



Extreme Food Risk Analytics

D5.4.1: EFRA Software Demonstrators for Decision Support

Lead Author: Giannis Stoitsis (Agroknow) and
Diimitris Effrosynidis (Agroknow)



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Lead Author (s)	Giannis Stoitsis (Agroknow), and Diimitris Effrosynidis (Agroknow)		
Contributors	Zacharoula Theodorakopoulou (Agroknow), Babis Thanopoulos (Agroknow), Manos Karvounis (Agroknow), Morgane Romeu (Agrivi), Tanja Folnovic (Agrivi), Yvonne Pfeifer (SGS), Anna Romanova (SGS), Mariano Orozco García (SGS), Nicola Colombo (SGS)		
Internal reviewer(s)	Franco Maria Nardini (CNR), Salvatore Trani (CNR), Raffaele Perego (CNR)		

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#	Participant Organisation Name	Short name	Country
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2	CONSIGLIO NAZIONALE DELLE RICERCHE	CNR	IT
3	STOCKHOLMS UNIVERSITET	SU	SE
4	STICHTING WAGENINGEN RESEARCH	WR	NL
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1 Executive Summary

The deliverable D5.4 presents the results of the developed software demonstrators for decision support tools (DSTs) to address challenges in the food and agriculture sector. The DSTs were developed based on the requirements of the food industry and end-users, and they were evaluated through pilot studies with real data.

A significant part of the project involved implementing and executing software demonstrators that enhance user decision-making processes within the three EFRA use cases. This included the development of AI explainable dashboards designed to deliver AI results to end-users in a comprehensible manner. Hybrid AI explainability methods were tested to provide insights into the decision-making processes of experts.

The deliverable D5.4 describes a suite of decision support demonstrators addressing critical areas in poultry management, pest management, and food regulations. These demonstrators leverage AI models to assist stakeholders in identifying risks, making informed decisions, and improving overall operational efficiency. Each demonstrator is meticulously crafted to address the unique needs of decision-makers, providing detailed mockups and development stages, showcasing their capabilities and interactive features to support data-informed decisions.

2 Introduction

This section briefly outlines the **objectives** of the at-hand EFRA Deliverable (outlined in **Table 1**) and how the rest of the document is structured to achieve them.

Table 1: Adherence to EFRA GA Deliverable & Tasks Descriptions

EFRA GA Component Title	EFRA GA Component Outline
Task 5.4 Empowering Decision Support with EFRA Services, Executing Trials, and Collecting Feedback	<p>The Task T5.4 will implement and execute software demonstrators that will use existing or new decision support tools to enhance the decision making of representative users in the three EFRA three use-cases. Crucially, it will develop a set of AI explainable dashboards to deliver the AI results to the end-users. Hybrid AI explainability methods that combine an explainable and a powerful but non-explainable AI model will be tested from an HCI perspective to gain insights on what the experts miss when explainability is not offered. Additionally, during EFRA's lifespan, two cycles are going to take place for each one of the use-cases. This task will coordinate their execution and support user partners in trials, by leveraging WP6 activities to invite relevant stakeholders of the food value chain and data economy to attend the demos and test novel solutions in real world challenges.</p>

The first version of deliverable D5.4 (D5.4.1) details the development and evaluation of software demonstrators for decision support tools (DSTs) to address challenges within the food and agriculture sector. The demonstrators were developed based on industry and end-user requirements and rigorously tested through pilot studies with real data.

The section on **Relevant Requirements** consolidates directives from previous deliverables (D1.1 and D1.2) and feedback from real-world users, emphasizing user-centric design and functionality (D5.3). The key requirements that guided the development of the software demonstrators are outlined.

The following sections (**Results on the Development of the Decision-Support Tools**) present the development process of the decision-support tools for the three use cases. Each section provides a detailed analysis of the tools' features, functionalities, and their impact on decision-making in the respective domains.

The section on Use Case 1 demonstrators (**Decision Support Tool(s) on UC#1 Risks Prediction for Poultry Pathogens**) focuses on designing software for poultry management and mycotoxins in animal feed. The poultry demonstrators highlight predicting risks related to poultry pathogens, including dashboards for early outlier detection, risk stratification, and incident forecasting. The demonstrators for mycotoxins in animal feed explore their role in monitoring concentration levels and forecasting incidents to improve animal production efficiency.

Use Case 2 demonstrators (**Decision-Support Tool on UC#2 Food Safety Optimal Pesticides Use**) aim to enhance predictive capabilities for pest management. This section highlights tools like interactive decision trees and feedback mechanisms to optimize pesticide use.

The section on Use Case 3 (**Decision-Support Tool on UC#3 Informing Regulatory, Decisions with Food Risk Intelligence**) focuses on informing regulatory decisions with food risk intelligence. It includes automated regulatory analysis and summarisation, providing comprehensive insights into compliance and food safety regulations.

The **conclusion** summarises the key achievements of the deliverable and outlines future steps for further development and implementation of the software demonstrators. It reflects on feedback received during the pilot phase and discusses potential improvements and expansions.

3 Introduction to EFRA Software Demonstrators

The foreseen software demonstrators will leverage existing and newly developed decision support tools to improve decision-making processes for representative users across three specific EFRA use cases. A key aspect of this project is the development of AI explainable dashboards designed to convey AI-generated results to end-users effectively. The decision-support tools encompass a range of demonstrators tailored to each EFRA use case:

I. Decision-Support Tools for Use Case #1: Risks Prediction for Poultry Pathogens

I-1. Poultry Management Demonstrators

- **Interactive Dashboard for Early Outlier Detection:** This dashboard offers historical and predictive visualizations of flock mortality and weight gain, allowing farm managers to input specific flock characteristics and receive probability predictions for potential outlier behaviour by the end of the life cycle.
- **Flock Risk Stratification Dashboard:** This dashboard categorizes flocks into risk levels based on health and performance data, highlighting high-risk groups and enabling focused attention where it is most needed.
- **Incident Forecasting Dashboard:** This dashboard provides a time-series visualization of food safety incidents related to poultry, presenting historical data and forecasted incident counts. Users can hover over data points to view detailed values and examine projected trends to anticipate future risks in poultry production. A supplementary dashboard offers granular details on each incident represented in the time series, allowing decision-makers to analyse the root causes, patterns, and factors contributing to these incidents.

I-2. Mycotoxins Management Demonstrators

- **Mycotoxin Concentration Dashboard:** This dashboard enables users to monitor and analyse monthly concentration levels of key mycotoxins (e.g., aflatoxin, ochratoxin, zearalenone, and DON) based on lab testing results. Users can select specific mycotoxins to view detailed time-series visualizations.
- **Incident Forecasting Dashboard:** Designed to provide predictive insights, this dashboard displays a time series of mycotoxin-related food safety incidents, highlighting historical incident counts and forecasted values.

II. Demonstrators for Use Case #2: Food Safety Optimal Pesticides Use

- **Interactive Decision Tree and Prediction Dashboard:** Built to explore pest management scenarios, this dashboard allows users to visualize decision trees based on historical data for specific pest types and regions.
- **Interactive Feedback Dashboard:** This tool enables farmers to input real-time field observations on pest activity and crop conditions, feeding this data back into the predictive models.

