ME-14 Records, the ballot and the minimum paperwork of honest government

The Materiality of Administrative Power: Writing, Inscription, and State Legibility

Political authority and communal memory do not exist as disembodied legal concepts; they are anchored in the material technologies through which rights, duties, and transactions are inscribed. The physical substrates of administration—incised clay tablets, knotted cords, notched sticks, animal skins, linen rag papers, and silicon registers—determine who can record, who can verify, and who can alter the social contracts governing human life. Across deep time, changes in the material medium of record-keeping have repeatedly transformed the architecture of power, shifting the balance between self-governing autonomy and authoritarian extraction.

Writing as a Technology of Cognitive and Social Asymmetry

The introduction of writing transformed human social organization not merely by transcribing spoken language, but by altering human cognition and social structures. Jack Goody, in *The Domestication of the Savage Mind* (1977) and *The Logic of Writing and the Organization of Society* (1986), showed that writing enabled administrative mechanisms that are impossible in oral societies: the decontextualized list, the tabular matrix, and the formulaic contract. In primary oral cultures, communal memory is homeostatic. Ancestral genealogies, boundary agreements, and rights to resources adjust over generations to match shifting social realities and prevailing balances of physical force.

Writing interrupts this organic adaptation. By fixing speech to an external, physical substrate, inscription creates an immutable artifact that endures across generations.

This externalization generates an immediate social and political asymmetry. Goody documented that early writing systems—such as Sumerian cuneiform (c. 3200 BCE) and Egyptian hieroglyphic and hieratic scripts—were complex crafts restricted to exclusive scribal schools (*é-dub-ba* in Mesopotamia). Scribes functioned as an administrative caste allied with temple estates and palace hierarchies.

Writing separated the moment of statement from the moment of reception, detaching legal pronouncements from face-to-face interpersonal negotiation. It turned local customary arrangements into rigid statutory codes, favored literate administrators over non-literate agricultural producers, and established depersonalized governance: surplus extraction could be audited, coordinated, and transferred across geographical expanses that exceeded the physical reach or personal charisma of any single ruler.

State Legibility, Cadastral Simplification, and Popular Evasion

In *Seeing Like a State* (1998), *The Art of Not Being Governed* (2009), and *Against the Grain*

(2017), James C. Scott analyzed the relationship between inscription and centralized power. Scott demonstrated that the fundamental objective of imperial statecraft is the creation of administrative "legibility." A pre-state ecological commons is defined by local, illegible complexity:

- Communal tenure systems feature overlapping usufruct rights to seasonal grazing, forest foraging, and open-field tillage.
- Shifting swidden agriculture relies on mixed crop polycultures.
- Naming customs use shifting patronymics and situational nicknames.
- Local weights and measures vary by village based on work capacity, soil quality, or grain volume.

To extract grain taxes, conscript soldiers, and enforce labor quotas, centralized states must flatten this communal complexity into standardized legibility. The state compiles cadastral surveys, assigns permanent family surnames, establishes uniform units of measurement, categorizes soils into abstract tax brackets, and records titles in central archives.

Cadastral maps reduce living ecosystems to standardized fiscal parcels. Scott demonstrated that this abstraction deliberately ignores micro-ecological variations and communal safety nets to maximize state extraction.

In response, populations across upland Southeast Asia (Zomia) and other non-state peripheries historically adopted counter-strategies of deliberate administrative illegibility:

- Maintaining oral cultures to prevent tax rolls from taking root.
- Cultivating escape crops (such as cassava, yams, and sweet potatoes) that mature underground and cannot be inventoried, seized, or burned by tax collectors.
- Dispersing along rugged ecological frontiers to escape sovereign reach.

Tripartite Reality of Bureaucratic Inscription

The institutional nature of administrative writing diverges depending on the analytical perspective:

- **What the arrangement's own people said it did:** Sovereign proclamations, royal edicts, and preambles to legal codes asserted that written records protected the defenseless against arbitrary tyranny, guaranteed property rights, prevented violent boundary disputes, and enforced universal justice across the realm.
- **What the record shows it did:** Administrative documentation codified unequal labor obligations, tied agrarian serfs to their manors, indexed agricultural surplus for state extraction, registered corvée labor duties, and facilitated military conscription.
- **What modern scholarship infers:** Inscription is a dual-use technology. While it provides an infrastructure for centralized extraction and elite consolidation, it also creates an objective paper trail that subaltern populations can preserve, cite, and deploy in court to limit autocratic predation and defend customary rights.

The Strongest Case Against: The Emancipatory Archival Hypothesis

The primary counter-thesis to Scott's framing of documentation as an oppressive instrument is advanced by economic institutionalists such as Avner Greif (*Institutions and the Path to the Modern Economy*, 2006). Greif argued that without impersonal, third-party-enforceable written contracts, human economic cooperation cannot scale beyond kin groups or personal

reputation networks. Written records lower transaction costs, enable long-distance trade, and permit investment across time.

Similarly, David Graeber and David Wengrow (*The Dawn of Everything*, 2021) noted that early accounting tablets in late Uruk administrative complexes and indigenous councils were frequently used to coordinate egalitarian communal grain distribution and allocate rations during seasonal shortages, rather than simply enforcing elite despotism.

From this perspective, administrative writing is an indispensable coordinating mechanism for complex human cooperation, rather than solely an instrument of predation.

Rung	**Operating Status**	**Institutional Breakdown Dynamics**
Household (4–10)	Never tried / Dysfunctional	Direct sight, shared kinship, and daily interpersonal negotiation make written land rolls and formal accounting ledgers an unnecessary overhead that damages familial cohesion.
Hamlet or Band (30–50)	Never tried	Complete physical visibility and shared oral norms allow resource allocation without the expense of a literate scribal apparatus.
Village (150–500)	Worked conditionally	Operates effectively only if records remain under local community control (e.g., parish registers) and are subject to public oral verification; becomes an instrument of feudal extraction if monopolized by external manorial agents.
Parish or District (1,500–5,000)	Worked historically	Essential for adjudicating boundary disputes between neighboring settlements, managing water infrastructures, and standardizing inheritance;

		requires multi-custodial safeguards to prevent scribal forgery.
Town or Watershed (15,000–50,000)	Worked historically	The historical core of municipal self-governance; written guild rolls, market charters, and drainage accounts prevent fraud across complex networks of non-kin specialization.
Region or Bioregion (0.5M–5M)	Worked historically	The primary operational domain of provincial land registries and tax administrations; prone to bureaucratic bloat and the systematic disenfranchisement of non-literate populations.
Nation or Continent (50M–500M)	Worked historically	The operating scale of modern centralized states; achieves high fiscal legibility, but risks extreme alienation, surveillance abuse, and bureaucratic capture by entrenched political elites.
Planet (8B)	Failed / Incomplete	Global documentation registries collapse under geopolitical rivalries, conflicting jurisdictions, and the practical impossibility of centralizing informal, customary tenure systems.

Capture Test: Bureaucratic Writing and Cadastral Registration

A person or faction with dark-triad traits—Machiavellian cunning, narcissistic grandiosity, and

psychopathic disregard for others—captures a written administrative system by monopolizing scribal literacy, restricting archival access, and amending documentary baselines to convert customary common rights into exclusive private property.

Historically, this occurred during the English Parliamentary Enclosures (c. 1750–1820). Wealthy gentry landlords, backed by specialized attorneys and land surveyors, deployed written title deeds and private enclosure acts through Parliament. Customary cottagers, smallholders, and squatters held traditional, unwritten grazing, foraging, and gleaning rights on the commons, protected only by generational memory and unwritten custom. Because these smallholders could produce no formal documentary deeds to satisfy parliamentary commissioners, millions of acres of common lands were enclosed and privatized. This dispossession forced families off the land and converted independent customary producers into wage laborers.

The primary features that historically resisted or mitigated this documentary capture were:

- Institutionalizing open, public readings of official registries before the assembled community (e.g., reading parish accounts at annual vestry meetings).
- Maintaining collective physical boundary verifications (e.g., annual rogationtide perambulations or "beating the bounds").
- Distributing split physical tokens (such as tally sticks) to illiterate parties to provide an unalterable receipt that did not require scribal literacy to verify.

The Architecture of the Vote: Secrecy, Openness, and Democratic Capture

When a self-governing body grows beyond informal consensus, voting mechanisms become necessary. The physical medium through which a vote is registered determines whether collective decisions reflect individual choices or the structural distribution of social, physical, and economic intimidation.

