3. Declared capacity of transport means per cargo type. 4. Availability of a considerable number of transport orders to extract matchmaking opportunities.
Post-conditions	1. The user receives route alternatives with TAT, emissions and cost estimates. 2. The user receives matchmaking alternatives for specific transport orders.

Basic flow			
Step	**Actor Action**	**System Response**	**Additional Information**
1	The user logs into the SecureFood platform and selects the RESILOG tool.	The system verifies the credentials and displays the personalized dashboard. Upon selecting the RESILOG tool, the user is directed to RESILOG GUI.	
2	The user submits transport order parameters such as origin, destination and cargo type /volume.	The system provides route alternatives.	
3	The user selects a route or a segment (leg) of a multimodal route to request matchmaking alternatives.	The system produces matchmaking alternatives for the requested time window and cargo type parameters (i.e. food cargo cannot be consolidated with dangerous goods transport or food pallets cannot be stackable in a truck).	
4	The user offline processes the alternatives and proceeds with the cargo routing and resilience planning of the shipments.		
Alternative Flows			
Step 2	The user utilizes RESILOG API to transmit transport orders.	The system verifies credentials and enables the relative web service for the transmission of the message payload.	
Step 3	The user utilizes RESILOG API to transmit request for matchmaking alternatives.	The system verifies credentials and enables the relative web service for the matchmaking alternatives for the requested time window and cargo type parameters (i.e. food cargo cannot be consolidated with dangerous goods transport or food pallets cannot be stackable in a truck).	

Step 4	The user processes the alternatives offline and proceeds with the cargo routing and resilience planning of the shipments.	The system displays interactive visualizations like line charts or flow diagrams based on the selected data and scope.	
User requirements coverage			
UR-DGT-9 Optimization of food transportation UR-DGT-10 Prediction of route performance			

Table 4.2.4 - UC4: Forecasting transportation routes' efficiency

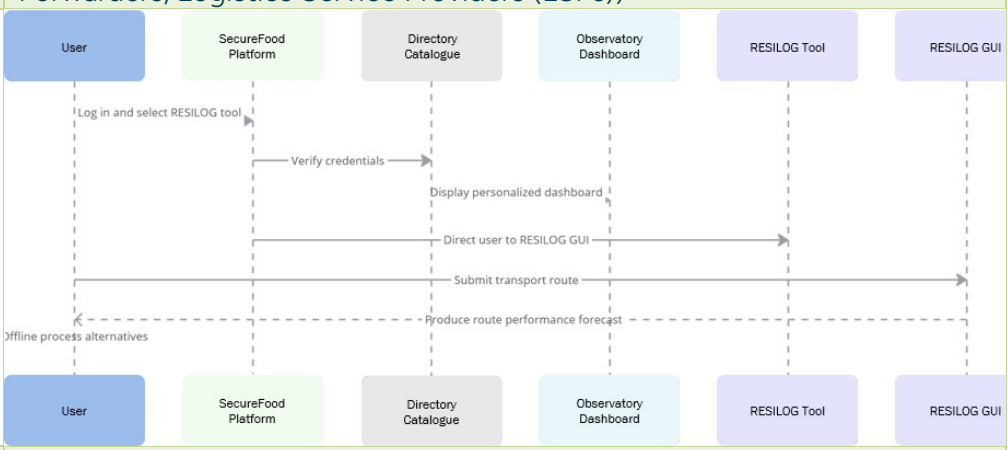
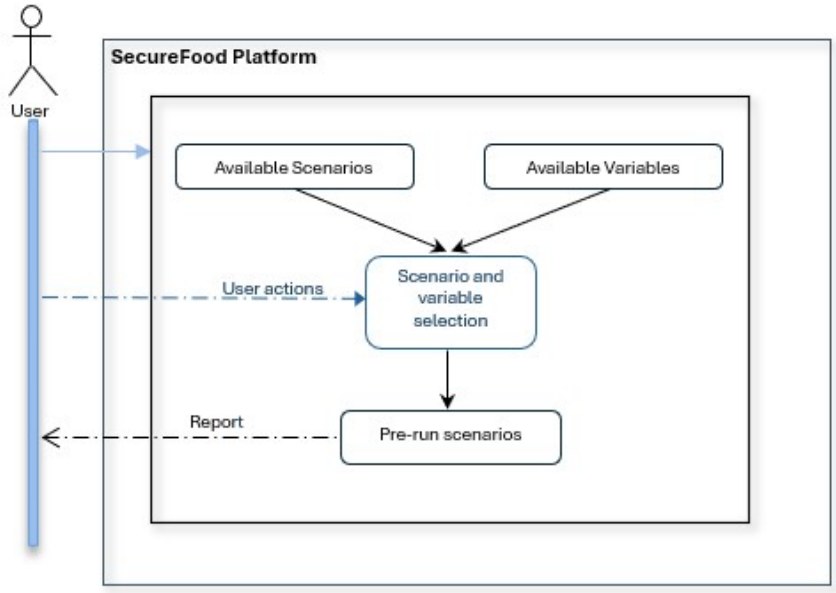
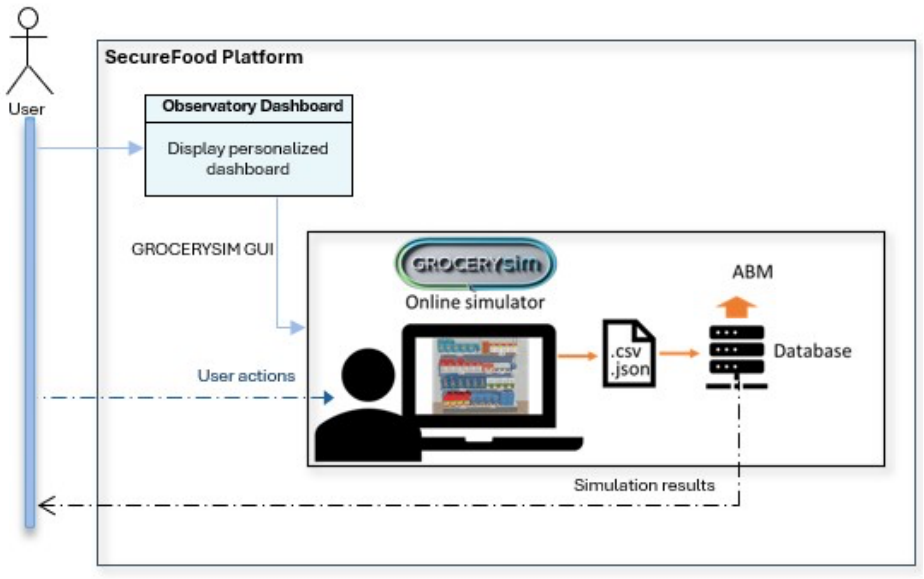
UC4: Forecasting transportation routes' efficiency			
Main actor	Food Supply Chain actors (i.e. Transport Operators, Shippers, Freight Forwarders, Logistics Service Providers (LSPs))		
Diagram			
Brief description	RESILOG supports the forecasting of the overall route efficiency in terms of cargo volumes transported over the declared capacities of transport operators on the platform as well as route availability over a specific time period.		
Pre-conditions	1. The user is successfully registered with the SecureFood platform. 2. Availability of transport schedules available in the designated geographical area. 3. Declared capacity of transport means per cargo type. 4. Offline availability of transported cargo volumes over the routes declared in RESILOG. 5. Offline availability of data regarding disruptions occurred over a specific time period in the geographical area of coverage. 6. Offline forecasted disruptions in the geographical area of coverage by EWS, DT and Information Exchange.		
Post-conditions	The user receives forecast for route capacity utilization and availability.		
Basic flow			
Step	**Actor Action**	**System Response**	**Additional Information**
1	The user logs into the SecureFood platform and selects the RESILOG tool.	The system verifies the credentials and displays the personalized dashboard. Upon selecting the RESILOG tool, the user is redirected to RESILOG GUI.	
2	The user submits forecast request for a specific route.	The system provides forecast for route capacity and availability.	
Alternative Flows			
-			
User requirements coverage			
UR-DGT-9 Optimization of food transportation UR-DGT-10 Prediction of route performance			

Table 4.2.5 - UC5: Simulation of policies and unexpected events impacts, on farm structures

UC5: Simulation of policies and unexpected events impacts, on farm structures			
Main actor	Policy Makers/Competent Authorities, Producers (Farmers)		
Diagram			
Brief description	The purpose of the AgriPoliS model is to analyze how farm structures evolve in response to various policy interventions and economic changes. The model specifically focuses on: 1. Structural changes: Understanding dynamics such as farm exits, farm growth, and shifts in the distribution of farm sizes. 2. Efficiency: Investigating changes in factors such as land rent, production levels, capital allocation, and labor input. 3. Distributional issues: Examining how policies impact land rental prices and farm income, providing insights into the distribution of economic benefits and costs within the agricultural sector. AgriPoliS is designed to capture the complex interactions between policy interventions and farm-level decision-making to predict the effects on agricultural structures and economic outcomes. While there is no direct response in this model, an Agent-Based Model (ABM) enables the observation of how the system evolves over time, including emergent phenomena such as agricultural structural changes. These include the evolution of farm sizes, production patterns, and farm performance. This is achieved via simulations conducted across multiple policy scenarios and shocks and availability of relevant data via the SecureFood platform.		
Pre-conditions	1. The user is successfully registered with the SecureFood platform. AgriPolis Autonomous process: • Simulation is run for several policy or shock scenarios		
Post-conditions	The system provides information on simulation results for selected scenarios and indicators.		
Basic flow			
Step	Actor Action	System Response	Additional Information
1	The user logs into the SecureFood platform and selects the	The system verifies the credentials and displays the personalized	