III. Demonstrators for Use Case #3: Informing Regulatory Decisions with Food Risk Intelligence

- **Regulatory Document Summarization Dashboard:** Developed for compliance officers and legal teams, this dashboard allows users to upload or select regulatory documents and generate customizable summaries.
- **Regulatory Citation and Compliance Chatbot:** Designed to facilitate quick access to regulatory requirements, this chatbot offers a natural language search feature that provides contextually relevant citations and explanations of compliance obligations.

Each demonstrator is meticulously crafted to meet specific functional requirements, addressing the unique needs of decision-makers in agriculture and food safety. This document provides detailed mockups and

development stages of each tool, showcasing their capabilities and interactive features that support users in making data-informed decisions.

4 Relevant Requirements

The requirements that guided the development of the software demonstrators reported in this deliverable include requirements from the deliverables D1.1 (EFRA Requirements Roadmap) and D1.2 (Ongoing Recommendations for EFRA Work) and direct feedback from real-world users during the first piloting cycle (reported in the second iteration of the deliverable D5.3 - D5.3.2: Use-case Plan, Reports & Recommendations).

The requirements from the deliverable D5.3.2 include the following findings:

- **Predictive and Risk Insights:** Provide historical and forecasted visualizations for key metrics like flock health, mycotoxin levels, and food safety incidents. Enable risk stratification to prioritize high-risk areas or flocks for targeted action.
- **Interactive Analysis:** Allow input of specific parameters (e.g., flock traits, environmental factors) to refine predictions and classify risks. Include drill-down features to explore clusters or patterns and gain deeper insights into anomalies or trends.
- **Real-Time Integration:** Support dynamic updates with real-time data (e.g., field observations and environmental monitoring) to enhance model relevance.
- **User-Focused Features:** Offer customizable dashboards tailored to user needs for operational or compliance-focused decision-making.
- **Scalability and Data Integration:** Support localized and global applications with robust integration of diverse datasets, from environmental to operational data.

The relevant requirements from the deliverable D1.2 that guided the development of the predictive AI models described here are the following:

ID	Functional.Platform.Poultry.1
Type	Functional Requirement
Title	Poultry Management: <i>Interactive Dashboard for Early Outlier Detection in Mortality and Weight Anomalies</i>
Description	The dashboard must provide both historical and predictive visualisations of flock mortality and weight gain data, allowing users to input flock characteristics and receive probability predictions for potential outlier behaviour by the end of the life cycle (at 4 weeks). Additionally, it must enable interactive exploration of historical outlier flocks to uncover patterns and risk factors. The goal is to allow farm managers to intervene early, ensuring flock health and production efficiency.

ID	Functional.Platform.Poultry.2
Type	Functional Requirement
Title	Poultry Management: <i>Flock Risk Stratification Dashboard</i>
Description	This dashboard must categorise flocks into risk levels (high, medium, low) based on health and performance data, allowing farm managers to focus on flocks requiring

	the most attention. It should visualise how mortality and weight gain rates evolve over time across different flock groups, highlight high-risk flocks, and allow users to drill down into underlying flock characteristics.
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ID	Functional.Platform.Pests.1
Type	Functional Requirement
Title	Pest Management: <i>Interactive Decision Tree and Prediction Dashboard</i>
Description	This dashboard must allow users to explore decision trees related to specific pest types and regions, based on historical data and AI models. It should enable users to select pest types or regions and visualise the decision tree that represents the conditions under which these pests are likely to appear. Additionally, users should be able to input relevant environmental parameters (e.g., temperature, humidity, crop type) to receive predictions from the AI model on whether these conditions are conducive to the appearance of specific pests.

ID	Functional.Platform.Pests.2
Type	Functional Requirement
Title	Pest Management: <i>Interactive Feedback Dashboard</i>
Description	This dashboard should allow farmers to input real-time field observations about pest activity and crop conditions, feeding this data back into the predictive models to refine future pest outbreak predictions.

ID	Functional.Platform.Regulations.1
Type	Functional Requirement
Title	Food Regulations: <i>Regulatory Document Summarization Dashboard</i>
Description	This dashboard must allow users to upload their own regulatory documents or select from a list of pre-existing regulatory documents and generate customizable summaries based on the desired level of detail. The system should offer flexibility in summarization length, enabling compliance officers and legal teams to quickly grasp key points or dive deeper into specific sections as needed.

ID	Functional.Platform.Regulations.2
Type	Functional Requirement
Title	Food Regulations: <i>Regulatory Citation and Compliance Chatbot</i>
Description	This chatbot must allow users to quickly search for specific regulatory requirements and receive citations related to compliance issues. It should integrate a natural language search feature and provide contextual explanations of regulatory obligations based on user queries.

5 Results of the Development of the Decision-Support Tools

5.1 Decision Support Tool(s) on UC#1 Risks Prediction for Poultry Pathogens

5.1.1 Demonstrators for Enhancing Safety and Efficiency in Poultry Farming

Demonstrator using Public Food Safety Incident Data

This section presents the software demonstrator for monitoring poultry-related food safety incidents globally. This tool enables decision-makers to explore a monthly time series displaying the number of incidents (Figure 1), with hover functionality for viewing exact values at each point and projected values shown as a forecasted time series. Separate panels provide predictions per geographical origin (Figure 2) and a risk heat map (Figure 3) that illustrates the most likely hazard affecting poultry products in the next 12 months.

The demonstrator connects with the EFRA Platform Timeseries Engine to use its capabilities to forecast future time series values and with the EFRA Scraping Platform to get the number of food safety incidents per month concerning poultry products. This demonstrator is made available through the FOODAKAI³ software.

Demonstrator key functionalities:

- **Monthly Timeseries Display**: Shows the number of poultry-related food safety incidents monthly.
- **Hover Functionality**: Allows users to view exact values on the time series graph at each point.
- **Forecasted Timeseries**: Displays projected values to anticipate future poultry-related food safety incidents trends.
- **Geographical Predictions**: Provides predictions per geographical origin to identify regional risks and trends.
- **Risk Heat Map**: Illustrates the most likely hazards affecting poultry products in the next 12 months.
- **EFRA Platform Integration**: Connects with the EFRA Platform Timeseries Engine to forecast future time series values and with the EFRA Scraping Platform to obtain the number of incidents per month.

These functionalities enable decision-makers to monitor, predict, and respond effectively to poultry-related food safety incidents.