The Secret Ballot: The Australian Reforms of 1856

Before the mid-nineteenth century, voting across the Anglo-American world was public. Electors mounted temporary wooden platforms (hustings), faced candidates, partisan mobs, their landlords, and their employers, and declared their votes aloud (*viva voce*) or cast brightly colored, pre-printed party tickets directly into open ballot boxes[1].

This visibility enabled landlords, employers, and political machines to verify whether those under their economic authority complied with political instructions[1]. Landlords routinely evicted tenant farmers who voted against estate interests, while factory owners docked wages or fired workers who failed to present the approved party ticket[1]. Furthermore, open voting supported an active market in vote-buying: political party agents handed cash, liquor, or patronage to voters at the hustings, observing the tally clerks to ensure the purchased vote was cast before releasing payment[1].

To address this coercion and corruption, the Australian colonies developed the standardized secret ballot. Formulated in 1856 by William Blandowski and Henry Samuel Chapman in Victoria (enacted into law on March 13, 1856) and independently by Robert Richard Torrens and Francis Stacker Dutton in South Australia (enacted April 2, 1856), the "Australian ballot" introduced four operational innovations:

1. Ballots were printed exclusively by public authorities at public expense, rather than by partisan political machines[4].
2. The ballot contained the names of all legally nominated candidates on a single, uniform sheet of paper[6].
3. The voter marked the sheet in complete visual isolation inside a private voting booth.
4. The folded ballot was cast anonymously into a sealed box, severing the link between the voter's identity and their vote.

The empirical impact of the Australian ballot has been thoroughly documented. Richard H. Heckelman (*Journal of Economic History*, 1995) analyzed the adoption of the secret ballot across United States jurisdictions between 1888 and 1910[3]. Heckelman showed that adopting the secret ballot caused an immediate, statistically significant decline in voter turnout, averaging a drop of 6.9 to 12.1 percentage points across Northern states.

Toke S. Aidt and Peter Sandholt Jensen (*Comparative Political Studies*, 2017) replicated and extended these findings across both U.S. states and British parliamentary constituencies following the UK Ballot Act of 1872[7].

Aidt and Jensen demonstrated that this turnout decline was not a sign of democratic retreat, but rather the structural collapse of the vote-buying market[3]. Under open voting, vote-buying cartels and political machines paid citizens to turn out and vote as directed[1]. Because secrecy prevented vote-buyers from verifying whether a bribed voter fulfilled their bargain, the return on political payoffs dropped sharply[3]. Secrecy introduced asymmetric information into the transaction: voters could accept a bribe from one party and vote for another, or accept money from multiple factions[3]. As vote-buying became uneconomical, turnout subsidized by machine payoffs collapsed[3].

Juan Felipe Riaño (2020) demonstrated that ballot design details were critical to these outcomes[6]. Analyzing historical micro-data across the United States, Riaño showed that when states adopted Australian ballots featuring a single "straight-party ticket" box at the top, machine bosses continued to monitor voters by watching for the single down-stroke pencil mark[6].

Only when jurisdictions adopted the "office-bloc" layout—requiring voters to read each candidate's name individually and register discrete choices for every contested office—did split-ticket voting increase significantly, dominant party vote shares fall, and voter intimidation decline[6].

Tripartite Reality of the Australian Secret Ballot

- **What the arrangement's own people said it did:** Parliamentary reformers, including Chapman and Dutton, argued that the secret ballot freed citizens from intimidation, allowed working men to vote according to their conscience, eliminated bribery, and brought order to election days[1].
- **What the record shows it did:** The secret ballot reduced voter turnout by eliminating the financial incentive to vote for paid electors[3], required literacy to navigate candidate lists (which disenfranchised some illiterate, Black, and immigrant voters in late nineteenth-century America), and drove political machines to alter their tactics toward

ballot-box stuffing and fraudulent tabulations.

- **What modern scholarship infers:** The Australian ballot shifted the vulnerability of the electoral system. By securing the voter from external surveillance in the booth, it transferred systemic vulnerability to the counting phase, making election integrity dependent on administrative custody, ballot-box security, and reliable tabulations.

The Strongest Case Against: John Stuart Mill and the Public Trust

The philosophical defense of open voting was articulated by John Stuart Mill in *Considerations on Representative Government* (1861)[2]. Mill broke with his father James Mill and his mentor Jeremy Bentham, both of whom had championed the secret ballot[9]. Mill argued that the franchise is not an individual right or private property, but a public trust exercised on behalf of the entire political community, including disenfranchised citizens and future generations[1].

Mill maintained that when a citizen votes in secret, they are accountable to no one. Cloaked in anonymity, the voter is free to indulge private selfishness, personal malice, class bias, or narrow commercial advantage without fear of social censure[1].

Open voting forces citizens to defend their choices publicly before their neighbors, encouraging civic responsibility, moral courage, and public justification[1]. Mill argued that secrecy fosters civic cowardice, whereas public voting educates the citizen to align their private judgment with the common good[1].

Rung	Operating Status	Institutional Breakdown Dynamics
Household (4–10)	Never tried / Broken	Interpersonal intimacy, shared quarters, and physical proximity make voting secrecy practically impossible to maintain.
Hamlet or Band (30–50)	Never tried	Small group sizes, recognizable handwriting, and constant personal interaction undermine attempts at anonymous paper voting.
Village (150–500)	Worked historically	Feasible using standardized tokens (such as black and white beans or uniform printed chits dropped into light-tight containers); prevents intra-village

		recriminations and kin retaliation.
Parish or District (1,500–5,000)	Worked historically	The optimal scale for the early Australian ballot; shields small tenants and agricultural laborers from local gentry, mill owners, and clergy intimidation.
Town or Watershed (15,000–50,000)	Worked historically	Essential for breaking urban political machines, corporate payroll coercion, and organized street-gang intimidations at polling stations.
Region or Bioregion (0.5M–5M)	Worked historically	The standard operational scale for regional democratic representation; requires strict bureaucratic chain-of-custody protocols for ballot transport.
Nation or Continent (50M–500M)	Worked historically	The institutional foundation of modern mass democracies; vulnerable to centralized administrative manipulation or coordinated tabulation interference without paper audits.
Planet (8B)	Never tried	Universal secret balloting across 8 billion people fails due to massive logistical obstacles, divergent jurisdictional frameworks, and the lack of a trusted administrative authority.

Capture Test: The Secret Australian Ballot

A dark-triad actor or political cartel captures a secret ballot system by targeting the chain of custody after the ballot leaves the voter's hands. Because individual votes are anonymous, fraudulent ballots cannot be easily identified or extracted from the pool once deposited in the box.

Historically, this vulnerability was exploited by American urban machines (such as Tammany Hall in New York and the Pendergast machine in Kansas City) through techniques like:

- Ballot-box stuffing (pre-loading ballot boxes with fraudulent, pre-marked ballots before polls opened).
- The "Tasmanian dodge" or chain-voting scam (an operative steals an official blank ballot, marks it outside the polling station, pays an elector to take it inside, cast it, and return the new blank ballot, repeating the cycle throughout the day).
- Intentional miscounts by partisan election judges behind closed doors.

The structural features that resisted or corrected this capture were:

- Bipartisan and non-partisan election observers stationed alongside the ballot box throughout the voting hours.
- Sequentially numbered ballot stubs detached at issuance to prevent chain-voting without compromising secrecy.
- Public hand-counting conducted immediately at the polling precinct before the ballots were moved.
- The formalization of physical chain-of-custody logs with tamper-evident seals signed by opposing partisan observers.

Open Assembly Voting: The Swiss *Landsgemeinde*

Against the modern reliance on secrecy stands open assembly democracy (*Landsgemeinde*), preserved across centuries in the Swiss rural cantons of Uri, Schwyz, Unterwalden (Obwalden and Nidwalden), Glarus, and Appenzell (Innerrhoden and Ausserrhoden). In these annual outdoor assemblies, citizens gathered in a public ring (*Ring*), deliberated on proposed legislation, and voted openly by raising their right hands (*Handmehr*) or brandishing sidearms as historical evidence of free citizenship.

Empirical studies on the *Landsgemeinde* reveal the structural constraints of open assembly voting. Hans-Peter Schaub (*Die Stimmbeteiligung an der Landsgemeinde*, 2012; 2016)[13], Lukas Leuzinger (2018)[13], and Schaub and Charlotte Rochat (*Swiss Political Science Review*, 2025)[13] compiled extensive longitudinal datasets comparing assembly democracy with secret ballot referenda across Switzerland[13].