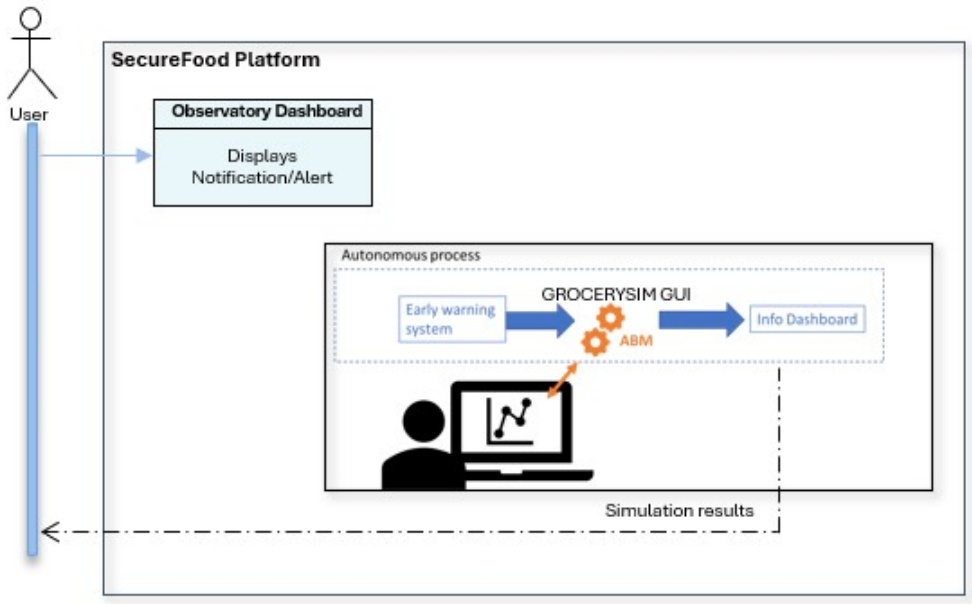
	AgriPoliS tool.	dashboard. Upon selecting the AgriPoliS tool, a list of AgriPoliS predefined scenarios and indicators is provided.	
2	The user selects the scenarios and indicators of interest.	The system provides information on simulation results for the selected scenarios and indicators.	Due to computational demand the simulations must be pre-run.
Alternative Flows			
-			
User requirements coverage			
UR-DGT-03 Agricultural structures simulation			

Table 4.2.6 - UC6: Real-time simulation of consumer and food actors' behavior in normal conditions (before crisis)

UC6: Real-time simulation of consumer and food actors' behavior in normal conditions (before crisis)			
Main actor	Consumers		
Diagram			
Brief description	GROCERYSIM is an online 3D simulation application designed to immerse users in realistic grocery store scenarios tailored to the SecureFood project. By navigating through pre-defined situations, users interact with a virtual environment to simulate and observe their decision-making and purchasing behaviors. The primary goal is to collect data on consumer behavior, which is later used to inform and calibrate the parameters of an Agent-Based Model (ABM), helping to better understand and predict responses in food-related contexts.		
Pre-conditions	1. The user is successfully registered with the SecureFood platform. 2. Accepting consent before starting the application. 3. Understanding how to navigate the application (the activities should be intuitive and user-friendly).		
Post-conditions	1. Receiving immediate feedback on behavioural activities compared to the study conducted with persons in a real environment (real grocery shop). 2. Indication that the simulation is over and that the application will be closed.		
Basic flow			
Step	Actor Action	System Response	Additional Information
1	The user logs into the SecureFood platform and selects the GROCERYSIM tool.	The system verifies the credentials and displays the personalized dashboard. Upon selecting the GROCERYSIM tool, the user is directed to GROCERYSIM GUI.	
2	The user activates the application.	The application loads on the screen and prompts the user for consent.	

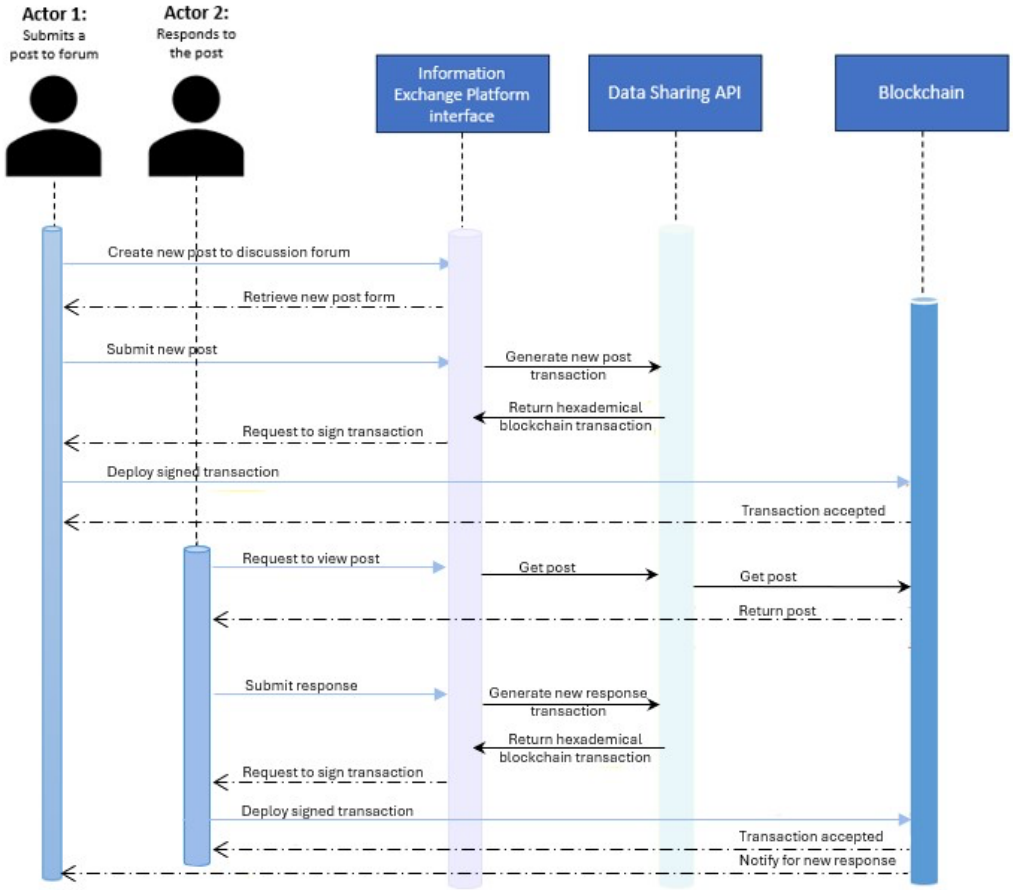
3	The user accepts the consent and selects the provided scenario.	The application starts and presents various scenarios.	
4	The user selects a scenario.	The system offers a 3D environment along with clear instructions for guidance.	
	The user interacts with the environment depending on the specific circumstances.	The system gathers data on consumer behavior to inform and calibrate the parameters of an Agent-Based Model (ABM), enhancing the ability to understand and predict responses in food-related scenarios.	
Alternative Flows			
1	The user logins to the SecureFood platform and selects the GROCERYSIM.	The system verifies credentials and displays the personalized dashboard. Upon selecting the GROCERYSIM tool, the user is directed to GROCERYSIM GUI.	
2	The user selects a scenario from a predefined list.	The tool provides the results of the simulations conducted.	
3	The user interacts with the graphical output.	The tool provides graphical interpretation of the simulation results.	
User requirements coverage			
UR-DGT-04 Consumer behavior analysis UR-DGT-21 Simulation and what-if scenarios			

Table 4.2.7 - UC7: Real-time simulation of consumer and food actors' behavior during the shock events

UC7: Real-time simulation of consumer and food actors' behaviour during shock events			
Main actor	Consumers (main actors), Actors involved in decision making: Policy Makers/Competent Authorities, Food Supply Chain actors (i.e. producers, processors, transport operators, wholesalers, retailers).		
Diagram			
Brief description	The ABM simulates potential changes in products' stocks and prices within a grocery store under various scenarios. It utilizes consumer behaviour data collected from the GROCERYSIM application and testing of consumers in a real environment to create realistic, scenario-based predictions. These scenarios can be triggered automatically by the Early Warning System in response to events, providing insights into market dynamics. Additionally, the ABM allows users to independently explore and experiment with custom scenarios, enabling them to assess the impact of different conditions on stock levels and pricing, independent of Early Warning System input.		
Pre-conditions	1. The user is successfully registered with the SecureFood platform. Autonomous process: 2. Information on an event received from the Early Warning System. 3. Database updated on consumer behaviour (uploaded to the ABM). 4. Setting the initial parameters (e.g. scenario selection).		
Post-conditions	Autonomous process: Providing information (simulation result) to the Observatory Dashboard via API. User interaction: Indication that the simulation is over and a visual representation of the results.		
Basic flow			
Steps	**Actor Action**	**System Response**	**Additional Information**
1	The user logins to the SecureFood platform.	The system provides notification/alert about a food security event.	The GROCERYSIM tool receives information from the Early Warning System. The model is

			activated, and the appropriate scenario is triggered.
2	The user clicks the notification/alert.	GROCERYSIM relevant simulation outputs are displayed.	GROCERYSIM sets the model to the initial state (listening for the events from the Early Warning System).
3	The user leverages the reported information to make informed decisions.		
Alternative Flows			
-			
User requirements coverage			
UR-DGT-19 Real-time monitoring of the food supply chain UR-DGT-04 Consumer behavior analysis UR-DGT-21 Simulation and what-if scenarios			

Table 4.2.8 - UC8: Information Exchange and Communication among trusted stakeholders