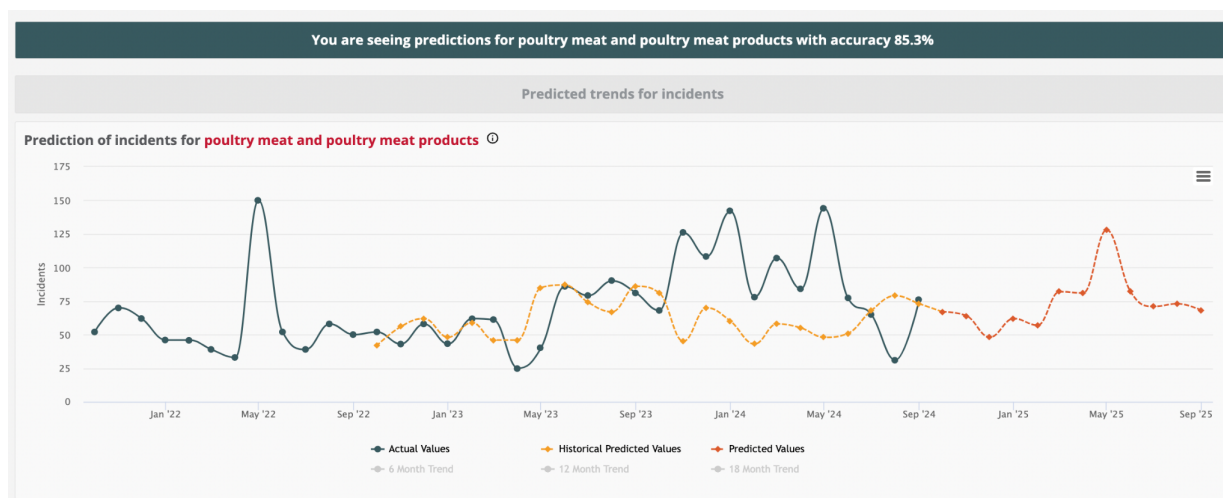


Figure 1: Monthly Timeseries of Poultry-Related Food Safety Incidents

³ <https://app.foodakai.com/>

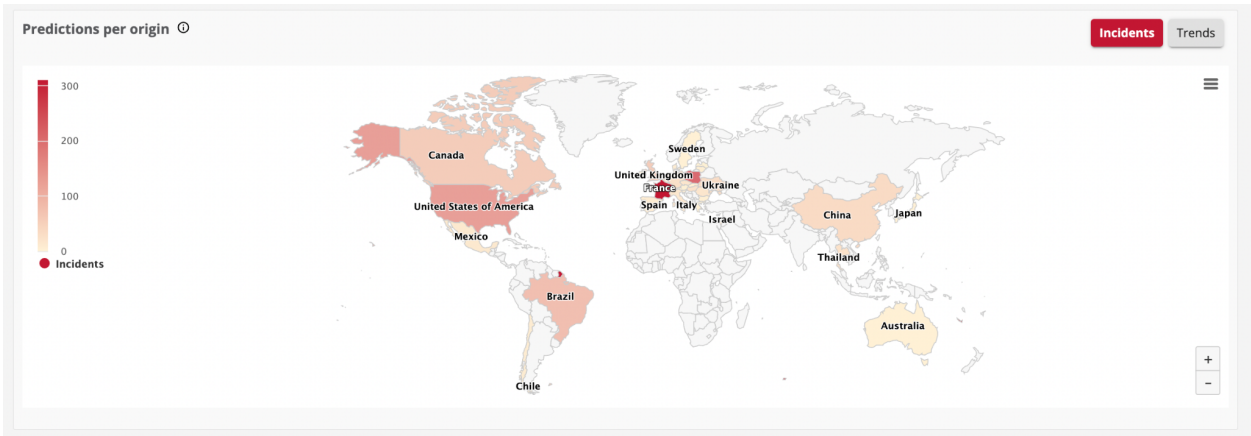


Figure 2: Geographical Origin Prediction Panel for Poultry Incidents



Figure 3: 12-Month Risk Heat Map for Poultry Product Hazards

Demonstrator using Private Poultry Production Data

In this section, we present high-fidelity mockups for the corresponding AI model reported in D3.1, designed to demonstrate essential functionalities for analysing poultry mortality and weight gain data patterns. The demonstrator enables users to visualize clusters based on mortality (Figure 4) and weight gain rates (Figure 5), where each cluster is represented by its most typical time series pattern. Users can hover over each time series

to view the number of flocks represented, providing an intuitive way to understand group distributions. Additionally, users can click on any time series to download detailed characteristics of the flocks within each cluster, allowing for deeper, targeted examination of specific data subsets. The user can also input the early mortality or weight of a given flock, and the dashboard will match it with the most appropriate cluster, thus indicating if it should be considered a high-risk outlier.

The demonstrator connects with the EFRA Platform Timeseries Engine to utilize its capabilities to forecast future time series values and with the EFRA Scraping Platform to retrieve the number of food safety incidents per month concerning poultry products. This demonstrator is made available through the FOODAKAI software.

Key demonstrator functionalities:

- **Mortality and Weight Gain Clustering:** The tool visualizes clusters based on poultry mortality and weight gain rates, where each cluster is represented by its most typical time series pattern. This allows users to identify trends and patterns in the data easily.
- **Interactive Time series Visualisation:** Users can hover over each time series to view the number of flocks represented, providing an intuitive way to understand group distributions. Clicking on any time series allows users to download detailed characteristics of the flocks within each cluster.
- **Risk Assessment:** Users can input the early mortality or weight of a given flock, and the dashboard will match it with the most appropriate cluster, showing if it should be considered a high-risk outlier. This functionality helps in early detection and intervention to mitigate potential risks.



Figure 4: Mortality Rate Clusters for Poultry Flocks

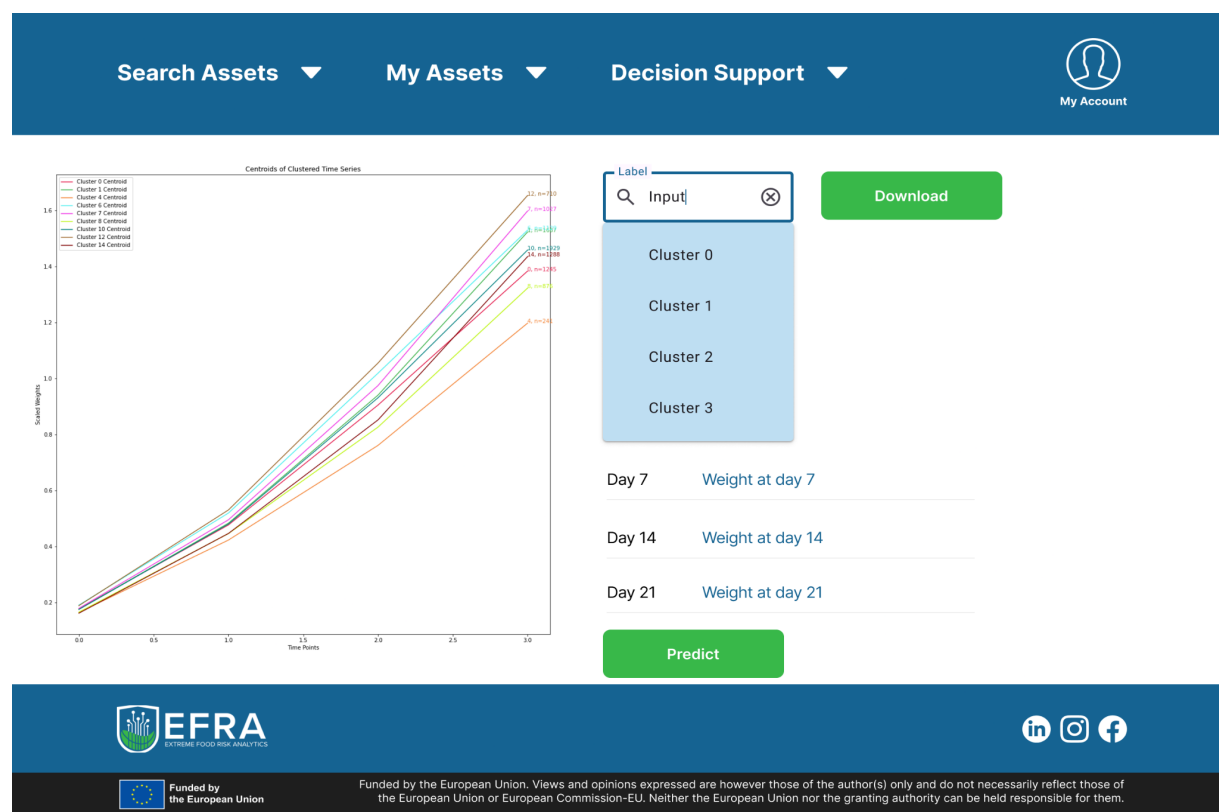


Figure 5: Weight Gain Rate Clusters for Poultry Flocks

5.1.2 Demonstrators for Mycotoxins in animal feed and effects on animal production

Demonstrator using Public Food Safety Incident Data

This section presents the software demonstrator for tracking global food safety incidents related to mycotoxins. This tool allows decision-makers to analyse a monthly time series of reported incidents (Figure 6), with the option to hover over each point for precise values and view forecasted trends for future incident counts. Separate panels provide predictions per geographical origin (Figure 7) and a risk heat map (Figure 8) that illustrates the most likely products affected by mycotoxins in the next 12 months.