Their findings demonstrate that participation rates in open assemblies are consistently and dramatically lower than in secret ballot elections[13]. While Swiss secret ballot referenda regularly register voter participation rates of 40% to 55%, the *Landsgemeinde* in Glarus and Appenzell Innerrhoden rarely attracts more than 20% to 35% of eligible citizens[13]. At the municipal level, average attendance across Swiss citizen assemblies (*Gemeindeversammlungen*) is approximately 9%, falling below 5% in municipalities with over 5,000 residents[13].

Schaub and Rochat (2025) proved that this low turnout creates significant "social selectivity"[13]. Attending a *Landsgemeinde* requires standing upright outdoors for three to five hours in varying weather conditions[13].

Because voting is entirely public, citizens who are economically vulnerable, socially insecure, or politically unconventional face steep social costs[13]. Participants are disproportionately male, older, highly educated (citizens with tertiary degrees are heavily overrepresented), long-term property owners, and local business leaders[13].

The exclusionary nature of open assembly voting was demonstrated in Appenzell Innerrhoden, where the all-male *Landsgemeinde* repeatedly voted down women's suffrage until the Swiss Federal Supreme Court (*Bundesgericht*) intervened in November 1990 (case BGE 116 Ia 359), declaring the exclusion of women unconstitutional under the federal basic law.

Faced with physical limits and subtle social intimidation, five of the seven historical *Landsgemeinde* cantons voted to abolish the open assembly in favor of the secret postal ballot: Uri (1928), Schwyz (1848/1898), Nidwalden (1996), Appenzell Ausserrhoden (1997), and Obwalden (1998), leaving only Glarus and Appenzell Innerrhoden in operation today.

Tripartite Reality of the *Landsgemeinde*

- **What the arrangement's own people said it did:** Cantonal traditions claimed the *Landsgemeinde* was the purest expression of direct, unmediated popular sovereignty, where all free citizens met as equals to deliberate freely and govern without party machines.
- **What the record shows it did:** The assembly systematically favored local notables, suppressed participation by tenant farmers and wage earners, excluded women from political rights until forced by federal court intervention in 1990, and relied on rough visual estimates (*Abschätzen*) by the Landammann (cantonal chief magistrate) rather than exact ballot counts.
- **What modern scholarship infers:** The *Landsgemeinde* functions primarily as a civic ritual that reinforces community consensus and cultural belonging rather than an open forum for radical political contestation. Its survival depends on small scales, cultural homogeneity, and modest stakes; it breaks down when exposed to sharp class conflicts or modern scale pressures.

The Strongest Case Against: Jane Mansbridge and the Tyranny of Face-to-Face Conformity

The definitive academic critique of open assembly democracy was formulated by political scientist Jane Mansbridge in *Beyond Adversary Democracy* (1980). Studying face-to-face direct democracy in a Vermont town meeting ("Selby"), Mansbridge demonstrated that open assembly voting privileges articulate, high-status, socially confident elites while silencing the less educated, the economically vulnerable, and ideological minorities.

Under the gaze of their neighbors, employers, and landlords, citizens experience intense social anxiety. Dissenters often remain silent or vote against their private convictions to avoid interpersonal conflict, ostracism, or economic retaliation. Frank M. Bryan (*Real Democracy*, 2004), while generally more sympathetic to Vermont town meetings, confirmed that

attendance declines as town size grows, noting that fear of public embarrassment is the primary deterrent for non-participants. Open voting often mistakes enforced public conformity for genuine democratic consensus.

Rung	**Operating Status**	**Institutional Breakdown Dynamics**
Household (4–10)	Worked	Natural domain of open face-to-face voice negotiation; low transaction costs, but vulnerable to patriarchal or domestic domination.
Hamlet or Band (30–50)	Worked historically	Universal model for hunting-and-gathering bands and traditional tribal councils; thrives on continuous interpersonal contact and social parity.
Village (150–500)	Worked historically	The practical limit for direct voice democracy where all speakers can be seen and heard without electronic amplification; social pressure remains high.
Parish or District (1,500–5,000)	Worked conditionally	Visual estimation of raised hands (*Handmehr*) becomes imprecise; class hierarchies and employer intimidation begin to distort open voting.
Town or Watershed (15,000–50,000)	Failed	Accurate counts of raised hands become impossible in massive crowds; debates are dominated by professional orators, and turnout drops under 10%.

Region or Bioregion (0.5M–5M)	Failed / Abolished	Physical assembly of the populace is impossible; abandoned by nearly all Swiss cantons due to logistical barriers and low participation.
Nation or Continent (50M–500M)	Never tried	Complete physical impossibility of assembling millions of widely dispersed citizens in a single deliberative space.
Planet (8B)	Never tried	Physical and cognitive impossibility.

Capture Test: Open Assembly Voting

A dark-triad actor or cohesive faction captures an open assembly by exploiting social fear, controlling the public platform, and deploying visible intimidation.
Historically, this occurred in classical Athens through the maneuvers of the oligarchic faction of the Four Hundred in 411 BCE (as recorded by Thucydides in *The Peloponnesian War*, Book VIII). The conspirators, led by Antiphon and Peisander:

- Publicly assassinated prominent democratic leaders to create fear.
- Stationed armed bands of young partisans around the open assembly at Colonus.
- Proposed a motion requiring all citizens to vote openly on replacing the democratic constitution with an oligarchy.

Under the direct gaze of armed partisans, ordinary citizens were terrified to speak against the measure or raise their hands in opposition, allowing the oligarchs to seize power through a superficially "unanimous" open vote.
The features that historically resisted this capture were:

- The secret ballot, which Athens used for ostracism votes and judicial juries (*dikasteria*), employing bronze tokens (*psephoi*) with solid or hollow axles dropped into urns to prevent visual monitoring.
- The constitutional action for illegal proposals (*graphe paranomon*), which held leaders criminally liable if they proposed unconstitutional decrees.
- Equal citizen rights to bear arms, preventing any single faction from dominating the physical assembly ground.

Modern Verification Protocols: Paper Auditability versus Digital Vulnerability

Computational systems have frequently been proposed to replace paper records, promising lower costs, immediate tabulations, and mathematical precision. However, contemporary computer science and election security research demonstrate that paperless voting systems introduce systemic, often undetectable vectors for electoral capture.

Paper Trails and Risk-Limiting Audits

The standard for electoral integrity requires a voter-verifiable paper audit trail (VVPAT) paired with statistical manual audits[17]. As formulated by Philip B. Stark (*IEEE Transactions on Information Forensics and Security*, 2008; *Statistical Science*, 2012), a Risk-Limiting Audit (RLA) is an empirical inspection protocol that provides a mathematically guaranteed upper bound on the probability that an incorrect electoral outcome will escape detection and correction[17].

An RLA operates on the principle that while computers may rapidly scan and tabulate ballots, electronic tabulations must be checked against an immutable physical paper record maintained under a verified chain of custody[18].

Auditors inspect a randomized sample of physical paper ballots drawn from the master ballot manifest[18]. If the reported victory margin is wide, a small sample size provides statistical certainty[18]. If the margin is narrow, or if errors are detected, the audit sample automatically expands until it either mathematically confirms the reported winner at the specified risk limit α, or escalates to a 100% hand recount that corrects the outcome[18].

Stark formalized this process through non-parametric methods, including Bravo (Ballot-polling Risk-limiting Audits to Verify Outcomes)[22]. In a two-candidate plurality election, let N be the total ballots cast, V_w the reported votes for the winner, and V_l the reported votes for the loser. The reported diluted margin is calculated as:

$$\mu = \frac{V_w - V_l}{N}$$

Auditors draw ballots sequentially at random without replacement[18]. Let S denote the running test statistic, initialized to $S_0 = 1$ [18]. With each audited ballot showing a vote for the reported winner, S is multiplied by:

$$\frac{2s_w}{s_w + s_l}$$

where $s_w = V_w/N$ and $s_l = V_l/N$. For each audited ballot showing a vote for the reported loser, S is multiplied by:

$$\frac{2s_l}{s_w + s_l}$$

The audit stops and certifies the outcome if $S \geq 1/\alpha$ [18]. For example, setting a risk limit of $\alpha = 0.05$ (a 95% confidence level that an erroneous outcome will be caught and overturned) requires sampling until $S \geq 20$.

The expected initial sample size n required to confirm a clean election scales inversely with the square of the diluted margin μ [19]:

$$n \approx \frac{-2 \ln \alpha}{\mu^2}$$

Diluted Margin (μ\muμ)	Expected Sample Size (Ballots at α=0.05\alpha = 0.05α=0.05)	Operational Feasibility and Field Burden
20.0%	~35	Easily achieved; completed by two workers in minutes.
10.0%	~140	Low burden; completed within two hours by a single precinct team.
5.0%	~560	Modest burden; standard afternoon municipal audit[18].
2.0%	~3,500	Substantial administrative effort; requires multi-team coordination[18].
0.5%	~56,000	Inefficient; statistically triggers a full 100% manual recount[21].

