

The open infrastructure for OIV standards

An open-source, decentralised digital commons helping winegrowers and the vitivinicultural sector meet their compliance obligations — from the electronic label to the digital batch passport.

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1 Executive summary

The vine and wine sector is entering a decade of digital standardisation. Since December 2023, Regulation (EU) 2021/2117 has required a nutrition declaration and a list of ingredients on wines marketed in the Union, most often provided through an electronic label accessed via a QR code. In 2024, the International Organisation of Vine and Wine (OIV) updated its International Standard for the Labelling of Wines (resolution OIV-ECO 676-2024) to accommodate the e-label, with one strong requirement: no personal data may be collected through these labels. Hundreds of thousands of wine references must now maintain, year after year, an electronic label that is compliant, durable, and faithful to the batch placed on the market.

Today's answers to that need are proprietary, centralised platforms. They are useful, but they create dependency: if a platform disappears or changes its terms, millions of QR codes printed on bottles point to nothing — an immediate non-compliance for the producer, through no fault of their own.

XDCellar proposes another path: turning the OIV's reference frameworks into an open digital infrastructure, managed as a commons. Concretely, the project develops three complementary open-source services: a **registry of OIV nomenclatures**, made machine-readable and anchored on a blockchain; a **verifiable e-label** service, compliant with the European framework and the OIV standard, whose integrity and publication date are provable;

and a **digital batch passport** aggregating attestations signed by the competent actors (producers, laboratories, certification bodies).

The blockchain — the public XDC Network, complemented by a regional anchor through BlockBFC — is not used as a database but as a notary: it timestamps fingerprints, guarantees the integrity of documents and the identity of signatories. No personal or commercial data is ever written on-chain.

No token. XDCellar v2 involves no token issuance. Transaction costs, near zero on XDC, are borne by the service operator: the blockchain is invisible to the winegrower. Governance rests on an open consortium — one member, one vote — not on holding a speculative asset.

The economic model combines a freely reusable open-source core with operated services (e-label SaaS, integrations, support), under a consortium governance bringing together producers, trade bodies, laboratories and technology actors.

2 Context: compliance as the winegrower's new routine

2.1 Regulatory pressure is going digital

Regulation (EU) 2021/2117 brought wine into the mainstream of consumer information law: any wine produced after 8 December 2023 and marketed in the Union must display its energy value on the physical label and make the full nutrition declaration and the list of ingredients accessible — the electronic route (QR code) being permitted provided that no user data is collected and no commercial content is displayed. Further requirements follow the same slope: sustainability claims, production conditions, allergen information and, in the medium term, the logic of digital product passports that the Union is rolling out sector by sector.

For an estate, every new vintage, every cuvée, every export market multiplies the label versions to produce and maintain. Compliance is no longer a one-off event but a continuous — and digital — flow.

2.2 The OIV has already done the harmonisation work

The OIV, the sector's intergovernmental reference organisation, has maintained for a century the corpus that harmonises national legislation: product definitions, permitted oenological practices, methods of analysis, labelling rules. In 2024, resolution OIV-ECO 676-2024 updated the International Standard for the Labelling of Wines to frame the e-label. The OIV has also made digital transformation a strategic axis: a digital trends observatory, dedicated symposia, and its first online course devoted to blockchain for the sector in 2024.

In other words: the reference framework exists, it is international, it is legitimate — but it is published as documents meant for lawyers and oenologists, not as data that software can consume. Every vendor, every platform, every ERP transcribes these standards its own way, with its own errors and deviations.

2.3 The missing link

The sector lacks a **reference digital transposition of the OIV standards**: open, free, versioned, interoperable — and whose history anyone can verify. That missing link is what XDCellar builds.

3 Vision and principles

XDCellar defines itself as a **digital commons for the vine and wine sector**. Four principles structure the project.

Open-source, end to end. Data schemas, smart contracts, tooling and reference applications are released under free licences. Any cellar-software vendor, labelling platform or trade body can integrate them without permission or royalties. The collaborative innovation of the founding whitepaper remains the project's engine.

The standard comes first. XDCellar invents no standard: the project faithfully transposes the OIV's reference frameworks and follows the rhythm of its resolutions. The project's value is to be a reference implementation, not a competing authority.