The demonstrator connects with the EFRA Platform Timeseries Engine to use its capabilities to forecast future time series values and with the EFRA Scraping Platform to get the number of food safety incidents per month concerning mycotoxins. This demonstrator is made available through the FOODAKAI software. Providing accurate and timely information helps decision-makers take proactive measures to protect animal health and ensure the sustainability of the livestock industry.

Key demonstrator functionalities:

- Interactive Time Series Analysis: Users can view a monthly time series of reported mycotoxin incidents. Each data point represents the number of incidents for a specific month. Users can see precise incident values by hovering over individual data points, providing detailed insights into specific time periods.
- Forecasting Trends: The tool includes forecasting capabilities that predict future incident counts based on historical data. Users can view forecasted trends to anticipate potential mycotoxin issues. Forecasted values are visually represented, allowing users to interpret and act upon the predictions easily.

- **Geographical Analysis:** Separate panels display predictions of mycotoxin incidents based on geographical origin. This helps users identify regions with higher risks of contamination. Users can analyse incident data per region, facilitating targeted decision-making and resource allocation.
- **Risk Heat Map:** The demonstrator features a risk heat map that illustrates the most likely products affected by mycotoxins in the next 12 months. This helps users prioritize monitoring and mitigation efforts. The heat map provides a clear and intuitive visualization of risk levels across different products, aiding in quick assessment and response planning.
- **Data Integration:** The demonstrator connects with the EFRA Platform Timeseries Engine to accurately forecast future time series values. It also integrates with the EFRA Scraping Platform to gather up-to-date data on food safety incidents involving mycotoxins, ensuring the reliability of the information provided.

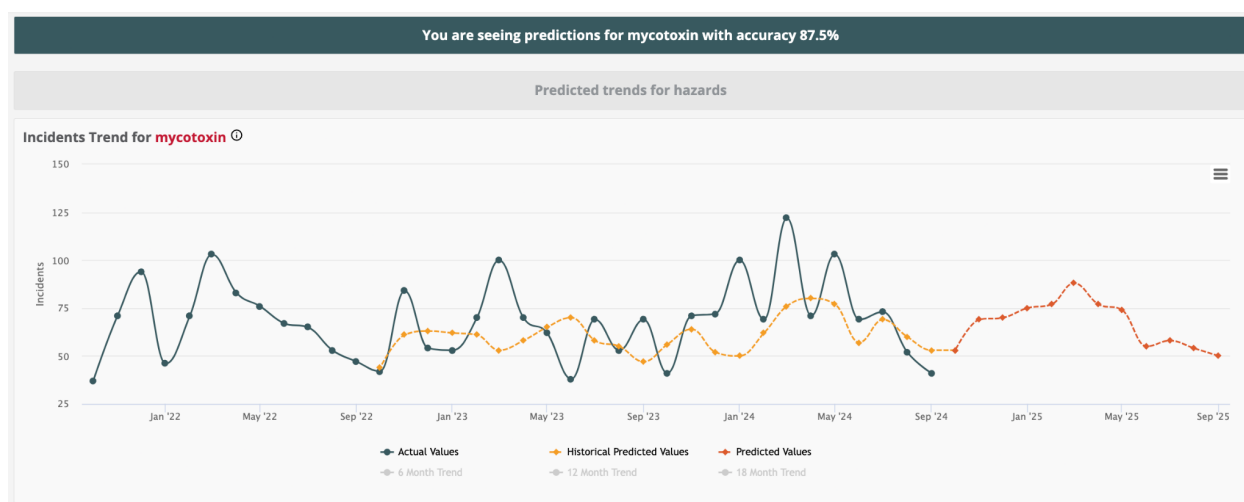


Figure 6: Monthly Timeseries of Global Mycotoxin-Related Food Safety Incidents

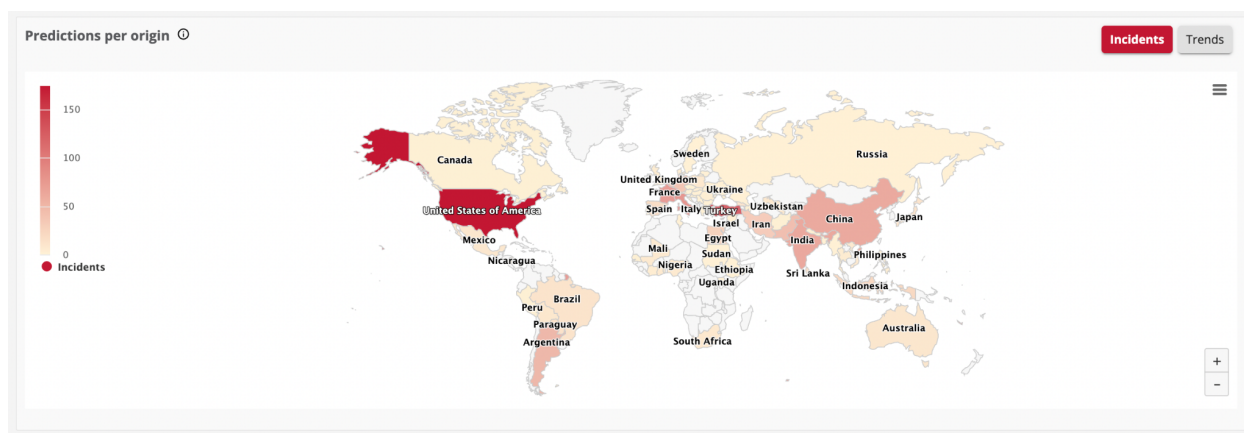


Figure 7: Geographical Origin Prediction Panel for Mycotoxin Incidents

Products to be affected from mycotoxin ⓘ

PRODUCTS LIKELY TO BE AFFECTED





















Product ⚙	Past 12 Months ⚙	Next 12 Months ⚙	Trend ⓘ ⚙
Melon Seeds 	1	11	1000% 
Apple Juice 	3	21	600% 
Groundnuts In Shell 	1	6	500% 
Shelled Almonds 	2	11	450% 
Ground Nutmeg 	2	9	400% 
Hazelnuts 	8	33	312% 
Chilli Powder 	2	8	300% 
Golden Raisins/Sultanas 	1	2	300% 
Dried Dates 	2	1	200% 
Roasted Pistachios 	3	8	166% 

Figure 8; 12-Month Risk Heat Map for Mycotoxin-Affected Products

Demonstrator using Private Mycotoxin Testing Data

This section presents high-fidelity mockups for the corresponding AI model reported in D3.1, focusing on analysing lab testing results for mycotoxin concentrations over time. The demonstrator allows users to interact with a time series displaying monthly concentration data for four selected mycotoxins: aflatoxin, ochratoxin, zearalenone, and DON (Figure 9). Users can hover over any data point within the time series to view its specific value, enhancing data transparency and accessibility. Additionally, by clicking on Analyse, the dashboard decomposes the main time series into three separate interactive components—trend, seasonality, and residuals (Figure 10).