When multiple contests are recorded on a single ballot card across varied jurisdictional

boundaries, Stark's SHANGRLA (Sets of Half-Average Nulls Generate Risk-Limiting Audits, 2020) framework demonstrates that using card-style data (CSD) reduces the audit workload by factors of six to ten, preserving verification efficiency without compromising statistical rigor[17].

Rung	Operating Status	Institutional Breakdown Dynamics
Household (4–10)	Never tried / Irrelevant	Sample sizes exceed group size; direct manual hand counting of all items takes seconds.
Hamlet or Band (30–50)	Never tried	Complete 100% manual counts of physical tokens render statistical sampling unnecessary.
Village (150–500)	Never tried	Manual hand-counting of 300 paper ballots takes less than an hour; sampling offers no operational advantage over complete enumeration.
Parish or District (1,500–5,000)	Worked	Feasible for hand-tabulated paper precincts; an audit sample of 100–200 ballots provides statistical certainty for clear races.
Town or Watershed (15,000–50,000)	Worked	Ideal operational scale for ballot-polling or comparison RLAs; avoids expensive full recounts in wide-margin races.
Region or Bioregion (0.5M–5M)	Worked historically	State-level deployment (e.g., Colorado since 2017) proves RLAs can audit

		thousands of machines efficiently using modest central teams[21].
Nation (50M–500M)	Worked conditionally	Feasible if decentralized across autonomous sub-units; hindered if national ballot design and custody standards are fragmented.
Planet (8B)	Never tried	Collapses due to lack of a unified physical ballot infrastructure, universal manifests, and standardized custody chains.

Capture Test: Risk-Limiting Audits

A dark-triad actor captures an RLA regime by manipulating the ballot manifest or compromising the physical chain of custody before the sample is drawn. If physical ballots can be substituted, added, or stolen, the audit sample will draw from a tainted pool, providing statistical confidence in a fraudulent baseline[18].

This dynamic was illustrated in early twentieth-century American municipal elections, where corrupt precinct captains tampered with ballot boxes stored in unlocked basements before recount challenges were heard.

The structural defenses that prevent this capture are:

- Creating a public, cryptographically or mechanically hashed ballot manifest before the random seed is generated, fixing the total ballot population[19].
- Generating the random audit seed publicly using physical dice rolls (such as 10-sided dice rolled in front of observers).
- Storing all voted ballots in containers secured with numbered, tamper-evident seals signed by multi-party observers, backed by around-the-clock physical custody logs.

Digital Vulnerabilities: Estonia's I-Voting Architecture

Estonia has used nationwide internet voting (i-voting) since 2005, relying on mandatory national identity cards with cryptographic microchips and two-factor PIN codes[23]. Proponents claimed that client-side encryption and server-side digital signature verification made paper audit trails obsolete[23].

This model was scrutinized in an independent academic security audit conducted by Drew Springall, Travis Finkenauer, Zakir Durumeric, Jason Kitcat, Harri Hursti, Margaret MacAlpine, and J. Alex Halderman (*Proceedings of the 21st ACM Conference on Computer and*

Communications Security, CCS 2014)[23].
The research team observed real operations during the October 2013 local elections and May 2014 European Parliament elections, while reproducing the entire client and server infrastructure in a laboratory setting[23]. Their work revealed structural vulnerabilities across both software and administrative operations:

- **Client-Side Exploitation ("Ghost Click Attack"):** Voter personal computers are unmanaged, vulnerable endpoints routinely infected with commodity malware[23]. The researchers built proof-of-concept malware that ran in user space, sniffed the voter's identity PIN, and silently cast an encrypted ballot for an attacker-selected candidate while displaying a fraudulent confirmation screen to the voter[23]. Subsequent additions, such as smartphone QR-code verification, were shown to be vulnerable as desktop and mobile platforms converge[27].
- **Server-Side Infiltration and Compilation Poisoning:** Official videos of Estonian backend setup revealed weak operational security[23]. Tabulation software was configured using unencrypted downloads over public networks, administrative passwords were typed in view of cameras, and unencrypted system backups were transported on consumer USB drives in personal backpacks[23]. The Halderman team showed that a hostile intelligence service or dishonest insider could inject a modified ISO image during server compilation[23]. This exploit could alter votes inside memory after digital signatures were stripped for anonymity, altering the tally while leaving no physical paper trail to reveal the fraud[23].

Halderman's findings demonstrated a core principle of electoral security: *digital systems are opaque by default*. Without an independent, human-readable physical audit trail, voters cannot verify whether their ballots were correctly recorded and counted[20].

Plutocracy and Structural Exploitation in On-Chain DAO Governance

Proponents of blockchain technology claimed that public distributed ledgers and smart contracts could replace fallible human bureaucracies with incorruptible on-chain governance. Decentralized Autonomous Organizations (DAOs) deployed token-weighted voting systems, wherein voting power is directly proportional to the number of governance tokens held by an address.
This architecture explicitly re-instituted plutocratic governance, where political influence is tied to capital ownership ($1 \text{ token} = 1 \text{ vote}$). This design introduced a fatal structural vulnerability: the *flash loan*.
A flash loan is an uncollateralized smart contract borrow transaction where an actor borrows millions in capital from decentralized liquidity pools (such as Aave or Uniswap), executes arbitrary logic across multiple platforms, and repays the full balance within a single atomic execution block. If the loan cannot be settled within that identical block, the entire transaction reverts, leaving the borrower with no capital at risk.
This vulnerability was demonstrated on April 17, 2022, during the exploit of Beanstalk Farms, an algorithmic credit protocol governed on-chain[29]. An attacker borrowed:

- 350 million DAI

- 500 million USDC
- 150 million USDT
- 32 million BEAN

Using these borrowed funds, the attacker acquired a temporary 78% supermajority of Beanstalk governance tokens (Stalk)[31].

The attacker immediately approved two malicious governance proposals (BIP-18 and BIP-19), which had been submitted a day earlier[32]. The code directed the protocol's entire asset reserve to a private wallet under the guise of an emergency donation to a Ukrainian relief fund[29]. Because the attacker controlled more than two-thirds of the voting power, they invoked the protocol's emergencyCommit() function, executing the code immediately, draining $181 million from the treasury, repaying the flash loan in the same transaction block, and securing $76 million in net profit in under thirteen seconds[29].

The Beanstalk exploit demonstrates the systemic hazards of paperless, financialized governance:

- It completely divorces voting rights from long-term residency, community membership, or moral responsibility.
- It enables a psychopathic or predatory actor to assemble overwhelming decision power instantaneously, liquidate collective wealth, and exit the jurisdiction before institutional friction can mount a defense.

Tripartite Reality of Digital and On-Chain Governance

- **What the arrangement's own people said it did:** Developers and proponents asserted that i-voting and DAOs remove corrupt gatekeepers, eliminate administrative friction, enable direct participation from anywhere, and automate governance through trustless cryptographic consensus[24].
- **What the record shows it did:** Nation-state i-voting introduced invisible systemic vulnerabilities to foreign state cyber-espionage[23], while on-chain DAO governance produced low participation (typically under 3%), concentrated power among venture capital whales, and suffered catastrophic flash-loan looting[29].
- **What modern scholarship infers:** Fully digital and on-chain governance systems suffer from the "abstraction fallacy." By removing the physical friction of material paperwork, in-person verification, and local presence, they make political systems fragile and vulnerable to rapid financial or cryptographic capture.

The Strongest Case Against: Leading Critics of Electronic and Digital Voting

The systematic critique of electronic voting is led by computer scientists and cryptographers such as J. Alex Halderman (University of Michigan)[23], Ronald Rivest (MIT, co-inventor of RSA cryptography), Matt Blaze (Georgetown University), and Bruce Schneier (Harvard Kennedy School). Rivest and Blaze co-authored foundational studies demonstrating that software independence is a prerequisite for secure voting: an election system is software-independent only if an undetected change or error in its software cannot cause an undetected change in the election outcome.

Because fully electronic systems (whether DRE machines, internet portals, or smart contracts) lack software independence, they can never be secured against determined insiders or nation-state attackers. Schneier established that securing internet voting is fundamentally harder than securing online banking: banking systems accept billions in annual fraud losses as an operational cost and rely on public financial identities to undo fraudulent transactions, whereas democratic elections require absolute secret balloting, meaning fraudulent votes cannot be cleanly identified or reversed after the fact.

