

# BOTQUAS: Blockchain-based Solutions for Trustworthy Data Sharing in Sustainable and Circular Economy<sup>\*</sup>

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## Abstract

This contribution describes the aim and the current results of the BOTQUAS project which is one of the project embedded in a larger initiative called MICS funded by the PNRR program. Basically, BOTQUAS focuses on the study of the adoption of blockchain and DLT technologies to support a trusted and quality aware data sharing in supply chains with a specific focus on scenario that enables the circular economy.

Monitoring business processes within complex supply chains demands efficient data collection and analytics tailored to diverse phenomena. Traditional centralized solutions face limitations in adapting to the dynamic nature of supply chains. This calls for distributed solutions which break the usual architectural assumption to have a central entity in charge of collecting, integrating and offering tools for the analysis.

The BOTQUAS project <sup>1</sup> is one of the projects included within a broader initiative, called MICS (Made in Italy Circolare e Sostenibile) <sup>2</sup>, funded by the Italian Ministry of University and Research within the PNRR program (National Recovery and Resilience Plan) on European funds Next Generation EU.

This project proposes an innovative distributed monitoring solution integrating blockchain for trust and adaptive data lake architectures for analytics efficiency. Leveraging the cloud-edge continuum and 5G connectivity, the solution aims to ensure secure data exchange, adherence to agreements, and real-time analytics. Expected outcomes include an innovative federated

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*DLT Workshop*

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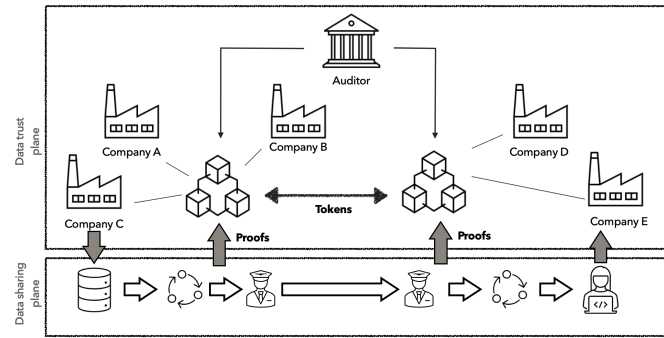
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<sup>1</sup><https://www.mics.tech/en/projects/8-06-blockchain-based-solutions-for-trusted-and-quality-aware-data-sharing/>

<sup>2</sup><https://www.mics.tech>



**Figure 1:** Overall approach

data lake architecture, 5G slice management solutions, an adversarial analysis of supply chain security, and a proof-of-concept implementation of the blockchain-based data flow tracking system. These developments aim to enhance the reliability, security, and efficiency of supply chain monitoring in dynamic industrial environments.

As shown in Figure 1, in case companies would like to share data, BOTQUAS envisions a *data sharing plane* to manage the actual data exchange, supported by a *data trust plane* based on blockchain to ensure the right level of trust in this exchange.

Assuming that the data provider and the data consumer agrees on the characteristics of the data sharing, blockchain technologies are used to store proofs concerning which, when, how data have been exchanged among parties. This to enable a possible auditor to confirm that the contract has been respected.

Being the sustainability one of the key element in the overall initiative, and also being the blockchain, often rightly, considered a technological element that is not sustainable from an energy point of view, the problem of satisfying all the requirements in terms of trust must be accompanied with approaches that minimize the energy footprint.

To support this approach, in the project different research investigations are active. Namely:

- The usage of Zero Knowledge Proofs to enable a privacy-preserved data sharing to limit the disclosures of the data to the strict necessary.
- The optimization of data distribution in federated machine learning while under the assumption of Independent and Identically Distributed (IID).
- A container-based solution to monitor, in a flexible way, the data exchange among parties able to balance between on-chain and off-chain data needed to ensure the adequate level of trust.
- Analysis of public and private data in blockchain to select the right configuration and setting of a blockchain to support the trusted data exchange.
- Blockchain interoperability to address scenario, which could be typical a multi-organizational context, where different blockchains could be involved.

The BOTQUAS project has a duration of 32 months, it started in May 2024 and will end in December 2025. The research lines listed above are currently running and will be validated against a common case study that is under finalization.

## **Acknowledgments**

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