The demonstrator connects with the *EFRA Platform Timeseries Engine* to use its capabilities to decompose time series into trend, seasonality, and residual. This demonstrator is made available through the FOODAKAI software.

Key demonstrator functionalities:

- **Interactive Timeseries Visualization:** Users can explore monthly concentration data for aflatoxin, ochratoxin, zearalenone, and DON. Hover functionality allows users to view precise data values at each point in the time series.

- Advanced Data Decomposition: The "Analyse" button activates the decomposition feature, breaking down the time series into trend, seasonality, and residual components. Users can interact with these components to better understand long-term trends, periodic patterns, and random variations in mycotoxin concentrations.
- Integration with EFRA Platform Timeseries Engine: The demonstrator connects with the EFRA Platform Timeseries Engine, leveraging its capabilities to decompose time series into trends, seasonality, and residuals. This integration ensures accurate and reliable decomposition results, supporting more informed decision-making.
- Accessibility and Transparency: The demonstrator enhances data transparency by making detailed mycotoxin testing results easily accessible and interpretable.

Users can confidently explore and analyse the data, supported by intuitive visualizations and interactive features.

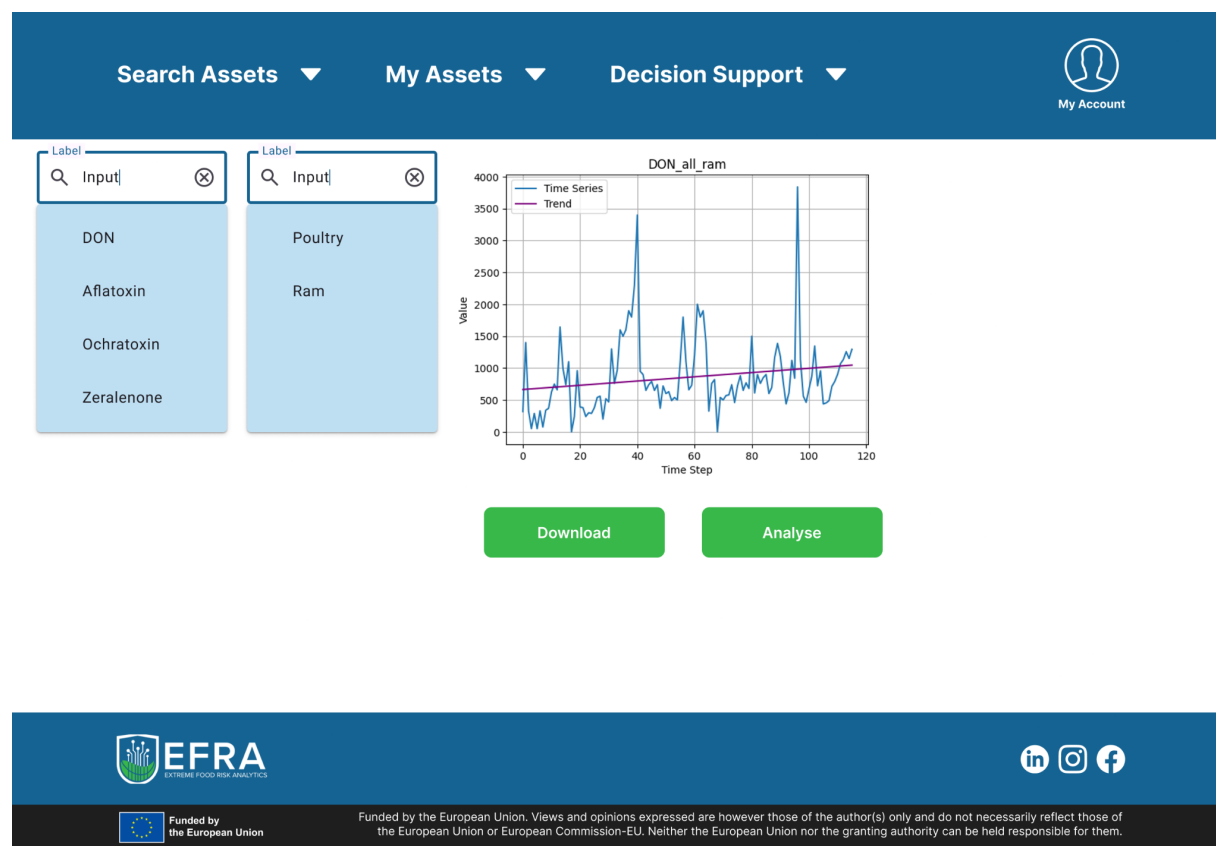


Figure 9: Monthly Timeseries of Mycotoxin Concentrations for Selected Mycotoxins

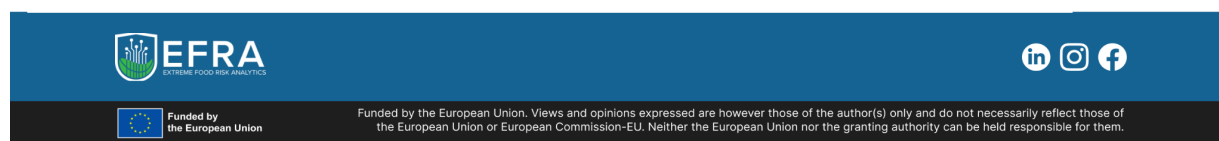
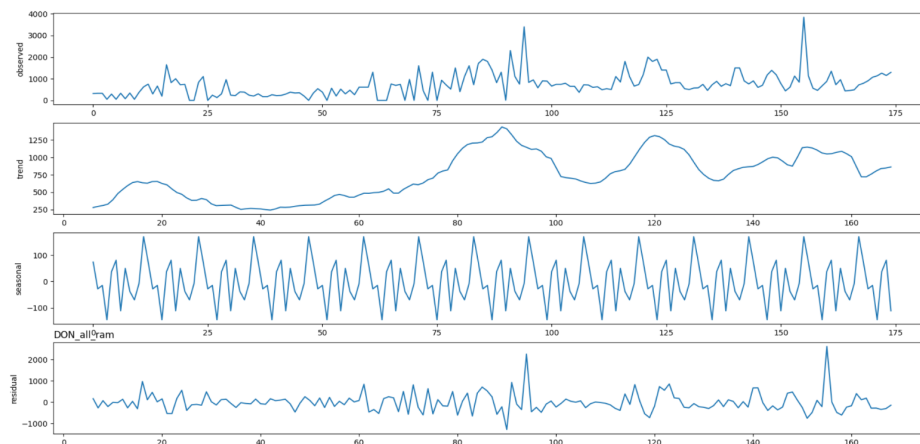
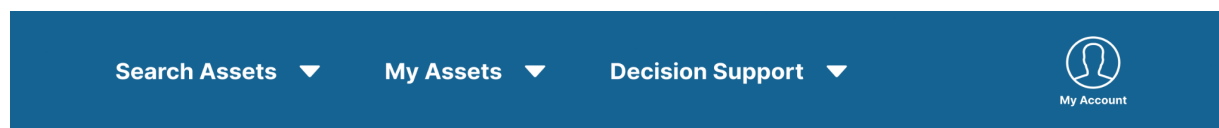


Figure 10: Decomposition of Mycotoxin Concentration Time series into Trend, Seasonality & Residuals

5.2 Decision-Support Tool on UC#2 Food Safety Optimal Pesticides Use

5.2.1 Demonstrator for Enhanced Predictive Capabilities for Pest Alarms with AGRIVI data

At the end of the first piloting phase, AGRIVI and WFSR partners introduced significant enhancements to the pest detection module, focusing on usability, workflow optimization, and better visualization for farmers and field operators.

