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Audit-Grade AI

Why evidence — not intelligence — is the bottleneck in regulated document analysis, and why the harness that solves it captures the value.

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ABSTRACT

Frontier language models have made *intelligence* abundant. They have not made *certainty admissible*. In regulated work — fund due diligence, DORA registers, contractual compliance, remediation — the binding constraint was never "can a machine read this document?" It is "can this finding survive an auditor, a regulator, or opposing counsel?" A single model answering a question produces **testimony**: fluent, plausible, unverifiable, and non-reproducible. Regulated institutions run on **evidence**: traceable to source, independently corroborated, reproducible on demand, committed under human accountability, and current with the law as written today.

This paper makes four claims. (1) The gap between testimony and evidence is structural, not incremental — no amount of model

scaling closes it, because it is a property of the *process*, not the *predictor*. (2) The gap is closed by a harness: a deterministic verification, redundancy, and accountability layer wrapped around interchangeable models. We specify the five properties such a harness must have and show that ComplianceOS implements each one in production. (3) Adoption in European regulated institutions is gated by a second, orthogonal wall — sovereignty, isolation, auditability of the vendor itself — which eliminates both raw frontier APIs and US-centric generalist wrappers, and which our architecture was built to pass. (4) The economics follow the guarantees: models are depreciating inputs whose price falls every quarter; the harness, the codified domain expertise, the regulatory data plane, and the stream of human-adjudicated corrections it generates are compounding assets. We close with the agentic roadmap: how the same architecture graduates, phase by phase and without ever compromising the evidence chain, from analysis tool to autonomous compliance analyst.

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§ 01

The Burning Problem: Regulators Stopped Accepting Attestations

Three forces converged on European regulated institutions this decade, and none of them is cyclical.

Regulatory volume and granularity. The EU's post-2020 wave — DORA (in application since January 2025), the AI Act (obligations phasing in through 2027), MiCA, NIS2, CSRD, alongside the standing mass of AIFMD, MiFID II, and GDPR — did not merely add rules. It changed the *unit of compliance*. DORA's Register of Information is the emblem: firms must maintain and submit structured, field-level registers of every ICT arrangement — legal entity identifiers, notice periods, subcontracting chains — in prescribed formats, on regulatory timelines. The deliverable is no longer a signed attestation; it is a **database the regulator can query**. Supervisory practice across the ESAs has moved the same direction: evidence, lineage, and traceability requests are now routine in inspections.

The evidence burden outgrew the workforce. Compliance and legal-review headcount cannot scale with document volume: data rooms of hundreds of documents per transaction, side letters and amendments layered over master agreements, multi-jurisdiction obligations drifting as legislation is amended. Industry surveys have placed compliance operating costs in financial services in the single-digit percentages of total operating expense and rising; whatever the precise figure at any firm, the direction is uncontested, and senior compliance labor is scarce, expensive, and burning out on mechanical review work that is 80% reading and 20% judgment.

AI arrived — and immediately hit the admissibility wall. Every institution has now piloted an LLM on documents. Most pilots die in the same place: legal and risk functions will not sign off on findings that cannot be traced, reproduced, or defended. The technology demonstrably *works* in the demo

and demonstrably *cannot be adopted* in the control environment. This is the burning problem in its precise form: **an enormous, regulator-mandated evidence workload; a workforce that cannot absorb it; and an AI supply that produces the wrong epistemic good.**

The market that resolves this tension is not "AI for documents." It is **audit-grade findings as a product** — and it is won by whoever makes machine findings admissible first.

§ 02

Testimony vs. Evidence: The Fundamental Difference

The distinction deserves precision, because it is the foundation of the entire thesis.

2.1 What a single-model answer is

A frontier model answering a question over documents is a **single draw from a conditional distribution**. Formally: given context *c* and question *q*, the model emits one sample from p(a | c, q). Four properties follow directly from this construction, and none of them can be prompted away:

1. **No error bars.** A point estimate carries no calibrated uncertainty. Models emit confidence *language* ("high confidence") that is itself generated text — a claim, not a measurement. The calibration literature is consistent: verbalized confidence correlates weakly with correctness, and the correlation degrades precisely on hard, long-tail cases — which in compliance are the cases that matter.
2. **A hallucination floor.** Generation is constrained to be fluent, not to be entailed by the source. Fabricated quotes, invented article references ("Article 30(2)(c)"), and plausible-but-wrong paraphrases are not defects of a particular model generation; they are the expected behavior of maximum-likelihood text continuation under uncertainty. Scaling reduces

the *rate*; it does not change the *type*: the output remains an unverified assertion.

