ALLIANCE

A hoListic framework in the quality Labelled food supply chain systems' management towards enhanced data Integrity and verAcity, interoperability, traNsparenCy, and tracEability

DELIVERABLE 4.1 – USE CASES: VALIDATION CAMPAIGNS AND DEMONSTRATION ACTIVITIES REPORT

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List of Abbreviations

Abbreviation	Description
AI	Artificial Intelligence
EPCIS	Electronic Product Code Information Services
EVOO	Extra Virgin Olive Oil
EWDSS	Early Warning Decision Support System
HSI	Hyperspectral imaging
IoT	Internet of Things
KPI	Key Performance Indicator
ML	Machine Learning
NIR spectroscopy	Near-Infrared spectroscopy
PDO	Protected Designation of Origin
PGI	Protected Geographical Indications
PUC	Pilot Use Case
NPK	Nitrogen (N), phosphorus (p), potassium (K)

Executive Summary

The ALLIANCE consortium, a European initiative dedicated to combating food fraud and safeguarding the authenticity of high-value European products, is progressing towards development and integration of innovative solutions/technologies tailored to specific use cases. This report outlines the ALLIANCE Pilots Use Cases (PUCs), summarising progress to M18. To ensure seamless integration of solutions/technologies within diverse high-value supply chains, EuroFIR (BE, Task 4.1) has addressed requirements including hardware, software, legal, data privacy, logistics, and maintenance, as well as validation requirements with Bologna University (IT). To collect critical insights related to the solutions/technologies, EuroFIR employed a guided interviews approach, capturing in-depth details on tool development, implementation, and future aspirations. The interviews revealed a common vision among providers regarding the interoperability of solutions/technologies to optimise food fraud detection and prevention that can be demonstrated in the otherwise diverse high-value European product supply chains. There is also intention to extend these solutions/technologies beyond the initial food supply chain applications, potentially adapting them to other high-value food items.

Despite the advancements, several challenges were identified that will require further work before M24 including interoperability and data privacy, training and logistics, and the validation roadmap. Also, a significant challenge in validation is the lack of comprehensive data describing the frequency of fraud specific to the high-value European products. The consortium recognises the need for improved data to support the effectiveness of anti-fraud technologies and is focusing on enhanced monitoring, reporting systems, and collaboration tools like blockchain to address these issues. However, to be successful in the market, the ALLIANCE solutions/technologies must demonstrate impact, which can most easily be achieved through reduced incidence of fraud and related to economic outcomes.

Information from ALLIANCE PUCs and solution/technology providers as well as the identified challenges will inform future deliverables D4.2 and D4.3, expected by M36.

ALLIANCE is making significant strides in developing technologies aimed at protecting the integrity of high-value European foods. While there are challenges in data collection and technology integration, the consortium is actively working on solutions/technology to ensure their successful deployment in real-world settings, thereby enhancing the authenticity, quality, and safety of European food products.

1 INTRODUCTION

1.1 Background

ALLIANCE is considering seven demonstrators, each focused on a different high-value European products with geographical indications or quality schemes[1] that ALLIANCE aims to help safeguard. Understanding these supply chains in depth will allow not only optimisation of potential solutions/technology offered by ALLIANCE and facilitate testing at the pilot scale and beyond, but also identify the unique needs of each value chain more generally. Thus, this deliverable is an important starting point in efforts to provide solutions/technologies that adapt to the unique challenges presented by the diverse supply chain environments of high-value European product chains with geographical indications or quality schemes and meet user communities' needs.

1.2. Objectives

The objectives of this deliverable, in presenting the ALLIANCE pilot use cases (PUCs), are to:

1. Establish foundations for implementation of ALLIANCE solutions/technologies in high-value European product supply chains
2. Support integration of ALLIANCE solutions/technologies into the seven product supply chains
3. Assist safeguarding of product authenticity and quality
4. Enable validation of ALLIANCE solutions/technologies efficacy
5. Learn lessons from implementation to inform future actions and improvements
6. Identify shortcomings, gaps and needs that might hinder application beyond the pilot-scale
7. Understanding the unique supply chain requirements
8. Prepare for future deliverables by providing a basis for delivery of PUCs and their assessment.

1.3. Scope

More specifically, this deliverable describes, for the first time, detailed plans for execution of each ALLIANCE pilot use case (PUC), establish a roadmap for timely implementation and assessment, describe next steps in these processes and post-pilot demonstration (WP5), and supporting for creation of training materials. It focuses on the unique requirements of each high-value European product and the associated PUCs, although these are still under development (up to M18). Requirements that have been considered include hardware, software, legal, data security, logistics, operational, training, and maintenance, and validation. Mapping out these and ascertaining potential gaps or shortcomings will allow for further refinement of potential solutions/technologies at the application and validation stages (WP5), paving the way for informed decision-making in the future as well as informing D4.2 Final Use Cases: Validation

[1] https://agriculture.ec.europa.eu/farming/geographical-indications-and-quality-schemes/geographical-indications-and-quality-schemes-explained_en

Campaigns and Demonstration Activities and D4.3 Final Pilots Assessment, Lessons Learnt, Experts Acceptance and Evaluation and the Practice Abstracts.

2 USE CASE SCENARIOS, PLANNING, AND PREPARATION

2.1 Overview

Two aspects considered herein, specifically the individual high-value European value chains and, secondly, the solutions/technology offered by ALLIANCE. These culminate in the PUCs and their subsequent validation and analysis, which will be described elsewhere (D4.2 and D4.3). The ALLIANCE PUCs address sector-specific needs but also defining key performance indicators (KPIs) and user communities, which will inform Task 5.3 Innovation management, market analysis and commercial roadmap and Task 5.4 Marketplace, Systemic Innovations and Industrial Data. Further, monitoring these indicators will help identification of food fraud related to geographical indications or quality schemes[2] and establish early warning systems, ultimately reducing occurrences, and fostering greater trust among actors and citizens. Whilst development of detailed plans for each PUC is integral for demonstration (WP5) and assessment (WP4), for these activities to commence, the PUC requirements, objectives, outcomes, and key exploitable results need to be defined, a process that is ongoing (M18).

2.2. Pilot use cases

The seven ALLIANCE PUCs focus on areas that are particularly vulnerable within organic and PDO/PGI products, as outlined in the Annual Report of the European Union Food Fraud Network[3].

2.2.1 PDO/PGI Extra Virgin Olive Oil

ALLIANCE is harnessing DNA fingerprinting technology to detect and prevent food fraud in extra virgin olive oil (EVOO) by assigning genetic identity to each variety, making adulteration near impossible as well as supporting biodiversity in this high-value crop. The solution can distinguish five Greek olive varieties and the PUC aims to deliver a portable, low-cost qPCR device for immediate on-site testing of at least four Italian varieties from the region of Umbria. Additionally, an AI-driven analytics pipeline will automate classification and verification, reducing costs by about half and speeding up results by a third as well as minimising human error. Looking ahead, BioCoS plans to extend DNA traceability to Italian organic PDO/PGI EVOO, culminating in the integration of DNA profiles into a blockchain system, ensuring traceability from field to store.

2.2.2 Feta Cheese

Blockchain technology will be used to increase trust, transparency, and accountability across the supply chain, but specifically collection and transportation of raw milk, in partnership with one of the largest dairy producers based in Greece. Data collected along the supply chain will also inform decision-making, considering interplay between agricultural resources, demographic changes, economic conditions, and climate change to help simulate different farming practices and assess policy impacts. Similarly, consumer behaviour will be examined

[2] https://agriculture.ec.europa.eu/farming/geographical-indications-and-quality-schemes/geographical-indications-and-quality-schemes-explained_en
[3] https://food.ec.europa.eu/document/download/5135ace4-2a9d-4bf7-afad-574621b43b1c_en?filename=ff_ffn_annual-report_2020_1.pdf

to create detailed profiles based on country, economic, educational, cultural, and religious factors that influence purchasing decisions.

2.2.3 Organic honey

Using decentralized blockchain technology, BeeMark will enable -for the time- tracking of honey from points of origin to sale through immutable, real-time digital channels. The system uses AI-enabled sensors to monitor the hives continuously to ensure bee health and maintains the purity and safety of honey. BeeMark aims to eliminate data manipulation, enhances accuracy of logistics, and speeds up processing, fostering increased trust, transparency, and accountability within complex European and specifically French organic honey supply chains.

2.2.4 PGI Asturian Faba Beans

There is a gap between the ideal and current analytical tools for detecting fraud in PGI faba beans that the ALLIANCE PUC aims to fill using low-cost, portable near-infrared (NIR) and hyperspectral imaging (HSI), offering rapid, non-destructive, easy-to-use methods generating real-time, low-cost results. ASINCAR has established these NIR and HSI technologies across various food applications and this knowledge will be further advanced to address PGI faba bean fraud, specifically to prevent fraudulent mixing of PGI faba beans with less expensive beans or deliberate mislabelling.

2.2.5 PGI Lika Potatoes

The primary aim of this ALLIANCE PUC is to digitalise traceability of PGI Lika potatoes and use blockchain to store trusted sensor-derived data, accessible to authorized parties within the supply chain as well as consumers. Improved traceability will enable quicker identification and verification of Lički krumpir, distinguishing these high-value products from similar varieties. The system could also be implemented at wholesale levels and enhance the activities of control bodies, thereby increasing control effectiveness and potentially boosting sales volumes.

2.2.6 Organic Pasta

Organic pasta is reliant upon organic Durum wheat and the PUC will exploit technologies that enable determination of farming practices (satellite imagery and pesticide analysis) for authentication. Samples will be sourced from food retailers and tested for pesticides residues using QuEChERS pre-treatment and either gas chromatography or liquid chromatography coupled with mass spectrometry. Data will be compared against reference standards and a control samples, which are known to be free from pesticide residues. Similarly, satellite imagery will be used to distinguish organic and non-organic farming practices by analysing differences in land use patterns, crop health, and element composition, particularly phosphorus, nitrogen, and potassium. The resulting databases will serve as a critical resource for ongoing monitoring and tracking of organic pasta, thereby enhancing transparency.

2.2.7 PDO Arilje Raspberries

This ALLIANCE PUC aims to enhance traceability and monitoring of PDO Arilje raspberry production as well as enhancing consumer awareness and understanding of quality guarantees associated with geographic origin. Approaches will focus on rapid, accurate, and cost-effective physio-chemical characterisations. Underpinned by blockchain, these approaches will ensure

the reputation of Arilje raspberries whether fresh, frozen, or processed, and aim to boost local consumption and fair competition in international markets.

2.3. ALLIANCE solutions/technologies

Some of the solutions/technology offered by ALLIANCE are being developed for specific PUCs (e.g., DNA fingerprinting and extra virgin olive oil), whilst others address data management generally and data transfer along the supply chain more specifically, which are related to needs identified for different value chains (e.g., Lika potato and Arilje raspberries; Table 1). For example, currently, the supply chain for Lika potatoes is manual. Digitalisation offers increased efficiency, transparency, and agility as well as, more specifically, real-time tracking, data-driven decision-making, reduced costs, improved collaboration, and better customer service. These potential improvements are not specific to Lika potatoes and in a European food landscape that is dominated by micro- and small business enterprises, businesses can benefit from these solutions/technologies, especially where general applicability supports wider adoption and, consequently, lower initial investment costs for implementation. Whilst the individual high-value European value chains will benefit from the solutions/technology offered by ALLIANCE, the value chains are also acting as a laboratory- and pilot-scale environments to test innovative change, enabling further scale up and, ultimately, supporting adoption actors in the same industry landscape or exploitation in new environment.

Table 1: Tool: Use Case Matrix - Solutions developed during ALLIANCE are dedicated to increase transparency and traceability in one or more supply chains

	PDO/PGI Extra Virgin Olive Oil	PDO Feta Cheese	Organic Honey	PGI Asturian Faba Beans	PGI Lika Potatoes	Organic Pasta	PDO Arilje Raspberries
Next Generation Portable DNA Sequencing for Food Analysis	X						
Advanced Spectroscopy NIR & HSI				X			
Early Warning System for Food Fraud Prevention	X	X	X	X	X	X	X
Blockchain-enabled IoT platform	X	X	X	X	X	X	X
Digital Knowledge Database	(X)	(X)	(X)	(X)	(X)	(X)	X
Vulnerability Risk Assessment Framework	X	X	X	X	X	X	X

2.3. Requirements

ALLIANCE PUC requirements are essential components in implementation of the solutions/ technologies offered by ALLIANCE, outlining specific functionalities and features these must have to address the needs and goals of the high-value European value chains and actors therein. These requirements will help define clear objectives, identify key performance indicators, and ensure that the solutions/ technologies meet expectations.

Primary requirements for the ALLIANCE PUCs are:

- **Hardware** including sensors, data recording and sampling devices, data storage devices and servers, wifi and/or satellite connection to cloud services, power source, transportation telematics, and any wet chemistry equipment, reagents, and protocols.
- **Software** such as data collection and management, database management system, data visualisation and reporting tools, user interface, authentication software, machine learning and artificial intelligence, and that enabling interoperability and exchange of data.
- **Legal** characteristics include limitation of defamation and reputational damage, robustness and accuracy of data, disclaimers, adherence with geographical indications or quality schemes, and smart contracts for blockchain access. It is also important to identify actors involved and define their responsibilities. These aspects also include **data privacy** in respect of personal and sensitive data, data transfer and exchange, particularly in/out of the European Union, as well as data ownership and access.
- **Operational support** includes training materials and approaches for user communities as well as technical support and maintenance, specifically entities responsible for support and maintenance, frequency and purpose, and costs.
- **Logistics**, i.e., factors impacting integration of solutions/ technologies offered by ALLIANCE minimising or avoiding disruption of workflows.
- **Validation** needs to consider metrics (KPIs) that can be used to test and corroborate functionality, performance, outcomes, feedback loops for improvement and optimisation.

2.4. Guided Interview Methodology

During March 2024, EuroFIR undertook a series of online guided interviews, using Microsoft TEAMS (see Table 2), exploring solutions/technology offered by ALLIANCE to inform both this Task and Task 5.3 Innovation management, market analysis and commercial roadmap (see Appendix A). The guided interviews focused on the nature of ALLIANCE solutions/technology, development before (if applicable) and during the project, contributing organisations, and post-project exploitation. These were led by Siân Astley or Hana Mušinović with support from Christina-Ariadni Valagkouti. The guided interviews were recorded for later analysis and are stored securely on the EuroFIR SharePoint with access limited to the interviewers; files are marked for destruction on or before 31st October 2025.

Information describing development of the PUCs was collected from Task 4.2 – A blockchain platform for food supply chain systems that uses DNA fingerprinting aiming at the PDO/PGI extra virgin olive oil authenticity validation (BIOCOS), Task 4.3 – Safeguard PDO Feta Cheese: Improve overall safety, performance and sustainability efficiency with increased traceability (OLYMPOS), Task 4.4 – Fighting fraud and adulteration and preserving authenticity in organic honey (WBP), Task 4.5 – AI-assisted NIR and HIS rapid testing for on-site verification of authenticity of PGI Faba beans (ASINCAR), Task 4.6 – Applying smart-contracts to fight food fraud in PGI Lika potatoes (UNIZG): Task 4.7 – Organic pasta: Combating counterfeit with rapid pesticide identification for organic pasta (AN), Task 4.8 – Improved traceability through a blockchain-enabled PDO Arilje raspberries food supply chain (ORIG), Task 4.9 Pilots assessment, lessons learnt and user acceptance evaluation (UNIBO), and Task 4.10 Meso-economic analysis of impacts and diffusion conditions of the innovation within industrial chains and territories (UTH) between September 2023 and March 2024, primarily from presentation at the consortium meetings. Information was also provided via the guided interviews although this was not the focus of these discussions, which were orientated towards the solutions/technologies.

