XDCELLAR

Blockchain use cases, benefits, application & UX

Synthesis document: what the OIV nomenclature registry, the verifiable e-label and the batch passport make possible in practice — for whom, with which benefits, and what the application will look like.

Product synthesis — working document July 2026 xdcellar.com

1 The foundation already built

This document rests on building blocks that already exist, not on intentions. The **oiv-schemas** repository contains the `oiv-wine-elabel` v1 data schema (a transposition of the OIV International Standard for the Labelling of Wines, 2025 edition, cross-mapped with Regulation (EU) 2021/2117), the controlled vocabularies (product categories, allergens, additive classes, sugar thresholds), the anchoring specification (JCS RFC 8785 canonicalisation + SHA-256 + Merkle trees) with its command-line tools, and the compiled **SchemaRegistry** contract, ready to deploy on XDC (Apothem testnet, then mainnet). On the showcase side, the **static front v3** is clean, self-contained and deployed.

> **The invariant principle**: the blockchain never stores data — only fingerprints, timestamps and signatures. The data stays with the actors. The chain answers a single question, but irrefutably: *“did this document exist in this exact form at this date, and who attested it?”*

2 The use cases, one by one

UC-1 — The winegrower publishes a compliant, provable e-label

Situation. Every cuvée placed on the EU market must provide a nutrition declaration and an ingredient list, most often via a QR code. **Flow.** The winegrower enters the cuvée in the application (or imports it from cellar software); the e-label is generated according to the OIV schema; at market release, its fingerprint joins the day's batch, whose Merkle root is anchored in the SchemaRegistry in a single transaction. **What goes on-chain.** One 32-byte fingerprint per batch of e-labels — nothing else. **Benefit.** In an inspection or dispute ("was this label modified after the fact?"), the producer holds enforceable proof of anteriority, independent of any provider; and the QR printed on thousands of bottles keeps resolving even if the service operator disappears.

UC-2 — The consumer scans the bottle

Flow. Scan the QR → an instant e-label page in the phone's language: nutrition, ingredients, allergens, vintage, varieties — and a discreet badge "integrity verified on …" that recomputes the fingerprint client-side and compares it with the anchor. **What goes on-chain.** Nothing: read-only. **Benefit.** Full transparency with zero collection: no personal data, no cookies, no tracking — the requirement of section 1.5 of the OIV standard turned into a trust argument. It is the anti-advertising-platform.

UC-3 — An inspector or importer verifies a batch

Situation. A control agent, importer or distributor wants to be sure the information accompanying a batch is the original. **Flow.** From the e-label page or the pro console: fingerprint check, anchoring date, version comparison if the label was updated (the `supersedes` field publicly chains the versions). **Benefit.** A documentary check that used to take e-mail exchanges becomes a one-minute verification, trusting no one's word — only the mathematics.

UC-4 — The laboratory signs an analysis certificate

Flow. The laboratory, identified by its DID (decentralised identifier) listed in the consortium's directory, issues a Verifiable Credential (W3C) referencing the OIV Compendium methods used (e.g. OIV-MA-AS312-01A); the certificate's fingerprint is attached to the batch. **Benefit.** A tamper-proof analysis certificate verifiable by any downstream link — answering the classic traceability trap: the chain does not make data true; the *accredited signatory* makes it trustworthy.

UC-5 — The certifier attests organic or sustainability claims

Flow. Same mechanics as UC-4: the certification body signs a structured attestation within the OIV-CST 518-2016 framework. It appears on the public e-label ("certified by…", verifiable in one click). **Benefit.** Environmental claims — increasingly regulated — become signed, dated

statements rather than unverifiable logos, protecting the honest producer and the consumer alike.

UC-6 — The batch passport follows the wine from cellar to distribution

Flow. A batch's digital dossier aggregates over time: declared practices (Code of Oenological Practices vocabulary), analysis certificate (UC-4), certifications (UC-5), transfers of custody (cooperative cellar → trade → logistics → importer), each event signed by its actor. **Benefit.** Enforceable end-to-end traceability, aligned with the digital product passport logic the EU is generalising — the sector is ready before the obligation, not after.

UC-7 — The software vendor builds on the registry

Flow. Cellar software, an ERP or a labelling platform consumes the registry: “OIV labelling schema v1.2” designates an exact, versioned object whose fingerprint is public. Generation, validation and anchoring go through open APIs. **Benefit.** The end of divergent home-made transpositions of the standard; market tools become clients of the commons instead of competing silos — the project's most powerful diffusion lever.

UC-8 — The consortium publishes a new standard version

Flow. After a resolution of the OIV General Assembly, the schema committee publishes the transposed version: `publishSchema()` anchors the fingerprint, the public event is authoritative, the history is append-only. **Benefit.** The governance of the reference framework is transparent and auditable: who published what, and when — with no way to rewrite history.

Outlook (deliberately deferred): UC-9, proof of storage conditions — sensors on open platforms such as Raspberry Pi in cellars and transport, readings periodically anchored, valuable for age-worthy wines, insurance and the secondary market. This case opens once batch passports have created the demand.