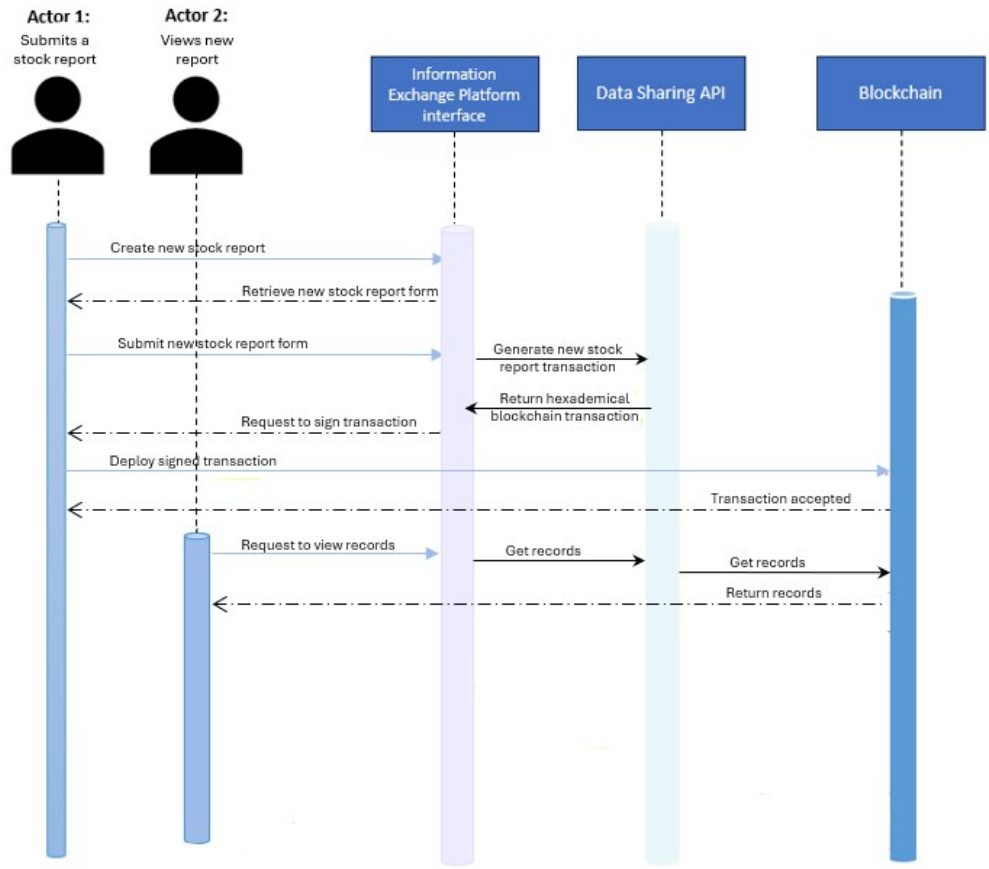
UC8: Information Exchange and Communication among trusted stakeholders				
Main actor	Actor Type 1: Food supply chain actor (e.g. producers, processors, transport operators, wholesalers, retailers etc. – the actor who asks for information/ best practice etc.) Actor Type 2: Interdependent actors / competent authorities (e.g. producers, processors, transport operators, wholesalers, retailers etc.-the actor who provides best practice/ knowledge including)			
Diagram				
Brief description	The Information Exchange Platform provides a trustworthy digital mechanism for advancing communication among food actors, sharing good practices and other information at national and European level. The tool provides user access to accurate, timely and potentially validated information that may not be easily compromised by external hostile actors, thanks to the specific benefits provided by the blockchain technology.			
Pre-conditions	1. The users are successfully registered with the SecureFood platform. 2. The users have smart wallet for signature purposes.			
Post-conditions	Actor Type 1 has successfully submitted a post asking for best practice / information. Actor Type 2 has successfully submitted an answer (providing relevant information) to Actor 1			
Basic flow				
Step	Actor Action		System Response	Additional Information
1	Actor Type 1 The user logs	Actor Type 2	The system verifies credentials and	

	into the SecureFood platform and selects the Information Exchange Platform tool.		displays the personalized dashboard. Upon selecting the Information Exchange Platform tool, the user is directed to Information Exchange Platform GUI.	
2	The user navigates to the discussion page and selects the preferred category based on the relevant position within the supply chain.		The tool presents the relevant records of the particular discussion.	
3	The user chooses the record that wants to contribute to.		The tool presents a (blank) form for the user to provide information.	
4	The actor fills the form providing all the relevant information and selects to submit.		The tool will generate the smart contract transaction that will be deployed in the blockchain and will prompt the actor to sign and deploy it to the blockchain.	The users when filling the form will need to "sign" their interaction (in blockchain terms this is a "transaction") using a specific key. This key is obtained by a smart wallet application, and this is how the transactions within a blockchain system are secured.
5	The user signs and deploys the transaction in the blockchain using their smart wallet.		The tool validates the transaction and incorporates it in the blockchain and notifies the actor that it was uploaded successfully	The tool will keep a record of the transaction.

6		The user logs into the SecureFood platform and selects the Information Exchange Platform tool.	The system verifies credentials and displays the personalized dashboard. Upon selecting the Information Exchange Platform tool, the user is directed to Information Exchange Platform GUI.	
7		The user navigates to the discussion page to view the submitted posts.	The tool presents a list of submitted transactions, including the post generated by actor 1.	
8		The user chooses the record that wants to contribute to.	The tool will present a (blank) form for the user to provide information.	
9		The user fills the form providing all the relevant information and selects to submit.	The tool will generate the smart contract transaction that will be deployed in the blockchain and will prompt the actor to sign and deploy it to the blockchain.	The users when filling the form will need to "sign" their interaction (in blockchain terms this is a "transaction") using a specific key. This key is obtained by a smart wallet application, and this is how the transactions within a blockchain system are secured.
10		The user signs and deploys the transaction in the blockchain using their smart wallet.	The tool validates the transaction and incorporates it in the blockchain and notifies the actor that it was uploaded successfully.	The tool will keep record of the transaction.
11	The user will be notified of the submission of actor 2 and		The tool will respond as described in steps 1-6. At the last step the system will	

	will repeat process steps 1-6 in order to view the offered response.		present all records including the response of Actor 2 in step 9.	
12	The user will leverage new knowledge to make informed decision.			
Alternative Flows				
Step 5. The tool fails to validate the transaction (e.g. mismatching cryptographic keys during the signature), rejects it and notifies the actor that the transaction failed) **Step 12.** Actor Type 1 may choose to respond to the response offered by Actor Type 2 and engage in further communication. As a result, steps 6-11 will enter an everlasting loop. * At the same time other actors may choose to respond to Actor Type 1. We assume that all actors intervening in the communication channel will follow the step-by-step process same as Actor Type 2 and enter the same loop as described.				
User requirements coverage				
UR-FR-01 Stakeholders collaboration UR-DGT-6 Digital communication among stakeholders				

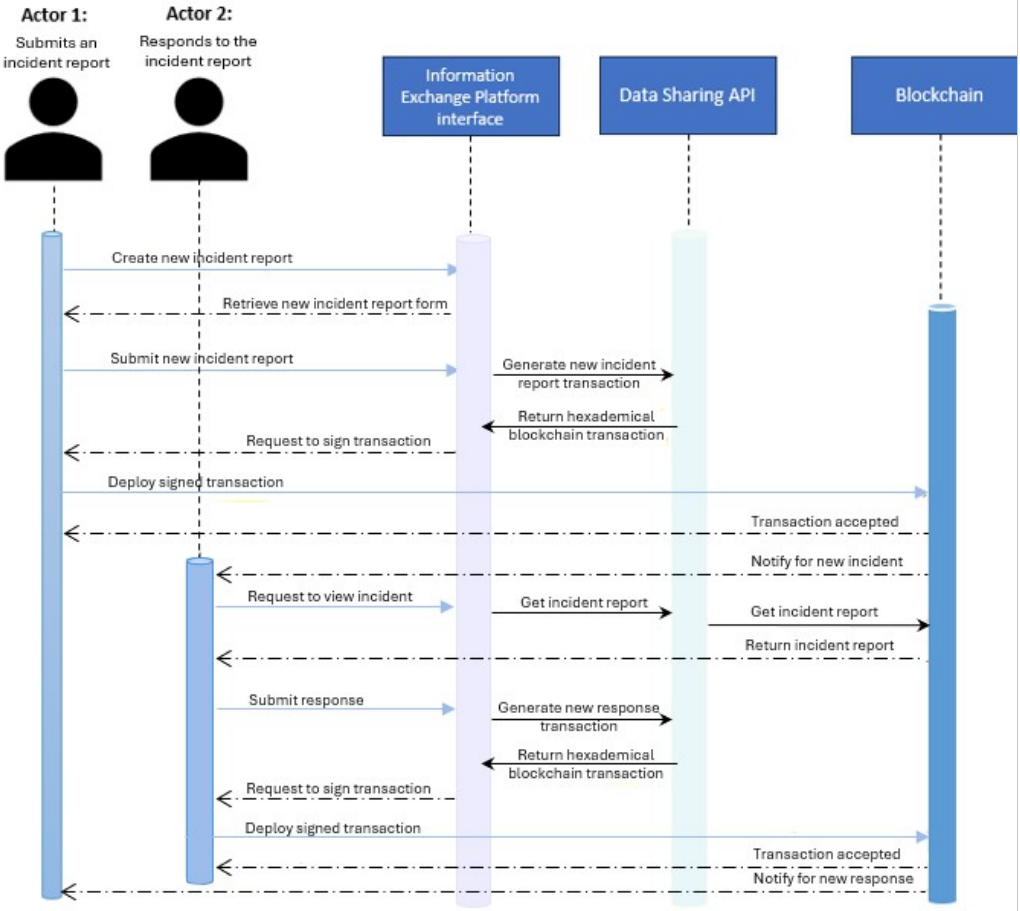
Table 4.2.9 - UC9: Reporting stock commodities

UC9: Reporting stock commodities			
Main actor	Actor Type 1: Food supply chain actor (e.g. producers, processors, transport operators, wholesalers, retailers etc. – the actor who asks for information/ best practice etc.) Actor Type 2: Interdependent actors / competent authorities (actor who views stock commodities available including producers, processors, transport operators, wholesalers, retailers etc.).		
Diagram			
Brief description	The system can provide a trustworthy digital mechanism for promoting awareness of the availability of essential commodities for food at national and European level. The system can provide user access to accurate, timely and potentially validated information that may not be easily compromised by external hostile actors, thanks to the specific benefits provided by the blockchain technology.		
Pre-conditions	1. The users are successfully registered with the SecureFood platform. 2. The users have smart wallet for signature purposes.		
Post-conditions	Actor Type 1 has recorded successfully their commodity stocks within the information exchange platform. Actor Type 2 has reviewed the stock availability.		
Basic flow			
Step	Actor Action	System Response	Additional Information
1	**Actor Type 1** The user logins to the SecureFood	The system verifies credentials and displays the personalized	

	platform and selects the Information Exchange Platform tool.		dashboard. Upon selecting the Information Exchange Platform tool, the user is directed to Information Exchange Platform GUI.	
2	The user navigates to the stock reporting page and selects the button indicating "create new report"		The tool presents the relevant form for the actor to submit	The predefined form of reporting stock will include: The name of the food actor; The date and time reporting; The location; Specifying the type of commodity (may include a two-level categorization. First level could be the general category based on the case studies e.g. Grain, milk & dairy products, fruits & vegetables, fish and aquaculture. The next lever is for the food actor to specify the type of commodity. If all types are predefined, there could be a dropdown list to choose from; The quantity of the stock; Anything else based on pilots needs;
3	The user completes the form with the appropriate values and submits it.		The tool will generate the smart contract transaction that will be deployed in the blockchain and will prompt the actor to sign and deploy it	The users when filling the form will need to "sign" their interaction (in blockchain terms this is a "transaction") using

			to the blockchain.	a specific key. This key is obtained by a smart wallet application and this is how the transactions within a blockchain system are secured.
4	The user signs and deploys the transaction in the blockchain using their smart wallet.		The tool validates the transaction and incorporates it in the blockchain and notifies the user that it was uploaded successfully.	The tool will keep record (logging) of the transaction.
5		**Actor Type 2** The user logs into the SecureFood platform and selects the Information Exchange Platform tool.	The system verifies credentials and displays the personalized dashboard. Upon selecting the Information Exchange Platform tool, the user is directed to Information Exchange Platform GUI.	
6		The user navigates to the stock reporting page to view the submitted reports.	The tool presents a list of submitted transactions, including the report generated by actor type 1.	
7		The user leverages the reported information to make informed decisions.		
Alternative Flows				
Step 4. The platform fails to validate the transaction (e.g. mismatching cryptographic keys during the signature), rejects it and notifies the actor that the transaction failed)				
User requirements coverage				
UR-DGT-7 Reporting of commodities stocks				