Table 2: Guided interviews with solution providers conducted in March 2024

Solution	Provider	Contact	Technology	Use cases						
				EVOO	Feta	Honey	Faba	Lika	Pasta	Raspberries
Next generation portable DNA sequencing	BIOCOS	Stelios Arhondakis (s.arhondakis@biocos.gr), Athanasia Maria Dourou (a.dourou@biocos.gr), Eva Lampropoulou (e.lampropoulou@biocos.gr)	DNA fingerprinting, portable qPCR	X						
Advanced spectroscopy	ASINCAR	Roberto Moran Ramailal (robertomr@asincar.com)	NIR & HIS				X			
Early warning decision support system	INTRASOFT	Amalia Ntemou (Amalia.NTEMOU@netcompany.com)	AI, ML, Big Data Analytics	x	x	x	x	x	x	x
Blockchain	UTH	Apostolis Apostolaras (apaposto@gmail.com) & Stavroula Maglavera (smaglavera@gmail.com)	• Blockchain & EPCIS • IoT • AI, ML, big data analytics, sensing	X	X	X	X	X	X	X
Digital knowledge database	FINS	Nikola Maravic (nikola.maravic@fins.uns.ac.rs), Tatjana Peulic (tatjana.peulic@fins.uns.ac.rs)	Cloud, Data analytics	(X)	(X)	(X)	(X)	(X)	(X)	X
Vulnerability risk assessment framework	UNIBO	Alessandra Castellini (alessandra.castellini@unibo.it), Maurizio Canavari (maurizio.canavari@unibo.it), Giulia Maesano (giulia.maesano2@unibo.it)	Consumer Questionnaire - distributed among 500 consumers in 6 countries of the use cases.	X	X	X	X	X	X	X

x = intended to be used; (x) potentially could be used

3 RESULTS (USE CASE SCENARIO PREPARATION)

3.1. Pilot use cases

Development of the ALLIANCE PUCs is ongoing, but most have now identified activities related to WP2 Food Traceability and/or WP3 Food Safety and Authenticity, which in turn will inform WP4 Use Cases.

3.1.1 PDO/PGI Extra Virgin Olive Oil

BIOCOS is focused on Task 2.2 Resilient food supply chain systems using blockchain and Task 3.2 Next Generation portable DNA Sequencing for food analysis (M5-M30) that will help reduce complexity and address fragmentation of the EVOO supply chain (see Figure 1), which enable malicious interventions such as mislabelling, false origin, substitution, dilution, counterfeiting, and theft. The solution is two-fold, i.e., portable DNA sequencing and automated AI/ML classification. Currently, the scenario aims to test and verify the solution/technologies at every stage along the supply chain (field, milling, storage, bottling, retail) as well as introducing an audit trail that can be access using a QR code on packaging. In addition, novel genetic markers for Italian varieties will be validated, creating a new DNA dataset, standardised DNA fingerprints, and an updated AI/ML pipeline. It is also hoped that time to results can be reduced. This work will begin with the 2023 harvest and focus on linking field, milling and storage. This work will be repeated with the 2024 harvest and followed through from field to retailer and beyond.

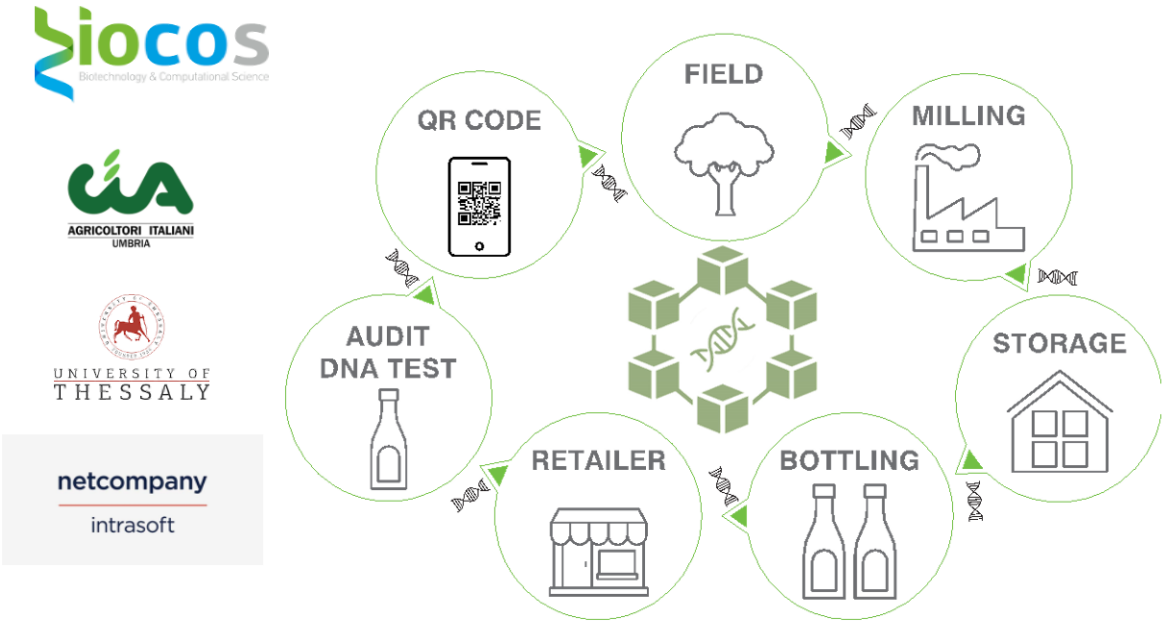


Figure 1 PDO/PGI EVOO supply chain

3.1.2 Feta Cheese

The supply chain for Feta cheese begins with dairy farming, where goats and/or sheep are raised and milked in specific geographical regions. Dairy farmers are responsible for ensuring the health and well-being of the animals, as well as proper milking procedures to maintain milk quality. The raw milk is collected and transported to collection points or dairy processing facilities using refrigerated trucks to maintain the freshness and quality of the milk during transit. It is these, rather than subsequent stages, which are particularly vulnerable to factors that impact quality and, therefore, reputation or malicious interventions including misappropriation of origin (animal or geographical location), adulteration (lower quality milks, fillers or extenders, or substitution). To combat potential frauds pre-manufacture, ALLIANCE aims to utilise blockchain to collect data from dairies and during transport and EWDSS to alert retail to any anomalies and, thereby, increased transparency, traceability measures, and certification programmes to help mitigate the risk of fraud and protect the integrity of Feta cheese.

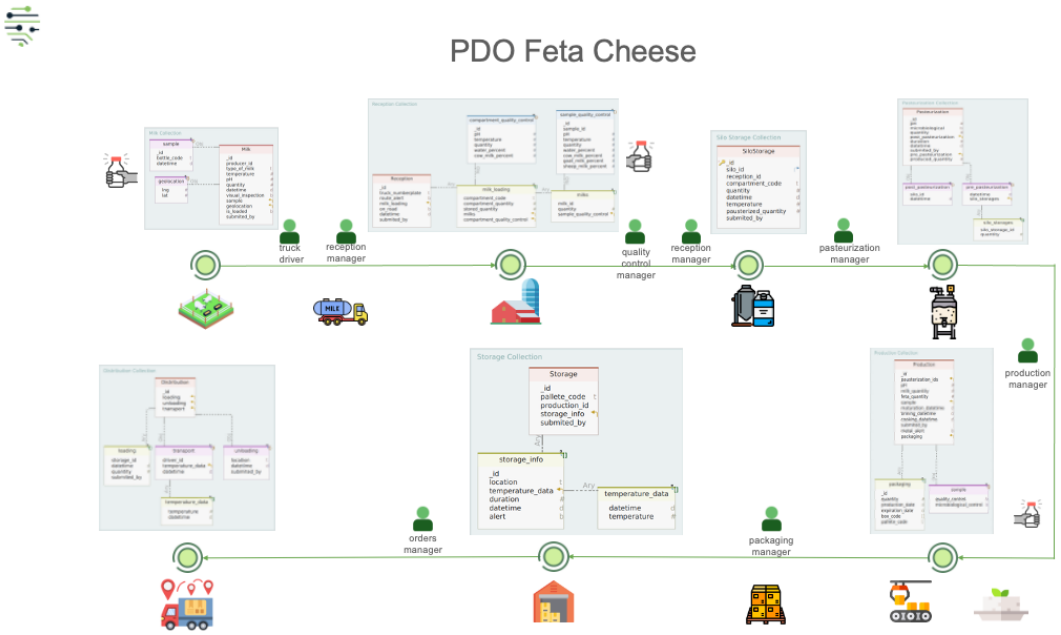


Figure 2: PDO/PGI EVOO supply chain and stylised data flow for blockchain

3.1.3 Organic honey

With labelling inconsistency across the EU for honey in general and no single test for authenticity, this PUC aims to test the capture of hive-to-jar supply chain data (see Figure 3). Some production data might be added manually to reduce costs whilst other data will be validated with additional information from hive sensors, satellite images, and chemical testing. Hive sensors will provide GPS location, bee health data, as well as production data. In the future, it might be possible to apply DNA technology since pollen from plants visited by the bees is present in all honeys and this would help validate hive locations. Satellite images can be used to identify and confirm crops growing near hives are farmed organically as well as being matched with pollen DNA profiles. However, because DNA testing in honey is still emerging H-NMR test might also be applied for testing final products. Thus, authentication would be based on 'weight of evidence' across multiple datasets and used to create a passport for each product. Next steps in this PUC will be collection of sensor data from beekeepers in Occitanie (FR), honey DNA profiles (BIOCOS), and introduction of pilot data into blockchain.

Figure 3: Organic honey hive-to-jar supply chain

3.1.4 PGI Asturian Faba Beans

Outcomes from this PUC will benefit the PGI control body (IGPFA) and public control authority (CMAST) and both have been involved in design and planning (M12-M19). Validation of the portable NIR and HSI devices will support routine oversight and help prevent adulteration with cheaper beans and mixtures of PGI fabas with beans from different plots in the same region. Refinement of the PUC and validation will be complete in M26. Currently, potential key performance indices are being discussed and include improved accuracy of analysis protocols (>70%), increased number of consumers and loyalty, and greater profitability (>40%), alongside reduced fraud securing employment (>80%) and decreased losses associated with counterfeited beans. Other activities M20-M26 include training for IGPFA and CMAST (M20) and deployment of the first validation campaign using a functional prototype. Subsequently, NIR and HSI datasets will be integrated with blockchain and AI/ML tools (see Figure 3).

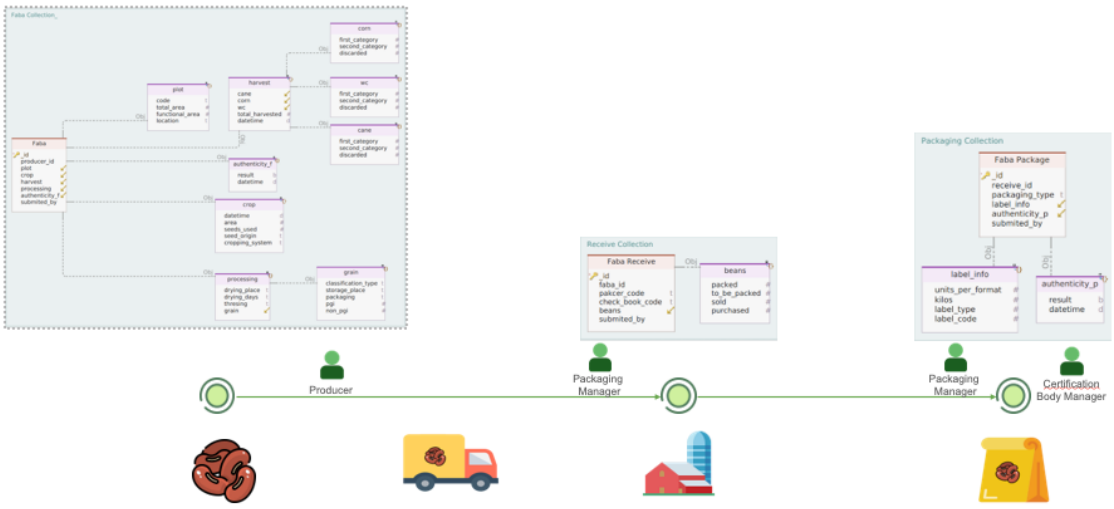


Figure 4: PGI Asturian Faba Beans supply chain and stylised data flow for blockchain

3.1.5 PGI Lika Potatoes

In 2023, it was determined that, despite the small number of PGI potato producers, it is difficult to monitor and prevent misuse of Lički krumpir, identify potatoes outside the PGI system, and documentation is manual (i.e., Word or Excel spreadsheets), and there was not only a lack of infrastructure but also knowledge to achieve digitalisation and implement blockchain for traceability. Organisations involved in the supply chain and, therefore, also the PUC include the Association of Lika Potato Producers (ALPP), Lika potato producers, Biotechnicon Ltd. (certification body), distributors, retailers (i.e., Migros), and consumers. Information flow has been mapped and system and data errors identified. The next steps will be to introduce essential information to blockchain at key stages (i.e., cultivation, reception, storage, orders and packing, and quality control) by actors along the supply chain (i.e., producers, association, certification body, retailer).

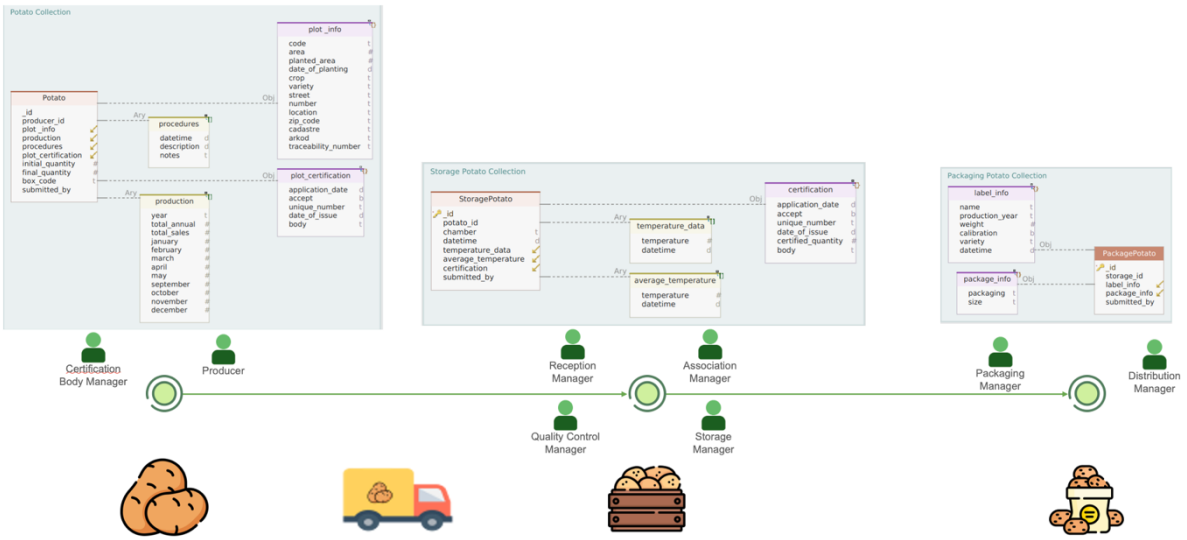


Figure 5: PGI Lika Potatoes supply chain and stylised data flow for blockchain

3.1.6 Organic Pasta

This ALLIANCE PUC is exploiting rapid pesticide fingerprinting to reduce or prevent fraud associated with organic pasta. Data will be collected using IoT in the field and pesticides residues measured in the laboratory during M21-M33 to validate these approaches. Sensors will be planted in organic and conventional fields in Tuscany (IT) where Durum wheat is cultivated and NDVI (normalized difference vegetation index) used to classify fields as organic or conventional farming practice. Factors that will be considered include soil temperature (°C), humidity (%), conductivity (us/cm), and nitrogen, phosphorous, and potassium concentrations [NPK, mg/kg) (see Figure 6). Cadastre information will be combined with satellite images to support remote analysis of farming methods, as preliminary evidence suggests there are detectable differences. These data are complex, and models require further refinement. The aim is to have AI identify fields that are high (conventional > 90%), medium (> 75%), and low (> 60%). Currently, the focus is on high conventional (> 90%) to ensure the AI/ML is robust. Subsequently, fields will be audited in person to confirm the models are accurate. In parallel, definition and evaluation of pesticide profiles in vitro are being explored in the literature and, from July 2024 (M21), multi-residual analysis will be carried out on conventional pasta (10), soils to compare and validate NPK data from sensors (4), Alce Nero semolina (10), and Alce Nero organic pasta (10).