3. **Non-reproducibility.** The same question, re-asked, may yield a different answer — across sampling runs, across model versions, across silent provider updates. An audit conducted in March must be defensible in November against the question "show me how this finding was produced." A stochastic API with a deprecated model version cannot answer it.

4. **Silent context loss.** Real matters exceed context windows. The failure mode of naive systems is quiet truncation: the model answers confidently about a document set it only partially read. The error is invisible *by construction* — no verifier inside the same truncated context can detect what was never presented.

Call this output what it is: **testimony**. A fluent witness of unknown reliability, unavailable for cross-examination.

2.2 What audit-grade evidence is

Evidence, in the sense that auditors, regulators, and courts use the term, is defined not by who produced it but by the **properties of the process** that produced it. Five are necessary; we treat them as axioms because each maps to an explicit doctrine in audit practice — sufficiency and appropriateness of evidence, chain of custody, segregation of duties, records currency:

T

TRACEABILITY

Every claim resolves to a verbatim, locatable passage in an identified source document — and the resolution is checked *mechanically*, not asserted by the same process that generated the claim. Numbers, dates, and amounts match exactly; "approximately right" is a category error when the difference between $100,000 and $1,000,000 is one token.

I

INDEPENDENCE

Material findings are corroborated by estimators whose errors are uncorrelated. Two passes of the same model share failure modes; two *different* models from *different vendors*, run blind to each other, do not. Crucially: **disagreement is signal, never noise** — it must surface to a human, never be averaged, arbitrated, or argued away by the machine.

R

REPRODUCIBILITY & CHAIN OF CUSTODY

The full production process of a finding — inputs, model identities, parameters, intermediate checks, timestamps — is recorded append-only and tamper-evidently (hash chains, RFC 3161 timestamps), such that the finding can be re-derived or forensically examined years later.

A

ACCOUNTABILITY BOUNDARY

Machines propose; identified humans commit. Every commit that carries legal weight — an entity resolution, a register field, a remediation state, an override of an AI conclusion — is executed by deterministic code on the instruction of a named, role-authorized person; overrides require a written rationale that is itself preserved. The AI's original output is never mutated; disagreement between human and machine is *recorded*, not erased.

F

FRESHNESS

Findings are made against the law as it stands *today*, loaded as versioned, hash-tracked data — never against the model's training-time memory of the law, which is stale by construction and unfalsifiable in an audit.

2.3 The structural claim

Here is the crux, stated plainly for a skeptical reader: **T-I-R-A-F are properties of a system architecture, not of a model.** A frontier model — any frontier model, at any future capability level — is one component that can satisfy none of them alone:

- It cannot *traceably verify itself*: a generator checking its own citations inside the same context is the definition of an uncontrolled process — and a verifier that shares the analyzer's context cannot detect a coordinated hallucination even in principle.
- It cannot be *independent of itself*.
- It cannot maintain a *chain of custody* over its own inference.
- It cannot bear *accountability* — legally or organizationally.
- It cannot guarantee *freshness* against amendments published after its training cutoff.

> ◆ **Better models are better components. The scarce good — admissibility — is manufactured a layer up. That layer is the harness.**

This is why "the models will get better" is not a threat to this thesis but a subsidy to it.

§ 03

The Harness Thesis: Why Our Architecture Is Optimal

ComplianceOS is a production implementation of the T-I-R-A-F process, wrapped around interchangeable frontier models. The design choices below are not features on a roadmap; they are shipped, tested, and in several cases

protected by deliberate *refusals* that competitors will find culturally difficult to copy.

3.1 The verification stack – T

Every extraction pipeline terminates in deterministic checks that the model cannot influence: verbatim quote verification against extracted source text, with exact-match discipline on numeric, date, and currency tokens; structured output enforced through tool-schemas rather than parsed prose; document-structure validation of claimed locations; and a hard extraction-quality gate that refuses to analyze an image-only or empty document rather than let a model improvise over blank input — the single cheapest way to prevent the most embarrassing failure class: confident findings about unread documents. Above the deterministic floor sit graded semantic and adversarial review passes — with the adversarial reviewer given *independent* context, so that the checker cannot inherit the generator's blind spots.

3.2 Dual-model cross-validation with a non-negotiable rule – I

High-stakes extractions — DORA RoI fields, party and entity adjudications — run through **two models, preferentially from different vendors**, blind to each other, with normalized comparison (dates to ISO, durations to days so a notice period is never off by a unit, LEIs, enumerations). Agreement auto-accepts and seals; **disagreement routes to a human, always** — the system is architecturally incapable of resolving a material model conflict on its own. A required field that both models leave blank is also escalated: an empty consensus is not evidence of absence. This rule is the institutional heart of the product, and a standing constraint of the codebase: high-stakes extraction runs at least two models, and disagreements are never silently resolved.