Rung	Operating Status	Institutional Breakdown Dynamics
Household (4–10)	Never tried / Absurd	Extreme technical overhead; using cryptographic ledgers among family members introduces friction with zero benefit.
Hamlet or Band (30–50)	Never tried	High capital requirements; introduces external technocrats into simple interpersonal governance.
Village (150–500)	Failed	Destroys local social trust; creates dependence on outside software engineers and proprietary equipment.
Parish or District (1,500–5,000)	Failed	Opaque to ordinary residents; vulnerable to technical manipulation with no mechanism for local manual auditing.
Town or Watershed (15,000–50,000)	Failed	Excludes non-technical citizens; eliminates verifiable physical chain of custody.
Region or Bioregion	Failed / Insecure	Vulnerable to state-level

(0.5M–5M)		cyber-warfare, insider software supply chain poisoning, and administrative compromise[23].
Nation (50M–500M)	Failed / Insecure	Implemented in Estonia; peer-reviewed research proves ongoing vulnerability to undetected state manipulation[23].
Planet (8B)	Failed	Global on-chain governance degenerates into extreme capital plutocracy and rapid flash-loan looting[29].

Capture Test: Digital and On-Chain Voting

A dark-triad actor captures digital or on-chain governance by acquiring temporary capital majorities or injecting malicious code into the compilation pipeline.

Historically, this occurred during the Beanstalk Farms hack on April 17, 2022, where the attacker used uncollateralized flash loans to gain 78% of the governance tokens, passed emergency proposals, and drained $181 million from the protocol[29].

The structural features that resisted or mitigated digital capture were:

- Abandoning paperless voting in favor of voter-verifiable paper ballots with statistical manual audits[17].
- Enforcing multi-week time-locks on smart-contract governance proposals, allowing participants to exit before execution.
- Implementing human-in-the-loop multi-signature councils composed of known, legally accountable community trustees.

Historical Record-Keeping in Self-Governing and Extractive Polities

To understand how communities maintained operational continuity, settled tenure disputes, and resisted external predation without modern communications, we examine five historical record-keeping arrangements across deep time.

English Manor and Parish Rolls: Tenurial Memory and Customary Conflict

From the late twelfth century through the early modern period, the English rural manor functioned through the manorial court (*curia domini*), operating either as a court baron

(regulating customary tenant obligations) or a court leet (exercising view of frankpledge and criminal peace-keeping)[34].
The lord's appointed steward presided, but the active inquest was formed by a jury of customary tenants (*homagium*)[34].
All transactions—land transfers, inheritance (*heriot* payments), agricultural boundary disputes, entry fines, and admissions of copyhold—were inscribed onto long strips of sheepskin vellum, stitched head-to-tail to form a court roll[34].
Landholders held acreage "by copy of court roll" (copyhold tenure)[34]. The tenant was handed an official parchment extract of the roll entry by the steward, which served as their title against peers[34].
The social reality of the manor roll was an ongoing struggle over the definition of custom. Manorial lords attempted to use rolls to document servile extraction, fix high entry fines, and register customary labor obligations (*corvée*). Peasants, however, used the identical rolls to prove that their customary rents were fixed "time out of mind," effectively capping the lord's rental extractions during inflationary periods[36].
When the Black Death (1348–1349) killed between a third and a half of the English agrarian labor force, lords attempted to use manorial records to enforce statutory wage ceilings and bind mobile laborers to unfree tenures[35].
The tension erupted in the Peasants' Revolt of June 1381, led by Wat Tyler, John Ball, and Jack Straw[37]. The rebel bands did not merely attack the persons of their lords; they systematically targeted the archives[38].
At the Temple in London, at the abbey of St Albans, and at Bury St Edmunds, the insurgents broke into monastic and royal treasuries, dragged court rolls into town squares, and burned them publicly[36]. The chronicler Thomas Walsingham recorded that the rebels intended to eradicate all written records of their servile status, believing that once the parchment was destroyed, no lord could prove that a tenant was a villein rather than a freeman[36].

Tripartite Reality of English Manor Rolls

- **What the arrangement's own people said it did:** Manorial stewards claimed the rolls preserved the ancient customs of the manor, prevented land theft, and recorded the legitimate will of the lord's court.
- **What the record shows it did:** The rolls systematically recorded feudal extractions, enforced unfree status, documented fines for marrying without the lord's license (*merchet*), and restricted peasant mobility[35].
- **What modern scholarship infers:** As shown by Christopher Dyer (*Everyday Life in Medieval England*, 1994), manorial rolls were a double-edged sword. While designed as instruments of feudal extraction, they were co-opted by customary tenants to establish secure property rights that gradually evolved into modern freeholds.

The Strongest Case Against: Rodney Hilton and Feudal Class Domination

The Marxist medieval historian Rodney Hilton (*Bond Men Made Free*, 1973) argued that manorial rolls were the documentary machinery of class oppression. Hilton contended that any

institutional stability credited to court rolls was an illusion created by the lord's legal monopoly. The rolls recorded customary law only after it had been filtered through the lord's steward, who held absolute authority to accept or reject tenant jury presentments. The burning of the court rolls in 1381 demonstrated that rural producers viewed the written archive not as a neutral register of rights, but as a coercive technology that enforced unfree labor and legal subjection[38].

Rung	Operating Status	Institutional Breakdown Dynamics
Household (4–10)	Never tried / Dysfunctional	Not applicable to intra-household decisions.
Hamlet or Band (30–50)	Never tried	Hamlet disputes were settled orally or absorbed into the wider manorial court.
Village (150–500)	Worked historically	The fundamental operational unit of the English manor; balanced tenant homage juries against the lord's steward[34].
Parish or District (1,500–5,000)	Worked historically	Coordinated through hundred courts and estate honorial courts; resolved inter-manor boundaries.
Town or Watershed (15,000–50,000)	Failed	Manorial rolls were unsuited for fluid commercial transactions, giving way to borough charters and merchant courts.
Region or Bioregion (0.5M–5M)	Failed	Decentralized manorial courts were too fragmented to provide uniform regional administration without royal

		courts.
Nation (50M–500M)	Never tried	National governance required central royal registries (Chancery, Exchequer, King's Bench) rather than localized manorial rolls[40].
Planet (8B)	Never tried	Not applicable.

Capture Test: English Manor Rolls

A predatory lord or steward captured manorial rolls by intimidating the tenant homage jury, fabricating past rental obligations, and unilaterally increasing entry fines when tenants died. This occurred during the fourteenth-century post-plague labor shortages, when monastic manors (such as St Albans Abbey) altered their records to re-impose forgotten labor dues on freeholders[36].

The primary mechanisms of resistance were:

- Peasant strikes and refusing to pay fines.
- Securing authenticated physical copies of the court rolls to present before royal courts.
- The physical destruction of the archives, as carried out during the 1381 rebellion[38].

Guild Books and Wardens' Accounts

In medieval and early modern European cities, craft and merchant guilds operated as self-governing brotherhoods that regulated commerce, certified master artisans, and maintained mutual aid systems.

Their administration centered on *wardens' accounts* and *ordinance books*. These documents recorded admission fees, apprenticeship indentures, fines levied for defective work, membership dues (*quarterages*), and welfare payments made to sick artisans or widows.

Tripartite Reality of Guild Records

- **What the arrangement's own people said it did:** Guild ordinances stated that their books maintained high craftsmanship, protected consumers from fraud, maintained fair prices, and supported brotherly charity among members.
- **What the record shows it did:** Guild books tracked high entry fees designed to exclude outsiders, detailed strict production limits, recorded price cartels, and documented fines levied against unlicensed female and rural competitors.
- **What modern scholarship infers:** In *The European Guilds: An Economic Analysis* (2019), Sheilagh Ogilvie demonstrated that guilds were rent-seeking distributional coalitions. Guild books served primarily to defend occupational monopolies, transfer wealth from consumers to masters, and slow technological innovation to protect incumbent producers.

The Strongest Case Against: Sheilagh Ogilvie and the Monopolistic

Capture Critique

Ogilvie's comprehensive quantitative analysis refuted the romantic view that guilds were open communities of mutual aid and craftsmanship.

Drawing on archival records from across Europe, Ogilvie demonstrated that guild records were designed to protect insiders:

- Guilds used their legal charters and books to exclude women, religious minorities, and poor laborers from skilled trades.
- Masters used their account books to exploit apprentices and journeymen, keeping wages low while preventing them from opening independent workshops.
- Guild regulations penalized innovative techniques (such as new weaving looms or improved dye processes) to shield established masters from competition.

The internal paperwork of the guild was a tool for managing an extractive economic monopoly.

