Internet of Things (IoT) and Artificial Intelligence (AI) used to increase competitiveness in Swedish fruit and wine production

Apple and vine farms in Sweden gain AI-improved decisions, providing better production efficiencies through more accurate and data-led insights, as well as reduced reliance on subjective assessments.

EAFRD-funded projects

Location: Lund, Sweden

Programming period: 2014-2020

Priority: P2 – Competitiveness

Focus Area: Farm performance, restructuring & modernisation

Measures: M16 – Cooperation

Funding:

Total budget:	387 212 (EUR)
EAFRD:	152 949 (EUR)
National/Regional:	234 263 (EUR)

Timeframe: 17/07/2018 – 31/12/2021

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Summary

Applying the Internet of Things (IoT) and Artificial Intelligence (AI) in agrifood production presents a unique opportunity to revolutionise traditional practices. By leveraging advanced technology, farmers can enhance their competitiveness, increase efficiency, and address environmental challenges. The project began with extensive research, including interviews with key stakeholders, to understand industry challenges concerning vine and apple cultivation. An EIP Operational Group developed an IoT-based platform, integrating sensors and AI algorithms. The system collected climate data, used contextual knowledge, and provided real-time insights for decision making. The IoT system helped to increase farmers' competitive edge by offering predictions, warnings and decision support that enabled farmers to optimise irrigation, predict frostbite, and improve harvest yields.

Project results

- In one case, a sensor system service provided by the project saved 50% of the crops in a vineyard by predicting frost.
- The system's intuitive design was easy to use, and the project team provided further guidance and support to help farmers adopt this new approach.
- While initially focused on vine and apple cultivation, the technology proved effective and adaptable to other crops and geographical areas.

Key lessons and recommendations

- Digital tools can provide cost-effective and affordable solutions to farmers to address the industry's pressing needs.
- The knowledge and systems created during the project for apples and vines can be adapted to other crops such as raspberries and strawberries.

* The project promoter/beneficiary is an EIP-AGRI Operational Group (https://eu-cap-network.ec.europa.eu/operational-groups_en)

- Farmer curiosity and the promise of potential benefits easily outweighed any hesitations they may have had about embracing digital technology.
- Project findings underscored the importance of involving both media channels and word-of mouth to generate interest in new initiatives.

Context

In Sweden, nearly half of agricultural businesses are classified as small or medium-sized. However, due to the low-margin nature of the industry and the fact that over a third of agricultural entrepreneurs are aged 65 or above, technology adoption and innovation have been limited among the intended beneficiaries. The challenge, therefore, is to introduce user-friendly technology into an industry that currently lacks digital skills.

The initial idea for this project came about during a conversation between a wine producer and an experienced tech entrepreneur, who was acquainted with a local technology development company. This meeting brought together the user, the catalyst, and the developer. Following discussions with the Swedish Department of Agriculture, the concept was expanded to encompass apples as well as vines, recognising the relatively small size of the Swedish winery industry.

The innovation at the core of this project lies in the combination of available technologies with extensive knowledge about crop properties. By using a finely interconnected network of sensors, climate and other relevant data are collected and transmitted to an IoT cloud system. An AI system acts as a digital assistant to the producer, offering irrigation forecasts, optimal harvest dates, and assessments of harvest quality.

Objectives

The aims of this project were to:

- Promote the widespread adoption of modern digital tools in agriculture to address the industry's pressing needs.
- Mitigate the impact of adverse weather conditions and pests on crop cultivation.
- Optimise the yield and productivity of agricultural processes.
- Implement sustainable practices to reduce the reliance on chemicals, resulting in cost savings and improved environmental sustainability.

Activities

The project was divided into three key components: working on the data and AI systems that would be used, collecting knowledge about biological and cultivation processes, and real-world application in the cultivation area. Dedicated teams were assigned to each component.

- The project started with a comprehensive analysis of the existing environment, including past initiatives in the field. Interviews were conducted with key stakeholders, including organisations interested in data-driven systems. Once collated, this interview data helped shape the project's understanding of industry challenges and potential future technology applications.
- The system was then developed using a combination of AI and ICT tools, including sensors to increase and optimise harvest yield, reduce environmental and climate impact on crops, and minimize labour costs.
- A finely interconnected network of sensors was implemented to collect weather and other relevant data. This data was then transmitted via IoT to a cloud system. Each sensor station uses the cellular NB-IoT technology to transfer data at low cost.
- To enhance system performance, a Machine Learning (ML) system was employed. This ML system used the collected data, along with manual observations of crop phenological stages and measurements taken by the producers. Manual observations included factors such as plant diseases and nutrient deficiency.
- The ML system served as a digital assistant to the producers, providing valuable insights such as disease prognosis, nutrient requirements, irrigation recommendations, optimal harvest dates, and yield quality assessment at harvest.
- Efforts were made to market the system within the industry, with the long-term goal of establishing a dedicated company to sell the technology to agricultural stakeholders.

The project work was carried out by a cross-functional team composed of various stakeholders including: producers; experts in food, agriculture, and horticulture; measurement specialists; professionals in the digitalisation of food systems; software/system developers; marketing specialists and AI/ML experts.

The EIP Operational Group included the following organisations: CFB Creative Future Business AB who also acted as project leader, the Department of Biosystems and Technology and the Department of Plant Breeding of the Swedish University of Agricultural Sciences (SLU), itWine AB, Future Place Leadership AB/Liljehill AB, the Research Institutes of Sweden (RISE), Svep Design Center AB, Flyinge Vineyard, AutoIDExpert Scandinavia, Kiviks Musteri AB, and Cystellar AB.

Main results

- Thanks to the sensor system service, farmers now have access to predictions, warnings, and decision support that draw upon both their own experience and contextual knowledge, as well as actual sensor measurements from their specific fields. The sensor system service proved its value by saving 50% of the crops in a vineyard by predicting frost. Prior to this project, farmers relied on manual decision-making, combining experience, contextual knowledge, assumptions, and guesswork.
- The system increased crop yield thanks to the implementation of advanced technology. It also reduced unnecessary irrigation, leading to improved sustainability and conservation of water resources.
- Apple and vine farmers, who were not accustomed to using technology in their farming practices, successfully learned how to use IoT/AI systems. This involved gaining knowledge about the sensor stations installed in their fields, and understanding the warnings and data presented to them via the web application. The system's intuitive design minimised the training required, and project members provided additional guidance and support.
- Farmers in Sweden, including apple and vine growers as well as forest owners, have expressed interest in the sensor system.

Key lessons and recommendations

- Given that agriculture operates within a low-margin business model, it is imperative that any new tools provide cost-effective and affordable solutions. Only then can farmers adopt and leverage technology effectively.
- The project team observed the smooth and seamless adoption of technology by individuals who were previously unfamiliar with its use. Their own curiosity and the promise of potential benefits easily outweighed any hesitations they may have had about embracing digital technology.
- This successful project has played a crucial role in spreading awareness and has underscored the importance of involving both media channels and word-of mouth to generate interest in new initiatives.

Quote

"It can provide an early estimation of the harvest time by the end of May, assisting the grower in manpower planning for the harvest season."

Project developer and vine grower

Additional information:

https://www.svep.se/

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