Table 4.2.10 - UC10: Incident reporting

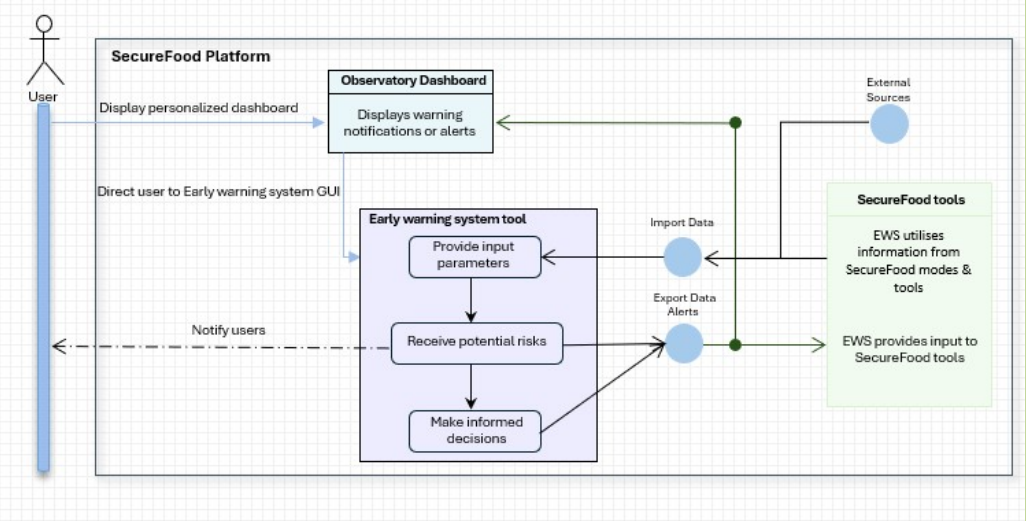
UC10: Incident reporting	
Main actor	Actor Type 1: Food actor e.g. producers, processors, transport operators, wholesalers, retailers, consumers. Actor Type 2: competent authorities / interdependent actors e.g. producers, processors, transport operator, wholesalers, retailers.
Diagram	
Brief description	The system offers incident reporting capabilities for supply chain actors through the Information Exchange Platform component. The platform assists in the response to incidents through specified communication channels between food actors (producers, industry, transporters and competent authorities). Food actors will be able to submit a suspicious activity or an event. Such actions include communication with interdependent actors in the supply chain, and if needed notify the authorities (and/or other food actors) through predefined messages. Therefore, stakeholders can be actively engaged in raising awareness and crisis communication supporting early warning across food supply chain.
Pre-conditions	1. The users are successfully registered with the SecureFood platform. 2. The users have smart wallet for signature purposes.
Post-conditions	Actor Type 1 has reported successfully the incident within the information exchange platform. Actor Type 1 has successfully notified relevant stakeholders. Actor Type 2 has subscribed to the relevant notification system. Actor Type 2 has reviewed the incident. Actor Type 2 has submitted successfully a response to Actor 1.

Basic flow				
Step	Actor Action		System Response	Additional Information
1	Actor Type 1 The user logins to the SecureFood platform and selects the Information Exchange Platform tool.		The system verifies credentials and displays the personalized dashboard. Upon selecting the Information Exchange Platform tool, the user is directed to Information Exchange Platform GUI.	
2	The user navigates to the incident reporting page and selects the button indicating "create new report".		The tool presents the relevant form for the actor to submit.	The predefined form of reporting incidents will include: 1. The name of the food actor 2. The date and time reporting 3. The location 4. Specifying the type of incident. (may include a two-level approach: one level specifies if the incident is disruptive or something else (e.g. invasive species etc. based on pilot's needs) 5. The quantity/ratio of the capacity affected 6. Mitigation Actions 7. Expected date of recovery 8. Anything else based on pilots needs
3	The user fills the form with		The tool will generate the smart contract	The users when filling the form will

	the proper values and selects to submit the form.		transaction that will be deployed in the blockchain and will prompt the actor to sign and deploy it to the blockchain.	need to "sign" their interaction (in blockchain terms this is a "transaction") using a specific key. This key is obtained by a smart wallet application and this is how the transactions within a blockchain system are secured.
4	The user signs and deploys the transaction in the blockchain using their smart wallet		The tool validates the transaction and incorporates it in the blockchain and notifies the actor that it was uploaded successfully.	The tool will keep record of (logging) the transaction.
5			The tool will notify actors who have subscribed to the relevant notification type.	
6		Actor Type 2 The user logs into the SecureFood platform and selects the Information Exchange Platform tool	The system verifies credentials and displays the personalized dashboard. Upon selecting the Information Exchange Platform tool, the user is directed to Information Exchange Platform GUI.	
7		The user navigates to the incident reporting page to view the submitted reports.	The tool presents a list of submitted transactions, including the report generated by actor 1.	
8		The user chooses to respond to the incident report generated by actor 1.	The tool will present a (blank/predefined) form for the user to provide information.	The response form could be either blank or predefined based on pilot's needs.

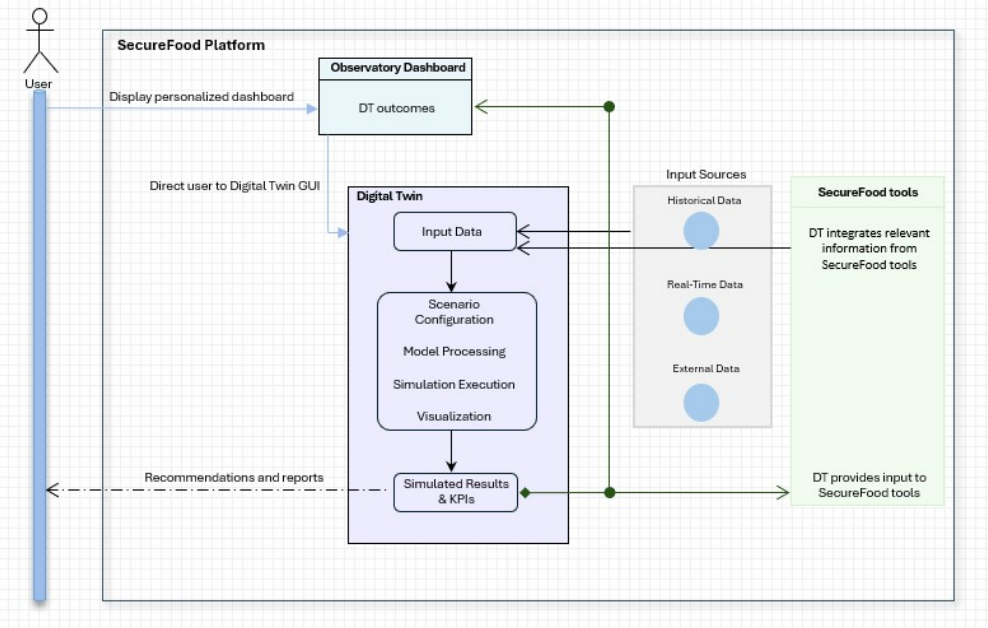
9		The user fills the form providing all the relevant information / suggesting mitigation actions and selects to submit.	The system will generate the smart contract transaction that will be deployed in the blockchain and will prompt the actor to sign and deploy it to the blockchain.	The users when filling the form will need to "sign" their interaction (in blockchain terms this is a "transaction") using a specific key. This key is obtained by a smart wallet application, and this is how the transactions within a blockchain system are secured.
10		The user signs and deploys the transaction in the blockchain using their smart wallet	The tool validates the transaction and incorporates it in the blockchain and notifies the actor that it was uploaded successfully	The tool will keep record of the transaction.
11	The user (actor type 1) will be notified of the submission of actor type 2 and will repeat process steps 1-6 in order to view the offered response.		The platform will respond as described in steps 1-6. At the last step the system will present all records including the response of Actor 2 in step 9.	
12	The user will leverage new knowledge to make informed decision.			
Alternative Flows				
Step 4. The platform fails to validate the transaction (e.g. mismatching cryptographic keys during the signature), rejects it and notifies the actor that the transaction failed) **Step 7.** The actor may choose not to provide a response therefore steps 7-9 cease to exist. **Step 11.** Actor 1 may choose to respond to the response offered by Actor 2 and engage further communication. As a result, the steps 6-11 will enter an everlasting loop. * At the same time other actors may choose to respond to Actor Type 1. We assume that all actors intervening the communication channel will follow the step-by-step process same as Actor type 2 and entering the same loop as described.				
User requirements coverage				
UR-DGT-8 Incident reporting UR-FR-01 Stakeholders collaboration UR-DGT-15 Alert notification				

Table 4.2.11 - UC11: Detection of potential critical events

UC11: Detection of potential events			
Main actor	Policy Makers/Competent Authorities, Food Supply Chain actors (i.e. producers, processors, transport operators, wholesalers, retailers)		
Diagram			
Brief description	The Early Warning System receives data regarding the food supply chain from both external sources (National, European and international platforms including among other weather data and economic indicators), and internal sources (e.g. Data Observatory, Digital Twin). Based on the data processing (big data analytics), events are detected, and notifications/alerts are generated, utilising AI techniques and user predefined thresholds. A criticality level is assigned to specific notifications/alerts (per user profile). The process supports users to make informed decisions. Relevant information is forwarded to internal modules along with generated alerts and user notifications (e.g. Observatory Dashboard, Digital Twin).		
Pre-conditions	1. The user is successfully registered with the SecureFood platform. 2. User input values on food supply chain stages are entered into the system. 3. Connection with external sources is available (e.g. to receive weather data or economic indicators). 4. Appropriate profiles are being generated. 5. Connection with internal tools is available.		
Post-conditions	Notifications/alerts are generated with different criticality levels (low, moderate, high, critical) and info is forwarded to other internal modules (e.g. Digital Twin, Dashboard).		
Basic flow			
Step	Actor Action	System Response	Additional Information
1	The user logs into the SecureFood platform and selects the Early Warning System tool.	The system verifies credentials and displays the personalized dashboard. Upon selecting the Early Warning System tool, the user is directed to EWS GUI.	
2	The user provides input values relevant to food supply chain	The system generates the appropriate profiles.	Input values such as weather monitoring, extreme weather