Rung	**Operating Status**	**Institutional Breakdown Dynamics**
Household (4–10)	Never tried / Dysfunctional	Not applicable.
Hamlet or Band (30–50)	Never tried	Too small to support division-of-labor craft guilds.
Village (150–500)	Failed	Village crafts were too small to sustain formal guilds; attempts to enforce guild monopolies in rural hamlets were rejected.
Parish or District (1,500–5,000)	Worked conditionally	Worked in specialized market towns; often came into conflict with surrounding rural cottage industries.
Town or Watershed (15,000–50,000)	Worked historically	The optimal operating scale for late medieval guild governance; successfully regulated urban markets and civic finances.
Region or Bioregion	Failed	Regional federations of

(0.5M–5M)		guilds degenerated into protectionist trade wars between rival chartered cities.
Nation (50M–500M)	Failed / Abolished	Guild systems were dismantled across Europe during the eighteenth and nineteenth centuries to allow national free trade.
Planet (8B)	Never tried	Not applicable.

Capture Test: Guild Records

A predatory clique of wealthy masters captured guild administration by raising admission fees, limiting masterships to their sons, and altering guild books to criminalize new production methods.

This occurred across sixteenth-century German and English craft guilds, where senior wardens turned guilds into closed family oligarchies.

The mechanisms that resisted this capture were:

- Revolts and unauthorized walkouts by journeymen's associations (*compagnonnages*).
- The growth of unregulated cottage industries in rural areas outside the legal jurisdiction of city charters.
- The intervention of sovereign authorities who dissolved guild monopolies to stimulate broader trade.

The Dutch Water Boards (*Waterschappen*)

Beginning in the twelfth century, the low-lying provinces of the Netherlands faced constant threats from river floods and North Sea storm surges. Survival required complex, continuous hydrological engineering. The result was the *waterschap* (or *hoogheemraadschap*), the world's oldest surviving specialized self-governing regional authority. Chartered institutions such as the Hoogheemraadschap van Rijnland (established in 1255 by Count William II of Holland) organized autonomous self-governance around drainage basins and dike networks.

The core administrative documents of the water board were the *schouwregister* (inspection register) and the *dijkboek* (dike book). The *schouwregister* divided every meter of a protective embankment, drainage canal, and sluice gate into discrete physical sections, mapped to specific landholders proportional to the acreage of low-lying land they owned within the polder basin.

Twice a year, during the *schouw* (inspection), the Dike-reeve (*dijkgraaf*) and councilors (*hoogheemraden*) rode along the dikes, comparing the physical height, slope, turf integrity, and ditch depth of each section against the recorded obligations in the *schouwregister*.

If a landholder failed to maintain their sector, the Dike-reeve executed the ancient sanction of *spike-striking* (*spade-steken*): a wooden spade was driven into the neglected dike crest. If the owner did not make immediate repairs, any neighbor who pulled the spade and performed the physical labor assumed full legal freehold ownership of the delinquent's underlying lands, dispossessing the negligent party permanently.
The Dutch water registers linked record-keeping directly to collective physical survival: honest bookkeeping was enforced by the shared threat of drowning.

Tripartite Reality of the Dutch *Waterschappen*

- **What the arrangement's own people said it did:** Water board charters claimed that all who held land in the polder were equal partners in the common defense against the sea, united by shared duties and mutual protection.
- **What the record shows it did:** Large landholders dominated the governing councils, shifting maintenance burdens to small peasant freeholders and expropriating properties when poor tenants defaulted on maintenance duties during storm seasons.
- **What modern scholarship infers:** As analyzed by Jonathan Israel (*The Dutch Republic*, 1995) and contemporary institutional economists, the *waterschappen* served as the training ground for Dutch democratic federalism. However, they were essentially elite-managed corporations where voting power was tied strictly to land acreage, combining technical competence with oligarchic control.

The Strongest Case Against: The Oligarchic Inequity of Polder Corporatism

The primary structural critique of the historical *waterschappen* is that they were not democratic commons, but rural capitalist corporations that burdened the poorest landholders. Historians of Dutch water governance, such as Petra van Dam, show that when catastrophic storms destroyed dikes, the costs of reconstruction fell heavily on smallholders who lacked capital reserves. Wealthy urban merchants and noble regents used the strict forfeiture rules of the *schouwregister* to seize the lands of impoverished peasants, steadily consolidating polder acreage into fewer hands.

Rung	Operating Status	Institutional Breakdown Dynamics
Household (4–10)	Never tried / Dysfunctional	Not applicable; single households cannot maintain drainage networks alone.
Hamlet or Band (30–50)	Failed	Small hamlets lacked the capital and engineering labor required to build sea-defense dikes.

Village (150–500)	Worked historically	Villages successfully managed local polders (*ringdijken*), but could not resolve conflicts with downstream settlements without a higher authority.
Parish or District (1,500–5,000)	Worked historically	The optimal scale for local drainage districts; coordinated ditch maintenance and local sluices.
Town or Watershed (15,000–50,000)	Worked historically	The natural domain of the *Hoogheemraadschappen*; integrated towns and rural districts into unified watershed governance.
Region or Bioregion (0.5M–5M)	Worked historically	Coordinated the national water line (*Waterlinie*) and massive reclamation projects (Zuiderzee) across centuries.
Nation (50M–500M)	Worked historically	Integrated into modern national ministries (Rijkswaterstaat) without abandoning regional board autonomy.
Planet (8B)	Never tried	Hydrological basin management is tied to regional watersheds and cannot be centralized at a planetary level.

Capture Test: Dutch Water Boards

A dark-triad actor captured a water board by acquiring vast tracts of polder land, taking over

the office of Dike-reeve, and selectively manipulating the *schouwregister* to impose maintenance burdens on rival properties while neglecting their own.
This occurred in seventeenth-century Holland during private land reclamation projects, where powerful city regents altered drainage plans to flood peasant common pastures while protecting their private estates.
The features that resisted this capture were:

- The shared reality of flood vulnerability: if an corrupt Dike-reeve allowed dikes to weaken, their own estates would drown alongside the rest of the polder.
- Public inspections (*schouw*) carried out in full view of assembled landholders.
- Independent appellate oversight provided by the provincial assemblies (the Estates of Holland).

The Inca *Quipu* (*Khipu*) and Imperial Auditing

The Inca Empire (*Tawantinsuyu*, 1438–1532) organized administrative control across 4,000 kilometers of Andean mountain terrain encompassing over ten million people entirely without an alphabetic writing script. Instead, they engineered an administrative database constructed from dyed, spun, and plied camelid and cotton fibers: the *quipu* (*khipu*).
As deciphered by Gary Urton (*Signs of the Inka Khipu*, 2003) and Frank Salomon (*The Cord Keepers*, 2004)[42], the *khipu* was a three-dimensional recording medium:

- It utilized a base-ten positional decimal system.
- Values were designated by three classes of knots: simple single overhead knots for tens, hundreds, and thousands; long knots with multiple twists indicating digits 2 through 9 in the units position; and figure-eight knots representing a value of 1.
- The cords used color classifications (e.g., undyed brown llama fleece for herds, white cotton for clothing, yellow for maize harvests), fiber spin and ply directions (S-twist versus Z-twist), and pendant attachment angles to encode qualitative categorical data[43].

This information was maintained by a specialized class of administrative accountants: the *khipukamayuq* (knot-keeper).
In every Andean community, two to four *khipukamayuq* operated independently, recording census data, storehouse (*qollqa*) inventories, tributary labor (*mit'a*) quotas, and agricultural yields[44].
To prevent corruption, the Inca state deployed itinerant imperial inspectors: the *tukuyrikuq* ("he who sees all"). The *tukuyrikuq* arrived unannounced, demanded the local *khipus*, and conducted spot-audits against the warehouse contents and field counts[44].
If discrepancies revealed embezzlement or false reporting, the responsible *khipukamayuq* faced immediate execution.
Frank Salomon (2004) and Sabine Hyland (*Latin American Research Review*, 2022) proved that the *khipu* was not exclusively an imperial command technology[43].
Centuries after the fall of the Inca state, Andean mountain communities, such as San Cristóbal de Rapaz and San Pedro de Casta, continued to manufacture and utilize communal *khipus* and *khipu boards* (*entablos*) to audit village corvée labor, water distribution, and church repairs, preserving community autonomy against Spanish colonial landlords[43].