Enhanced Scouting Features and Map Display

- Improved Field Operation View:
 - A compact menu now consolidates key actions within a single UI component, creating more space for map display and reducing visual clutter.
 - Filtering options enable users to refine data views easily.
 - Pest infestations can be pinned to specific field locations, providing actionable insights directly on the map.
- Module-Specific Interactions: Map functionalities are now segmented by individual modules (e.g., Tasks, Spray Advisor, Scouting), simplifying interactions and improving usability.

Streamlined Workflows

- More precise Navigation: Users can seamlessly move between scouting steps and reporting with workflows designed to minimize friction.

- **Integrated Data Analysis:** Enhanced data analytics capabilities allow for more accurate predictions and better decision-making. Farmers can access historical data trends and receive real-time updates on pest activities.

Improved User Experience

- **Decluttered UI:** The interface now emphasizes essential elements, making it more accessible and visually streamlined.
- **Standardized Patterns Across Modules:** Consistent workflows (e.g., Primary Menu → Filters → Bottom Tabs) improve predictability and ease of use.
- **Better Accessibility:** Farmers can quickly distinguish between key actions and focus on field-specific tasks with less distraction.
- **Enhanced Mobile Compatibility:** The platform is optimized for mobile devices, ensuring that farmers can access the tool on-the-go, whether in the field or at home.

Additional Features

- **Customizable Alerts:** Users can set customized alerts for specific pest activities or thresholds, ensuring timely interventions and minimizing crop damage.
- **Training and Support Resources:** Comprehensive training materials and support resources are provided to help farmers make the most of the new features and enhancements.
- **User Feedback Loop:** Regular feedback from farmers is collected and incorporated into future updates, ensuring that the tool continues to evolve based on real-world needs and experiences.

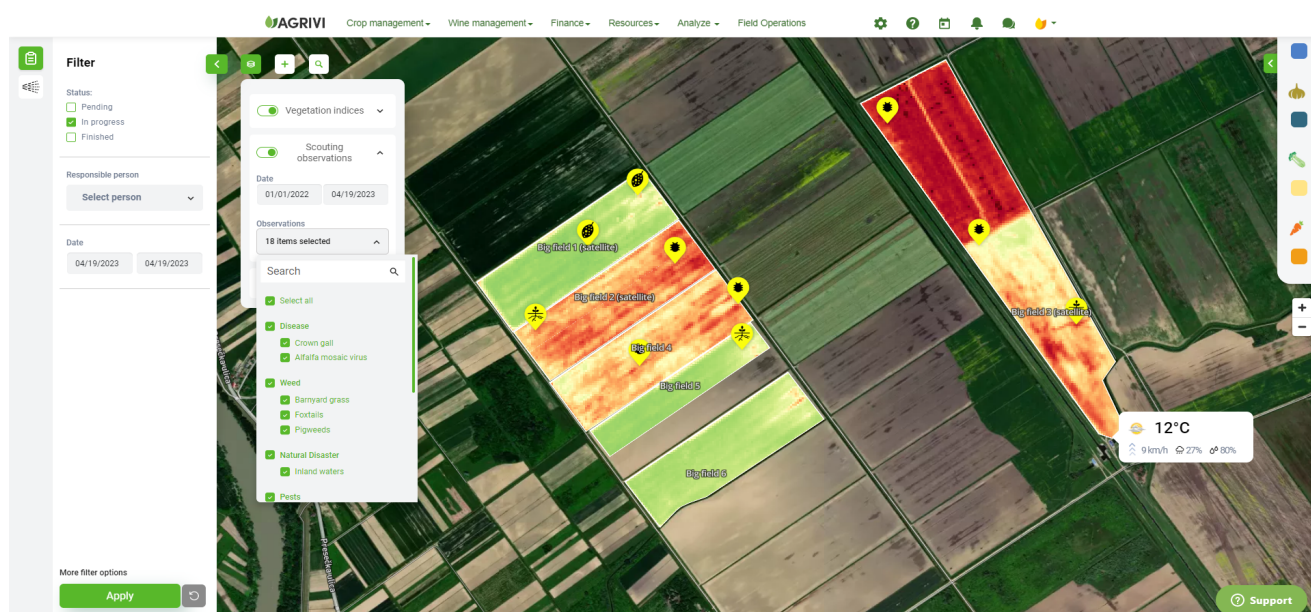


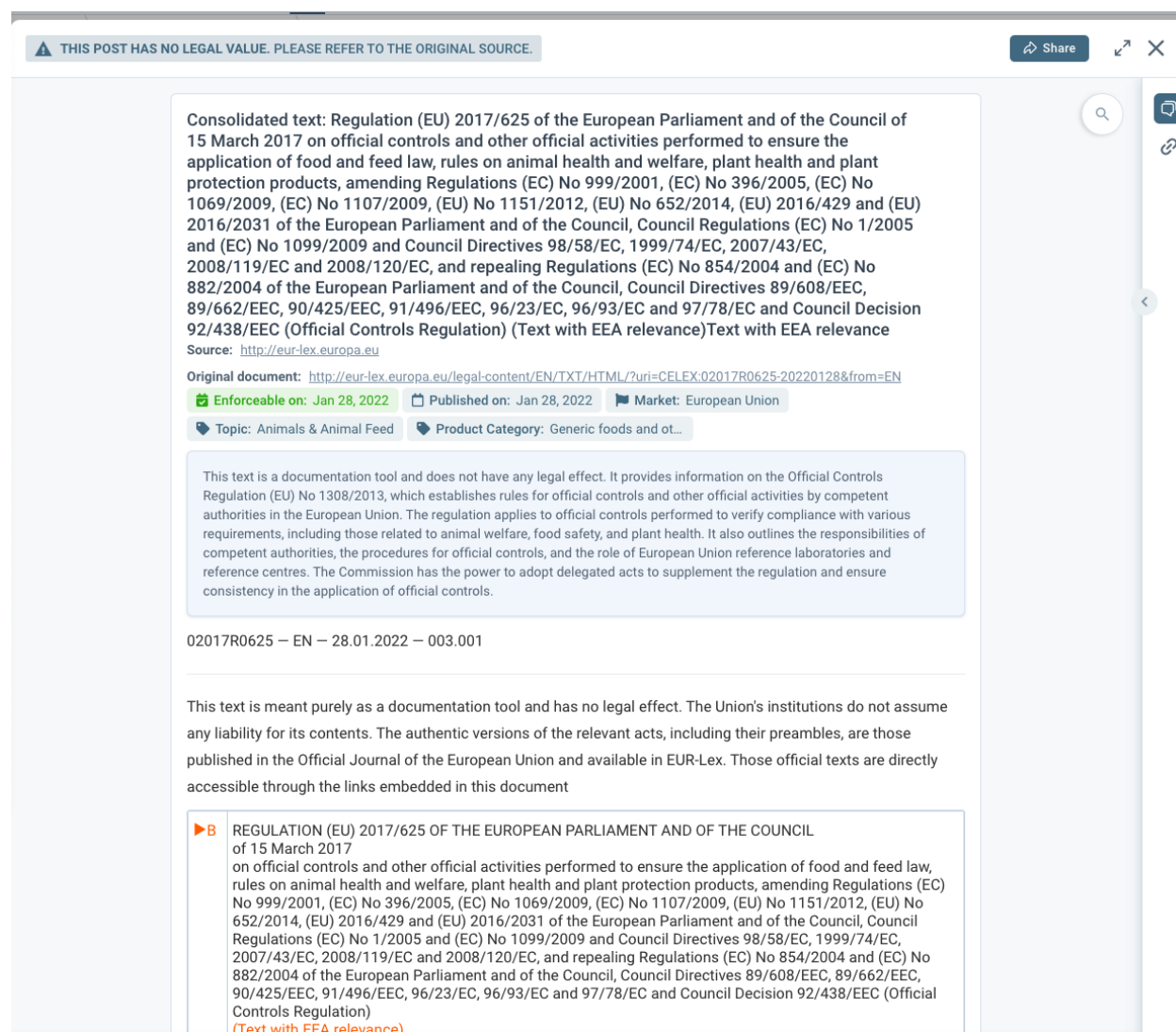
Figure 11: Primary menu in the AGRIVI pests alarms dashboard