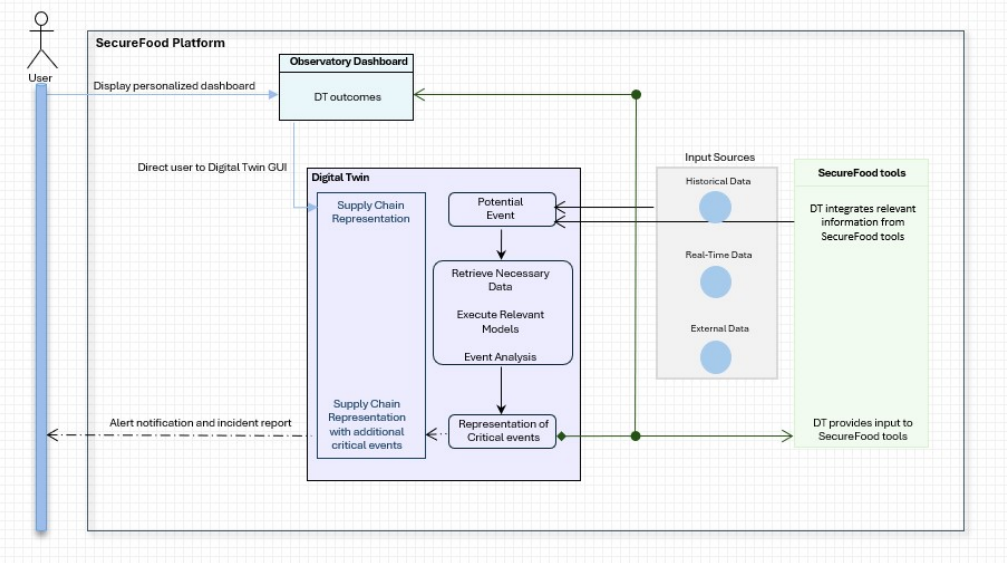
	stages (e.g. production, processing, transportation, market).		forecasts, market prices etc. The user may be able to input baseline data for the system to establish a comparative basis.
3		The system processes the food supply chain data continuously, according to the generated profiles, detects events (correlations/deviations), generates alerts and provides estimates regarding their criticality level (pre-characterization of notifications/alerts).	The Early Warning System processes the events utilising also information from SecureFood models and tools such Risk and Vulnerability Assessment etc.
4	The user views and verifies the preliminary alert characterization, so as to confirm and mark possible actual events that could compromise their supply chain.	The tool displays the user verified events and sends them to other SecureFood tools e.g. Digital Twin, Observatory Dashboard, Resilog that displays them along with their criticality level and other relevant info.	
5	The user is supported in making informed decisions.	Among all the possible estimated (or/and actual) system events (notifications/alerts) the system allows a user to decide which events they would like to keep and which to disregard.	The system will update events records depending on user actions and internal components information.
Alternative Flows			
-			
User requirements coverage			
UR-DGT-12 Detection of various kinds of hazards and threats UR-DGT-13 Timely prediction of long-term stresses UR-DGT-14 Timely detection of short-term shocks UR-DGT-15 Warning notification/Alert UR-DGT-16 Criticality of warning notification/alert UR-DGT-22 Information filtering UR-REL-01 Accurate information UR-REL-02 Event correlation UR-REL-04 Close to real time notification UR-CONF-01 Digitally secure, safe and resilient			

Table 4.2.12 - UC12: Simulate Supply chain operations in virtual environment

UC12: Simulate supply chain operations in virtual environment			
Main actor	Policy Makers/Competent Authorities, Food Supply Chain actors (i.e. producers, processors, transport operators, wholesalers, retailers, consumers)		
Diagram			
Brief description	Digital twin models and simulates multiple supply chain streams, offering a digital representation based on diverse data sources, including historical, real-time, and external data, as well as data derived from SecureFood tools. It enables stakeholders to analyze, predict, and optimize supply chain performance by integrating models relevant to foresight analysis, interdependencies assessment, risk and vulnerability assessment, and micro- and macroeconomic evaluations. By leveraging tools such as the Observatory Dashboard, Early Warning System, Information Exchange Platform, and RESILOG, the system provides supply chain dynamics, offering insights into changes and performance at various scales. It supports what-if scenarios and stress tests, related to workforce integration, climate impact forecasting, feed availability trends, energy alternatives etc. Simulations may address seasonal demand shifts, disruptions, or bottlenecks, with outcomes presented through graphical representation for actionable insights.		
Pre-conditions	1. The user is successfully registered with the SecureFood platform. 2. Access to data sources from interdependencies assessment analyses, risk and vulnerability assessment models, resilience assessment models and economic models. 3. Capability to exchange data seamlessly with other SecureFood tools, including the Information Exchange Platform, Early Warning System, RESILOG and the Observatory Dashboard.		
Post-conditions	1. Visual/graphical representations of the food supply chain operations. 2. Analytical data generated from scenario simulations.		
Basic flow			
Step	Actor Action	System Response	Additional Information
1	The user logs into the SecureFood platform and selects the Digital	The system verifies credentials and displays the personalized	

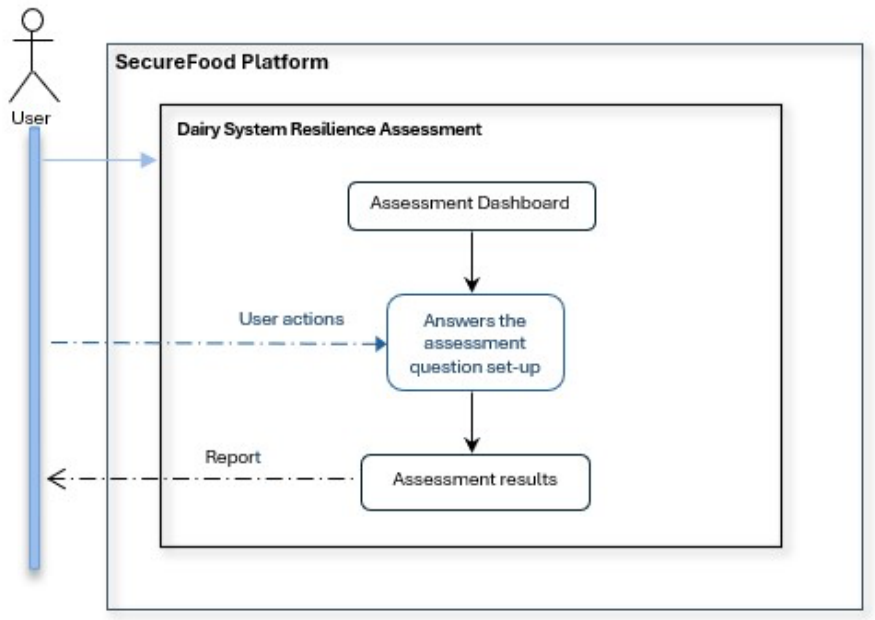
	Twin tool.	dashboard. Upon selecting the Digital Twin tool, the user is redirected to Digital Twin GUI.	
2	The user provides the required information.	The system requests the user to define key parameters and characteristics of their supply chain (input data).	
3		Digital Twin displays the supply chain setup. Based on the initial user input the model baseline parameters are defined.	Digital Twin utilizes data e.g. historical, real-time/ external data sources as well as integrates relevant information from other SecureFood tools to ensure a comprehensive dataset.
4	The user explores various "what-if" scenarios.	Digital Twin prompts the user to build and run simulation scenarios. Digital Twin processes the input, analyses relevant metrics and presents related analysis and simulation results. Digital Twin provides predictions about supply chain dynamics, assess and supports decision-making processes.	The Digital Twin simulations dynamically utilize models related to foresight analysis, interdependencies, risk, resilience and vulnerability assessment, as well as micro- and macroeconomic evaluations to provide its results.
5	The user accesses their past what-if scenarios and simulation results.	The Digital Twin stores simulation results and makes them available to the user.	
6	The user considers the results, for effective supply chain management.		
Alternative Flows			
-			
User requirements coverage			
UR-MOD-01 Interdependencies assessment UR-MOD-02 Risk and vulnerability assessment UR-MOD-04 Resilience assessment UR-MOD-07 Forecast future supply chain disruptions UR-DGT-19 Real-time monitoring of the food supply chain UR-DGT-20 Systems representation UR-DGT-21 Simulation and what-if scenarios			

Table 4.2.13 - UC13: Monitoring of the food supply chain

UC13: Monitoring of the food supply chain			
Main actor	Policy Makers/Competent Authorities, Food Supply Chain actors (i.e. producers, processors, transport operators, wholesalers, retailers)		
Diagram			
Brief description	The Digital Twin, supported by other SecureFood tools such as the Early Warning System and the Information Exchange Platform, facilitates also near real-time monitoring of the food supply chain, communicating alerts with recommended actions to relevant actors. Upon an event detection/prediction, it provides advanced situational awareness to the users through timely notifications/alerts. It also generates detailed incident reports in formats like Word or PDF and allows users to confirm events resolution once alerts are addressed.		
Pre-conditions	1. The user is successfully registered with the SecureFood platform. 2. Access to data sources from interdependencies assessment analyses, risk and vulnerability assessment models, resilience assessment models and economic models. 3. Capability to exchange data seamlessly with other SecureFood tools, including the Information Exchange Platform, Early Warning System, RESILOG and the Observatory Dashboard.		
Post-conditions	1. Visual/graphical representations of the food supply chain. 2. In the event of a detected hazard, the system will issue an alert notification accompanied by an incident report.		
Basic flow			
Step	Actor Action	System Response	Additional Information
1	The user logs into the SecureFood platform and selects the Digital Twin tool.	The system verifies credentials and displays the personalized dashboard. Upon selecting the Digital Twin tool, the user is redirected to Digital Twin GUI.	
2		Upon logging into the	