Tripartite Reality of Inca *Khipu* Administration

- **What the arrangement's own people said it did:** Imperial Inca ideology stated that the *khipu* allowed the Sapa Inca to ensure that no subject starved, that storehouses were filled to relieve famine, and that labor duties were distributed equitably among all lineages (*ayllus*).
- **What the record shows it did:** The *khipu* was a centralized extraction database that recorded the relocation of rebellious populations (*mitmaquna*), tracked forced corvée labor on imperial road networks, and indexed agrarian surplus for the imperial military.
- **What modern scholarship infers:** The *khipu* was a flexible, multi-layered recording medium capable of operating simultaneously as a centralized imperial accounting tool and as a local communal ledger that sustained horizontal Andean mutual-aid systems.

The Strongest Case Against: The Authoritarian Fragility of Monopolized Knowledge

The structural weakness of the imperial *khipu* system lay in its vulnerability to elite capture and centralized collapse. Anthropologists note that *khipu* literacy was an esoteric skill restricted to state specialists and hereditary local elites. When Spanish conquistadors under Francisco Pizarro executed the Inca leadership, looted the provincial warehouses, and banned the cords as pagan artifacts, the centralized recording network collapsed rapidly.
Because ordinary farmers could neither read nor tie complex administrative *khipus*, they could not deploy the system to maintain wider inter-valley cooperation, leaving local communities fragmented and exposed to colonial exploitation.

Rung	Operating Status	Institutional Breakdown Dynamics
Household (4–10)	Never tried / Dysfunctional	Not applicable.
Hamlet or Band (30–50)	Worked historically	Used in local pastoral hamlets to track llama herds and rotational grazing duties.
Village (150–500)	Worked historically	The optimal scale for communal *khipus*; managed village irrigation rotation and church duties across centuries[43].
Parish or District (1,500–5,000)	Worked historically	The standard operational scale for the imperial *pachaka* (100 households) and *waranga* (1,000

		households) administrative tiers.
Town or Watershed (15,000–50,000)	Worked historically	Coordinated entire Andean valleys; audited provincial storehouses (*qollqas*) and labor brigades.
Region or Bioregion (0.5M–5M)	Worked historically	Used across the four imperial quarters (*suyus*); integrated provincial registries through courier runners (*chaskis*).
Nation or Continent (50M–500M)	Worked historically	Maintained administrative continuity across the 4,000-kilometer expanse of Tawantinsuyu.
Planet (8B)	Never tried	Not applicable.

Capture Test: Inca *Khipu* Administration

A dark-triad actor captured a *khipu* regime by forming an alliance between local *khipukamayuq* accountants and the visiting *tukuyrikuq* inspector to falsify census returns, conceal agricultural surplus, and extort unrecorded labor from local lineages.

Historically, this occurred following the Spanish Conquest, when native Andean kurakas (hereditary chiefs) used *khipu* registers to hide tributary livestock and laborers from Spanish encomenderos while extracting extra surplus for their private households.

The features that resisted this capture were:

- The employment of multiple, independent *khipukamayuq* per village who were required to cross-check each other's cords[44].
- The surviving communal practice of public *khipu* display, where cords were unrolled in open assemblies (*entablos*) so villagers could confirm whether their labor days had been accurately recorded[43].

The 1086 Domesday Survey as an Extractive Capture Instrument

The compilation of the Domesday Book in 1086 under William the Conqueror represents one of the most comprehensive, centralized administrative audits ever imposed on a conquered territory. Following the 1066 Norman Conquest, William faced external military threats from Scandinavia and internal rebellions. To maximize tax extraction (*Danegeld*) and formalize the redistribution of conquered lands among his Norman barons, William ordered an exhaustive administrative inquest across his realm at the Gloucester midwinter court of 1085[45].

The Crown dispatched circuit commissioners (including figures like Remigius, Bishop of Lincoln) to every shire in England[45].
The inquest operated through sworn inquisitions: in every hundred court, the commissioners convened a mixed jury consisting of twelve men—six Normans and six native Anglo-Saxons[46].
The jury answered an unbending fifteen-point questionnaire for every estate:

- Who held the manor in the time of King Edward the Confessor (1066)?
- Who holds it now (1086)?
- How many hides of land are there?
- How many plow teams are on the lord's demesne, and how many belong to the tenants?
- How many villeins, cottars, slaves, and freemen live on the estate?
- How much woodland, meadow, and pasture exists?
- How many mills and fisheries?
- What was the economic value in 1066, when granted, and what is its value today?
- Could more value be extracted from the land than is currently being drawn?

The resulting survey, compiled into Great Domesday and Little Domesday, documented a complete transfer of wealth.
Prior to 1066, approximately 4,000 Anglo-Saxon thegns held the land of England. By 1086, the Domesday Book recorded that over 85% of English land had been confiscated and concentrated into the hands of just 180 Norman tenants-in-chief, with King William personally holding 20% in royal demesne.
Anglo-Saxons survived almost entirely as unfree, sub-tenurial peasants.
Richard Fitznigel, Royal Treasurer and Bishop of London, recorded the impact of the survey in his *Dialogus de Scaccario* (c. 1179)[40]:

> "This book is called by the natives 'Domesday', that is, by metaphor, the Day of Judgment. For just as the sentence of that strict and terrible last trial cannot be evaded by any skillful subterfuge, so when a dispute arises in the realm concerning the facts recorded in this book, appeal is made to it, and its sentence cannot be quashed or set aside with impunity."[40]

Domesday demonstrates the mechanics of administrative capture: an invasive, centralized fiscal audit deployed by a conqueror to freeze land tenure, eliminate customary flexibilities, extract maximum taxation, and strip native populations of self-governing capacity.

Tripartite Reality of the Domesday Survey

- **What the arrangement's own people said it did:** Norman royal apologists claimed the survey brought legal order, recorded ancient rights from the reign of King Edward the Confessor, and provided a clear basis for royal peace and equitable taxation.
- **What the record shows it did:** The survey formalized the expropriation of Anglo-Saxon landholders, established a high tax baseline, and bound the native population into an unfree feudal framework[46].
- **What modern scholarship infers:** Modern historians, such as David C. Douglas (*William the Conqueror*, 1964), view Domesday as an administrative achievement that centralized power in the Crown, preventing England from fragmenting into autonomous feudal principalities.

The Strongest Case Against: The Totalitarian Extraction Critique

The classic critique of the Domesday survey is preserved in the contemporary *Anglo-Saxon Chronicle* (entry for 1085). The native chronicler recorded the shame, anger, and devastation felt across the land:

> "So very narrowly did he cause the survey to be made, that there was not a single hide nor a yard of land, nor—it is shameful to relate, though he thought it no shame to do it—was there an ox, or a cow, or a pig, which was not set down in his writing."

The primary case against Domesday is that it operated as an instrument of total administrative surveillance. It eradicated traditional communal flexibilities, destroyed the fluid compromises of Anglo-Saxon customary law, and concentrated military and economic power in an alien elite.

Rung	Operating Status	Institutional Breakdown Dynamics
Household (4–10)	Never tried / Dysfunctional	Not applicable.
Hamlet or Band (30–50)	Never tried	Hamlets were treated as minor components within manorial surveys.
Village (150–500)	Worked historically	The basic unit of data collection; villages were audited and assessed for tax yields.
Parish or District (1,500–5,000)	Worked historically	Operates through the Hundred court juries that provided sworn testimony for the survey[46].
Town or Watershed (15,000–50,000)	Worked historically	Audited urban boroughs, markets, and regional river tolls.
Region or Bioregion (0.5M–5M)	Worked historically	Organized across regional shires and circuits led by royal commissioners[45].
Nation (50M–500M)	Worked historically	Applied across England (approximately 1.5 million

		people in 1086); provided the blueprint for centralized fiscal administration.
Planet (8B)	Never tried	Not applicable.

Capture Test: The Domesday Survey

A dark-triad actor captures a community through a Domesday-style audit by exploiting administrative expertise and state power to map, inventory, and legally seize local assets. Historically, this occurred in 1086 when Norman commissioners used sworn local inquests to discover assets hidden by native populations, re-allocating them to the conqueror's military followers[45].

The primary historical resistance strategies were:

- Passive under-reporting and collusion among local jurors to conceal livestock and woodland resources.
- Peasant rebellions and the burning of royal records.
- Fleeing the audited lowlands for inaccessible bogs, forests, and upland peripheries.

Physical Security, Tamper-Evidence, and Archival Preservation

In the absence of industrial supply chains and digital backups, communities must rely on physical, human-readable records. A record is administratively useless if it can be forged by a local despot, altered by a corrupt clerk, or destroyed by dampness, rodents, or fire. Deep-time administrative history provides four proven technologies of physical document security.

Split Tally Sticks (*Tallia Split*)

The medieval English Exchequer and European merchant markets relied extensively on the split tally stick to record debts, tax payments, and contracts, operating as a durable technology of bilateral verification.

