# REAMIT – Improving Resource Efficiency of Agribusiness supply chains by Minimising waste using Big Data and Internet of Things sensors

## Celebrating the Achievements of REAMIT

## We are REAMIT

**www.reamit.eu**

REAMIT is a transnational European territorial cooperation project, implemented by 14 partner organisations from Higher Education Institutions, business support organisations, technology and food enterprises in North West Europe. **The REAMIT consortium has brought several academics, business support organisations and industry partners closer to achieving the core objective of using Internet of Things (IoT) sensors and big data analytics in food supply chains to reduce food waste.**

**The REAMIT project has received Euro 5.74 million, co-funded by Interreg North West Europe Programme and partner organisations in the UK, Ireland, France and The Netherlands (January 2019 – July 2023).**

## REAMIT Achievements

(1) **Implemented 11 technology demonstration projects (pilot tests) across the North West Europe region.** This involved designing, developing and executing 9 IoT sensor prototypes, designing 1 Raman spectroscopy IoT prototype (from TRL 4 to TRL6/7), and furthering 1 Fluorescence spectroscopy prototype. The prototypes connect data from IoT sensors with an alerting system of the dashboard, which enables food owners to take decisions in time to prevent food from becoming waste. The pilots were conducted with the following companies:

- WD Meats Clostridium Bacteria, UK
- WD Meats Dry-aging, UK
- Musgrave, UK
- Andy Kerry Refrigeration, UK
- Yumchop, UK
- Fresh Detect, Ulster University, UK
- Human Milk Foundation, UK
- Picnic, The Netherlands
- Biogros, Luxembourg
- Burns Farm Meats, Ireland
- Raman Spectroscopy, University of Nantes, France

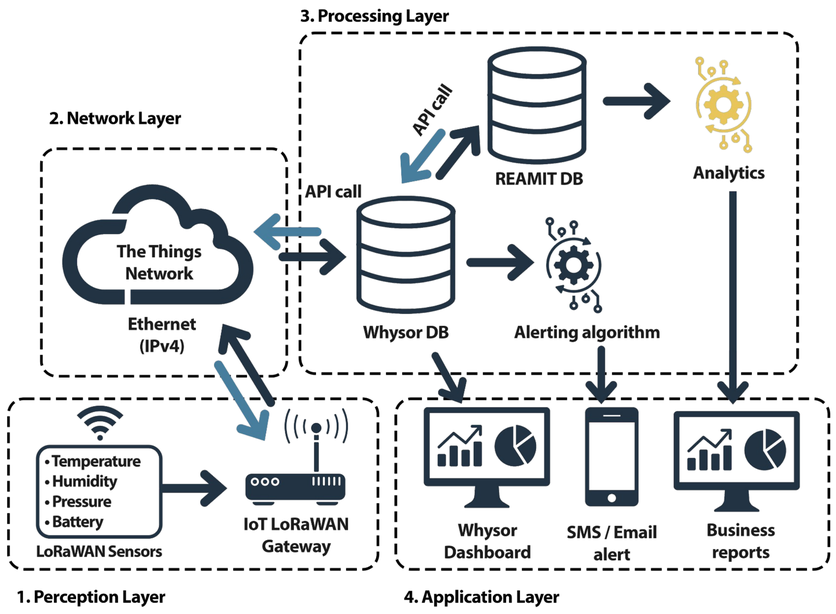


*Figure 1. Example of REAMIT IoT architecture*


(2) **Introduced new processes** related to storage and transportation of food in 9 agri-food enterprises in the North West Europe region through testing and adapting IoT sensor and Big Data technologies. This has led to improving food supply chains through reducing food waste, optimising resources and improving financial indicators of 9 partner agri-food enterprises. 5 partner companies recruited for REAMIT pilot tests are in the UK (WD Meats, Musgrave, Andy Kerry Refrigeration, Yumchop and Human Milk Foundation), 1 in the NL (Picnic), 1 in Luxembourg (Biogros), 1 in the Republic of Ireland (Burns Farm Meats) and 1 in France (Routhiau).