3.3 The suggestion-only commit boundary – A

Machine matching and machine judgment, everywhere in the system, write to *suggestion* fields. The authoritative field — the entity link, the register value, the remediation state — is written only by exact deterministic matches

or by a named human through role-gated endpoints. Overrides never mutate AI output; they are recorded beside it, with mandatory rationale, in an append-only action ledger. The design maxim, taken from the code itself: *a false merge in a compliance product is worse than a miss.* This boundary is what lets a General Counsel sign the adoption memo.

3.4 The evidence chain – R

Findings are sealed into a per-tenant, tamper-evident hash-chained ledger (the EVU ledger), with RFC 3161 timestamp proofs on captured evidence, screenshot capture with content hashes for web-sourced material, and append-only audit trails on clause decisions and remediation actions. The product's answer to "prove this finding existed, in this form, on this date, produced this way" is a cryptographic artifact, not a promise.

3.5 The regulatory data plane – F

Legal sources are synchronized from official publications, content-hashed, cached, and version-tracked; validation rules load as data and update without redeploys; extraction targets are built from the regulatory specifications on disk, never from model memory. When monitored legislation changes, the system detects it, computes which playbooks and analyses are affected — and *notifies*, because silently mutating a compliance configuration is itself an audit failure. Continuous surveillance re-fingerprints documents, playbook versions, and law, so a finding's staleness is a detected state, not a discovered embarrassment.

3.6 Codified expertise as an asset class

Playbooks — structured, versioned, shareable question programs with conditional logic, red-flag semantics, and regulatory bindings — turn a firm's review methodology into executable, improvable capital. Multi-persona review panels run several playbooks through several expert lenses and consolidate by explicit consensus policy, with conflicts surfaced first. The ontology layer (parties, providers, arrangements, document relationships) makes the document *corpus* — not the document — the unit of

analysis: concentration risk, evidence reuse, and requirement impact become graph queries.

3.7 Why this is *optimal*, not merely good

Optimality is a strong claim; here is its form. Given the constraint set of regulated adoption — (i) worst-case guarantees dominate average-case brilliance, (ii) the accountable party must be human, (iii) the process must be examinable years later, (iv) the law must enter as data — **the harness architecture is the minimal structure that satisfies all four, and every deviation from it fails at least one.** Remove deterministic verification and traceability collapses to self-attestation. Replace dual independent models with a single stronger model and you trade a measurable disagreement signal for an unmeasurable error rate. Let the machine commit and the accountability boundary — the thing the regulator actually inspects — dissolves. Pull the law from model memory and freshness becomes unfalsifiable.

Competitors converging on this same design from the chat-assistant side must *retrofit refusals* — un-shipping autonomy their users already have. We built the refusals first and are adding autonomy on top of them. That ordering, as § 06 shows, is the entire game.

§ 04

The Second Wall: Sovereignty and the Institutional Checklist

Technical adequacy is necessary and insufficient. European regulated institutions run a second, orthogonal gate — procurement, DPO, information security, outsourcing oversight — and it is here that most AI vendors quietly die. The considerations, and the architectural answers:

EXHIBIT 1 — ADOPTION BLOCKERS AND ARCHITECTURAL ANSWERS

ADOPTION BLOCKER	WHAT THE INSTITUTION REQUIRES	COMPLIANCEOS ANSWER
Data residency & sovereignty	Documents and findings remain in the EU, under EU-law hosting; no silent transfers	Customer's choice of **sovereign EU hosting or AWS** — both supported, data stays in the EU; storage behind an S3-compatible abstraction with the endpoint as configuration
Model exposure	Customer data must not train foreign models; inference paths must be contractually clean	Inference via AWS Bedrock (EU regions, no training on customer data) with model-agnostic fallbacks; provider selectable per deployment — **no single-vendor dependency**, including on any one US lab
Tenant isolation	Hard multi-tenancy, provable	Row-Level Security on every table as the security model — enforced in the database, not the application; every new table ships with RLS policies, a migration, and a test, as a standing engineering rule
Vendor lock-in / exit	Portability as a condition of outsourcing approval (DORA Art. 28 logic)	Fully containerized; Postgres-based queueing (no proprietary cloud services); S3-compatible storage abstraction; secrets via environment only — the stack relocates to sovereign infrastructure without re-architecture
Human oversight (EU AI Act)	Demonstrable human control over consequential outputs	The suggestion-only commit boundary *is* Article-14-style oversight, implemented structurally rather than procedurally — the system cannot bypass it even if misconfigured
Record-keeping & explainability	Logs and lineage adequate for supervisory inspection	The evidence chain of §3.4: per-finding provenance, hash chains, timestamp proofs, append-only ledgers
Access & identity	Enterprise auth, MFA, role separation	MFA-enforced authentication; three-tier role model; server-authoritative workspace resolution