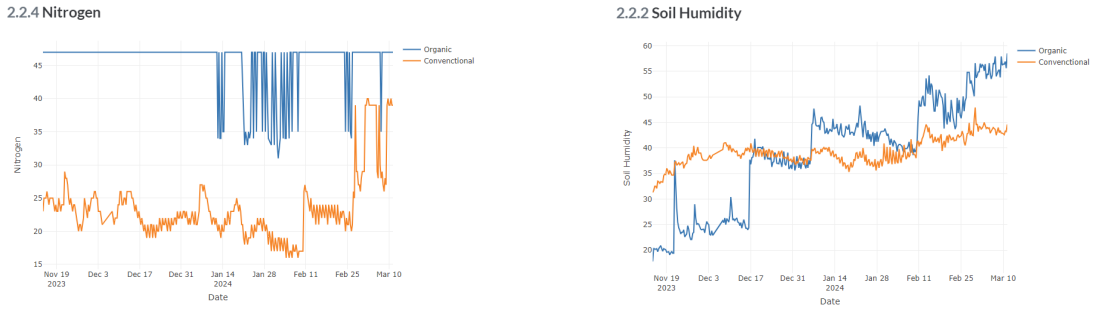


Figure 6: Comparison of nitrogen concentrations and soil humidity for organic and conventional farming practices

3.1.7 PDO Arilje Raspberries

This PUC aims to improve traceability and monitoring of quantities and origins of PDO Arilje raspberries by integrating data from rapid, accurate, and low-cost techniques for physio-chemical characterisation into blockchain. The PUC comprises four stages, namely developing and testing blockchain, testing at the retail level in Greece and Turkey, deployment of rapid, accurate and low-cost techniques for physio-chemical analyses, and compiling representative dataset for multivariate data to monitor compliance and mitigate fraud. An early warning decision support system EWDSS for Arilje raspberries will be established on the production side for fresh, frozen, and freeze-dried raspberries and linked to existing data sources. Then, blockchain traceability and EWDSS will be incorporated into the certification process. These processes will need to be refined in partnership with Migros to ensure retailers' needs are addressed, and the PUC validated subsequently using fresh fruit. In parallel, a sensory committee will be trained (FINS) on frozen and freeze-dried fruit during the early season (May/June) before continuing to work with fresh raspberries in the late season (September/October).

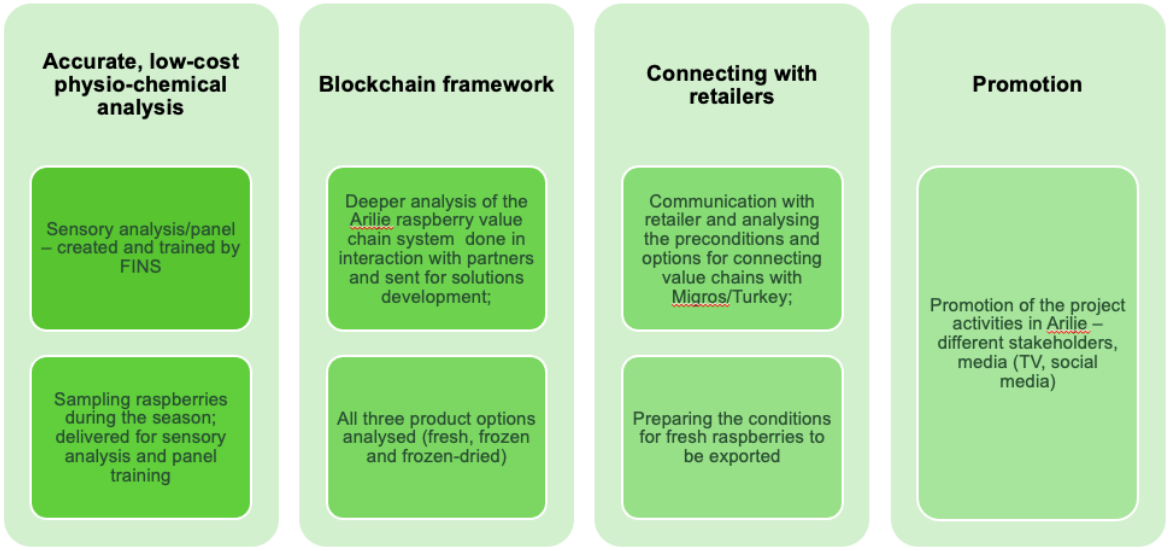


Figure 7: Blockchain framework and low-cost analysis for Arilje raspberries

3.2. PUC assessment, lessons learned, and user acceptance

Procedures for evaluating how customers respond to an innovative product or value proposition require a validation campaign using both quantitative and qualitative approaches. Typically, this will entail comparing results across various acquisition patterns or settings of the assessment procedure, which is crucial for defining criteria, measurement methods, and the adoption of scales and weights. In-depth interviews will complement survey outcomes, forming a comprehensive workflow of activities. Duration of this process varies depending on factors such as investment, clarity of product explanation, development of key messaging, and levels of respondent participation.

The literature review will address theoretical gaps in implementation and understanding of innovation resistance and adoption, and the interviews will offer insights into how customers respond. However, further work will be essential to determine how resistance to innovation manifests and what can be done to overcome this natural response since it is a primary factor contributing to innovation failure. Despite its significance, there remains a scarcity of literature comprehensively explaining innovation resistance and such a review will serve to consolidate existing knowledge, identify gaps, and offer insights into strategies for addressing resistance and enhancing acceptance, thereby informing activities in WP5, specifically Tasks 5.3 and 5.4. The literature review is ongoing, but a draft framework has been developed for the unified theory of acceptance and use of technology (UTAUT, Figure 8).

Factors that will be considered include **performance expectancy** (individuals' beliefs that using a technology system will enhance job performance) and **effort expectancy** (perceptions that such a system will require minimal effort). Social influences reflect degrees to which important individuals approve or disapprove of behaviours whilst facilitating technical assistance, resources, and infrastructures that ease adoption and use of new technology. Socio-demographic factors and previous experiences with similar systems shape individuals' perceptions and knowledge. **Voluntariness** underscores freedom of choice (in adopting the technology) and **behavioural intention** denotes motivation and willingness (to exert effort) to use the technology. Finally, **use** represents the specific behaviour exhibited by individuals concerning the technology.

Validation campaign for the high-value European products with geographical indications or quality scheme and solutions and the in-depth interviews will be carried out by the Bologna University (IT) after M30 amongst (500) internal and external participants (validation campaigns).

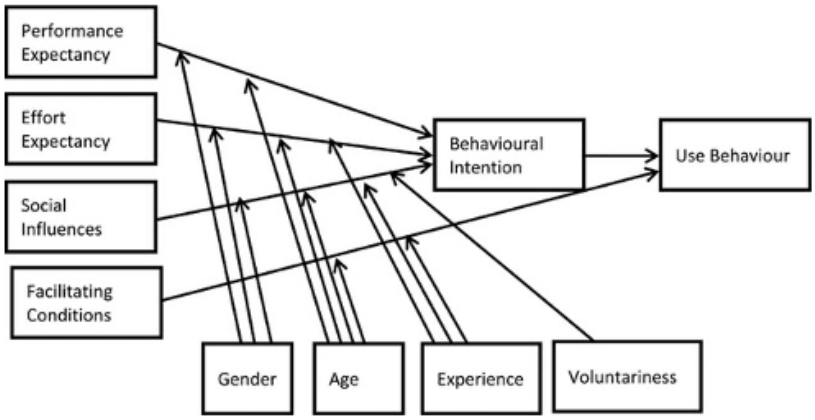


Figure 8: Identification of the Unified Theory of Acceptance and Use of Technology (UTAUT) framework

3.3. Meso-economic analysis

The aim of this aspect of the ALLIANCE PUCs is to discern the opportunities, risks, and uncertainties perceived by stakeholders regarding alternative traceability systems. This will be achieved through focus groups with value-chain actors employing knowledge synthesis and Q-methodology. A set of statements representing various viewpoints is composed and participants Q-sort these according to personal beliefs, preferences, or attitudes using a Likert scale. Data will undergo factor analysis to unveil patterns or clusters of similar viewpoints. The results offer insights into diverse perspectives and to pinpoint opportunities, risks, and uncertainties. This approach will also consider institutional and market contexts to provide a comprehensive understanding of innovation adoption, considering the transition requirements of industrial, consumer, and societal demands, informing Tasks 5.3 and 5.4.

The dynamic agricultural household bio-economic simulator model (DAHBSIM) will be applied to examine intricate dynamics within agricultural households. This scenario-based bio-economic model will quantify connections between resources within – for example – the Feta cheese supply chain and external factors. These parameters include population growth, household food needs, changing economic situations, policies, climate change, and more, operating at the field, farm, and regional levels. Different dairy farm types will undergo assessment through scenario simulations, enabling a comprehensive understanding of their operations. Furthermore, the impact of current policy measures and potential policy changes on farmers' incomes and the adoption process of these policies will be evaluated. The model will be applied across all products under scrutiny within the ALLIANCE, providing valuable insights into the agricultural landscape and facilitating informed decision-making.

DAHBSIM consists of several steps. Firstly, model initialisation and preparation, which involve setting up initial conditions of any simulation and preparing questionnaires. Following this, data are gathered and pre-processed to ensure compatibility with the model. Parameters are specified as well as variables governing agricultural household behaviour and the surrounding environment, along with defining the scenarios to be simulated. Once the parameters are set, simulation begins, where the model runs with the specified input data and scenarios. Subsequently, simulation results can be analysed to understand the impacts of different scenarios on different aspects such as agricultural households, land use patterns, income distribution, and food security. Validation and interpretation are critical steps, wherein the

simulation results are corroborated against empirical data or existing knowledge to ensure the credibility and relevance of any conclusions. Finally, the communication and reporting phase should present the findings in a clear and accessible manner to convey any implications for policymaking, agricultural development strategies, and future research directions. Currently, UTH (EL) is at the initial phase, with simulation defined and questionnaires in preparation.

3.4. ALLIANCE solutions/technologies

Guided interviews provided information about the solutions/technology offered by ALLIANCE as well as how they might be implemented in specific PUCs and, more generally, how they might safeguard authenticity and quality, facilitate efficacy testing and validation, and identified some potential shortcomings, gaps and needs that might hinder application beyond the pilot-scale, as well as requirements (i.e., hardware and software requirements, privacy and legal considerations, data accessibility and interoperability, operational support, training materials).

Primary requirements for specific ALLIANCE PUCs were identified as:

3.4.1. Hardware Requirements

DNA authentication and traceability (BIOCOS)

- In-house portable qPCR device
- DNA extraction kit
- DNA sequencer
- Barcode and labelling systems
- Chain of custody system
- Secure storage and transport solutions

Advanced Spectroscopy (ASINCAR)

- Portable scanning device incorporating near-infrared spectroscopy (NIR) and hyperspectral imaging (HSI)
- Sample handling kit
- Barcode and labelling systems
- Chain of custody system
- Secure storage and transport solutions

Early Warning Decision Support System (EWDSS) (INTRASOFT), **Blockchain** (UTH), **Digital Knowledge Database** (FINS), **Vulnerability Risk Assessment Framework** (UNIBO)

- IT platform

3.4.2. Software Requirements

To fulfil the requirements of the various ALLIANCE PUCs, combination of bioinformatics software, database management tools, and data visualisation tools would be required.

DNA authentication and traceability (BIOCOS)

- Bioinformatics software capable of running experiments automatically and analysing DNA markers as well as tools for genotyping, sequence alignment, and marker detection (e.g., BLAST, NCBI)
- Laboratory information management systems (LIMS)
- Database management system, where DNA profiles are stored and compared (e.g., MySQL)
- Data visualisation tools for easy-to-understand presentation of results (e.g., Python with matplotlib)
- Additional tools for database integration, tools to integrate DNA profiles into the comparative database, APIs or scripts for data transfer and integration, or custom scripts or middleware.
- Quality control and assurance tools to ensure accuracy and reliability of results, quality control measures within bioinformatics software, and custom scripts or algorithms for verifying accuracy of DNA marker comparisons.
- Security and access control software for the comparative database and authentication and authorisation mechanisms to restrict/control and monitor access.
- Documentation and workflow management tools for documenting experiments, procedures, and workflows, and project management software for tracking progress and managing tasks.
- Collaboration tools for team members working on the project (e.g., Microsoft Teams)
- Backup and recovery solutions
- Compliance software, depending on the nature of the data and the regulations governing use.

Advanced Spectroscopy (ASINCAR)

In addition to many of tools and software identified above (e.g., collaboration tools, database management system), for processing NIR and HSI spectra, specialised software designed for analysis and data visualisation are required such as Unscrambler X (multivariate data analysis), Grams/AI, MATLAB with PLS or Chemometrics Toolboxes, R with spectral analysis packages, ENVI designed for processing and analysing remote sensing data, including hyperspectral imagery, Python with spectral analysis libraries, and/or HORIBA LabSpec in addition to any proprietary software tailored for processing specific data types that come with the portable scanning device.

Early Warning Decision Support System (EWDSS) (INTRASOFT)

EWDSS typically integrate a variety of data sources, analysing them in real-time or near real-time, and providing actionable insights to support decision-making. The choice of software for EWDSS depends on specific requirements, types of data, complexity of analysis, scalability, and user interface. Software options commonly used include Python and R, Tableau or Microsoft Power BI, Apache Kafka and Apache Spark, Esri ArcGIS or QGIS, and Google Cloud AI Platform or Amazon SageMaker.

Blockchain (UTH)

The ALLIANCE PUCs blockchain is based on Hyperledger Fabric, a permissioned blockchain framework under the Hyperledger umbrella, which is hosted by the Linux Foundation. It is designed for enterprise-grade blockchain solutions, providing a modular and scalable platform for building distributed ledger applications. Key features and characteristics include permissioned network, modular architecture, privacy and confidentiality, smart contracts (chaincode), pluggable consensus mechanisms, scalability and performance, identity

management, and permissioned membership services, which engender flexibility, trust, security, and regulatory compliance.

