

Cereals supply-chain traceability using blockchain and IoT technology

Marianthi Giannakopoulou¹, **George Adamides***¹, Andreas Pallides¹, and Nikos Nikoloudakis²

¹ Agricultural Research Institute, Nicosia, Cyprus

² Cyprus University of Technology, Limassol, Cyprus

*Contact email: gadamides@ari.moa.gov.cy



George Adamides

George Adamides received his master's degree in Computer Science from Western Michigan University, USA in 1999 and the Doctor of Philosophy in Information and Communication Systems from the Open University of Cyprus in 2016.

His research work focuses on smart farming specifically on robotics, smart sensors, Internet-of-Things, and applications of Unmanned Aerial Vehicles (drones) in agriculture.

1. TraCEREAL project objectives



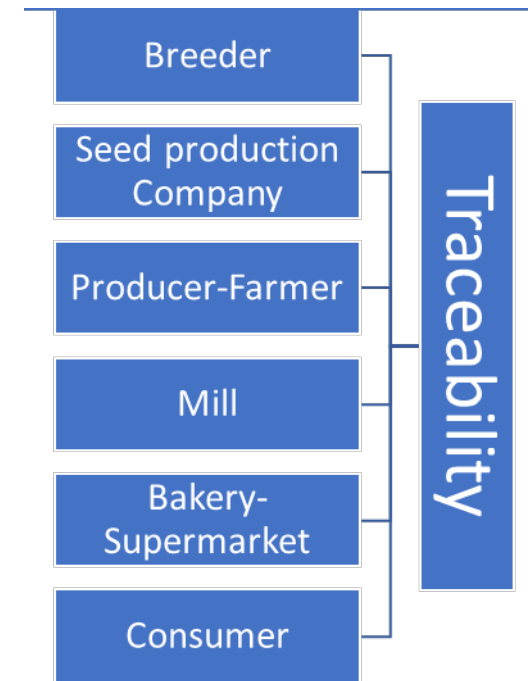
- The TraCEREAL project objective is to develop and demonstrate a functional prototype system consisting of an intelligent algorithmic framework, seamlessly integrated with IoT technology.
- Cultivation practices for recording sensory data were implemented as part of the demonstration activities, including a set of pilot experimental fields established across Cyprus.
- Telemetric stations equipped with IoT sensors were installed in mid-January (2025) at each plot to comprehensively track and report crucial environmental and soil conditions.
- The sensors can collect real-time data on various critical soil parameters, such as moisture levels, temperature, salinity, PH, and nitrogen/phosphorus/potassium content.



2. Aims and contributions of our poster



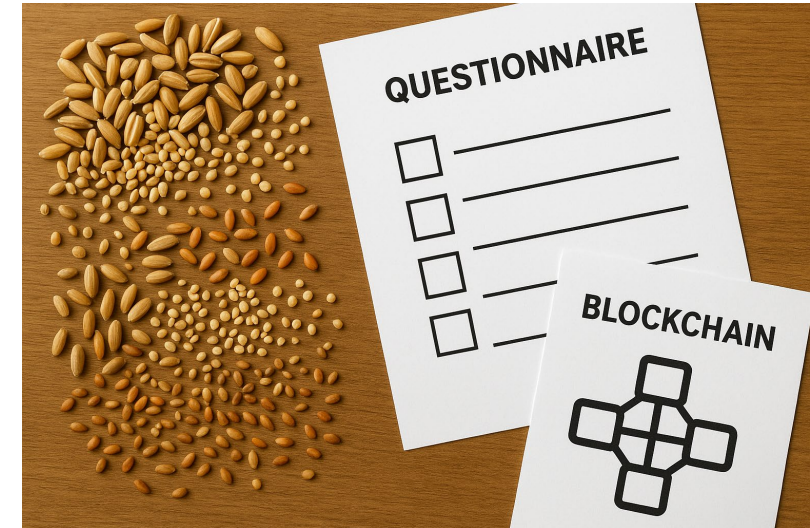
- The main objective of this work was to identify and document the priorities and needs of the key actors across the cereal supply chain
- For the development of the TraCEREAL system, the first step was to map the key actors across the cereal supply chain:
 - a) breeders, can document and track the genetic characteristics of new crop varieties, ensuring their adaptation to environmental conditions and market needs,
 - b) seed producers, receive insights on seed quality, germination rates, and resistance to environmental factors, facilitating better production planning,
 - c) farmers, can utilize IoT sensor data and platform recommendations to optimize agricultural inputs, irrigation, fertilization and yield, ensuring sustainable and high-quality production,
 - d) flour mills, gain access to detailed grain quality analyses, enabling them to maintain consistency and improve processing efficiency, and
 - e) end-users, i.e., bakeries and consumers benefit from full traceability, with access to information on the origin, nutritional properties, and processing history of food products (e.g., flour, pasta).