Read the exhibit as a whole and the strategic point emerges: **each row eliminates a competitor class.** Raw frontier APIs fail residency, oversight, and record-keeping. US-centric generalist legal assistants fail sovereignty and portability, and — because their UX is chat-first — struggle to *demonstrate* oversight rather than assert it. Legacy GRC platforms pass the checklist and fail the intelligence test entirely. The intersection — audit-grade intelligence *and* a clean pass through the institutional gate — is narrow, and it is what stands between adoption and oblivion. ComplianceOS was engineered for that intersection from the first table.

The Economic Architecture: Pricing the Guarantee, Not the Seat

If the thesis of §§ 02–03 is right, the correct unit of value is not a seat, a token, or a query — it is a **sealed, assured finding**. ComplianceOS prices in Evidence Units (EVUs): each sealed finding carries a deterministic weight derived from its response type and, critically, from the **assurance depth applied** — adversarial review multiplies the weight, multi-model panels more so, captured evidence more again — recorded against actual token cost in a versioned, append-only price book.

Three consequences matter to an investor:

1. **The invoice is a trust statement.** Customers can see that they paid more for a finding precisely because more independent scrutiny was applied to it. Assurance depth, cost, and price move together — an alignment no per-seat or per-token model can express.
2. **Margin is governed, not hoped for.** The price book carries a token and model cost basis; model price declines (a certainty) flow through as margin expansion or assurance deepening, at our choice — the harness decides how much redundancy each finding class receives, which means *we* control the cost of goods in a way thin wrappers cannot.
3. **Usage-based, never per-seat, by standing decision.** The buyer's alternative cost is senior professional review time. Pricing per assured finding scales with the value displaced and survives the headcount-flat future that per-seat pricing is structurally short.

§ 06

The Agentic Roadmap: From Analysis Tool to Analyst on Staff

Autonomy is where this architecture's compounding advantage becomes visible — because in regulated work, **autonomy is downstream of trust, and trust is downstream of the evidence chain.** Competitors who built chat-first must now bolt guarantees onto free behavior. We built guarantees first; each phase below adds behavior onto them, and no phase ever moves the commit boundary.

The roadmap is organized as three planes:

GROUNDING PLANE — HOW ANSWERS GET MADE

Citation-first generation: extract verbatim passages, verify them deterministically, then compose answers **only from verified passages** — the model structurally cannot cite text that does not exist. Orchestrator–worker execution with isolated per-worker contexts, which doubles as an anti-collusion control: verifiers build their view of the source independently of the analyzer. Threshold-gated retrieval for corpora beyond context limits.

ASSURANCE PLANE — HOW ANSWERS GET CHECKED

Hardened deterministic verifiers; independent-context adversarial review; a **risk-weighted verification ladder** in which compute escalates with stakes — deterministic checks always, then semantic verify, adversarial, dual-model, human — aligned with EVU weights so assurance, cost, and price stay one number. A single bounded corrective retry as backstop, never allowed to launder confidence or dissolve a model disagreement.

AUTONOMY PLANE — WHEN WORK HAPPENS WITHOUT BEING ASKED

The shipped continuous-surveillance backbone — fingerprinting documents, playbook versions, and legislation — gains a triage brain: on change, compute blast radius through the ontology graph, re-run only affected analysis, and deliver a **change-impact brief**: what changed, which findings moved, which obligations are newly at risk, drafted next steps.

EXHIBIT 2 — PHASED DELIVERY; EACH PHASE INDEPENDENTLY SHIPPABLE

PHASE	DELIVERS	INVESTOR-RELEVANT MEANING
0	Verifier hardening (exact numeric matching, factual adversarial challenge, engine parity) + evaluation harness seeded from production human decisions	Deterministic, fast, makes every later claim *measurable* — discipline as a feature
1	Citation-first generation; bounded self-correction; natural-language email intake; self-improving playbook generation	Accuracy up, review queues down, on current workloads
2	Agentic retrieval + worker isolation; agent-trace evidence; exceptions inbox + plan cards	The scaling wall ("document set too large") falls; the trust UX ships
3	Surveillance triage → change-impact briefs; external tool grounding (registries, LEI); conflict tie-break drafting; omission detection with document access	**Ambient autonomy** — the system briefs you when the world changes
4	Plan-artifact orchestration ("run full DD on this data room" → one approved, reusable plan compiled onto the task queue); workspace-scoped correction memory; progressive autonomy levels	The platform layer — autonomy granted per playbook, per workspace, revocably