Digital Knowledge Database (FINS)

A digital knowledge database is a centralised repository of information and knowledge that enables users to search for, access, and contribute. Key components and features typically comprise a content management system, search functionality, user access control (authorisation and authentication), collaboration tools, content curation and quality assurance, metadata and tagging, versioning and revision history, integration with other systems (e.g., CRM, HTTP or FTP), and analytics and reporting.

3.4.3. Legal and Data Privacy

The European Union (EU) has comprehensive legal frameworks governing data privacy and protection, with the General Data Protection Regulation (GDPR) being the most prominent. GDPR aims to protect the personal and sensitive data of individuals within the EU and the European Economic Area (EEA) and applies to all organisations, regardless of their location, which process personal and sensitive data in the EU. GDPR sets out principles for data processing, defines the rights of data subjects, and imposes obligations on data controllers and processors (see Figure 9).

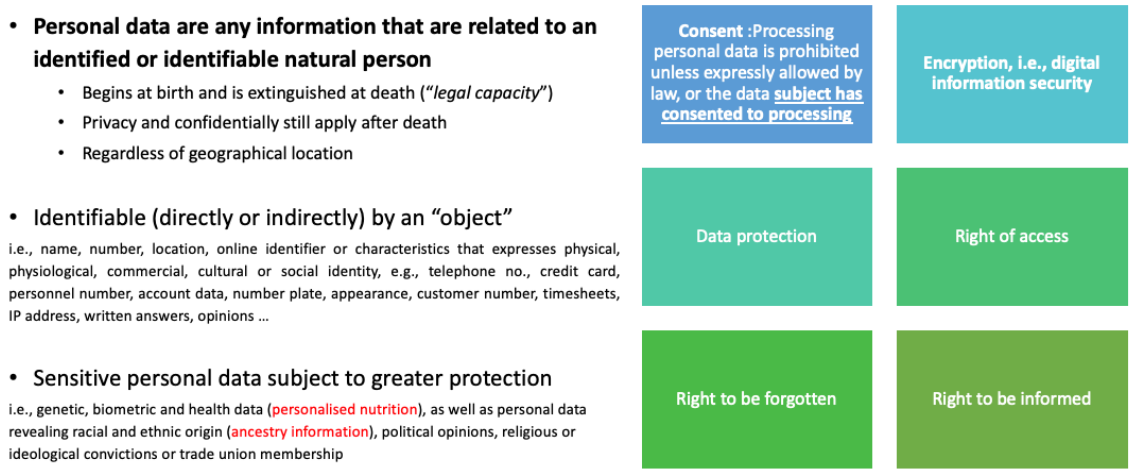


Figure 9: Personal and sensitive data under GDPR in the European Union

Other key regulations and directives related to data privacy in the EU that might be relevant for ALLIANCE include the (1) ePrivacy Directive or "Cookie Law", which governs the privacy of electronic communications and requires websites to obtain consent from users before storing or accessing information on their devices, such as cookies, and provides rules for electronic marketing communications; (2) Directive on Privacy and Electronic Communications (ePrivacy Directive 2002/58/EC), which complements the GDPR and addresses specifically privacy rights in the electronic communications sector such as confidentiality of communications, processing of personal data in electronic communications services, and spam regulations; (3) Directive on Data Protection in Law Enforcement (Directive (EU) 2016/680), which governs the processing of personal data by competent authorities for the purposes of prevention, investigation, detection, or prosecution of criminal offenses or the execution of criminal penalties; (4) Schrems II ruling, which is not a regulation or directive, but a landmark ruling by the Court of Justice of the European Union (CJEU) in July 2020 that invalidated the EU-U.S. Privacy Shield framework for data transfers and clarified requirements for international data transfers under the GDPR, emphasising the importance of ensuring an equivalent level of protection when transferring data to third countries; (5) Data Protection Authorities (DPAs) or the authority responsible for enforcing data protection laws within its jurisdiction; and (6) Data Protection Impact Assessments (DPIAs), which are required under GDPR for assessing potential risks and impact of data processing activities on individuals' privacy rights and mandatory for high-risk processing activities and identification of measures to mitigate risks. Compliance with these regulations is essential for organizations operating within the EU or processing personal data of EU residents. Non-compliance can result in significant fines and reputational damage. Therefore, ALLIANCE partners will need to implement (or extend) robust data protection measures for each of the PUCs, including privacy policies, data security protocols, and mechanisms for obtaining consent from data subjects.

When consider data protection regulations, the focus is typically on personal data and privacy. However, in the context of foods, there are regulations and standards related to food safety, labelling, and traceability including food safety regulations (e.g., General Food Law Regulation No. 178/2002), food labelling regulations (e.g., No. 169/2011 on the provision of food information to consumers), organic certification standards (i.e., Regulation (EU) 2018/848), genetically modified organisms (GMO) regulations such as Directive 2001/18/EC and Regulation (EC) No 1829/2003, although these are not relevant to ALLIANCE, and traceability requirements (e.g., Regulation (EC) No 178/2002). While these regulations primarily focus on

food safety, labelling, and traceability, they have a crucial role in safeguarding the integrity and safety of foods and protecting the health of citizens.

DNA authentication and traceability (BIOCOS)

- Provision of Food Information to Consumers (Regulation (EU) No 1169/2011)
- Convention on Biological Diversity (CBD), which is an international treaty
- Codex Alimentarius Commission (CAC) guidelines
- Environmental regulations
- ISO Standards
- GDPR
- IP (copyright, patent, trademark and trade secret)

Advanced Spectroscopy (ASINCAR)

- Provision of Food Information to Consumers (Regulation (EU) No 1169/2011)
- Convention on Biological Diversity (CBD)
- Codex Alimentarius Commission (CAC) guidelines
- Food safety, environmental, and occupational safety regulations
- ISO Standards
- GDPR
- IP (copyright, patent, trademark and trade secret)

Early Warning Decision Support System (EWDSS) (INTRASOFT)

- Provision of Food Information to Consumers (Regulation (EU) No 1169/2011)
- ISO Standards
- GDPR
- IP (copyright, patent, trademark and trade secret)

Blockchain (UTH)

Regulations covering blockchain technology in the European Union (EU) aim to foster innovation while ensuring consumer protection, data privacy, and compliance with existing legal frameworks. Key regulations and initiatives relevant to blockchain technology in the EU include:

- GDPR
- Digital Identity Regulation
- Regulatory Sandboxes and Innovation Hubs
- European Blockchain Partnership (EBP)
- European Blockchain Services Infrastructure (EBSI)
- Payment Services Directive 2 (PSD2), which regulates payment services and providers

Digital Knowledge Database (FINS), **Vulnerability Risk Assessment Framework** (UNIBO)

- GDPR
- IP (copyright, patent, trademark and trade secret)

3.4.4. Operational Support

DNA authentication and traceability (BIOCOS)

- ISO 9001
- Sample collection protocols
- Laboratory and in-field facilities and equipment
- Data processing and analysis
- Quality control and assurance including certification (CNR, IT)
- Training and education
- Compliance with regulatory requirements
- Continuous improvement and innovation

Advanced Spectroscopy (ASINCAR) - as above but also

- Calibration and standardisation

Early Warning Decision Support System (EWDSS) (INTRASOFT) and **Digital Knowledge Database** (FINS)

- Database management:
- Data collection and integration protocols
- Data quality assurance
- Data analysis and visualisation
- Early warning system AI & ML algorithms, training and test datasets
- Alerting and notification mechanisms and protocols
- System monitoring and maintenance
- User training and support
- Compliance and governance

Blockchain (UTH)

- Network infrastructure
- Node management
- Consensus mechanisms
- Security measures
- Smart contract management
- Transaction processing
- Data management
- Compliance and governance
- Scalability and performance optimisation
- User support and training

Vulnerability Risk Assessment Framework (UNIBO)

- Marketing or polling agency
- Translation services
- Policies and procedures, i.e., objectives, scope, methodologies, roles, and responsibilities
- Asset inventory and classification, i.e., ALLIANCE PUCs and solutions/technologies

- Risk assessment methodologies
- Vulnerability remediation workflow, i.e., feedback loop to PUCs and solutions/technologies

3.4.5. Logistics

DNA authentication and traceability (BIOCOS) **and Advanced Spectroscopy** (ASINCAR)

Logistics for DNA authentication and traceability or advanced spectroscopy involve managing the transportation, handling, and storage of samples and related data throughout the process.

- Sample collection kits
- Transportation protocols
- Sample tracking system
- Laboratory receiving and processing protocols
- Storage facilities, wet chemistry (e.g., leaves) and data archiving
- Data management and security
- Sample disposal and destruction
- Chain of custody documentation
- Contingency planning

Early Warning Decision Support System (EWDSS) (INTRASOFT), **Digital Knowledge Database** (FINS) and **Blockchain** (UTH) involve managing the infrastructure(s), data flows, and processes to ensure the efficient operation and timely delivery of alerts and insights, and most aspects have been identified in the categories above, i.e., hardware, software, protocols, etc. Similarly, needs for **Vulnerability Risk Assessment Framework** (UNIBO) have been identified above.

3.4.6. Validation Roadmap

Development of the validation roadmaps for the ALLIANCE PUCs is ongoing and some 'next steps' are described above including testing of systems (real world and virtual) and corroboration of results (e.g., DNA testing at each stage from field to retail or collection of hive-to-jar supply chain data, manual auditing of Cadastre information for organic Durum wheat, etc.). These activities will ensure the accuracy, reliability, and compliance of the proposed traceability and authentication systems.

Figure 10: Validation roadmap showing the six key phases

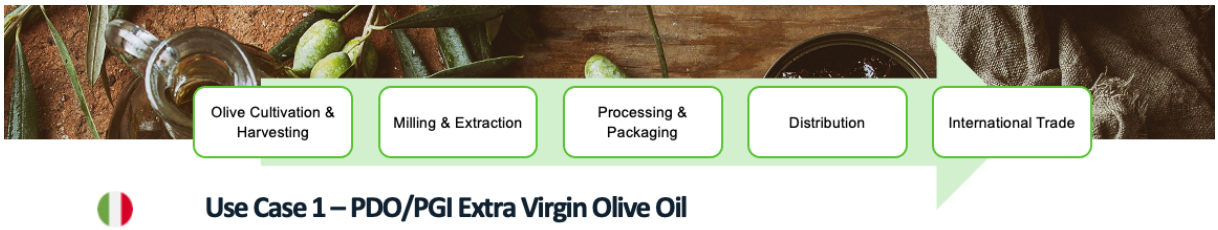
3.5. Access to fraud incident data in Europe

Separately, and in the context of validation, it has emerged that, whilst it is generally acknowledged that high-value European products with geographical indications or quality schemes are vulnerable to fraud, and the types of fraud can be defined, it is much harder to obtain data describing frequency. For example, fraudulent activities associated with extra virgin olive oil (EVOO), which is the best understood value chain amongst those considered by ALLIANCE, include mislabelling (i.e., lower-quality olive oils are labelled and sold as extra virgin olive oil), adulteration (i.e., mixing extra virgin olive oil with lower-quality oils or substances such as refined olive oil, other vegetable oils, or even colorants and flavourings to improve appearance and taste while reducing production costs), blending with non-EU oils, which do not adhere to the same quality standards and regulations, and quality degradation (i.e., improper storage and handling practices during transportation, storage in inappropriate conditions, or exposure to light, heat, or oxygen). Frequency of these fraudulent activities varies but the extent of the issue is difficult to determine precisely due to the complexity of global – or indeed EU – supply chains, limited resources for enforcement, and the involvement of actors at different stages of production and distribution. Definitive and comprehensive data on instances of fraud related to high-value European products with geographical indications or quality schemes is essential when presenting solutions/technologies to the market (Task 5.3-5.4) but measuring the effectiveness of efforts to combat fraud – be that DNA testing, spectroscopy, or blockchain – without a baseline understanding the prevalence and scope of fraud is impossible. Thus, to address this, data describing fraud associated with high-value European products need to be improved (e.g., specific to high-value European products with geographical indications not just food groups [e.g., extra virgin olive oil versus PDO/PGI EVOO], nationally as well as cross border) and made FAIR (findable, accessible, interoperable, and re-usable). This might be achieved through enhanced monitoring and reporting systems, which is addressed in part by ALLIANCE (Early Warning Decision Support System for Food Fraud Prevention), data sharing and collaboration (e.g., blockchain), surveillance and sampling programmes (e.g., DNA sequencing, advanced spectroscopy), greater public awareness campaigns, and more coordinated research and analysis.

3.6. Linking ALLIANCE PUCs and solutions/technologies

The diagrams presented below, from Task 4.1 presentation at the ALLIANCE Consortium Meeting (9-10th April 2024, M18), illustrate current understanding of solutions/technology describe above and their application in high-value European product supply chains, which the project aims to help safeguard. They also highlight potential exploitable results, crucial for informing Task 5.3 and 5.4.

3.6.1 PDO/PGI Extra Virgin Olive Oil



Use Case 1 – PDO/PGI Extra Virgin Olive Oil

SC Indicative for:	Implementation Requirements	Exploitable Outcomes
DNA Authentication & Traceability	• Portable qPCR device and training materials • Secure data management and GDPR compliance • Higher speed and accuracy, lower costs • Expansion of DNA marker database	• Quality Assurance Service • Expansion of market DNA database for olives • Scalability within olive oil industry • Applicability to other SCs

Other Tools with Potential for Implementation	Indicative Use Case
Blockchain Platform	Use Case 2 (Feta Cheese)
Early Warning Decision Support System	Use Case 2 (Feta Cheese)
Digital Knowledge Database	Use Case 7 (Arilje Raspberries)

Vulnerability Risk Assessment Questionnaire	Validation Roadmap

3.6.2 Feta Cheese

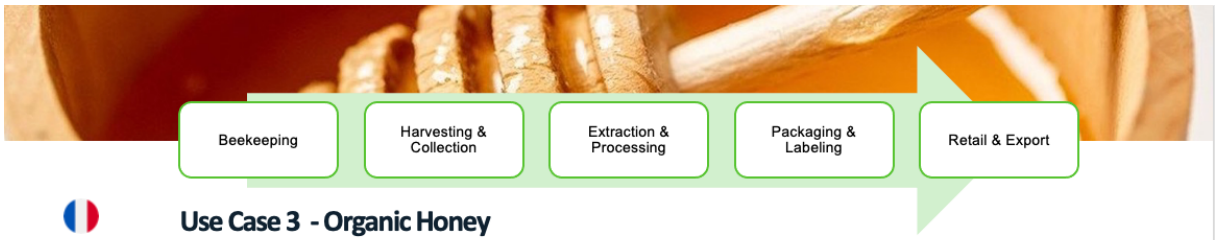
Use Case 2 – PDO Feta cheese

SC Indicative for:	Implementation Requirements	Exploitable Outcomes
Blockchain Platform	• Set-up of IoT devices for data collection • Set-up of IT platform for data storage • Establishment of interconnection for data exchange	Quality assurance & data integrity service
Early Warning Decision Support System	• Finalization of modules and interconnection with blockchain • Establishment of end-user input & feedback collection mechanism • Finalization of risk-calculating algorithm	Food safety warning system & data integrity system

Other Tools with Potential for Implementation	Indicative Use Case
Digital Knowledge Database	Use Case 7 (Arilje Raspberries)