(3) **Improved supply chains of agri-food enterprises:**

- Beef producers
- Last mile delivery food supermarkets
- Frozen ready to eat meal food factory
- Human Milk Foundation
- Full agri-food supply chain companies
- Food storage and refrigeration companies

(4) **Developed 5 REAMIT Life Cycle Assessment studies to prove the net carbon reduction in the pilot tests, and produced a REAMIT Life Cycle Assessment (LCA) tool,** which is easy to use, readily available tool offering estimations for several impact categories such as climate change, ionizing radiation, water consumption. The REAMIT LCA tool can support agri-food companies (food producers, food supply chain companies in processing and logistics, as well as public authorities, academics, and digital technology providers) in conducting LCA and exploring the problem of food waste and the solutions to achieve more sustainable food systems. The REAMIT LCA tool contains LCA information on the processes in each phase of the food production and supply chain. With the tool, the company can gain insight into its products' environmental performance and the contribution of company-specific production processes to the total impact. The REAMIT-LCA tool can also assess the environmental impact of improvement options, such as implementing IoT technologies. An independent team of academics in the REAMIT consortium have used LCA to check whether there is net carbon benefit from the use of technology in the project. This exercise compares the environmental impact resulting from installing the technology (e.g., carbon emissions in producing the sensors and batteries) with the carbon emissions avoided due to the reduction of food waste. The results conclusively proved that there is net carbon reduction – carbon emissions avoided are much more than the indirect carbon emitted due to the installation and use of the technology


(5) **Produced tools and techniques for food waste reduction using big data analytics**

1. Route optimisation for Donor Human Milk Delivery: Utilising data analytics, the REAMIT team developed a maximum journey length prediction model for Human Milk Foundation (HMF) to aid in optimal route design for milk bikes, taking into account distance, journey duration, weather conditions, and milk volume.
2. Chicken Freshness Prediction: Raman spectroscopy data was recorded, analysed, and used to develop a model for predicting the freshness of chicken, allowing for improved inventory management and waste reduction during transportation.
3. Anomaly Detection in Cold Storage: Temperature data was analysed to develop an anomaly detection model for identifying irregular patterns in cold storage, helping to prevent spoilage and reduce waste.
4. Dry-Age Optimisation: Temperature and humidity data were utilised to investigate an optimisation model for dry-ageing meat, aiming to reduce trim loss caused by dark-facing meat and improve overall efficiency while minimising waste.
5. Milk Spoilage Prevention: A milk spoilage model was investigated based on handheld fluorescence spectroscopy (FreshDetect) data, enabling consumers to quickly evaluate milk quality to prevent spoilage and minimise waste.

(6) **The REAMIT project has brought technology providers and agricultural stakeholders closer to each other.** By constant engagement with both the groups, an integrated technology that customises sensor and big data technology to suit the needs of agricultural stakeholders has been brought from TRL of approximately 4 to approximately 7. The activities of Work Package T3 elaborate on future proofing of the technology.

(7) **Developed and published 13 research articles in the 'Sustainability' Special Issue open access journal – 'New Multidisciplinary Approaches for Reducing Food Waste in Agribusiness Supply Chains'.** All articles from this special issue are available as open access to all readers. They aim to help achieve REAMIT's long term objectives of creating environmental, social and economic impacts in food supply chains, using IoT sensors and Big Data, in the North West Europe region and beyond.

(8) **Developed and submitted new project proposals inspired by REAMIT achievements to roll out the REAMIT approach to new companies, regions and sectors, and to expand and accelerate REAMIT impact :**

- In November 2022, University of Essex won GBP 8k for a spin-off company inspired by REAMIT from University of Essex investment fund to further develop ideas inspired by REAMIT.
- In March 2023, University of Nantes won EUR 100k from regional public authorities of France for their project focusing on Raman Spectroscopy portable sensor and its application to identify food quality and reduce food waste.
- In May 2023, Ulster University submitted a stage one project proposal (EUR 5m) to PEACE PLUS Programme, focusing on extending the REAMIT approach to food enterprises in the Northern Ireland and the Border Region of Ireland.
- In May 2023, University of Bedfordshire submitted a project proposal to University of Bedfordshire Impact and Acceleration Fund call for small projects (GBP 10k). The project aims to promote and roll out the REAMIT approach to food enterprises in UK and EU in the first quarter of 2024.