Blockchain as a notary, not a database. The chain records only cryptographic fingerprints, timestamps and signatures. The data itself stays with the actors or in conventional storage. This choice guarantees compliance (GDPR, the OIV requirement of no personal data collection), sobriety and durability alike.

Economic neutrality. No token, no speculation, no capture of governance by capital. A project that aspires to work alongside an intergovernmental organisation and trade bodies must be beyond reproach on this point.

4 The foundation: OIV standards

The OIV's normative corpus is the project's raw material. Five sets are transposed into data schemas, in order of priority:

OIV framework	Content	Use in XDCellar
International Standard for the Labelling of Wines (rev. OIV-ECO 676-2024)	Mandatory and optional particulars, e-label, nutrition declaration, ingredients, requirement of no personal data collection	Pivot schema of the verifiable e-label service
International Code of Oenological Practices	Permitted practices and treatments, product definitions	Vocabulary for describing interventions on a batch; generation of the ingredient list
International Oenological Codex	Specifications of oenological products used in winemaking	Standardised referencing of inputs
Compendium of International Methods of Analysis	Reference analytical methods (including authentication)	Typing of analysis certificates signed by laboratories
Sustainability principles (OIV-CST 518-2016 and implementation guide)	Environmental, social, economic and cultural framework	Structure of the sustainability attestations in the batch passport

Each framework is transposed into **open JSON-LD schemas**, aligned wherever possible with supply-chain interoperability standards (GS1, EPCIS 2.0), versioned at the pace of the resolutions of the OIV General Assembly, and published in the registry described in chapter 5. The mapping to European Union requirements (Regulation 2021/2117 and its implementing acts) is documented field by field, since EU compliance is the producers' immediate need.

5 The XDCellar services

Three services, built one upon the other. The first is the shared foundation; the second answers winegrowers' immediate compliance need; the third prepares end-to-end traceability.

Service 1 — The OIV nomenclature registry (*the foundation*)

A public registry of the data schemas derived from OIV standards. Each schema version is published open-source, its fingerprint is anchored on the XDC blockchain with a timestamp, and it receives a stable identifier any software can reference. The registry thus guarantees that two actors who declare using "OIV labelling schema v1.2" are using exactly the same object, and that the version history is tamper-proof.

The registry is the quiet infrastructure beneath everything else: free, countless, barrier-free. It is also the natural ground for cooperation with the OIV and with trade bodies, which can find in it a digital reference implementation of their work without having to build it themselves.

Service 2 — The verifiable e-label (*everyday compliance*)

A service allowing a producer to generate, for each cuvée and each batch, an electronic label compliant with Regulation (EU) 2021/2117 and the revised OIV standard: nutrition declaration, ingredient list built from the vocabulary of the Code of Oenological Practices, allergens, multilingual versions. When the batch is placed on the market, the e-label's fingerprint is anchored on-chain.

That fingerprint delivers what centralised platforms cannot. First, **enforceable proof**: the e-label consulted today is demonstrably the one that accompanied the batch when it was placed on the market — protecting the producer in the event of an inspection or dispute. Second, a **durability guarantee**: the content, addressed by its fingerprint and replicable by any network operator, survives the disappearance of any single provider — a printed QR code still resolves ten years on. Third, **compliance by construction**: consultation collects no personal data, as both the European regulation and the OIV standard require.

Service 3 — The digital batch passport (*end-to-end traceability*)

For each batch, a digital dossier aggregates attestations signed by the competent actors: the producer describes vineyard and cellar practices in the OIV vocabulary; the laboratory signs the analysis certificate referencing the methods of the Compendium; the certification body signs the organic or sustainability attestation within the framework of the OIV-CST 518-2016 principles; transfers of custody (cellar, trade, logistics) are recorded.

The passport addresses the classic trap of traceability blockchains: a chain never guarantees that a piece of data is true, only that it has not changed since it was recorded. Truth comes from **who signs**. This is why every attestation is carried by the verifiable digital identity of its issuer (chapter 6). The passport also prepares the sector for the European generalisation of digital product passports, and provides the factual basis for the e-label of service 2.