Vulnerability Risk Assessment Questionnaire	Validation Roadmap

3.6.3 Organic honey

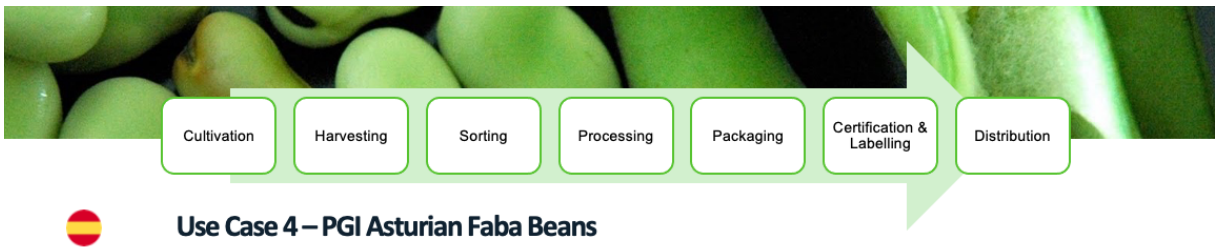


Use Case 3 - Organic Honey

Tools with Potential for Implementation	Indicative Use Case	Desired Outcomes
Digital Knowledge Database	Use Case 7 (Arilje Raspberries)	• DNA database • Authentication System • Policy Development
Blockchain Platform	Use Case 2 (Feta Cheese)	
Early Warning Decision Support System	Use Case 2 (Feta Cheese)	
DNA Authentication & Traceability System	Use Case 1 (EVOO)	

Vulnerability Risk Assessment Questionnaire	Validation Roadmap

3.6.4 PGI Asturian Faba Beans



Use Case 4 – PGI Asturian Faba Beans

SC Indicative for:	Implementation Requirements	Exploitable Outcomes
Advanced Spectrometry	• Hardware procurement (available on the market) • Completion of data analysis and identification of the most fitting processing technique • Development of training curriculum for certification bodies' staff	• Quality Assurance certification service • Database of Asturian faba bean physical (and chemical) characteristics

Other Tools with Potential for Implementation	Indicative Use Case
Blockchain Platform	Use Case 2 (Feta Cheese)
Early Warning Decision Support System	Use Case 2 (Feta Cheese)
Digital Knowledge Database	Use Case 7 (Arilje Raspberries)

Vulnerability Risk Assessment Questionnaire	Validation Roadmap

3.6.5 PGI Lika Potatoes

Use Case 5 – PGI Lika Potatoes

Tools with Potential for Implementation	Indicative Use Case	Desired Outcomes
Digital Knowledge Database	Use Case 7 (Arilje Raspberries)	Database on: • Dry matter content • Yield • Variety • Location
Blockchain Platform	Use Case 2 (Feta Cheese)	
Early Warning Decision Support System	Use Case 2 (Feta Cheese)	

Vulnerability Risk Assessment Questionnaire	Validation Roadmap

3.6.6 Organic Pasta

Use Case 6 – Organic Pasta

Tools with Potential for Implementation	Indicative Use Case	Desired Outcomes
Digital Knowledge Database	Use Case 7 (Arilje Raspberries)	• Organic Certification service • Durum pasta certification service
Blockchain Platform	Use Case 2 (Feta Cheese)	
Early Warning Decision Support System	Use Case 2 (Feta Cheese)	
DNA Authentication & Traceability System	Use Case 1 (EVOO)	

Vulnerability Risk Assessment Questionnaire	Validation Roadmap

3.6.7 PDO Arilje Raspberries

Use Case 7 – PDO Arilje Raspberry

SC Indicative for:	Implementation Requirements	Desired Outcomes
Digital Knowledge Database	• Conversion of Excel sheet into an IT interface • Interoperability with the other ALLIANCE offerings • Development of operational support • Determination of specifics for data visualisation	• Digitalised certification service for producers • (Database on raspberry characteristics)

Other Tools with Potential for Implementation	Indicative Use Case
Blockchain Platform	Use Case 2 (Feta Cheese)
Early Warning Decision Support System	Use Case 2 (Feta Cheese)

Vulnerability Risk Assessment Questionnaire	Validation Roadmap

4 CONCLUSIONS

4.1. Summary of Key Points

1. Explored the ALLIANCE solutions/technologies for high-value European product supply chains
2. Detailed integration of ALLIANCE solutions/technologies into the seven product supply chains
3. Updated progress on ALLIANCE pilot use cases up to M18
4. Considered requirements for the ALLIANCE pilot use cases, i.e., hardware, software, etc.
5. Identified key exploited results preliminarily to inform WP5

4.2. Recommendations

Development of the ALLIANCE pilot use case scenarios are ongoing, although some will deploy limited activities to test approaches M19-M25, which is critical in system design and business analysis (WP5).

Key recommendations for continued effective ALLIANCE PUC development include:

1. **Expand details for each ALLIANCE PUC**, e.g.,

- Actor Definition: Clearly identify and describe each actor involved, detailing their roles within the interaction with ALLIANCE PUCs and related solutions/technologies.
- Scenario Description: Include specific timelines, objectives, and the context
- Preconditions that must be in place before a PUC can be initiated
- Postconditions that must be achieved after the PUC concludes.
- Key Performance Indicators (KPIs): Establish clear metrics for success and failure, incorporating regular feedback mechanisms to assess performance.

2. **Collaborate to identify actors and stakeholders**

Work jointly across WP4 and WP5 to understand the roles of actors and stakeholders to support T5.3-5.4, enhancing alignment and integration, and ascertaining/ agreeing key exploitable results etc.

3. **Finalise requirements for PUCs and solutions/technologies**

Systematically document requirements related to each PUC and the associated solutions/ technologies to guide the development and implementation processes as well as the validation roadmap.

4. **Emphasise clarity and simplicity in communication and presentation**

Use straightforward, jargon-free language to ensure documentation and communications are easily understandable, enhancing collaboration and comprehension.

5. **Develop the validation roadmap**

The validation roadmap is the least developed aspect of the ALLIANCE PUCs (w.e.f M18) but it is also the most difficult to elaborate given the PUCs continue to be developed and refined. Also, the PUCs needs to reach a point where they can focus on future aims and ambitions rather than implementation to work with Bologna University on assessment, lessons learned, and user acceptance. Ideally, this should be the focus of activities by M24.

6. **Enhance documentation accessibility and updates**

Considerable work had been done on the nature and objectives of each PUC between M12 and M24, but this had not been adequately communicated with WP4 and WP5 until the Consortium Meeting (M18). The consortium needs to consider how these developments can be better communicated horizontally with imposing a further burden of work on those focused on the PUCs.

7. **Address non-functional requirements**

Those responsible for PUCs need to explicitly consider and document non-functional requirements, i.e., performance, usability, security, and acceptability. These aspects are critical for the overall success and user acceptance of the solutions but – understandably– less of a priority now.

8. **Access and analyse fraud data related to high-value European product supply chains**

These data are crucial for measuring and demonstrating the performance and impact of the PUCs.

By focusing on these enhanced recommendations, ALLIANCE PUC development will be more detailed and better aligned with the overall project objectives, ensuring a comprehensive approach to addressing the needs and challenges of high-value European product supply chains.

4.3. Next steps

- Continue to detail each ALLIANCE PUC and related requirements to draft D4.2 – Final Use Cases: Validation Campaigns and Demonstration Activities by M24 (due M36)
- Schedule regular review meetings to update and refine these details as necessary and enhance collaboration across WPs as well as reinforcing communication channels for regular updates.
- Support further development of the validation roadmap by M24 by developing greater understanding of non-functional requirements and ensure these are integrated in overall PUC development and the validation roadmap to enhance performance, usability, and acceptability.
- Access specific data describing fraud related to high-value European product supply chains.
- Supplement Deliverable with additional reading and reference, as necessary.

5 APPENDICES

5.1. APPENDIX A: Guided Interview Script

Lead Beneficiary: EuroFIR

Please note:

- This is an informal guideline to support the researchers and Task 4.1/5.3.
- There is not a right or wrong answer. The aim is just to know and understand the state of the tool. Therefore, "no" and "I don't know" are completely valid answers.
- For the sake of a common understanding, please note that exploitation and commercialisation are not the same concept. While exploitation refers to sharing your tool with the user communities with the aim of contribute to progress in the relevant domain, commercialisation relates to introducing the tool to the market for the purpose of making profit. Having said this, please bear in mind that these questions refer only to exploitation.
- Who are you? (your name and your organization)
- You are developing a tool within ALLIANCE, right?
- What is the tool name?
- What is the tool doing / what it will be doing?
- Which is/are the main objective(s) of the tool?
- Where in the process are you now? (i.e., still collecting data, usability test, etc)
- What elements make up the tool? (i.e., software, source code, database, algorithm)
- How will it be used?
- Where do you get the inputs from (i.e., users, databases, satellite)
- Once you have received these inputs, what do you do with the outputs?
- Do you or another 3rd of your, "touch" it? (i.e., order, rename, curate, combine with other data)
- What happens to the data collected? Who has access to it and how?
- Would you share the tool? Where? How? What conditions?
- Who is the tool targeted to? Which is the audience?
- Does it process/do you use personal data (any information that relates to an identified or identifiable living individual; i.e., name and surname, home address, email, IP address, etc) when running the tool? If so, do you consider the General Data Protection Regulation (GDPR)?
    - Does it process/do you use sensitive data (e.g., genetic, biometric and health data)
- How are you testing correctness, robustness, and reliability? Are you collecting feedback? How would you handle errors reported by users? What is your legal liability?

BEFORE ALLIANCE:

- Is there any element of the tool that was already there before ALLIANCE?
- If yes, which one(s)?
- Who created that? In case it wasn't you, do you know under which conditions can you (your organisation) and ALLIANCE (the project) make use of it?
- Do you have any written and signed proof of this agreement? (i.e., contract, licence)
- Other comments

DURING ALLIANCE:

- Which elements of the tools are being developed under ALLIANCE funding?
- Who has contributed and in what element(s)?
- Do these elements have formal agreement? (i.e., contract, licence - *not* verbal)
- Are these elements interoperable with other ALLIANCE tools and/or tools outside ALLIANCE?
- Has any of these elements already been published or available to the public (i.e., GitHub, Zenodo, any other repository)? If yes, where and under what terms and conditions?
- Do you plan to publish these elements? If so, where?
- Have you discussed training and support internally or with potential users in ALLIANCE?
- How do you develop your tool? Is it a team? If so, what is the contractual relationship with the members of the team?
- When you develop it, do you use any kind of common repository? i.e., Github, Gitlab, etc.
- In the tool, is ALLIANCE funding clearly acknowledged?
- Other comments

AFTER ALLIANCE:

- What is your wish for the tool after the project? Do you see it being made available on the market? What does that look like for you?
- Will the tool be updated? If so, what costs are associated with both maintaining and updating?
- Will you reuse parts of the tool in another project?
- Will you include the tool in a bigger development?
- Will you allow derivative works of the tool?
- Do you contemplate having any conditions to the user (i.e., share any new data generated using the tool)? If so, what and why?
- What would be your role in this process? Would you be providing user support?
- Other comments

Other comments (feel free to add whatever piece of information you consider is missing):

5.2. APPENDIX B: Guided Interview Notes and Recording Links

5.2.1. ASINCAR Guided Interview

- **Who are you? (your name and your organization)**

  Roberto Moran, on behalf of ASINCAR, an organization that supports food processing companies through innovation, technology, and training.

- **You are developing a tool within ALLIANCE, right?**

  Yes, Roberto is responsible for the European projects in ASINCAR.

- **What is the tool name?**

  The tool is unnamed, there's only the technological basis for it.

- **What is the tool doing / what it will be doing?**

A portable device that encompasses two different technologies – NIR and HSI. The tool will be able to identify fraudulent practices in the PGI faba bean value chain. There are two main fraudulent practices – mixing of PGI beans with non-PGI beans and mixing of PGI beans from different plots. The device is focusing on detecting the cases of mixing PGI beans with non-PGI beans.

- **Which is/are the main objective(s) of the tool?**

  The technology is meant to be used as a "filter" for identifying the suspicious cases that need to be referred to a lab. Its innovative feature is its portability, and it will allow authorities to do a "first scan". Any sample identified by the device as suspicious, will be redirected to a laboratory, so that the dispute about its PGI origin can be settled through validated laboratory tests.

- **Where in the process are you now? (i.e., still collecting data, usability test, etc)**

  The tool is focusing on detection of samples that contain a mixture of PGI and non-PGI faba beans. The data (spectra and physicochemical parameters) collection phase has been completed. At the moment, the data analysis is being carried out: technical staff is experimenting with different mathematical, statistical, and artificial intelligence techniques for the processing of these data. ASINCAR is aiming to complete this by month 18, and to be ready for a demonstration of the prototype in month 20/21.

- **What elements make up the tool? (i.e., software, source code, database, algorithm)**

  The tool is a combination of hardware and software. The hardware is commercially available, so the research and development performed were exclusively focused on the software development. The device is similar to a laser scanner (used e.g. in supermarkets for scanning the barcodes) and contains a spectrometer working with both IR and HS.

- **How will it be used?**

  The device is meant to allow testing anywhere, bringing portability to the HS technology (which is usually a bench technology). Intended users are the staff of the control bodies, and the device is meant to be incorporated in their operation.

- **Where do you get the inputs from (i.e., users, databases, satellite)**

  The input will come directly from the scanning function of the device. Several scannings will be performed, of different orientation of the sample. The input will be compared to the spectra and the characteristics of the PGI beans of the specific region and the sample, and the spectra of the beans used most frequently as substitutes when there is fraud. The database contains beans from Bolivia, Argentina, and the Galicia region of Spain.

- **Once you have received these inputs, what do you do with the outputs?**

  The output will be a "yes" or "no", in regards to relation with fraud. As it is not a certified method, the sample will be taken to a certified lab and a reference method will be applied in order to confirm the origin of the bean.

- **Do you or another 3rd of your, "touch" it? (i.e., order, rename, curate, combine with other data)**

  The PGI certification staff will test and validate the tool, and also the partners in ALLIANCE. ASINCAR is also looking to complement the tool's data with other data (e.g. plot location,

name of producer etc.). Addition of data that will enable traceability (from cropping until packaging) is also being examined, mainly with the contribution of UTH.

- **What happens to the data collected? Who has access to it and how?**

  Momentarily, only UTH has access, but the idea is that the output is available for anyone. Of course, the stakeholder that is expected to use it the most will be the authorities. There are also plans to make it available to the people involved in the development of the blockchain platform (UTH, potentially Intrasoft).

- **Would you share the tool? Where? How? What conditions?**

  Similar projects that deal with validation of origin will be interesting for the developers (establishment of feedback loop, further improvement and testing of the tool). It would be of interest to make the tool available so that it will be tested for other PGIs as well; however ASINCAR recognised that the use case of faba beans is quite specific and that the algorithm will require extra training. ASINCAR is open to new research projects that would test and help with fine-tuning the precision and the robustness of the tool.

- **Who is the tool targeted to? Which is the audience?**

  The tool is mostly targeted to authorities, mainly inspectors from the competent regional authorities for food safety and quality. The control body of the PGI has the characteristics of a private organisation, but the tool can also be used by the public authorities.

