



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

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Project brochure

Innovation and traceability in the production chain of medicinal and aromatic plants cultivated in the Emilia-Romagna region

Project No. 5725596

Objectives

The general objectives of the TRACE Innovation Plan are to develop a new organizational model for supply chain management aimed at ensuring the full achievement of minimum product quality specifications (minimum active ingredient content in crops), environmental sustainability of the production process, and the effective and secure transfer of relevant information to the end customer.



Initiative carried out by the University of Bologna – Alma Climate Interdepartmental Centre within the framework of the Regional Rural Development Programme 2023–2027 – CoPSR 2023–2027 Emilia-Romagna – Intervention SRG01 – OS2 – Application No. 5725596.

Project: "Innovation and traceability in the production chain of medicinal and aromatic plants cultivated in the Emilia-Romagna region" – Acronym: TRACE.

The TRACE project and Medicinal and Aromatic Plants (MAPs)

The agricultural sector is currently facing major global challenges in the near future, such as water and natural resource scarcity, limited arable land, climate change, and the sustainability of supply chains and production processes. In this context, technological solutions can play a decisive role. The current and constantly evolving socio-economic environment has greatly increased the value of introducing crops into farm production systems that can serve as new sources of income for agricultural entrepreneurs.

From this perspective, the medicinal plant sector offers significant development opportunities at the national level, both by creating space for the cultivation of agricultural products with highly attractive market outlets and by providing a valid production alternative in marginal areas. The introduction of the Law on the cultivation, harvesting, and primary processing of MAPs (Legislative Decree 21 May 2018, No. 75) has established a new framework for the sector promoting its growth and development through the relaunch and enhancement of national production.



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The TRACE Project in the Context of Digitalization

In recent years, growing consumer attention to the origin of products and the raw materials used has become an important opportunity to enhance national production. This is a positive trend, provided that product identity and the sustainability of local agricultural supply chains are effectively preserved. In this context, it is useful to consider the adoption of certification systems and innovative monitoring technologies, such as Internet of Things (IoT) systems based on sensors capable of systematically transmitting data and information to a single central server.



These systems can be integrated with Artificial Intelligence (AI) algorithms to identify patterns and make predictions on product quality aspects, as well as with blockchain technologies to better ensure the authenticity, traceability, and immutability of collected data and processes within the agricultural supply chain.

In general, the supply chain from production to final consumption is often long and complex.

To date, traceability models and the collection of potentially useful data for improving production processes are carried out in a linear manner, using systems that are often inefficient and inaccurate, and that do not adequately meet the needs of either consumers or producers.



The TRACE plan aims to develop an innovative methodology capable of enhancing product traceability systems, increasing transparency across the entire supply chain, ensuring product quality standards, and making products more attractive and desirable in national and international markets, particularly with regard to quality, tradition, environmental sustainability, and health aspects.

Implementing blockchain within the business ecosystem means certifying each of these steps with certainty, protecting the product from fraud and misuse at every stage of its production, while also achieving significant reductions in administrative and infrastructural costs.





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TRACE Project Results

The expected results of the TRACE plan are as follows:

- Strengthening the sustainability of the medicinal plant supply chain by improving interaction among producers, systematizing procedures and activities, and making them stable over time;
- Adoption of precision agriculture tools (weather stations and soil moisture sensors) and real-time monitoring systems (e.g. wireless IoT sensors);
- Application of digital tools along the supply chain to simplify traceability operations (e.g. through blockchain) and support automated data analysis processes (e.g. through artificial intelligence).



- Increased skills of agricultural enterprises, through training activities, in the use of digital and advanced technological tools (platform, Decision Support Systems – DSS, precision agriculture tools), in the management of sustainable production, in the adoption of low environmental impact cultivation techniques, and in sustainability and traceability certification.

The TRACE Plan involves stakeholders operating at different stages of the supply chain, from agricultural production to the processing and primary transformation of raw materials

Plant products derived from open-field cultivation by the farms participating in the Operational Group will be delivered to facilities dedicated to primary processing

(drying), processing (cutting, defoliation), and packaging (compaction into pallets) to obtain the final medicinal product, which will be enhanced through the activities of this project and subsequently marketed.

The minimum quality standards of the medicinal product required by buyers will be ensured through the process innovation developed within the TRACE plan.

The results of the TRACE plan represent a model for applying an organizational strategy that will improve the sustainability of the medicinal plant supply chain at both regional and national levels.

The outcomes of the plan, which will provide a detailed description of both operational procedures and impacts in terms of production, environment, and economics, will serve as a key tool for replicating this model in other production supply chains across the territory.

The planned reporting program and dissemination activities will enable effective transfer of the project's actions to other regional and national production contexts.