Two design commitments distinguish this from every "agent" pitch deck an investor will see this year:

Autonomous, not chatty. The unit of interaction is a reviewable work product — a findings grid with per-cell citations, a change-impact brief, a plan card approved once up front — never a conversation. The system is silent about everything that went right; humans see exceptions, ranked by stakes. Autonomy is granted in explicit, revocable levels (suggest → draft-and-queue → auto-with-audit), and the high-stakes commits of §3.3 remain human-gated at *every* level, permanently. Chat exists as an escape hatch, and anything resolved in chat is offered back as standing configuration — the user never says the same thing twice.

The flywheel only we can build. Because machines only suggest and humans adjudicate, production operation manufactures a continuous stream of the highest-grade training signal that exists: **expert decisions, with written rationales, on real disagreements** — every entity-resolution review, every dual-model conflict a human settled, every override with its mandatory justification. This stream feeds two compounding assets: frozen evaluation sets (every roadmap phase ships with a measured accuracy delta, not a claim) and workspace-scoped correction memory (the system learns each

customer's entities, precedents, and risk posture — inside their tenancy, under their RLS boundary, visible in the trace).

> **Chat-first competitors accumulate transcripts; we accumulate adjudications. The moat deepens with every review click — and it accrues per customer, which is precisely where switching costs live.**

§ 07

Competitive Position, Stated Fairly

- **Frontier models / DIY internal builds.** The models are our suppliers, not our competitors; a bank's internal build must reproduce §§ 03–04 in full — a multi-year, compliance-supervised engineering program — to reach our *starting point*. Most will pilot, stall at the admissibility wall, and buy.
- **Generalist legal AI assistants (Harvey, Legora, and successors).** Superb products for interactive legal drafting and review, and validation that the spend exists. Structurally, they are testimony engines with growing safeguards: chat-anchored, generalist by design, US-centric in hosting and posture. Competing with them for the assistant use case would be a mistake; we don't. We sell the thing their architecture makes hard: **standing, sovereign, evidence-sealed autonomy** on the compliance workload specifically. Their tabular review is their strongest surface; our equivalent adds per-cell verifiable citation and the evidence chain beneath it.
- **Legacy GRC platforms.** Own the workflow, lack the intelligence; their attempts to add it inherit the testimony problem plus a decade of technical debt. They are a channel and an acquisition bid, not a threat.

WHAT WOULD HAVE TO BE TRUE FOR THIS THESIS TO FAIL

Regulators would have to *retreat* from evidence-based supervision (the trend is decisively opposite); frontier labs would have to offer sovereign, auditable, human-gated evidence chains as a platform primitive (their economics and generality point elsewhere); or a generalist could re-architect commit boundaries and sovereignty faster than we ship autonomy on top of ours (they would be un-shipping features their users depend on; we are adding features our users are asking for).

We consider each unlikely — and only the third is within a competitor's control.

§ 08

Conclusion

The burning problem is real, regulator-manufactured, and growing: an evidence workload that human teams cannot absorb, and an AI supply that produces the wrong epistemic good. The fundamental difference between what frontier models supply and what regulated institutions can adopt is the difference between **testimony and evidence** — and that difference lives in five process properties (traceability, independence, reproducibility, accountability, freshness) that no model can provide about itself, at any scale, ever. The value therefore accrues to the harness that provides them.

ComplianceOS is that harness, in production: deterministic verification the model cannot influence, dual independent models with disagreement routed to humans by architectural law, a cryptographic evidence chain, the law as versioned data, sovereignty and isolation designed for the European institutional gate, and pricing that makes assurance depth legible on the invoice. On this foundation — and only because of it — the agentic roadmap converts the product from a tool that answers into an analyst that watches, briefs, and drafts, with autonomy granted in revocable degrees and the commit boundary never moved. Every phase ships measured against

evaluation sets built from our own customers' adjudications — a data asset that compounds per tenant and cannot be bought.

> **Admissible certainty is not a bigger model — it is a discipline: an orchestrated, tuned, multi-model harness and a workflow engine built for the intricacies of regulated review.**

Intelligence is now a commodity with a falling price; audit-grade evidence still has to be produced. That is the discipline ComplianceOS exists to practice: the most advanced techniques that are also the sensible ones, applied so that every result is empirically trustworthy — verified, corroborated, and defensible long after it is made.