6 Technical architecture

6.1 Networks

XDCellar builds on the **public XDC Network** (mainnet for production, Apothem testnet for development), chosen for the characteristics already identified in the founding whitepaper: high transaction throughput, transaction costs in the order of a hundredth of a cent, low energy footprint, EVM compatibility. **BlockBFC**, a French regional blockchain infrastructure, completes the setup as a territorial anchor point and local relay for pilots conducted with French actors.

6.2 What goes on-chain, and what does not

On-chain (public)	Off-chain
Fingerprints (hashes) of schemas, e-labels and attestations, batched in Merkle trees	Content of e-labels and passports (content-addressed, replicated storage)
Timestamps and version identifiers	Estates' operational data (ERP, cellar software)
Registries of the verifiable identities (DIDs) of signing organisations	Any personal data, without exception

Batched anchoring (Merkle trees) writes thousands of fingerprints in a single transaction: the marginal cost per e-label is negligible and borne by the service operator. The producer has no crypto wallet to manage and no token to acquire — the blockchain is an implementation detail they never have to see.

6.3 Identities and attestations

Signatories (estates, laboratories, certification bodies, trade organisations) are identified through **decentralised identifiers (DIDs)** and issue **Verifiable Credentials (W3C)**. A directory of accredited identities, governed by the consortium (chapter 7), makes it possible to verify that an analysis certificate does come from a recognised laboratory. This accreditation mechanism is the keystone of trust: without it, even the most sophisticated traceability merely timestamps unverifiable claims.

6.4 Interoperability

Schemas are published in JSON-LD with documented mappings to GS1/EPCIS 2.0 for supply-chain events, and open APIs (REST/JSON) allow integration into existing cellar software, ERPs and platforms. The explicit goal is for XDCellar to be a layer that market tools consume, not one more silo. All code is released under free licences (schemas and documentation under an open licence such as CC-BY; code under Apache 2.0/AGPL-type licences depending on the component) in public repositories.

7 Governance: an open-source consortium

XDCellar v2 abandons the token-based DAO model of the founding whitepaper in favour of a structure more legible to the sector's institutions: a **non-profit consortium** (initially a French law-1901 association), whose members are organisations and individuals committed to the project.

7.1 Principles

The rule is simple: **one member, one vote**. Decision-making power cannot be bought. Members are organised in colleges — producers and cellars, trade bodies and appellation organisations, laboratories and certifiers, software vendors and technology actors, academia — so that no category of actors dominates the others. Decisions, minutes and roadmaps are public.

7.2 The schema committee

A technical committee maintains the nomenclature registry: it transposes OIV resolutions after each General Assembly, examines change requests, and publishes new versions through a documented, transparent and dated process — each publication being anchored on-chain. This mirrors the way open standards bodies work (W3C, IETF): legitimacy comes from the quality of the process, not from voting rights weighted by capital.

7.3 Digital tooling for governance

Should online voting tooling prove useful as the consortium grows, it may rely on **non-transferable membership tokens** (non-tradable, without monetary value, one per member) issued on XDC — a mere technical instrument serving the "one member, one vote" rule, in no way an asset. This option is neither necessary at launch nor a goal in itself.

Why no token? A utility or governance token would add an adoption barrier for non-crypto-native users, a volatility foreign to the mission, and regulatory obligations (the European MiCA regulation) with no benefit to the sector. Should a real need for distributed economic incentives emerge in the future, the question would be examined by the consortium — as a response to an observed need, never as a prerequisite.

8 Economic model

The model distinguishes the commons from the services. **The commons** — schemas, registry, contracts, libraries, documentation — is free and open-source; its development is funded by consortium membership fees, public grants (regional and national schemes supporting agricultural digitisation, European programmes) and contributions from ecosystem actors, including XDC ecosystem support programmes.

The operated services generate recurring revenue that sustains the structure: SaaS subscription to the verifiable e-label (simple per-estate pricing designed for small operations, with pooled offers through trade bodies and cooperative cellars), integration services for software vendors and ERPs, hosting and service levels for batch passports, training and support. Because everything is open-source, an actor who prefers self-hosting is free to do so: the value of the services lies in operational quality, not in a lock-in.