3 The benefits, actor by actor

Actor	Main benefit	What changes day to day
Winegrower / cellar	Provable EU + OIV compliance, no provider lock-in	10 minutes per cuvée, zero blockchain knowledge, one durable QR
Cooperative cellar / trade	Pooling (one account, all members), traced custody transfers	Bulk publication, ERP exports
Trade body / appellation org.	A compliance tool offered to the vineyard, harmonised data	Pooled offers, anonymous aggregate statistics
Laboratory	Tamper-proof certificates, OIV methods referenced	Digital signature built into the analysis flow
Certifier	Attestations verifiable in one click	Less logo fraud, more value in the certificate
Importer / distributor	Instant documentary verification	Fewer disputes, solid import files
Consumer	Complete information, zero tracking	One scan, the label's truth, in their language
Public inspector	Proof of anteriority and integrity	Faster, better-targeted controls
Software vendor	Stable, versioned, free reference framework	API integration instead of re-transposing the standard

And transversally, what the blockchain brings compared with a plain database: **proof of anteriority** (the timestamp depends on no server), **survivability** (the registry outlives its operator), **non-repudiation** (a signature cannot be retracted), and **neutrality** (no actor — not even XDCellar — can rewrite history). Its limits, owned: it does not guarantee truth — hence the directory of accredited actors — and it is not a storage medium — hence the “fingerprints only” architecture.

4 Application vision: three surfaces, one rule

The rule: **the blockchain is invisible**. Nobody — winegrower, consumer, laboratory — sees a wallet, a gas fee or a hexadecimal hash in the foreground. The operator anchors in the background (sponsored transactions, grouped into daily batches); cryptography only appears as a trust badge and a “proof” page for whoever wants to dig.

Surface A — The producer workspace (web app)

A sober web application, graphically continuous with the site (dark background, magenta accents), designed for someone whose craft is wine, not IT. Key screens: **My cuvées** (list with status: draft / published / anchored, market release date, downloadable QR); **E-label editor** (a guided form shaped by the OIV schema: controlled vocabularies become menus, the nutrition declaration is computed from the analysis certificate or the OIV factors, the invariants — no personal data, no commercial content — are guaranteed by construction, with a live preview of the public page and the mandatory physical particulars); **Publication** (one “Release to market” button, one sentence of explanation — “your label will be sealed tonight in the public registry” — no jargon); **Proofs** (per batch: fingerprint, anchoring date, link to the XDC explorer, Merkle path exportable as PDF for an inspection file).

Surface B — The public e-label page (the QR)

This is the most-seen screen: it must be impeccable. An ultra-light static page (same philosophy as front v3: pure HTML/CSS/JS, no framework), loading in under a second on a phone in a cellar or a store aisle. Content in order of importance: the wine's identity (name, appellation, vintage, varieties), nutrition declaration and ingredients (the regulatory obligation), allergens highlighted, signed attestations (“analysed by…, certified by…”), and in the footer the **“Integrity verified”** badge — one click opens it in “proof mode”: fingerprint recomputed in the browser, compared with the on-chain anchor, all verifiable without taking our word for it. Multilingual according to the phone's language, zero cookies, zero requests to advertising third parties — and this absence is *displayed*, because it is a differentiator.

Surface C — The pro console (laboratories, certifiers, inspectors)

An austere, efficient interface: submitting an attestation (drop the certificate PDF, reference the OIV methods, sign with the organisation's key), verifying a batch (paste a lot number or scan a QR → full history of versions and attestations), managing signature delegations within the organisation. The directory of accredited actors, governed by the consortium, is publicly browsable.

Three journeys to picture it

The winegrower, 10 minutes. Sign in (e-mail, no wallet) → “New cuvée” → 4 guided steps (identity, composition from the winemaking sheet, auto-computed nutrition, review) → “Release to market” → the QR arrives by e-mail and in the workspace, ready for the printer. Anchoring happens on its own, in the evening, with the day's other e-labels.

The consumer, 5 seconds. Scan → the page opens in their language → they read what the law guarantees them, without being tracked → if curious, the badge shows them the proof; if not, they see no technology at all.

The laboratory, 2 minutes. Console → “New attestation” → drop the report, tick the OIV methods, enter the lot number → sign → the certificate instantly appears on the batch's public e-label, stamped with the laboratory's name.

Technical architecture (summary)

Layer	Choice	Why
Public e-label pages	Static (pure HTML/CSS/JS), content-addressed	Speed, durability, replicable by any operator
Producer workspace & console	Light web app + API (Node) built on the oiv-schemas repo (ajv validation, JCS hashing)	Reuses tools already written and tested
Anchoring	SchemaRegistry on Apothem (pilot) then XDC mainnet; daily Merkle batches; sponsored fees	Near-zero marginal cost, no user wallet
Pro identities	DIDs + Verifiable Credentials (W3C), consortium directory	Trust comes from accredited signatories
Data	Nothing personal on-chain, ever; e-labels replicated and content-addressed	GDPR + section 1.5 of the OIV standard, by construction

Product roadmap

MVP (to plug into the current front): public demo e-label page + fingerprint verifier, SchemaRegistry deployed on Apothem, publication of schema v1.0.0 — the registry's first public transaction. **Pilot**: producer workspace with 3–5 estates through a trade body, BlockBFC as territorial anchoring relay, first printed QRs. **Extension**: pro console with a partner signing laboratory, then full batch passports. Every step produces something showable — to winegrowers, to the OIV, to funders.

5 Related documents

- XDCellar Whitepaper v2.0 (EN/FR) — full positioning, token-free consortium governance
- oiv-schemas repository v1.0.0-draft — e-label schema, vocabularies, OIV↔EU mapping, tools, SchemaRegistry contract
- Pitch deck EN/FR — the case in 13 slides
- Static front v3 — deployed showcase, host of the future e-label pages

Internal working document of the XDCellar project. References to the OIV's work are an independent implementation and imply no endorsement by the OIV.