3. Methodology



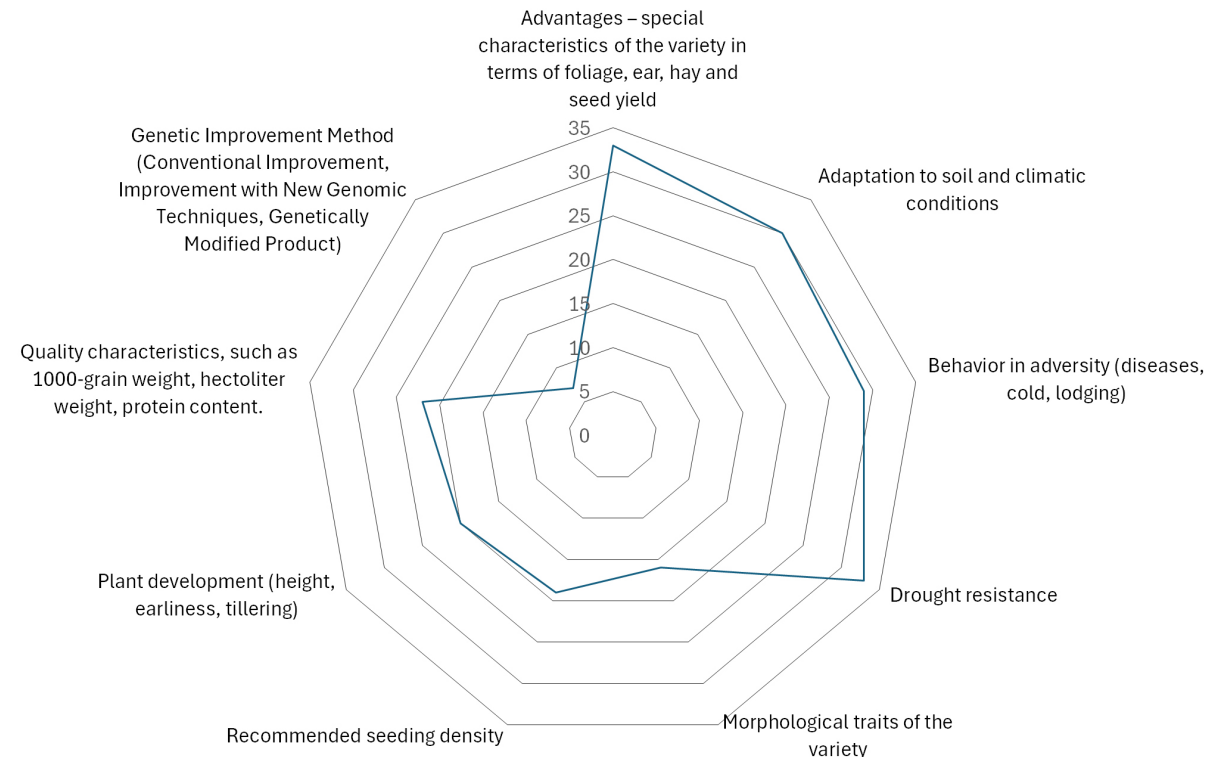
- Three different structured questionnaires were created to determine which traits should be included in the blockchain.
 - Seed producers and farmers
 - Flour mills
 - End-users
- Personal interviews were conducted with seed producers, cereal farmers, flour mills, and bakeries.
- An online questionnaire was used to collect data from consumers.