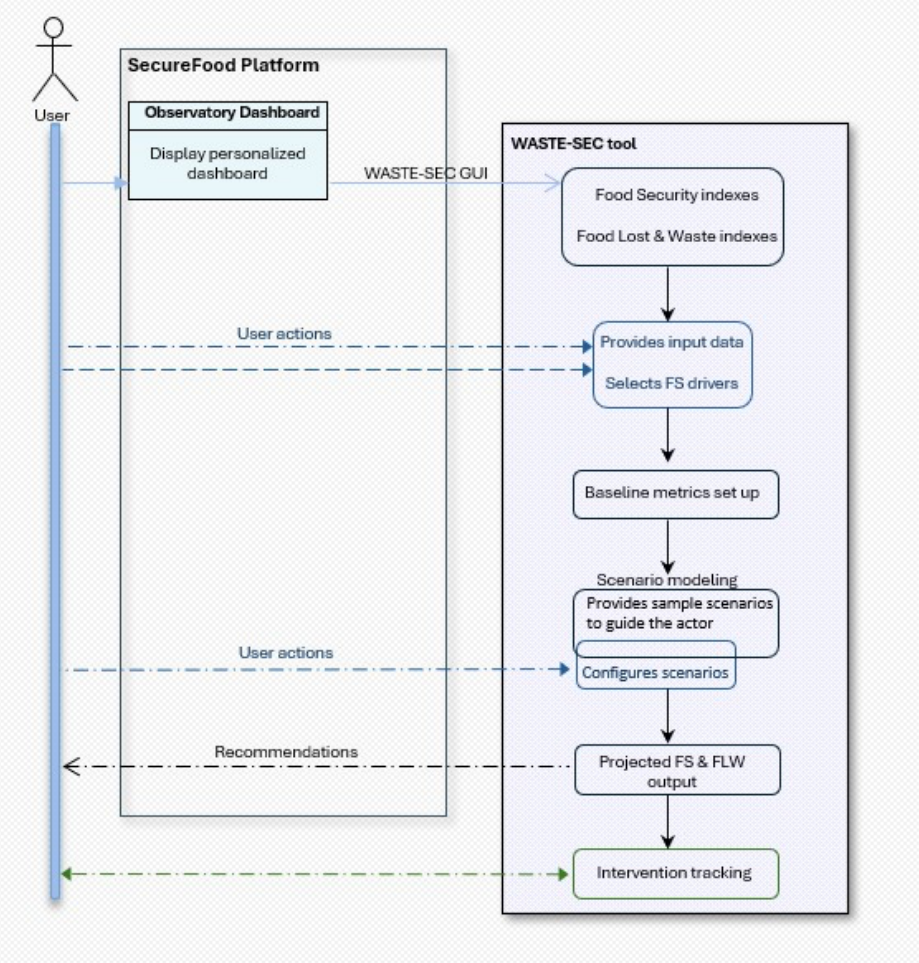
		Digital Twin, the Digital Twin provides a representation of the supply chain.	
3		If a potential event has been detected/predicted Digital Twin displays a warning notification/alert to the user.	Digital Twin communicates and receives data from other SecureFood tools e.g. Early Warning System, Information Exchange Platform.
4	The user clicks on the alert message to retrieve more information.	Digital Twin provides relevant information e.g. time stamp, location, criticality of alert, interdependent actor(s) affected etc. It also provides recommended actions to effectively address the detected/predicted event.	Digital Twin integrate real-time data and events sourced from tools such as the EWS, Observatory Dashboard, and Information Exchange Platform. This integration enhances the system's ability to provide accurate, actionable insights considering real-time data streams.
5	The user utilizes offline the recommendations for effective incident management.		
6	The user "de-activates" the alert after the successful completion of the mitigation measures.	Digital Twin archives the alert and can be accessed as historical data in the system.	
Alternative Flows			
-			
User requirements coverage			
UR-DGT-17 Support action / Recommendation action UR-DGT-19 Real-time monitoring of the food supply chain UR-DGT-20 Systems representation UR-DGT-23 Report generation UR-DGT-16 Criticality of warning notification/alert			

Table 4.2.14 - UC14: Dairy Chain Resilience Assessment

UC14: Dairy System Resilience Assessment (DSRA)			
Main actor	Policy Makers/Competent Authorities, Food Supply Chain actors (i.e. producers, processors)		
Diagram			
Brief description	The Dairy System Resilience assessment (DSRA) approach is based on a conceptual framework and designed to assess key resilience determinants within dairy production under external and internal disruptions. The focus of DSRA is on the operationalization of the dairy system resilience and its assessment. The conceptual framework considers the following dimensions of resilience: capacity to buffer, recover, and adapt to changes and disturbances. The DSRA includes agronomic, economic and social performance indicators supplemented with interview data (such as diversity of production, domestic renewable energy production, profitability, and wellbeing of farmers) to capture the capacities to confront both short- and long-term challenges in production. The assessment is conducted by a structured set of questions. During the questionnaire user provides both qualitative and quantitative estimates. The validation of relevant questions and assessment process enables resilience assessment and identifies strengths and weaknesses in dairy system. This approach empowers key actors in dairy sector to enhance their preparedness, response, and recovery mechanisms, promoting robust resilience management in food systems.		
Pre-conditions	1. The user is successfully registered to resilience assessment process provided by the SecureFood project. 2. The guidelines for respondents will provide clear advice to help dairy farms and key actors to navigate through the questions effectively.		
Post-conditions	1. DSRA framework is providing an empirically tested application through results from dairy farmers and the actors in dairy supply. 2. User case gives assessment reports on vulnerabilities and strengths of dairy system resilience, and recommendations on measures to enhance the resilience in dairy sector.		
Basic flow			
Step	Actor Action	System Response	Additional Information

1	The users log into the DSRA process provided by SecureFood project.	The provided system verifies the credentials and displays the dashboard for assessments.	The DSRA will operate as a standalone application.
2	The user answers the assessment question set-up.	The guidance in answering is included in dashboard to help answering the questions.	A guidebook explaining e.g. the propositions and/or definitions of each questions set-up is provided. Further information is provided by linking external URLs available.
3	The user submits their responses to assessment sections.	The system stores responses and makes a preliminary report of results. Data is available for further analysis.	The respondent receives an assessment report, and feedback option is organized.
Alternative Flows			
Step 1. The user accesses the predefined questions and/or questionnaire through an external URL (e.g. external survey platform, consent form included and access to Privacy Notice). **Step 2.** The user submits his/her responses on the Dairy resilience questions.			
User requirements coverage			
UR-FR-02 National plans UR-FR-03 Resilience plans UR-MOD-04 Resilience assessment UR-DGT-1 Resilience management			

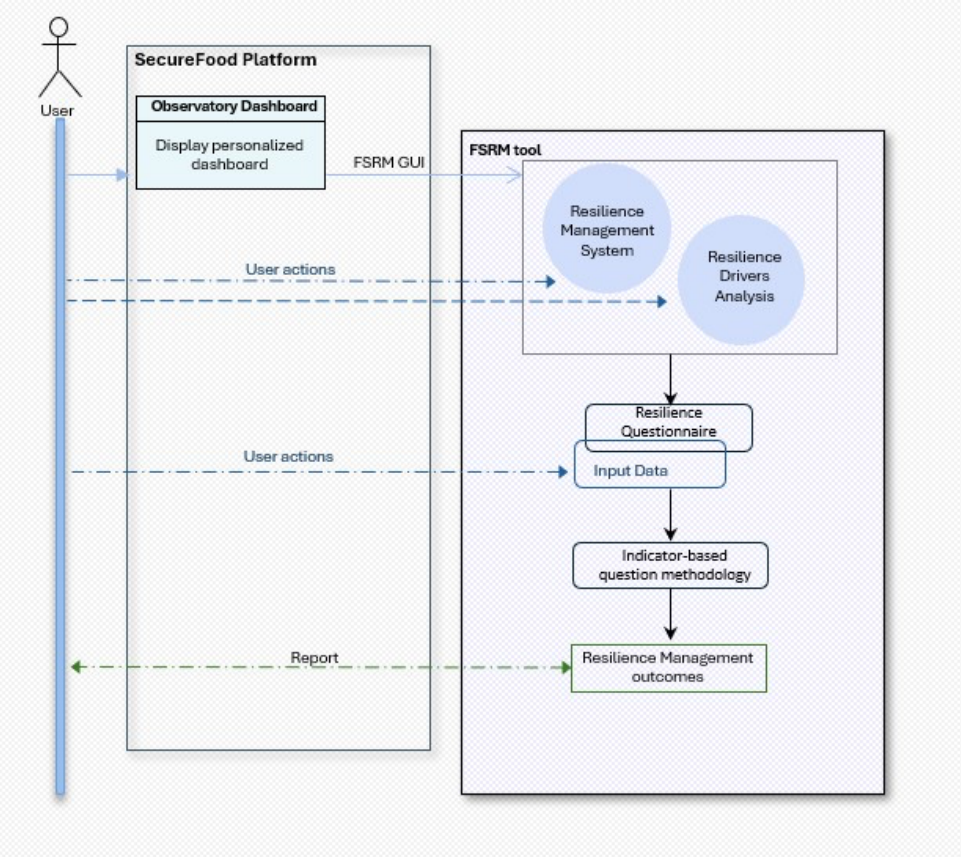
Table 4.2.15 - UC15: Optimizing Food Loss and Waste for Enhanced Food Security

UC15: Optimizing Food Loss and Waste (FLW) for Enhanced Food Security	
Main actor	Policy Makers/Competent Authorities, Food Supply Chain actors (i.e. producers, processors, transport operators, wholesalers, retailers)
Diagram	
Brief description	The WASTE-SEC tool helps optimize FLW in the supply chain by modeling the influence of food security drivers on FLW and food security indexes. Using historical/literature data on FLW and food security, the tool provides food actors with insights into how specific food security drivers, such as economic, technological, biophysical, and socio-cultural factors, affect FLW levels and food security indexes like the Global Food Security Index. Users can simulate positive and negative scenarios for each driver to observe their impacts on FLW and food security. The tool also supports preparedness and response planning by displaying comparative data for each scenario, and enabling users to assess the outcomes of interventions based on past disruptions or changes in food security drivers. This helps food actors make data-driven decisions to improve resilience and reduce waste without compromising food security.
Pre-conditions	1. The user is successfully registered with the SecureFood platform 2. Actors should have a foundational knowledge of food security drivers and the ability to interpret scenario outcomes to analyze FLW and food security effective impacts within the tool. 3. Data on FLW quantities and percentages is available across supply chain stages, regions, and several supply chains. 4. Access to FLW quantities and food security indexes (e.g., Global Food Security Index).