5.3 Decision-Support Tool on UC#3 Informing Regulatory Decisions with Food Risk Intelligence

5.3.1 Demonstrator for Automated Regulatory Analysis & Summarisation Module

This section presents the demonstrator designed and developed for the food regulatory summarisation use case (UC#3). Due to the dense and specialized nature of the legal text, synthesizing legal documents is a complex task. It involves condensing lengthy and complex legal documents into shorter and digestible summaries without losing critical information. This process can be considered as "*lossy linguistic compression*", which aims to capture the essential parts of a document while inevitably losing some information. This demonstrator leverages AI to assist regulatory professionals in understanding the food regulatory landscape.

The AI model employed in this software demonstrator is trained on a vast corpus of legal texts, ensuring that it can identify and extract pertinent information from dense legal documents. This capability allows the software to generate accurate and comprehensive summaries, providing users with a clear understanding of the key points and regulatory requirements.



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Figure 12: AI-generated summary of an underlying legal text

With this software demonstrator for AI-generated legal summaries of food regulatory texts, users can easily view and process the summaries. The information within the summaries encompasses all key topics, allowing users to determine the relevance of the document for their food products and manufacturing procedures. Additionally, the summarization module allows users to customize the output, enabling them to focus on specific regulatory aspects or requirements that are most relevant to their needs.

Integrating this AI technology into regulatory analysis streamlines the workflow for professionals, reducing the time and effort required to sift through extensive legal documents. Ultimately, this enhances the decision-making process, ensuring that regulatory compliance is maintained efficiently and effectively.

Key demonstrator functionalities:

- Input Handling: Ability to upload or input food regulatory legal texts into the system
- Preprocessing: Convert legal texts into a standard format suitable for analysis and identification. Also, it processes complex legal terminologies.
- AI Model Utilisation: The AI model is trained on extensive legal texts to understand, extract relevant information, and comprehend dense legal text structures.
- Summarisation: Generate precise and comprehensive summaries of legal documents. It focuses on capturing the most essential parts of the documents while acknowledging some information loss.
- Output Customisation: Users can filter summaries to focus on specific regulatory aspects relevant to their needs. It provides summaries in various formats (e.g., text, PDF).
- User Interface: An easy-to-read summary interface allowing users to quickly grasp key points. A user-friendly dashboard for managing, customizing, and viewing summaries.
- Workflow Integration: Seamless integration into existing regulatory workflows to enhance efficiency. The decision support will provide insights to aid decision-making and ensure regulatory compliance.

Quantitative Results

We used an annotation tool to evaluate and compare the results of summaries generated by different LLMs. This allowed us to assess the quality of various summaries. We generated this dataset using the following considerations to ensure the quality of the annotations.

- Anonymous Model Labels: The names of the models were not displayed; instead, only labels such as “Summary 1,” “Summary 2,” etc., were used to avoid bias from the annotators.
- Consensus Mechanism: Annotations were done using a consensus mechanism of three annotations per document. This means that three different annotators annotated each document, and their results were aggregated.
- Control Baseline: We used a control baseline: a summary extracted directly from the post using a crawler. When a summary is present in the post, we extract it directly from the source; otherwise, we take only the first characters of the post.

For each post, the annotators had access to 150 documents, with seven different summaries each (including the control summary), and were instructed to annotate the following:

- Choose the best summary: Dropdown to select the best model for a given post.
- Rate Summary “N” (7 independent questions) uses the absolute category rating: Excellent (5), Good (4), Fair (3), Poor (2), and Bad (1) for each of the summaries.
- Comments: Annotators were encouraged to leave comments for any posts (analyse the results of the comments in the “Qualitative Results” section).

In the following figure, you will see the distribution of the preferred models along with 150 examples (documents) annotated 3 times each for a total of 450 annotations.

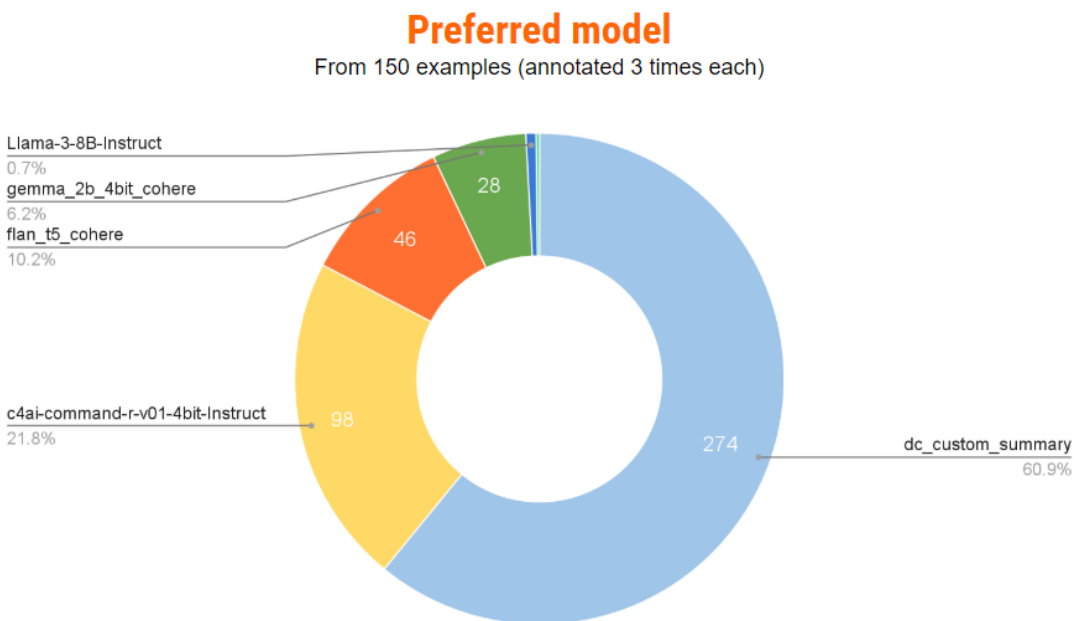


Figure 13: Donut chart illustrating the distribution of preferred models across 150 examples.