4.1 Results seed producers and cereal farmers



- Interested in
 - drought resistance,
 - disease resistance,
 - adaptation to diverse edaphoclimatic conditions
 - accessing data on yield, soil temperature, soil moisture, and fertilization needs
- Not Interested in
 - breeding method, i.e., conventional breeding or the use of New Genomic Techniques
 - starch composition and dough traits



4.2 Results from the milling industry

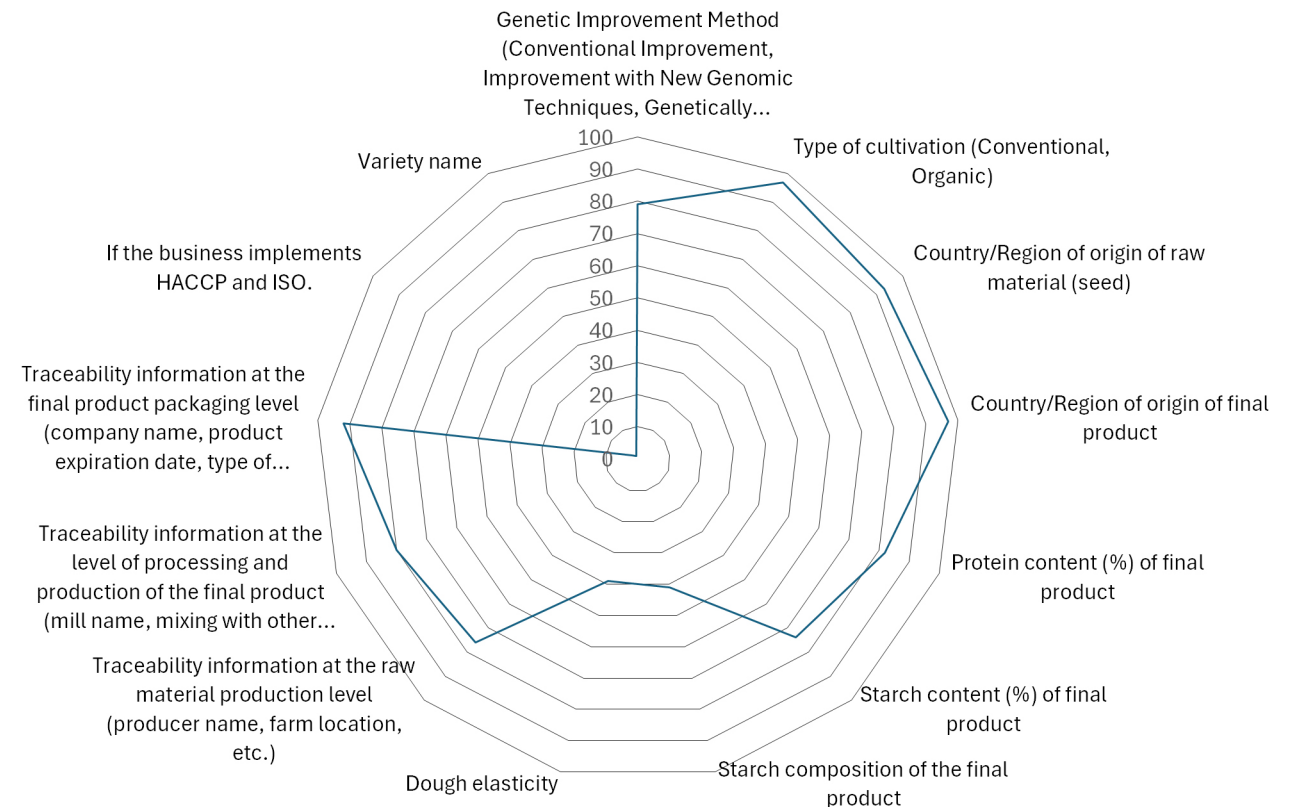
- The milling industry, has a distinct set of priorities regarding the data of interest within the blockchain system.
- The most important traits that emerged are:
 - the type of cultivation (conventional or organic),
 - protein and starch content, and
 - dough elasticity



4.3 Results from end-users (bakeries and consumers)



- The most important aspects of traceability information are
 - the country of origin for the raw material,
 - the origin of the final product (e.g., flour, pasta), and
 - the type of the cultivation
- Not Interested in
 - implementation of HACCP and ISO certificates
 - specific crop varieties used.



5. Conclusion



- The system aims to assist policymakers and industry players in creating more resilient cereal supply chains, specifically adapted to the unique needs of Cyprus.
- The initial phase involved mapping and documenting the priorities and requirements of the main stakeholders throughout the cereal supply chain.
- Survey results revealed that each key actor has distinct priorities and needs.
- This feedback will contribute to building the TraCEREAL blockchain framework and database.

Thank you!



TraCEREAL

**A Comprehensive Cereal Supply Chain Quality
Control and Decision-Making Framework**



The Project is funded by the European Union Recovery and Resilience Facility of the NextGenerationEU instrument, through the Research and Innovation Foundation. CODEVELOP-AG-SH-HE/0823/0133