- **Does it process/do you use personal data (any information that relates to an identified or identifiable living individual; i.e., name and surname, home address, email, IP address, etc) when running the tool? If so, do you consider the General Data Protection Regulation (GDPR)?**
    - **Does it process/do you use sensitive data (e.g., genetic, biometric and health data)**

  The tool does not really process any personal data, as it only deals with the spectra and the physicochemical characteristics of the beans. The name of the producer/packer is in the PGI database, and that is governed by GDPR regulations.

- **How are you testing correctness, robustness, and reliability? Are you collecting feedback? How would you handle errors reported by users? What is your legal liability?**

There will be validation of the tool, but the challenge is to collect samples of beans from foreign trade regions. So one priority would be to increase the variability of the samples. Additionally, different formats of samples will be tested – the whole bean, the bean cut in half, and the bean flour. There is a calibration protocol that will be followed, with faba beans from Asturias.

BEFORE ALLIANCE:

- **Is there any element of the tool that was already there before ALLIANCE?** Yes.
- **If yes, which one(s)?**

  The NIR technology was under the belt of ASINCAR more than 10 years ago, and the methods were already developed. The systems and the equipment for the analysis were also in place, and the models for determination of protein or humidity etc of food items as well.

The hardware was also there, but it was not coupled with training, with a “brain”. It could scan spectra but it could not draw any conclusions about the bean origin.

- **Who created that? In case it wasn’t you, do you know under which conditions can you (your organisation) and ALLIANCE (the project) make use of it?**

  There are two different suppliers for the hardware, the software is being developed by ASINCAR.

DURING ALLIANCE:

- **Which elements of the tools are being developed under ALLIANCE funding?**

  The portability and making the software specific to faba beans. Also, the combination of the hardware with a “brain” that can draw conclusions about the origin of the beans.

- **Who has contributed and in what element(s)?**

  ASINCAR will provide inputs to the blockchain, and is the main technology developers regarding faba beans. The regional authorities have provided specification requirements, as well as their interests and desires, and they will be included in the design phase and the end of the validation phase.

- **Do these elements have formal agreement? (i.e., contract, licence - *not* verbal)**

  No.

- **Are these elements interoperable with other ALLIANCE tools and/or tools outside ALLIANCE?**

  Yes, as they will be included in the blockchain

- **Has any of these elements already been published or available to the public (i.e., GitHub, Zenodo, any other repository)? If yes, where and under what terms and conditions?**

  There are workshops being organised about the project at a regional level, but no scientific paper has been published.

- **Do you plan to publish these elements? If so, where?**
- There are expectations of participation to (international) conferences, but the dissemination needs to be done responsibly.
- **Have you discussed training and support internally or with potential users in ALLIANCE?**

In regards to training, ASINCAR has mostly the workshops, where they demonstrate the objectives of the project, the portable hardware, but also some of the benchtop equipment and its applications. For the PGI staff and the regional authorities, there are plans for one or two training sessions before the validation phase.

- **How do you develop your tool? Is it a team? If so, what is the contractual relationship with the members of the team?**

The development is internal and the staff have a regular work contract with ASINCAR. There are two teams developing the application and intellectual property remains within the company. In the case of a patent, there is a list with the main contributors.

- **When you develop it, do you use any kind of common repository? i.e., Github, Gitlab, etc.**

  No repository used.

- **In the tool, is ALLIANCE funding clearly acknowledged?**

  Not relevant at the moment.

AFTER ALLIANCE:

- **What is your wish for the tool after the project? Do you see it being made available on the market? What does that look like for you?**

The idea is that the tool will reach the market, but the type of protection that will be the most apt is still for consideration. Since it's a software, it will probably be patented, as it is the most common protection format. The types of commercialisation scenarios that are being considered include licensing of the technology, or royalties based on sales, or direct purchases by other companies.

- **Will the tool be updated? If so, what costs are associated with both maintaining and updating?**

  Additional studies are needed.

- **Will you reuse parts of the tool in another project?**
  Additional studies are needed.

- **Will you include the tool in a bigger development?**

  Additional studies are needed.

- **Will you allow derivative works of the tool?**
  Additional studies are needed.

- **Do you contemplate having any conditions to the user (i.e., share any new data generated using the tool)? If so, what and why?**

One possible condition would be that the purpose of new data sharing would be under the context of refining the tool. ASINCAR could also potentially explore how exclusivity or non-exclusivity would fit in that context.

- **What would be your role in this process? Would you be providing user support?**

ASINCAR would be willing to provide support, as they are the ones who know the tool, but the business actor will have to provide the daily maintenance. However, the business actor would also be able to subcontract ASINCAR for expert knowledge they would need to repair the tool or to reply to a client.

Full Recording: [ALLIANCE] ASINCAR Guided Interview-20240306_143349-Meeting Recording.mp4

5.2.2. BIOCOS Guided Interview

- **Who are you? (your name and your organization)**

  Stelios Arhondakis, CEO of BIOCOS, company dedicated to increase transparency and traceability in the olive oil industry using DNA data.

- **You are developing a tool within ALLIANCE, right?**

  Yes, our role in Alliance is to optimize the DNA authentication and traceability for the PDO/PGI olive oils which are of remarkable cultural and societal importance.

- **What is the tool name?** DNA testing, no real name at the moment.
- **What is the tool doing / what it will be doing?**

  It is the DNA authentication and traceability tool (for the olive oil industry currently) that is looking at the DNA fingerprint and combines DNA data with other relevant features that are connected to the supply chain to optimize and increase accuracy of the technology.

  The most important are the samples that can be olive oil leaves or the oil. [CV: olive oil leaves AND the oil]

  Technology enables to catch DNA markers that bear information and give reliable information. At present we use two different types of markers - SSR markers (longer variations) and SNPs (shorter variations).

  CV: There are plans to integrate additional technologies like ML, to increase accuracy beyond the capacity of traditional DNA testing.

- **Which is/are the main objective(s) of the tool?**

  The technology is not meant as a mean of verification, but more as a mean of offering more transparency to the consumers. In the supply chain there are several points where information and data flow in and out between different people with different interests. To bridge all these people we need the transparent system of interactions, which is also well known as blockchain or other similar technologies.

  Moreover, another impact that the collection of DNA samples from the fields offers is building a resource of knowledge of what the nature has, which in the future can have a relevant impact in the sustainability of the industry, but also in protection of the biodiversity, and also has a great local importance for societies. So, I think we need to train also the industry to not see the technologies as a mandatory action to be in the market, but as an investment to become better and offer more towards the environment, the society and more transparency to the consumer.

- **Where in the process are you now? (i.e., still collecting data, usability test, etc)**

  At present the technology can discriminate between 40 varieties commercially important and representing Greek, Italian and Spanish products. But of course there are many more at the market.

  We focus on scaling up in terms of improving speed and accuracy, lowering costs and including more varieties.

Specifically during ALLIANCE we focus more on scalability and improvement in olive oil sector. We try to target specific varieties that are of relevant importance in the PDO and PGI sector of the industry. And we try also to connect to existing data from the Greek side.

- **What elements make up the tool? (i.e., software, source code, database, algorithm)**

  Technology consists of the box that runs experiment automatically and gives results into the computer. Results are additionally post processed to give nice and easy to understand visuals to the end user. There is also comparative DB to verify DNA markers.

  The aim is to link it to other aspects in the supply chain with other technologies (like machine learning) that can help post process additional data next to the DNA data and in that way overcome some limitations, increase accuracy and extract relevant information to optimise traceability. We always look to a holistic solution and believe every technology has something to add to create a complete solution. We believe that combining different technologies and different expertise we can deliver systems that ensure transparency of products, ensure origin and offer a differentiation to the industry.

  And all this data of course need support of other technologies like software that can collect data from the stakeholders of the value chain.

- **How will it be used?**

  Testing can be done anywhere, also in the field. Producers to be able to run this on their own and get the results.

  The need for Wi-Fi connection depends on whether you want to store data in cloud or if you decide to have the results inside.

- **Where do you get the inputs from (i.e., users, databases, satellite)**

  Information during sample collection is provided by the producer sending their samples and sometimes we travel to take them on spot. Producers sign a document that they know that we can go and do random checks anytime.

- **Once you have received these inputs, what do you do with the outputs?**

  When we get the profile first we compare it with the existing profiles and we give a reply. Finally, we also include it in our (internal) comparative DB in order to constantly increase our internal resources and also to combine other technologies for the post processing of the inside data to improve the accuracy and identify potential relevant aspects that they can be useful to our technology.

- **Do you or another 3rd of your, "touch" it? (i.e., order, rename, curate, combine with other data)**
- CV: The information is provided by the producer, and it is not collected by BioCoS, due to the unfeasibility of such frequent travel. The agreement allows BioCoS to do random checks. The comparative database contains genetic marker data from the Germplasm DB and data from other germ plants, purchased samples of well-characterized varieties.

- **What happens to the data collected? Who has access to it and how?**

  The data from the comparative database comes from Germplasm DB in Italy and we have a certificate that guarantees that the variety that we use as a control, it is the one that we have. The use of Germplasm data comes with terms and conditions for their use. The

determined condition is that you do you have a normal commercial exchange. We can have a very clear and direct commercial acquisition of material. We just can't purchase the samples and we have only access to the varieties that are most common varieties, because also the German ones have varieties that are protected and they do not share.

CV (From my understanding, this question refers to the data collected as a result of the sampling process): Everything that can be connected back to a name is anonymized and not communicated openly, as it is imposed by GDPR rules. Data from the orchards is included in the BioCoS database in order to increase internal resources and to combine with other tech in order to improve accuracy. That data belongs exclusively to BioCoS, and even in the case of information processing, they still would not be shared (this can be achieved via federated machine learning).

- **Would you share the tool? Where? How? What conditions?**

  Yes, also within the olive oil industry or to licence the actual DNA test to another company.

  Important is to understand that overall technologies help industry become better and are meant to bring value and not to create damage for the others that don't use it.

  If we advance beyond the DNA testing and have a commercial agreement with the owner of the DNA i.e. company that provides the samples, then they will pay us money to do it. If in the future we discover something, we leave the DNA property to them in order to be able to offer them the possibility to take actions that they can return to them a commercial value using different channels rather than producing olive oil. It can be a resistant variety to a pathogen. It can be a new variety. But of course we never know unless we do it. For us has value in terms of technology for them it has value for in terms of what road they want to follow. It can be, I don't know, it can be a breeding strategy of this variety and commercialization. It can be an IP, we cannot know this and this is up to them because also this aspects demand funds demand a lot of financial expenses. So it is not always easy, but it's good we give them the information and the knowledge to take commercial application at one step.

- **Who is the tool targeted to? Which is the audience?**

  Beside analytical laboratories, growers, authorities... I would break the audience into two broader categories – The first one is part of the industry that wants to use it to market transparency, sustainability and biodiversity. The second part is the massive production of olive oil that uses it as internal controls to demonstrate that olive oil is safe for the consumer.

  The intention is not to punish as something is good/bad but on the contrary that such an olive oil is unique and the point is it gets properly labelled.

- **Does it process/do you use personal data (any information that relates to an identified or identifiable living individual; i.e., name and surname, home address, email, IP address, etc) when running the tool? If so, do you consider the General Data Protection Regulation (GDPR)?**
  - **Does it process/do you use sensitive data (e.g., genetic, biometric and health data)**

  We collect some personal data and they are anonymised, kept internally and not communicated openly, compliant with GDPR. Germplasm DB in Italy only has information about the all varieties and there are no personal data.

- **How are you testing correctness, robustness, and reliability? Are you collecting feedback? How would you handle errors reported by users? What is your legal liability?**

  We have Internal control for compliance with ISO 9001. The validation of our markets was performed by the CNR in Italy and at present we are also working next to the LGL within our project.

  We never talk about 'errors' and I think this is a very big mistake. We need to see the technologies as allies of the industry. The X variety doesn't mean that the olive oil is bad. Contrary, it has a unique genetic ID compared to other varieties and it means that it is even better to trace it. So we just talk about DNA profile as DNA testing gives just signals that are identifiers of certain olives.

BEFORE ALLIANCE:

- **Is there any element of the tool that was already there before ALLIANCE?** Yes
- **If yes, which one(s)?** All
- **Who created that? In case it wasn't you, do you know under which conditions can you (your organisation) and ALLIANCE (the project) make use of it?**

  It was exclusively BIOCOS. The technology of DNA testing and attempts to do DNA testing, in particular in the olive oil sector, existed already and was well known. In 2019 BIOCOS developed the bioinformatics pipeline that can process genomic data and extract potential DNA signatures for a species. BIOCOS applied this to the olive genome because we had already a good background. We extracted the DNA signatures, did validation experiments, primers. The database used to compare results is based on a Germplasm DB in Italy. With also won grants and slowly managed to create what we have and now we are constantly scaling to be always more accurate.

- **Do you have any written and signed proof of this agreement? (i.e., contract, licence)**

  We've received grants, EC grant for SME instrument phase one to make a business plan feasibility study, and then another grant on a specific varieties.

DURING ALLIANCE:

- **Which elements of the tools are being developed under ALLIANCE funding?**

  Scalability and improvement to target mostly specific varieties relevant in the PGI/PDO.

  CV: In addition, BioCoS is trying to incorporate existing data from Greek databases.

- **Who has contributed and in what element(s)?**

  We work with association of producers, LGL, and some other partners, but they will not contribute to the DNA technology. No partner in ALLIANCE is making a specific contribution to the DNA technology. LGL is a neutral institution, does not have and must not have any commercial benefits because their role is to control and maintain a neutral observe.

  However, we need experts to explore innovative solutions, because we're not here just to follow the secure path but to try to create innovation and potential commercialisation. We need to understand the industry to understand the commercial value of this innovation.

We were working side by side with the Bavarian Health and Food Authority running experiments in parallel and all the aspects around the DNA technology and cross checking them as an independent party. They will publish together but they will not claim the ownership and in fact they cannot have any commercial benefit.

- **Do these elements have formal agreement? (i.e., contract, licence - *not* verbal)**

  We have NDA already in place with LGL because we share with them our data.

- **Are these elements interoperable with other ALLIANCE tools and/or tools outside ALLIANCE?**
- CV: Perhaps the answer to this can be derived from other things he shared, but I am not 100% confident. E.g. he talks about incorporating data from existing Greek databases. He talks about achieving a transparent system of interactions using blockchain. So, at least in theory, there is interoperability. In practice, we cannot be certain at this point.
- **Has any of these elements already been published or available to the public (i.e., GitHub, Zenodo, any other repository)? If yes, where and under what terms and conditions?**

  Not yet.

- **Do you plan to publish these elements? If so, where?**

  Yes, but we still need to find solutions to publish. Publication is important because it is worth showing something and gain scientific validity.

- **Have you discussed training and support internally or with potential users in ALLIANCE?**
- **How do you develop your tool? Is it a team? If so, what is the contractual relationship with the members of the team?**

  The majority of BIOCOS ownership are my shares and also includes Athanasia, BIOCOS CEO.

  IP rests within the company. Sometimes this is not exclusive strategy because we're not a huge corporation. For follow a very creative environment. We're born from research and out of curiosity, so we try to keep these to the people that are working with us, at least at this stage of our company.

- **When you develop it, do you use any kind of common repository? i.e., Github, Gitlab, etc.**

  Not relevant at the moment.

- **In the tool, is ALLIANCE funding clearly acknowledged?**

  Not relevant at the moment.