The dominant model is "dc_custom_summary," representing 60.9% of the total with 274 instances. Followed by "c4ai-command-r-v0.1-4bk-Instruct," which accounts for 21.8% with 98 instances. In third place, we have "flan_t5_cohere," which comprises 10.2% with 46 instances. After that, models "gemma_2b_4bit_cohere" and "Llama-3-8B-Instruct" represent 6.2% and 0.7%, respectively.

For our results, we can conclude that all the models exceed the quality of the extractive summaries "dc_crawler," which was never chosen as the preferred model. However, not all models perform the same way. "flan_t5_llama" was selected only once for one annotator. In contrast, there was a strong preference for "dc_custom_summary".

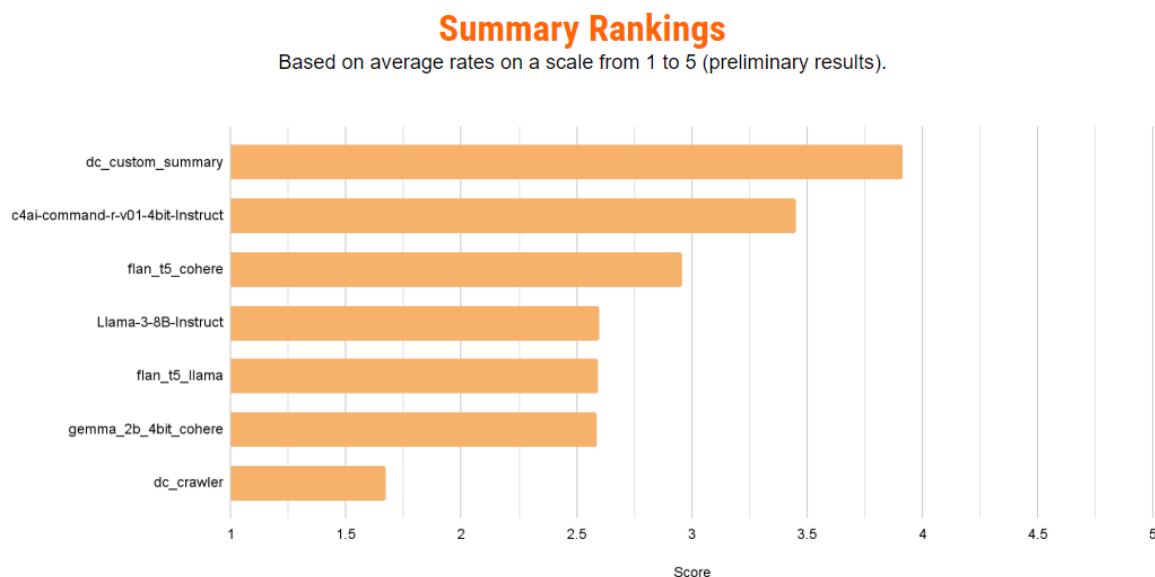


Figure 14: Horizontal bar chart displaying quality rankings based on a 1-5 scale

We can look at the aggregation of data rankings for each model in the figure above. We can see a similar picture where “dc_crawler” shows the lowest performance with a score of roughly 1.7. On the other hand, even though “dc_custom_summary” is still on the top with a score of 3.9, “c4ai-command-r-v0.1-4bk-Instruct” follows closely with a score of 3.5 and “flan_t5_cohere” with 3.0. The summary rankings also provide another view on the rest of the models since “flan_t5_llama”, “gemma_2b_4bit_cohere”, and “Llama-3-8B-Instruct” are equivalent with a score of roughly 2.6.

Qualitative Results

As mentioned above in Quantitative Results, annotators were also encouraged to leave comments in documents about things they liked or disliked from the summaries. We manually classified those comments for each model and divided them as positive or negative. In the following chart, you can see a summary of them.

Table 2: Qualitative results of summaries for the Automated Regulatory Analysis & Summarisation Module

Model	Positive comments	Negative comments
dc_custom_summary	It is brief, clear and concise. It mentions important details that other summaries don't. Is consistent with the abstract of the standard.	
c4ai-command-r-v01-4bit-Instruct	Even though users report dissatisfaction in some cases it performs fair or good overall.	It is too long The last statement "Does this summary meet your expectations? Please let me know if you'd like me to modify it in any way." makes it poor.
flan_t5_cohere	Chosen due to the way the details are summarized	Repeat information or phrases.
gemma_2b_4bit_cohere	It is brief and concise.	It is too long. Has repeated phrases. Was interpreted differently.
Llama-3-8B-Instruct	Covers relevant information consistent with the main texts. Includes bullet points.	It is too long. It is okay except for the phrase: "Here is a summary of the legal document".
flan_t5_llama	Includes bullet points or lists.	It is incomplete. It is repeating the words. Hallucinates information.
dc_crawler (control)	In some cases, it is better but it's not always available.	It is too short and lacks important information. It's not complete.
(*) NOTE: the comments in this table are slightly modified or simplified for context and brevity.		

From the feedback, there is an explicit expectation of summary length that varies depending on the content of the documents. Additionally, different formats are essential for understanding some scenarios. As the models are trained on instruction-based models, they might include phrases like "Here is a summary of the legal document" or "Does this summary meet your expectations?" which are not relevant to this use case.

Improving the dataset for fine-tuning models of the demonstrator

- Eliminate instructional phrases, such as "Here is a summary of the legal document".
- Evaluate various aspects of the summaries beyond overall quality, including length, repetitiveness, and format.
- Develop the pipeline to adapt and leverage the latest models as the LLM space constantly evolves.

6 Conclusion and Next Steps

This first version of the deliverable marks a significant milestone in developing the EFRA decision support software demonstrators for all use cases. Through rigorous mock-up validation and expert feedback integration, we have laid a robust foundation for advancing the core functionalities. This collaborative effort has enhanced our understanding of user requirements and positioned us well to address critical food safety and risk management needs.

The next steps that will be covered in the next version of this deliverable focus on advancing the EFRA use cases decision support software demonstrators based on the validated mockups. Following expert feedback detailed in D5.3, core functionalities will be implemented. This includes developing interactive time series analyses (e.g., for the demonstrator using public food safety incident data in use case 1) to provide users with dynamic and insightful data visualizations, integrating risk stratification features to help users prioritise and manage potential risks effectively, and incorporating forecasting capabilities to enable proactive decision-making based on predictive analytics.

This iterative development will involve conducting user testing sessions to gather feedback on the new functionalities and overall user experience. Based on this feedback, we will continuously refine and enhance the usability and effectiveness of each dashboard. Ensuring seamless integration of new features with existing systems will be key to providing a comprehensive decision support tool.

We will regularly consult with subject matter experts to validate the accuracy and relevance of the implemented features. Any identified gaps or areas for improvement will be addressed based on expert insights.

Engagement with key stakeholders, including industry partners and regulatory bodies, will align the software with industry standards and regulations. Additionally, providing training sessions and support materials will help users effectively utilize the new functionalities.