	5. Access to food security drivers and baseline food security and FLW indexes.		
Post-conditions	1. Scenario-based reports showing food security and FLW index projections. 2. Visualization of FLW hotspots and associated driver impacts. 3. Archived interventions and their outcomes on food security and FLW metrics. 4. Comparison reports of baseline versus projected food security and FLW levels. 5. Generated recommendations for targeted FLW reduction interventions 6. The tool should indicate where estimates have been used instead of actual data, aligning with the 'Estimate Missing Data' function to help users distinguish between calculated estimates and original input values."		
Basic flow			
Step	Actor Action	System Response	Additional Information
1	The user logs into the SecureFood platform and accesses the WASTE-SEC tool.	The system verifies the credentials and displays the personalized dashboard. Upon selecting the WASTE-SEC tool, the user is directed to WASTE-SEC GUI. The system displays an overview of current food security and FLW indexes and the user can select specific drivers (e.g., market, biophysical, technological).	The system may also display historical food security and FLW metrics.
2	The user selects the food security drivers they wish to analyze (with options to choose "driver categories and subcategories" to refine projections) and inputs data related to FLW (e.g., quantities, percentages, critical FLW generation points, historical data, etc.).	The system processes the input data with quantification methods and sets baseline metrics for the food security and FLW percentages/indexes.	By selecting specific subcategories within each driver, the user can obtain more detailed insights into FLW and food security indexes, allowing for a deeper yet straightforward analysis within the model. The system may also highlight areas of FLW and historical food security index fluctuations. Options for drivers may include different levels of subcategories of drivers. The user may be able to input baseline food security and FLW data for the system to establish a comparative

			basis.
3	The user configures scenarios for each selected driver, choosing from three main configurations (positive, neutral, or negative) to keep options straightforward.	The system calculates and displays each scenario's projected food security and FLW levels, showing potential percentage changes in the food security index and FLW quantities. Based on these projections, it generates a list of tailored recommendations to mitigate negative impacts or enhance positive outcomes.	Scenarios allow the user to simulate the effect of specific changes, like improved access to credit, etc. The system provides sample scenarios to guide the actor (e.g., for the "liquidity" driver, the positive scenario might be "easy access to credit," the neutral might be "limited access," and the negative might be "severe liquidity constraints"). These sample configurations help the user understand each driver's potential impact on food security and FLW indexes.
4	The user reviews recommended interventions for each scenario and selects those they plan to implement, which are then documented in the tool.	The system archives the selected interventions and displays the expected outcome of each intervention relative to the baseline, reinforcing that the tool operates as a model based on historical data and scenario-based insights. This allows users to see the projected effectiveness of interventions within the modelled framework.	Recommendations may include actions like improving storage methods or adjusting policy approaches. The actor can annotate and save selected interventions for tracking purposes.
Alternative Flows			
Step 3 (Scenario Configuration). If the user wants to refine initial projections, they can adjust scenario inputs by modifying drivers or scenarios, such as economic or biophysical factors. The system will then recalculate projections and display updated **food security** and FLW indexes, providing new insights based on the refined scenarios. **Step 2 (Data Input and Processing).** If specific FLW data points are unavailable, the actor can proceed with available data by selecting an "Estimate Missing Data" option. The system will use quantification methods or historical averages or external sources (e.g., literature, databases) to interpolate missing values. Estimated values are clearly labeled to help the actor distinguish them from actual data, allowing the analysis to continue seamlessly while awaiting complete data.			
User requirements coverage			
UR-MOD-06 Food loss and waste modeling UR-DGT-2 Food loss and waste tool			

Table 4.2.16 - UC16: Assessment of maturity of Resilience Management procedures

UC16: Assessment of maturity of resilience management procedures	
Main actor	Policy Makers/Competent Authorities, Food Supply Chain actors (i.e. producers, processors, transport operators, wholesalers, retailers, consumers)
Diagram	
Brief description	The Food Systems Resilience Management (FSRM) tool is designed to estimate an aggregated resilience index, reflecting the maturity level of resilience management practices applied by food stakeholders. This tool facilitates a comprehensive diagnosis of strengths and weaknesses across technical, organizational, and operational dimensions, identifying areas that require additional resources to ensure continuity in food supply chain operations. The resilience index is derived from various indicators aligned with the core aspects of food systems resilience, as defined in the Resilience Management Framework. These indicators are assessed through a structured set of questions that guide users in providing qualitative estimates. The FSRM tool supports two primary applications: **Resilience Management System**: This module offers a comprehensive evaluation of an organization's resilience by examining corporate, organizational, technical, and managerial processes. It provides a holistic view of resilience across multiple dimensions and topics. **Resilience Drivers Analysis**: This module focuses on a detailed evaluation of specific drivers of food security, assessing capacity and readiness levels across the stages of the resilience cycle: before, during, and after crises. Through these capabilities, the FSRM tool empowers stakeholders to enhance their preparedness, response, and recovery mechanisms, promoting robust resilience management in food systems.
Pre-	1. The user is successfully registered with the SecureFood platform.

conditions	2. The user manual will provide sufficient guidance to help actors navigate through the modules' questions effectively.		
Post-conditions	Report on evaluation results.		
Basic flow			
Step	Actor Action	System Response	Additional Information
1	The users logs into the SecureFood platform and selects the FSRM tool.	The system verifies the credentials and displays the personalized dashboard. Upon selecting the FSRM tool, the user is directed to FSRM GUI.	The FSRM tool will operate as a standalone application, offering ex-ante assessments and generating reports derived from expert judgment.
2		The tool prompts the actor to choose one of the two modules: 1) "Resilience Management System" or 2) "Resilience Drivers Analysis ".	The tool will offer a step-by-step guidebook (user-manual) outlining the objectives of each module and providing detailed instructions on how to respond to the associated questions.
3	The user submits their input by responding to the individual indicator-based questions and completing the required fields.	The system logs and analyzes the responses using an indicator-based question methodology.	
4	The user has access to the analysis outcome.	The system stores input data and makes it available to the user upon request	The outcome of the above process is a comprehensive report that consolidates the responses, evaluates them based on predefined indicators, and provides actionable insights. The user can access their previous evaluations and generate new estimates based on updated inputs.
Alternative Flow			
Step 1. The user accesses the FSRM tool through an external URL, accompanied by an authentication process utilizing email credentials. The actor via an external URL, can access their previous evaluations and generate new estimates based on updated inputs.			
User requirements coverage			
UR-FR-03 Resilience plans UR-DGT-1 Resilience management			

Table 4.2.17 - UC17: Representative compiled UC utilising SecureFood tools for resilience planning

UC17: Representative, compiled UC utilising SecureFood tools for resilience planning			
Main actor	Policy Makers/Competent Authorities, Food Supply Chain actors (i.e. producers, processors, transport operators, wholesalers, retailers)		
Brief description	Food actors have access to various SecureFood tools designed to support resilient supply chain planning and facilitate effective decision-making during incident management. This use case focuses on an end-to-end process where one or more actors- depending on whether a single actor oversees supply chain planning or multiple entities collaborate- uses SecureFood tools for product(s) shipments planning. These tools provide critical information, notifications and alerts enabling actors to enhance supply chain resilience planning and effectively respond to incidents or disruptions that may impact the scheduled shipments.		
Pre-conditions	1. The user is successfully registered with the SecureFood platform. 2. SecureFood tools are functional.		
Post-conditions	The user has access to essential information to support the planning and execution of transport orders.		
Basic flow			
Step	Actor Action	System Response	Additional Information
1	The user logs into the SecureFood platform.	The system verifies credentials and displays the personalized dashboard.	
2	The user selects the Digital Twin tool.	Upon selecting the Digital Twin tool, the system redirects the user to the Digital Twin GUI.	
3	The user submits Digital Twin parameters for the execution of the Digital Twin simulation.	The Digital Twin executes the simulation and provides forecasts related to climate related disruptive events, cargo production volumes, consumption and other disruptive events. The risk management model of the Digital Twin provides risk assessment parameters and mitigation options.	
4	The user returns to the Observatory Dashboard and selects the AgriPolis tool.	Upon selecting the AgriPoliS tool, the user receives information on pre-run simulations about the farm economics in a designated area.	
5	The user returns to the Dashboard and selects	Upon selecting the GROCERYSIM tool,	

	the GROCERYSIM tool.	system redirects the user to the GROCERYSIM GUI.	
6	The user executes simulations to examine consumer behaviour under different scenarios including forecasted shock events identified earlier by DT.	GROCERYSIM presents consumer behavior simulation results.	
7	The user returns to the Dashboard and selects the WASTE-SEC tool.	Upon selecting the WASTE-SEC tool, system redirects the user to the WASTE-SEC GUI.	
8	The user executes simulations based on organization assumptions relative to the WASTE-SEC tool.	WASTE-SEC provides the user with recommendations based on submitted assumptions.	
9	The user returns to the Dashboard and selects the RESILOG tool.	Upon selecting the RESILOG tool, system redirects the user to the RESILOG GUI.	
10	The user submits the transport orders to RESILOG and requests matchmaking options for each one of them.	RESILOG responds with route alternatives and matchmaking opportunities.	
11	The user requests forecasting information for route capacity and availability.	RESILOG responds with forecasted capacity and availability.	
12	The user collects the information recovered by SecureFood tools and proceeds to make the organization supply chain transport resilience planning offline.		
13	The user returns to the Dashboard and selects the FSRM tool.	Upon selecting the FSRM tool, system redirects the user to the FSRM GUI.	
14	The user uses both modules of FSRM.	The FSRM responds with a comprehensive report based on the user interaction with its modules.	
15	The user validates offline the organization resilience plan and finalizes it.		

16	The user returns to the Dashboard and selects the Early Warning System tool.	The user sets up profile parameters based on the organization transport and resilience planning.	
17	The user regularly logins to the SecureFood platform during the execution phase of the transport and resilience plan to receive up-to-date supply chain information.	The SecureFood platform displays the latest information related to the supply chain including warnings and disruptions.	
18	The user logs into the SecureFood platform and selects the Information Exchange Platform to declare an incident.	The Information Exchange Platform executes the process to validate and record the incident.	
19		Upon verifications of the incident, it is shared with the relative SecureFood tools to update user information for affected profiles.	
20	The user reruns any steps of the above process to update the organization's transport order or even the transport and resilience planning.		
Alternative Flows			
-			
User requirements coverage: UR-MOD-02 Risk and vulnerability assessment UR-MOD-07 Forecast future supply chain disruptions UR-DGT-21 Simulation and what-if scenarios UR-DGT-3 Agricultural structures simulation UR-DGT-4 Consumer behavior analysis UR-MOD-06 Food loss and waste modelling UR-DGT-2 Food loss and waste tool UR-DGT-9 Optimization of food transportation UR-DGT-10 Prediction of route performance UR-FR-03 Resilience plans UR-DGT-1 Resilience management UR-DGT-12 Detection of various kinds of hazards and threats UR-DGT-13 Timely prediction of long-term stresses UR-DGT-14 Timely detection of short-term shocks UR-DGT-8 Incident reporting UR-DGT-11 Drivers' analytics UR-DGT-20 Systems representation			

5 Key Performance Indicators

5.1 SecureFood KPIs for development and validation

When developing a new product (either a technical solution or even a framework and a model), KPIs serve as essential metrics to evaluate the product's effectiveness, success, and impact at key development stages. These indicators provide a structured approach to assess how well a solution aligns with its core objectives and delivers desired outcomes.