- **Other comments**

AFTER ALLIANCE:

- **What is your wish for the tool after the project? Do you see it being made available on the market? What does that look like for you?**

We would like to see it being recognised scientifically (publish) and also being used by the wider olive oil industry, both for transparency, authenticity and potentially for aiding the protection of PDO/PGI products so that they get the value they should for protecting citizens from being sold something that's not what they're paying for, but also the benefit, potentially for better understanding of biodiversity and the protection in the long term of the industry.
Our vision of the future for this technology is definitely not one way and sometimes the market that drives application. Our vision is to see in the future the olive oil producers, the growers, to be able to run this on their own, to be able to apply this on their own and get the results.

Of course, we cannot exclude the intervention of authorities in using the DNA test.

- **Will the tool be updated? If so, what costs are associated with both maintaining and updating?**

  There is continuous development as technology gets faster, more accessible and have potential to expand.

  It is a very good momentum of this technology with constant improvements in wet chemistry aspect, bioinformatics, faster computing and comparison of relatively large data sets, and a lot of data being produced also in the olive sector, Olive Science, let's call it like this. And this shows that technologies are becoming faster, more accessible and have the potential to expand and become also obligative.

  COVID also brought drastic changes in the reputation of the technology and accelerated the idea that non scientific people can do analysis and also helped people not to be afraid of the word DNA and PCR. Another aspect that really helped a lot during COVID is the increased investment in the DNA testing and the portability of the technologies, so in two years we had more than 100 portable devices doing DNA testing.
  CV: Stelios also mentioned earlier that there are plans to use ML in order to increase accuracy. It was not explicitly stated if he will keep purchasing germlines from databases in order to keep it updated.

- **Will you reuse parts of the tool in another project?**

  Possibly.

- **Will you include the tool in a bigger development?**

  Willing to share the technology under licence and that has other potential for opening up other markets.

  CV: Stelios is also willing to explore federated machine learning, where multiple devices or servers collaboratively train a shared model without sharing raw data.

- **Will you allow derivative works of the tool?**

  There is potential as well to move this technology into other sectors that suffer from mislabelling and biodiversity impact. We are already doing this internally in ALLIANCE where there is a discussion about using it also in the honey sector.

- **Do you contemplate having any conditions to the user (i.e., share any new data generated using the tool)? If so, what and why?**
- CV: Stelios explained that the user will do the sampling by themselves, but BioCoS maintains the right to do random checks.
- **What would be your role in this process? Would you be providing user support?** CV: Not explicitly mentioned but since BioCoS has the vision of making this technology a tool to facilitate transparency and not to enforce compliance, it is possible that the same tone will be set for any publications, demonstrations, collaborations, and interactions, shaping directly and indirectly the image of the technology and the way it is perceived.
- **Other comments**

  Alliance is extremely beautiful project because it targets an important sector of European products, the PDO/PGI and the organic, and this is what I truly love. We have excellent partners inside with different expertise, and very targeted aims which is important not get lost in translation. And I think it flows very nicely and we always hope to see also commercial outcomes out of this. We are a company and if there is one commercial outcome, it means that the project is really going good.

Full Recording: ALLIANCE - Guided Interview-20240229_150355-Meeting Recording.mp4

5.2.3. FINS Guided Interview

- **Who are you? (your name and your organization)**

  Nikola, Tatjana, and Jovana, working for Food Institute Novi Sad.

- **You are developing a tool within ALLIANCE, right?**
  Yes.
- **What is the tool name?**

  Digital Knowledge Database, perhaps it changes in the future.

- **What is the tool doing / what it will be doing?**

  The tool will collect data from other databases (e.g. certificates, study results etc), aiming to give an accurate representation of the instances of food fraud and the tools that can be used for its prevention. Right now, the tool is focused on raspberries but at the end of ALLIANCE it will encompass all food items.

- **Which is/are the main objective(s) of the tool?**
- To provide a database about food fraud regarding Arilje raspberries, adaptable to all food items in ALLIANCE.

- **Where in the process are you now? (i.e., still collecting data, usability test, etc)**

  Data collection phase.

- **What elements make up the tool? (i.e., software, source code, database, algorithm)**

  It will be convenient for the tool to be a platform, but currently it is an excel file. The final form will depend greatly on the form of data collected.

- **How will it be used?**

- The data will be available to anyone who wants to access it and use it. However, there will be sections only available to project partners (e.g. of sensitive information).
- **Where do you get the inputs from (i.e., users, databases, satellite)**

  Data will be collected from producer reports (e.g. production size, methods, certifications, etc), and the parameters that differentiate Arilje raspberries from other varieties will be included in the database as well.

- **Once you have received these inputs, what do you do with the outputs?**

  The outputs will be visualized, the specifics are yet to be determined – feedback from the project partners will be valuable in the further development.

- **Do you or another 3rd of your, "touch" it? (i.e., order, rename, curate, combine with other data)**

  No.

- **What happens to the data collected? Who has access to it and how?**

  They will be partly publicly available, through a website/platform.

- **Would you share the tool? Where? How? What conditions?**

  There is no interest in sharing the tool for now, except of course the data that will be made public.

- **Who is the tool targeted to? Which is the audience?**

  The tool is aimed mostly at the producers, but perhaps there are elements that are relevant for the general public, especially Arilje raspberry consumers. Uncertain if/how authorities might use it.

- **Does it process/do you use personal data (any information that relates to an identified or identifiable living individual; i.e., name and surname, home address, email, IP address, etc) when running the tool? If so, do you consider the General Data Protection Regulation (GDPR)?**
    - **Does it process/do you use sensitive data (e.g., genetic, biometric and health data)**

  If there are any, they will be GDPR compliant.

- **How are you testing correctness, robustness, and reliability? Are you collecting feedback? How would you handle errors reported by users? What is your legal liability?**
    - The database is not developed yet.

BEFORE ALLIANCE:

- **Is there any element of the tool that was already there before ALLIANCE?**
  Yes.
- **If yes, which one(s)?**

  Some databases used for input (e.g. the certification databases)

- **Who created that? In case it wasn't you, do you know under which conditions can you (your organisation) and ALLIANCE (the project) make use of it?**

  Governmental institutions are responsible for the certification, so they are the ones who created the database and determined the characteristics that differentiate the particular variety from other varieties.

- **Do you have any written and signed proof of this agreement? (i.e., contract, licence)**

  The raspberry producer association are project partners, and the data regarding the certificate are already publicly available.

DURING ALLIANCE:

- **Which elements of the tools are being developed under ALLIANCE funding?**

  The database itself.

- **Who has contributed and in what element(s)?**

  FINS is developing the excel file, another project partner (undetermined) will take over the IT development. All project partners are expected to give feedback.

- **Do these elements have formal agreement? (i.e., contract, licence - *not* verbal)**

  Project grant agreement.

- **Are these elements interoperable with other ALLIANCE tools and/or tools outside ALLIANCE?**

  Interoperability with other ALLIANCE tool is expected to naturally be a part of the tool development.

- **Has any of these elements already been published or available to the public (i.e., GitHub, Zenodo, any other repository)? If yes, where and under what terms and conditions?**

  No publications currently.

- **Do you plan to publish these elements? If so, where?**

  No plans to publish.

- **Have you discussed training and support internally or with potential users in ALLIANCE?**

  Still under discussion.

- **How do you develop your tool? Is it a team? If so, what is the contractual relationship with the members of the team?**
- FINS is relying heavily on other project partners for the IT development. Contractual relationships have not been discussed yet within ALLIANCE.
- **When you develop it, do you use any kind of common repository? i.e., Github, Gitlab, etc.**

  Not applicable.

- **In the tool, is ALLIANCE funding clearly acknowledged?**

  Not applicable.

AFTER ALLIANCE:

- **What is your wish for the tool after the project? Do you see it being made available on the market? What does that look like for you?**
  - It will depend on how the final version turns out.
- **Will the tool be updated? If so, what costs are associated with both maintaining and updating?**

  Uncertain – FINS recognizes the importance of maintaining the usage of the tool after the end of ALLIANCE.

- **Will you reuse parts of the tool in another project?**
- Not applicable.
- **Will you include the tool in a bigger development?**

  Not applicable.

- **Will you allow derivative works of the tool?**
  Not applicable.
- **Do you contemplate having any conditions to the user (i.e., share any new data generated using the tool)? If so, what and why?**

  Depends on ownership, which is unclear at the moment.

- **What would be your role in this process? Would you be providing user support?**

  It will depend on future agreements.

Full Recording: [ALLIANCE] FINS Guided Interview-20240312_103325-Meeting Recording.mp4

5.2.4. INTRA Guided Interview

- **Who are you? (your name and your organization)**

  Amalia Ntemou, project manager at the R&I department of the IT company Intrasoft.

- **You are developing a tool within ALLIANCE, right?**

  Intrasoft are the technology providers in the ALLIANCE project, responsible for developing the early warning decision support system, the marketplace, and some other predictive analytics models.

- **What is the tool name?**

  Tool #1: Early Warning Decision Support System (EWDSS)

  Tool #2: Marketplace

  Predictive analytics is a module of EWDSS.

- **What is the tool doing / what it will be doing?**

  EWDSS is implementing datasets that the use case pilots Olympos and Masoutis have suggested, in order to provide recommendations and warnings. The Marketplace will be providing a platform where consumers can buy products (data sets, source codes, training, additional information).

- **Which is/are the main objective(s) of the tool?**
- EWDSS is aiming to provide a holistic data-driven approach that will leverage diverse data sets in order to create predictive models that can detect potential food fraud incidents. There will be efforts to develop it in a way that allows it to be applied to more than one food item. The Marketplace is aiming to provide a centralised solution for entities interested to buy services and integrate them into their production line.
- **Where in the process are you now? (i.e., still collecting data, usability test, etc)**

  EWDSS started in March 2023 and is scheduled to end in April 2025. Right now, the focus is on submitting the deliverables.

- **What elements make up the tool? (i.e., software, source code, database, algorithm)**

  EDWSS is a platform. There will be an interface and modules that can be integrated to it. The data collection module will compile information about products, reports for food fraud detection, and statistical and financial data. The AI module and the machine learning modules will work together with the data analytics module to identify suspicious patterns and the incidence of fraud. Another module will be a continuous monitoring loop with monitors focusing on the data collection process, in order to provide some warnings in the future. Number of modules may change, depending on the kind of information the model consumes.

- **How will it be used?**

  The users will be interacting with the interface, which will visualise historical data and feed them in the data collection module. There will be graphical representations of the information that has been collected, trends in the market and financial or health impact.

- **Where do you get the inputs from (i.e., users, databases, satellite)**

  The data will come directly from IoT devices, placed on the field. There will be a blockchain connection to enable information exchange. However, for cases that required further investigation and went through processing, it is important to have input also from the end users. On top of that, values are not fixed, they change over time and are affected by other parameters. Thus, end users can provide feedback. This feedback collection mechanism will not change the normal processes, only support them and make them be aware of what is happening in advance. Additional data makes the system become more robust.

- **Once you have received these inputs, what do you do with the outputs?**

  The outputs help the system deduce the status of the sample, which is presented to the end user. A calculation of the risk will be provided, alongside with colour coding (green, yellow, orange, and red).

- **Do you or another 3rd of your, "touch" it? (i.e., order, rename, curate, combine with other data)**

  For now, nothing like this is happening.

- **What happens to the data collected? Who has access to it and how?**

  Mainly Intrasoft has access, but also project partners at a later stage. The data collected will be used to validate the tool and increase its robustness.

- **Would you share the tool? Where? How? What conditions?**

  INTRA is open to sharing the tool with anyone who wants to use it. Of course, before going to the market, INTRA needs to make sure that the system works properly and that it has undergone all the tests.

- **Who is the tool targeted to? Which is the audience?**

  In general, it is aimed to stakeholders in the agrifood sector. Specifically, INTRA is considering regulators and policy makers. Ministries and entities that deal with food chain regulations might have an interest to this tool. The system is also quite flexible so it can be adapted to a wider range of entities that are not being considered right now.

- **Does it process/do you use personal data (any information that relates to an identified or identifiable living individual; i.e., name and surname, home address, email, IP address, etc) when running the tool? If so, do you consider the General Data Protection Regulation (GDPR)?**
    - **Does it process/do you use sensitive data (e.g., genetic, biometric and health data)**

  It's uncertain which of the collected data will be considered sensitive, but if that is the case, their handling will be GDPR-compliant.

- **How are you testing correctness, robustness, and reliability? Are you collecting feedback? How would you handle errors reported by users? What is your legal liability?**
    - The domain experts are the ones who have the knowledge to evaluate the system, so they are the ones involved in the process. Stakeholders are part of the design process only, in order to make it more relevant to them. INTRA frequently collects feedback through questionnaires. There is no legal liability, as the system will be an additional tool, but it will not replace any existing tools. It will only indicate the cases that need further investigation.

BEFORE ALLIANCE:

- **Is there any element of the tool that was already there before ALLIANCE?**
  Yes.
- **If yes, which one(s)?**

  Some parts of the code were reused from other projects.

- **Who created that? In case it wasn't you, do you know under which conditions can you (your organisation) and ALLIANCE (the project) make use of it?**

  The software developers from INTRA.

- **Do you have any written and signed proof of this agreement? (i.e., contract, licence)**

  Not applicable.

DURING ALLIANCE:

- **Which elements of the tools are being developed under ALLIANCE funding?**

  The elements already exist, so in the context of ALLIANCE, the functionalities will be brought together to complement each other.

- **Who has contributed and in what element(s)?**

  Currently unclear.

- **Do these elements have formal agreement? (i.e., contract, licence - *not* verbal)**

  Not applicable.

- **Are these elements interoperable with other ALLIANCE tools and/or tools outside ALLIANCE?**

  There is an interconnection with the systems of ALLIANCE, as the data is coming from blockchain and marketplace, so interoperability will be part of the equation. In the future, there might be APIs for other technical partners to integrate their solutions.

- **Has any of these elements already been published or available to the public (i.e., GitHub, Zenodo, any other repository)? If yes, where and under what terms and conditions?**

  No publications currently.

- **Do you plan to publish these elements? If so, where?**

  INTRA is planning to publish before the end of the project material that explains the solution (videos, press releases). The upload will be done on the website of the project and the marketplace as well.

- **Have you discussed training and support internally or with potential users in ALLIANCE?**

  There will be material for the users of the solutions. INTRA does not envision courses, but it recognises the responsibility to train the users, as they are the ones who develop the solution.

- **How do you develop your tool? Is it a team? If so, what is the contractual relationship with the members of the team?**

  The development is internal. The employees work within the company, intellectual property will be determined by the exploitation manager.

- **When you develop it, do you use any kind of common repository? i.e., Github, Gitlab, etc.**

  There is a repository for code sharing in Github, so that everyone in INTRASOFT has access to the code.

- **In the tool, is ALLIANCE funding clearly acknowledged?**

  It will be once the tool goes public.

AFTER ALLIANCE:

- **What is your wish for the tool after the project? Do you see it being made available on the market? What does that look like for you?**
    - There are plans for market release and commercialisation, for the solution to become a product by the end of the project.
- **Will the tool be updated? If so, what costs are associated with both maintaining and updating?**
    - In the context of improving it, yes. The costs still need to be worked out.
- **Will you reuse parts of the tool in another project?**
    - Only if the product is enhanced with other features that are relevant.
- **Will you include the tool in a bigger development?**
    - The idea is to develop APIs that will provide this flexibility.
- **Will you allow derivative works of the tool?** In the context of its improvement or increase of its flexibility.
- **Do you contemplate having any conditions to the user (i.e., share any new data generated using the tool)? If so, what and why?**

  There will be restrictions but they have yet to be defined based on which are the partners and the type of entities that would like to interact with the system, but also on its applicability.

