

A dynamic DPP (Digital Product Passport) for complying to the new European regulation, and improve dynamic tracking of product transport conditions throughout the supply chain

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What is a DPP?

“The **Digital Product Passport** (DPP) is a digital container for products, components, and materials, which will store relevant information to support products’ sustainability, promote their circularity and strengthen and facilitate legal compliance.” [1]

What is a dynamic DPP?

“A dynamic DPP, unlike the static DPP, supports a dynamic information flow, allowing verified users (e.g., repairers) to update DPPs with necessary lifecycle information (e.g., maintenance details).” [3]

Research focus

Exploring the lifecycle of an agrifood product by modeling it as a state machine, enforced by a smart contract on the blockchain. The research **must** propose a formal model for this dynamic, analyze how a permissioned blockchain/DLT can guarantee traceability and prevent counterfeit entries in this supply chain. Exploring the anchoring of a dynamic DPP to its physical counterpart is also an extra option (via QR codes, NFC tags, etc.).

Primary research question

How can the states and state transitions of an agrifood product be formally modeled and enforced with smart contracts?

What is expected

- ➔ State of the art on this exact topic.
 - 1/ A review of existing standards for agrifood traceability (CEADS).
 - 2/ An analysis of academic and industry proposals for blockchain in supply chain management.
 - 3/ Identification of research gaps in modeling stateful assets on DLT.
- ➔ Demonstrate the creation and management of a dynamic DPP of a single food pack. This requires a full scenario definition and simulation, introducing different possibilities and conditions.
- ➔ Design a state machine for the dynamic DPP (Manufactured, Shipped, Dispensed, etc.)
- ➔ Implement a smart contract (chaincode) that manages the state machine of the dynamic DPP. It creates states and manages their transitions under different conditions by providing smart contract functions.

Technologies

Hyperledger Fabric (infrastructure), Chaincodes (Node.js, python, Go..), Node-Red.

Node-Red is a powerful visual flow simulation programming tool. It enables us to create a flow that visually represents the supply chain and the triggers, conditions and scenarios of a medicine pack lifecycle.

Node-Red also provides [node-red-contrib-hyperledger-fabric](#) which allows for integration between the visual flow and the blockchain, it can invoke smart contract functions to simulate the whole lifecycle and states.

Deliverables

- The code under git for the MVP or small PoC to be later integrated into a bigger pilot
- The report detailing the state of the art, and all the initiatives and achievement

References

[1] https://single-market-economy.ec.europa.eu/single-market/digital-product-passport_en

[2] Commission implementing decision (EU) 2026/1736, of 14 July 2026, on harmonised standards for digital product passports drafted in support of Regulation (EU) 2024/1781 of the European Parliament and of the Council, https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=OJ:L_202601736.

[3] Paul Keng Fai Wan, Shanshan Jiang, Enabling a dynamic information flow in digital product passports during product use phase: A literature review and proposed framework, Sustainable Production and Consumption, Volume 54, 2025, Pages 362-374, <https://doi.org/10.1016/j.spc.2025.01.014>

[4] Georgali, S., Lekawska-Andrinopoulou, L., Chatziioannou, K., Theodoropoulos, T., Tsimiklis, G., Amditis, A. (2026). Dynamic Digital Product Passports: Advancing Circularity and Sustainable Innovation in the Steel Industry Supply Chain. In: Traverso, M., Mankaa, R.N., Bonaffini, D., Covais, A. (eds) Life Cycle Management from Global to Local . Springer, Cham. https://doi.org/10.1007/978-3-032-17987-6_6