Within SecureFood, KPIs play an important role in capturing critical system characteristics and defining the functionalities needed for a successful performance. Drawing on that, the present deliverable aimed to define KPIs that are simple, measurable, relevant, timely, and visible. These KPIs will support the targeted development of the SecureFood solutions and will guide what aspects of the SecureFood ecosystem will be tested, measured, and validated in the case studies, ensuring a robust validation process. The definition of the SecureFood KPIs was facilitated by the information extracted through the ad-hoc questionnaire (T2.1), the high priority user requirements and the initial version of the architecture that is currently being drafted in T2.4 and will be presented detailing in D2.3. Moreover, the SecureFood KPIs include a range of measurable indicators and validation metrics that were initially identified during the proposal phase and are documented in the DoA.

The SecureFood KPIs are structured into two distinct sets: the first regards the performance characteristics of each individual SecureFood solution, while the latter addresses the most critical performance features of the SecureFood ecosystem (cross-KPIs).

As mentioned above, the performance of the SecureFood solutions and their ability to achieve the KPIs target values, will be measured in WP6, as part of the validation activities.

5.2 The SecureFood KPIs

The KPIs of the individual SecureFood solutions are presented in Tables 5.2.1-5.2.16, while the cross-KPIs of the SecureFood ecosystem are available in Table 5.2.17.

Table 5.2.1 - Interdependencies assessment model KPIs

Interdependencies assessment			
Indicator	**Description**	**Method of measurement**	**Target value**
Networks	Develop risk networks and related analysis for each UC. Collect data and integrate with the analytical framework.	Number of use cases.	6
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

Table 5.2.2 - Supply chain modelling model KPIs

Supply chain modelling			
Indicator	**Description**	**Method of measurement**	**Target value**
Supply chain models libraries	Develop model libraries for risk predictions in UC food supply chains	Number of risks to be predicted per UC.	≥ 24
Models' assessment	Provide accuracy and precision indicators for each model library	Precision Recall F1 Score Confusion Matrix	≥ 4 indicators associated with the libraries
Data Sources	Identify relevant data sources for each model library	Number of databases available from observatory or tailor-made by UC.	≥ 8 per UC
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

Table 5.2.3 - Risk and vulnerability assessment model KPIs

Risk and vulnerability assessment			
Indicator	**Description**	**Method of measurement**	**Target value**
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
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	Measured through the elapsed time to execute the dedicated function within the tool (e.g., Digital Twin) incorporating the	< 10 min

	risk assessment models.	pseudo-code of the risk models.	

*Table 5.2.4 - **Resilience assessment** model/tool KPIs*

Resilience assessment			
Indicator	**Description**	**Method of measurement**	**Target value**
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%
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

*Table 5.2.5 - **Economic modelling** KPIs*

Economic modelling			
Indicator	**Description**	**Method of measurement**	**Target value**
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)
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
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
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	> 3 data sources

		wholesale, technology.	

*Table 5.2.6 - **Resilience Governance Framework** KPIs*

Resilience Governance Framework			
Indicator	**Description**	**Method of measurement**	**Target value**
Scenario coverage ratio	Percentage of food crises scenarios requiring the collaboration between the public and private sector measured on at least 4 crises scenarios.	Evaluating the percentage of food crises scenarios requiring the collaboration between the public and private sector covered by the Resilience Governance Framework (measured on at least 4 crises scenarios).	≥ 70%
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.
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	>20

		authority, research institutions).	

*Table 5.2.7 - **FSRM Framework** KPIs*

FSRM framework			
Indicator	**Description**	**Method of measurement**	**Target value**
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 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 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

Table 5.2.8 - FSRM tool KPIs

FSRM tool			
Indicator	**Description**	**Method of measurement**	**Target value**
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)
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
Food security	Number of different food security drivers	Counting the different food security drivers	>8 drivers

drivers' coverage	that will be addressed by the FSRM tool.	analyzed by the tool.	

Table 5.2.9 - Waste-SEC tool KPIs

Waste-SEC			
Indicator	**Description**	**Method of measurement**	**Target value**
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 modeled across at least 2 subcategories per main category of drivers
Modeled scenarios	Total number of positive and negative scenarios configured and analyzed by users during pilots.	Tracking the total count of positive and negative scenarios configured and analyzed by users during pilot tests.	2-5 per case study; ≥10 overall
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
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
Optimized food security gain	Maximum food security improvement through food loss and waste reduction.	Compare food security indexes before and after implementing FLW reduction scenarios to calculate percentage improvements.	>15%

*Table 5.2.10 - **Digital Twin tool** KPIs*

Digital Twin			
Indicator	**Description**	**Method of measurement**	**Target value**
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
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
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. Assess prediction accuracy using precision-recall metrics and error rates.	< 6 hours (short-term) < 6 months (long-term)

Table 5.2.11 - AgriPoliS tool KPIs

AgriPoliS			
Indicator	**Description**	**Method of measurement**	**Target value**
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
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 agricultual production in CS region.	> 3 scenarios with different combinations of shocks/stresses and political measures
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

*Table 5.2.12 - **3D XR-based simulator** tool KPIs*

3D XR-based simulator			
Indicator	**Description**	**Method of measurement**	**Target value**
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
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	90% scenario completion rate

		through SecureFood dashboard and number of final data reports will show the scenario completion rate.	
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
System uptime	Percentage of the time the application is operational and available.	Server errors will be provided indicating downtime.	99% system uptime
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

Table 5.2.13 - Observatory Dashboard tool KPIs

Observatory Dashboard			
Indicator	**Description**	**Method of measurement**	**Target value**
Data Ingestion Latency	Time taken to fetch and integrate data from external sources	Estimate time needed through system logs.	≤ 6 secs
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
System Uptime	Percentage of time the dashboard is operational and accessible to users.	Estimate time through system logs.	>99.5%
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

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%

Table 5.2.14 – Early Warning tool KPIs

Early Warning			
Indicator	**Description**	**Method of measurement**	**Target value**
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
Critical event acknowledgement rate	Number of critical events acknowledged by user.	Estimated through System logs/ database entries, internal KPIs dashboard and PDCA cycle.	>65%
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

Table 5.2.15 - Resilog tool KPIs

Resilog			
Indicator	**Description**	**Method of measurement**	**Target value**
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
Cargo volume	Candidate cargo volume for matchmaking to optimize logistics and ensure efficient allocation of	Count the number of transport order submitted via the RESILOG API or the GUI for which a matching option for	>10% of the total cargo volume examined

	resources.	consolidation has been identified.	
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 Km^2
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
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%

*Table 5.2.16 - **Information Exchange Platform tool** KPIs*

Information Exchange Platform			
Indicator	**Description**	**Method of measurement**	**Target value**
User Engagement	Number of users using the Information Exchange Platform for reporting purposes.	Measured through blockchain transaction monitoring.	≥ 8 users (≥2 per case study)
User Engagement	Number of users engaging in best practices and knowledge sharing.	Measured through blockchain transaction monitoring.	≥ 8 active users (≥2 per case study)
Accessibility	Successful and timely logins by users to the information exchange platform.	Measured through system logs (keycloak).	> 95%
Trigger Time	Time needed for an	Estimate time	≤ 2 min

	incident report to trigger the early warning system through platforms' API.	needed through system logs.	
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
Report submissions approvement	Report submissions successfully approved by the Blockchain Smart Contract Execution Manager.	Measured through blockchain transaction monitoring.	> 95%

Table 5.2.17 - The SecureFood cross KPIs

System Cross-KPIs			
Indicator	**Description**	**Method of measurement**	**Target value**
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%

6 Conclusions

Deliverable 2.2 aimed on three primary objectives i) the elicitation of the SecureFood user requirements, ii) the definition of the SecureFood use cases and iii) the development of the SecureFood KPIs.

The user requirements were developed using a structured, methodological approach that included feedback collection through dedicated questionnaires, two focus group sessions, and a workshop. The questionnaires were addressed to the end users for defining their needs and priorities for enhancing the security of the food supply chain, as well as to the technical partners for gathering critical information about the solutions to be developed in the project. During the two focus group meetings, attended by both SecureFood end users and technical partners, participants were introduced to the core SecureFood functionalities and were guided to define the system characteristics that reflect their expectations and needs. The outcome of these sessions was a list of user requirements, which was subsequently validated by the extended stakeholders group and the PAG during a dedicated workshop held in M12. The final list comprises 66 user requirements serving as an initial reference for the design, development, and implementation of the SecureFood ecosystem. As part of T2.4 activities, these user requirements will be translated into system requirements, in the form of a traceability matrix, enabling the tracking of each requirement fulfilment throughout project's lifespan.

The entire user requirements elicitation process, along with the draft system architecture defined in T2.4, facilitated the definition of the SecureFood use cases. The use cases formalize the system's functionalities and their application in achieving user goals, outlining the interactions between the users and the system. In collaboration with technical partners, a set of 17 use cases was defined. Each use case provides a step-by-step description of both user and system actions, supplemented by visual diagrams and additional information on pre-conditions and post-conditions. These use cases offer a comprehensive overview of the tasks users can perform with each digital tool solution developed within the project, either independently or in combination with other solutions.

This deliverable also addresses the creation of the SecureFood KPIs. KPIs provide measurable indicators to assess the project's efficiency in achieving its key objectives and to evaluate the quality and performance of the proposed solutions. The identified KPIs are categorized into two sets: the first regard the key performance characteristics of each SecureFood solution (solution-specific KPIs), and the other the most critical performance features of the SecureFood ecosystem (cross-KPIs). The user requirements, the system architecture and the metrics already available in the DoA facilitated the definition of the SecureFood KPIs. The KPI inventory includes 58 solution-specific KPIs, and 7 cross-KPIs, providing tangible and measurable metrics crucial for validating the project's success. These KPIs will be measured during the four piloting activities in WP6.