This economic architecture protects the project from two symmetrical drifts: commercial capture (the core remains a commons) and dependence on volunteering (the services fund permanent staff). Profitability remains, as the founding whitepaper put it, "necessary but secondary" to the mission.

9 Roadmap

Phase	Horizon	Deliverables
1. Foundations	H2 2026	Constitution of the consortium; JSON-LD transposition of the labelling standard (ECO 676-2024) and of a first subset of the Code of Oenological Practices; nomenclature registry deployed on Apothem then XDC mainnet; public repositories and documentation.
2. Verifiable e-label	H1 2027	E-label service in production with 3 to 5 pilot estates recruited through a regional trade body, BlockBFC anchoring; structured dialogue with the OIV (digital observatory) to position the registry as a reference implementation.
3. Batch passport	H2 2027	Directory of accredited identities (DIDs); first partner laboratory signing analysis certificates; first sustainability certifier; pilot passports on partner estates' batches.
4. Scale-up	2028	Growth through trade bodies and software vendors; broader coverage of the OIV corpus; internationalisation (language versions, regulatory mappings beyond the EU).

Outlook. The sensors and physical-infrastructure track (monitoring of storage and transport conditions, on open platforms such as Raspberry Pi) is deliberately deferred: it will only be opened once batch passports have created the demand — proof of proper storage then enriching a passport already adopted, not the other way round.

10 Risks, compliance and caveats

Integrity is not truth. A blockchain faithfully timestamps whatever it is given, including false claims. The project addresses this risk through the accreditation of signatories (an identity directory governed by the consortium) and by giving precedence to attestations from competent third parties (laboratories, certifiers) over self-declarations.

Personal data. No personal data is ever written on-chain. E-labels are consulted without an account, without tracking cookies and without individualised analytics, in line with the GDPR, Regulation (EU) 2021/2117 and the revised OIV standard.

Crypto regulation. With no token, the project falls outside the issuer obligations of the MiCA regulation. The use of blockchain is limited to anchoring proofs — a documentary use that creates neither an asset nor a crypto-asset service for users.

Interoperability and non-duplication. The risk of adding "yet another platform" is addressed by the layer strategy: open schemas, GS1/EPCIS mappings, public APIs, and an active search for partnerships with existing labelling platforms rather than head-on competition.

Institutional dependency. XDCellar transposes OIV standards without an official mandate from the OIV. The project owns this status of an independent, open-source implementation while seeking a structured dialogue with the organisation; the transparency of the transposition process (every deviation documented, every version public) is the best protection against misinterpretation.

Adoption. The main risk remains the inertia of a sector already solicited from all sides. The answer lies in the project's very design: start from a mandatory need (the e-label), make the blockchain invisible, and go through network heads (trade bodies, cooperative cellars, software vendors) rather than recruiting estate by estate.

11 References

- OIV — Standards and technical documents (International Code of Oenological Practices, International Oenological Codex, Compendium of International Methods of Analysis, International Standard for the Labelling of Wines): [oiv.int/what-we-do/standards](https://www.oiv.int/what-we-do/standards)
- Resolution OIV-ECO 676-2024 — Update of the International Standard for the Labelling of Wines (e-label, nutrition declaration, ingredients): [oiv.int/node/3814](https://www.oiv.int/node/3814)
- Resolution OIV-CST 518-2016 — OIV general principles of sustainable vitiviniculture: [oiv.int](https://www.oiv.int)
- OIV — Digitalisation, the future of the vine and wine sector (symposium and digital trends observatory): [oiv.int/digitalisation-the-future-of-the-vine-and-wine-sector](https://www.oiv.int/digitalisation-the-future-of-the-vine-and-wine-sector)
- OIV — First online course on blockchain for the vine and wine sector (2024): [oiv.int/press](https://www.oiv.int/press)
- Regulation (EU) 2021/2117 — wine labelling, nutrition declaration and list of ingredients
- CEEV — Digital labelling / U-label platform: ceev.eu/projects/digital-labelling
- W3C — Decentralized Identifiers (DID) v1.0; Verifiable Credentials Data Model
- GS1 — EPCIS 2.0, supply-chain event exchange standard
- XDC Network: xdc.org — BlockBFC: blockbfc.fr
- XDCellar — Founding whitepaper (v1, January 2025): xdcellar.com

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