- **What would be your role in this process? Would you be providing user support?**
    - Besides the role of support for the new users, INTRA envisions a role of the system owner, the partner and the technology provider who can develop such solutions, the company that can provide similar solutions and adapt the solution to new needs.

Full Recording: [ALLIANCE] INTRA Guided Interview-20240308_101142-Meeting Recording.mp4

5.2.5. UTH Guided Interview

- **Who are you? (your name and your organization)**

Apostolos Apostolaras, Senior Researcher at UTH. Stavroula Maglavera, Project coordinator at UTH.

- **You are developing a tool within ALLIANCE, right?**

Yes

- **What is the tool name?**

Blockchain platform

- **What is the tool doing / what it will be doing?**

Blockchain platform is a system that will be able to host several tools (e.g. tool that makes the statistics analysis and the AI) that can offer solutions in order to identify weak points in the value chain of the food products that we identified as most vulnerable and based on the results to be able to provide insights to the users to make informed decisions.

- **Which is/are the main objective(s) of the tool?**

The main objective is to provide the food actors with a system that can support them so that they could be able to track and monitor every step in their value chain and be able to go backwards in order to identify what are the missing things or the problems and secure the integrity of their value chains.

- **Where in the process are you now? (i.e., still collecting data, usability test, etc)**

We have collected all the information from use cases, identified each step of the value chain and we have intran one indicative value chain, Feta cheese use case as the most complex one, to use as the basis for the system development of the Blockchain platform. Afterwards the same core system will be adopted according to the needs of other use cases in order to be able to offer specialised and custom made solutions and tools to other use cases. We have relied on Feta cheese use case to build the first implementation of the Blockchain platform where we expect to accommodate other tools that other partners develop (Intrasoft, Asincar, Biocos) in order to support other use cases in their value chains.

- **What elements make up the tool? (i.e., software, source code, database, algorithm)**

In order to develop our Blockchain platform we have relied on an open source solution that is called Hyperledger Fabric in order to build upon and specialize each use case. We have also used some other software, for example off-chaindatabase.

Not all the parameters and the information shall be stored on the Blockchain platform because it is something that requires processing effort so it might not be so performance efficient to store all the information there. So we have chosen to store essential information on the Blockchain DB and all the other information on the off-chain database. And there is also an integration part with the standard vocabulary that we have been using for the EPCIS standardization that we try to align with. We also support the endpoint interfacing that will connect and communicate the Blockchain platform with the solutions that other partners develop.

Elements to enter Blockchain were identified in discussion with each user case to know which kind of information is the most critical one to be stored.

- **How will it be used?**

From the technical perspective I believe this will be a valuable platform that will offer valuable tools to the stakeholders, actual actors, to be able to monitor and control their value chains. After the end of the project it will also be offered to the final consumers. We have a consumer demand assessment that will be conducted by the University of Bologna and that will provide us with meaningful information on how the end users perceive that information of the value chain.

Use cases have to provide information per each specific step in each value chain and that information is data secure and data integrity in order to be able to prevent someone from providing wrongful information or committing fraud. There is no repudiation button. And we collect information that has been identified during the previous steps and during all of these years in order to capture all the steps in each value chain and try to record all the process from farm actual production (the fork is another part that is considered in the retailing value chain where we have two retailers, Migros and Masutis where we capture their part accordingly).

It is very difficult to fully integrate Blockchain platform to other systems because they have a very sophisticated commercialised, industrialised solution based on Tetra Pak so there are contracts that cannot be violated to install our system upon that. What we have considered for the purpose of this project is to have a parallel system that follows the Tetra Pak system that

has already been installed on the Olympos factory and try to follow the procedure and provide a feedback to that system. In the Raspberry value chain where they do not have system yet it is possible to build ours from scratch.

For other stakeholders that may like to use the platform after the project end we offer a modular solution that can be easily replicated (module for manufacturers, retailers, consumers…), especially considering that there is a task for interoperability so we could have continuity in the process. We have identified different users within the value chain and those users are for security reasons permitted to access only specific kind of information.

- **Where do you get the inputs from (i.e., users, databases, satellite)**

Food business organisations and retailers insert parameters they collect on each step of the Feta cheese process (farm name, milk volume, geographical location, date, temperature, driver, quality control metrics, biological data, chemical data…). The same step by step processing scheme will be presented for each value chain (in D3.1 due end April 2024).

- **Once you have received these inputs, what do you do with the outputs?**

Critical information is stored on Blockchain DB (developers have identified which information is critical) and verified by other users that participate in the Blockchain in order to ensure data integrity (to be tractable and identified backwards to the source and who was responsible for it) – there is chain of evidence, chain of custody.

- **Do you or another 3rd of your, "touch" it? (i.e., order, rename, curate, combine with other data)**

We homogenize data (do not want to call it manipulate due to negative connotation assigned to this word). We use data model for each use case in order to put the data under the same spectrum or in the range that is measurable. Raw values (meaning outside of specific acceptable / expected value limits / range identified with each owner) are translated to a specific expected range. If a specific value falls very outside of this region that might be explored and investigated further. It might be a fraud or it might be related with the health of animals.

- **What happens to the data collected? Who has access to it and how?**

All the actors that are participating in the value chain can have access to the platform but not to every part of it, only to specific parts according to their role and responsibility in the value chain. There are two types of permissions - reading and writing.

There is always a risk that users provide wrongful information. However, we have non repudiation capability because in order to submit the wrongful information the actor has to press the button with his name and takes the responsibility for the input that he or she provides. The system cannot differentiate between intentional mistakes or just errors but can assist the user to identify whether something might seem wrongful. The system keeps record of all historic values so can be tracked when and who changed them.

- **Would you share the tool? Where? How? What conditions?**

Intention is to provide this platform to every user case. However, we understand that there are some limitation considering the other partners. But the basic functionality of this platform can be applied to all the use cases.

- **Who is the tool targeted to? Which is the audience?**

Food business organisations, retailers, consumers.

- **Does it process/do you use personal data (any information that relates to an identified or identifiable living individual; i.e., name and surname, home address, email, IP address, etc) when running the tool? If so, do you consider the General Data Protection Regulation (GDPR)?**
    - **Does it process/do you use sensitive data (e.g., genetic, biometric and health data)**

Yes (name connected to ID and IP address), but every personal info is pseudo anonymised and not publicized.

- **How are you testing correctness, robustness, and reliability? Are you collecting feedback? How would you handle errors reported by users? What is your legal liability?**

We have consulted specific people with relevant expertise on the farms to advise on the expected values (considering seasonality and type of feed). Accepted range is based on the standard way of operation of specific business. If the values of specific parameters fall outside the accepted range, then this indicates possible risk of fraud and needs to be investigated.

BEFORE ALLIANCE:

- **Is there any element of the tool that was already there before ALLIANCE?**

Yes, expertise that supported front-end user interface.

- **If yes, which one(s)?**

Expertise that supported front-end user interface. Blockchain platform did not exist previously.

- **Who created that? In case it wasn't you, do you know under which conditions can you (your organisation) and ALLIANCE (the project) make use of it?**

UTH research, not inside any other project.

- **Do you have any written and signed proof of this agreement? (i.e., contract, licence)**
- Other comments

DURING ALLIANCE:

- **Which elements of the tools are being developed under ALLIANCE funding?**

User interface is being improved and Blockchain platform is being created from scratch. We also try to connect those two separate subsystems.

- **Who has contributed and in what element(s)?**

Just UTH team.

- **Do these elements have formal agreement? (i.e., contract, licence - *not* verbal)**
- **Are these elements interoperable with other ALLIANCE tools and/or tools outside ALLIANCE?**

Yes, Asincar, Intrasoft and Biocos tools will take data from the Blockchain platform and provide their tools and data back. In that way also contributing to Blockchain robustness.

- **Has any of these elements already been published or available to the public (i.e., GitHub, Zenodo, any other repository)? If yes, where and under what terms and conditions?**
- **Do you plan to publish these elements? If so, where?**

Yes, maybe not fully open but the solution can be downloadable. So users can build upon it and provide their amendments or customization to their needs.

- **Have you discussed training and support internally or with potential users in ALLIANCE?**

Yes, it is essential part and we have plans to develop training material, user manuals/guidelines or videos and provide support also bilaterally if users face a specific problem.

- **How do you develop your tool? Is it a team? If so, what is the contractual relationship with the members of the team?**

Solely UTH team.

IP stays within UTH, it is not shared with its personnel.

- **When you develop it, do you use any kind of common repository? i.e., Github, Gitlab, etc.**
- **In the tool, is ALLIANCE funding clearly acknowledged?**

Yes but lacking statement that EC just provides funding but does not endorse anything (TBC).

- Other comments

AFTER ALLIANCE:

- **What is your wish for the tool after the project? Do you see it being made available on the market? What does that look like for you?**

Expand solution to more stakeholders to use it and continue developing it within further research.

- **Will the tool be updated? If so, what costs are associated with both maintaining and updating?**

Yes, to continue in research environment to be further developed.

- **Will you reuse parts of the tool in another project?**

Yes, if possible.

- **Will you include the tool in a bigger development?**

Yes.

- **Will you allow derivative works of the tool?**

Yes, new users can build upon it and provide their amendments or customization to their needs.

- **Do you contemplate having any conditions to the user (i.e., share any new data generated using the tool)? If so, what and why?**

Commercialization to 3rd party is not foreseen but we are open for discussion to sell under licence.

- **What would be your role in this process? Would you be providing user support?**

Yes, provide support.

Full Recording: [ALLIANCE] UTH Guided Interview-20240311_091043-Meeting Recording.mp4

6.2.6. UNIBO Guided Interview

- **Who are you? (your name and your organization)**

Alessandra Castellini from University of Bologna, a partner of ALLIANCE.

- **You are developing a tool within ALLIANCE, right?**

UNIBO team is focused on social sciences, so their "tool" will be a survey that will be used to deliver a summary at the end of the project.

- **What is the tool name?**

The name is not defined, currently it is being referred to as Vulnerability Risk Assessment Framework.

- **What is the tool doing / what it will be doing?**

It's going to be a survey, measuring social acceptance of the solutions of ALLIANCE and collecting data to perform user acceptance evaluation.

- **Which is/are the main objective(s) of the tool?**

The main objective is the analysis of the factors that make the consumers more interested in traceability systems supported by the tech offerings of ALLIANCE. Additionally, the survey aims to analyse the case studies and assess the risk of vulnerability of each supply chain post-ALLIANCE.

- **Where in the process are you now? (i.e., still collecting data, usability test, etc)**

The questionnaire will be discussed in the consortium in Athens (9-10 April 2024) in order to be finalised. The quotes from the agency responsible for the distribution of the questionnaire have been received, and the survey will be ready for distribution on the 13th of April.

- **What elements make up the tool? (i.e., software, source code, database, algorithm)**

There will be a questionnaire aimed for the consumers, and a questionnaire aimed at the producers. There will be adaptations done for each supply chain, and a distribution agency will be hired to distribute the questionnaires to the different countries of the use cases.

- **How will it be used?**

The distribution agency will translate the questionnaire in the languages of the countries involved in each case study, and then they will distribute it. Afterwards, UNIBO will do the analysis of the data collected.

- **Where do you get the inputs from (i.e., users, databases, satellite)**

For each case study, an aim of 500 consumers has been set. However, for specific cases where one country has two case studies, the possibility to include only 250 consumers per case study is being investigated.

- **Once you have received these inputs, what do you do with the outputs?**

University of Bologna will analyse the answers of the questionnaire in order to provide insights regarding consumer behaviour, especially the factors that make them more interested in traceability systems supported by the ALLIANCE offerings.

- **Do you or another 3rd of your, "touch" it? (i.e., order, rename, curate, combine with other data)**

Not applicable.

- **What happens to the data collected? Who has access to it and how?**

The distribution agency only has access to the contacts of the respondents, and university of Bologna only has access to the responses.

- **Would you share the tool? Where? How? What conditions?**

Not applicable.

- **Who is the tool targeted to? Which is the audience?**

Consumers of each supply chain involved in the ALLIANCE use cases are meant to respond to the questionnaire, but its output is meant to produce insights useful to the ALLIANCE use cases.

- **Does it process/do you use personal data (any information that relates to an identified or identifiable living individual; i.e., name and surname, home address, email, IP address, etc) when running the tool? If so, do you consider the General Data Protection Regulation (GDPR)?**

Sex, age, city, and income will be shared by email or in person, depending on the distribution service.

- **Does it process/do you use sensitive data (e.g., genetic, biometric and health data)**

UNIBO will not have access to the contact of the people, only the distribution service will.

- **How are you testing correctness, robustness, and reliability? Are you collecting feedback? How would you handle errors reported by users? What is your legal liability?**

Not applicable.

BEFORE ALLIANCE:

- **Is there any element of the tool that was already there before ALLIANCE?**

Not applicable.

- **If yes, which one(s)?**

Not applicable.

- **Who created that? In case it wasn't you, do you know under which conditions can you (your organisation) and ALLIANCE (the project) make use of it?**

Not applicable.

- **Do you have any written and signed proof of this agreement? (i.e., contract, licence)**

Not applicable.

- **Other comments**

DURING ALLIANCE:

- **Which elements of the tools are being developed under ALLIANCE funding?**

The questionnaire.

- **Who has contributed and in what element(s)?**

University of Bologna has created the questionnaire and a distribution service will translate it and distribute it.

- **Do these elements have formal agreement? (i.e., contract, licence - *not* verbal)**

An external contractor will be hired to perform the survey but University of Bologna will have full ownership of results.

- **Are these elements interoperable with other ALLIANCE tools and/or tools outside ALLIANCE?**

Not applicable.

- **Has any of these elements already been published or available to the public (i.e., GitHub, Zenodo, any other repository)?** If yes, where and under what terms and conditions?

Not applicable.

- **Do you plan to publish these elements? If so, where?**

Publishing is the main goal, but the outlet has yet to be determined. University of Bologna will orientate around other similar projects' publications.

- **Have you discussed training and support internally or with potential users in ALLIANCE?**

Not applicable.

- **How do you develop your tool? Is it a team? If so, what is the contractual relationship with the members of the team?**

The researchers at the university of Bologna have prepared the questionnaire through literature research.

- **When you develop it, do you use any kind of common repository? i.e., Github, Gitlab, etc.**

Not applicable.

- **In the tool, is ALLIANCE funding clearly acknowledged?**

Not applicable.

- **Other comments**

AFTER ALLIANCE:

- **What is your wish for the tool after the project? Do you see it being made available on the market? What does that look like for you?**

UNIBO wishes to carry on some more research using the lessons learned from the ALLIANCE project, especially by coupling it with BSc or MSc theses.

- **Will the tool be updated? If so, what costs are associated with both maintaining and updating?**

Not applicable at the moment.

- **Will you reuse parts of the tool in another project?**

UNIBO would be interested in taking part in other projects about food authenticity (e.g. PGI, PDO, organic), especially around consumer preferences.

- **Will you include the tool in a bigger development?**

Not applicable at the moment.

- **Will you allow derivative works of the tool?**

Not applicable at the moment.

- **Do you contemplate having any conditions to the user (i.e., share any new data generated using the tool)? If so, what and why?**

Not applicable.

- **What would be your role in this process? Would you be providing user support?**

Not applicable.

- **Other comments**

Full recording: [ALLIANCE] UNIBO Guided Interview-20240329_100416-Meeting Recording.mp4