As recorded by Richard Fitznigel in *Dialogus de Scaccario* (1179), a hazelwood rod (seasoned, dry, straight, approximately 8 to 9 inches long and the thickness of a thumb) was smoothed into a four-sided shaft[40].

Notches were carved across the edge to represent numerical monetary denominations[40]:

- £1,000 was cut as wide as the hand is broad[40].
- £100 was the breadth of a thumb[40].
- £20 was the breadth of the little finger[40].
- £1 was the width of a swollen kernel of barley[40].
- 1 shilling was a smaller incision[40].
- 1 penny was a mere slit cut perpendicular to the wood with no material removed[40].

Once notched, a short diagonal relief incision was made approximately two to three inches from the base[47]. The shaft was then split longitudinally down its center through the notches,

dividing the wood along its natural grain into two unequal pieces[40]:

1. **The Stock (*stipes*):** The longer piece, retaining the wooden handle and the diagonal projection, given to the payer as an unalterable receipt[40].
2. **The Foil (*folium*):** The shorter piece, kept by the Exchequer or creditor in the treasury[40].

The split tally was nearly unforgeable. Hazelwood possesses irregular, complex grain lines.
To prove payment or settle an account, the two pieces were brought together (*they "tallied"*)[47].
If an actor attempted to carve additional notches onto their stock to falsely claim a higher payment, the new cuts would not match the foil retained in the treasury[40].
If someone carved an entirely fraudulent hazel stick, it was impossible to match the three-dimensional, fibrous cleft of the original split[47].
In 1297, a debtor named William de Boochose attempted to pocket 60 shillings cash by carving matching fraudulent notches onto an existing five-mark tally stick; upon presentation at the Exchequer, the mismatch was instantly detected, and he was sentenced to prison for a year and a day[40]. The tally system was simple, cheap, operational for illiterate citizens, and remained in official use by the British Treasury until 1826[40].

Chirographs and Indentures

For written parchment agreements, medieval chirographs provided tamper-evident, pre-image resistance. Two or more identical copies of a legal conveyance, boundary treaty, or financial lease were written on a single sheet of vellum, separated by a blank middle space[43]. Across this intermediate space, the scribe wrote the word *CHIROGRAPHUM* in large capital letters.
The vellum was then cut in two using an irregular, wavy (*undulated*), or sharply zig-zagged (*indented*) pattern right through the text of the word *CHIROGRAPHUM*.
Each party took one half (an *indenture*).
If a party later forged or modified the text on their half of the vellum, the physical fraud was revealed by holding the two halves together. If the teeth of the parchment cut did not mesh along the unique, microscopic grain of the skin, the document was rejected by the court.

The Three-Lock Parish Chest: Physical Multi-Signature Custody

On September 5, 1538, Thomas Cromwell, Vicar-General to Henry VIII, issued an official Royal Injunction to the clergy of England[50]: every parish priest was required to maintain a weekly written register of all baptisms, marriages, and burials performed in the parish[51]. Because local communities immediately suspected that this register was a new scheme to impose taxes on life transitions, resistance was widespread[50].
To secure the register against unilateral alteration, extortion, or destruction, the Crown mandated physical multi-signature custody[51].
The Injunction required the parish to provide:

> "one sure coffer with two locks and keys, whereof the one to remain with you [the parson], and the other with the wardens"[50].

In 1597, under Queen Elizabeth I, the Convocation of Canterbury elevated this standard, demanding that registers be transcribed from perishable paper onto durable vellum parchment, and that the parish coffer be upgraded[51].
This was formally codified into ecclesiastical law under the Church of England's **Canon 70 of**

1603[51]:

> "The register-book shall be kept in one sure coffer with three locks and keys; whereof the one to remain with the minister, and the other two with the churchwardens, severally; so that neither minister without the two churchwardens, nor the churchwardens without the minister, shall at any time take that book out of the coffer."[50]

Canon 70 established a functional 3-of-3 physical threshold system[51]:

- The minister was an appointed cleric, representing ecclesiastical authority.
- The two churchwardens were laymen, independently elected by the parish vestry to represent the property-holding parishioners.
- The chest could only be opened when all three individuals gathered in the church vestry[51].
- Under the law, the book had to be opened every Sunday after service in the open presence of the churchwardens, the new vital entries written down, and the book locked back inside the chest[50].

Furthermore, to create off-site redundancy against fire, Canon 70 required that once every year, within one month of Easter, the wardens transmit a certified transcript of all entries across the preceding twelve months to the Bishop's Diocesan Registry (the "Bishop's Transcripts")[51]. If the village parish chest was destroyed by fire, the diocesan archive preserved the redundant backup[51].

Substrates and Inks: Surviving Fire, Moisture, and Wear

Long-term non-industrial record durability depends on the chemical composition of the substrate and the ink:

Material Medium	Chemical Mechanism	Alteration & Erasure Resistance	Vulnerabilities & Preservation Mitigation
Parchment / Vellum (Animal skin)	Collagen fiber matrix prepared from limed, scraped, dried sheep, goat, or calf dermis.	Extreme. Mechanical scraping (*palimpsest*) thins the dermis, leaving visible textural scars[54].	Vulnerable to damp, mold, and rodents. Store in dry, lime-washed chests elevated off stone floors[55].
100% Linen / Rag Paper (Pre-1850)	Long cellulose fibers derived from beaten linen and cotton rags; sized with gelatin.	High. Ink penetrates deep into the rag matrix; scraping tears the fiber surface.	Resilient across centuries if dry; rots if subjected to prolonged flooding. Store in ventilated

			boxes.
Modern Wood-Pulp Paper (Post-1850)	Short cellulose fibers bound with acidic lignin sizing; rapid chemical decay.	Low. Easily bleached or erased; leaves little fiber evidence.	Highly acidic; yellows and crumbles within 50 to 100 years. Unsuitable for long-term records.
Iron Gall Ink	Ferrous sulfate ($FeSO_4$) reacting with gallotannic acid from oak galls, bound with gum arabic[54].	Maximum. Acid burns into collagen fibers; cannot be washed off with water[54].	Acid excess can slowly corrode paper over centuries; highly durable against moisture and fading[54].
Carbon / India Ink	Fine carbon soot suspended in water with animal glue or gum arabic binder.	Moderate. Sits on the substrate surface without burning; can be scraped or washed away.	Chemically inert; will never fade under sunlight, but can smudge if exposed to water.

Historical surveys of English parish registers showed that when chests were made of unpainted iron or stored in damp crypts, documentary losses were severe: dampness accounted for 42% of destroyed registers, fire caused 42%, and theft or negligence caused 16%[55].
Parchment inscribed with iron gall ink and stored in elevated, iron-reinforced wooden chests in dry, ventilated environments demonstrated the highest survival rates over centuries[51].

Minimum Viable Record Architecture for Post-Collapse Governance

When industrial supply chains fail and state reach disappears, human communities must self-govern at the local territorial scale. Re-establishing administrative order requires an operational toolkit scaled to local capacity.
Attempting to run an elaborate bureaucracy consumes scarce calories and empowers rent-seeking clerks. Conversely, relying entirely on unwritten oral custom invites boundary conflicts, arbitrary dispossessions, and capture by local predatory actors.
A post-collapse community requires a minimum viable paperwork system designed to operate without electricity, silicon, or industrial chemical factories.

The Post-Collapse Village of 300 (Approximately 50–70 Households)

A community of 300 people sits at the upper threshold of Dunbar's number for mutual familiarity. At this scale, daily social pressure operates effectively, but inter-household property boundaries, agricultural resource distribution, and long-term debts require objective documentation.
The village requires exactly **four active operational record books**:

Register Name	Physical Medium	Content & Granularity	Custody & Access Rules
1. Land Cadaster & Commons Roll	Bound vellum or rag-paper codex.	Identifies all arable strips, pasture stints (head of livestock allowed on the commons), woodlot cutting rights, and irrigation allocations.	Held in the village three-lock chest; read aloud annually at the spring planting assembly; boundaries walked on Ascension Day ("beating the bounds").
2. Village Assembly Minute Book	Bound rag-paper codex.	Records all formal assembly decisions, adopted ordinances, fines levied, communal grain distributions, and elections of village officers.	Maintained by the elected village clerk; entries signed at each weekly assembly by the reeve and two elected elders.
3. Barter & Labor Tally Roll	Bound ledger paired with hazelwood tallies.	Bilateral debts, communal seed loans, and performed corvée workdays (road repair, defensive palisade labor).	Bilateral balances kept on physical split tallies[40]; ledger totals updated quarterly in public meetings; universal right of inspection.
4. Roll of Inhabitants & Membership	Bound parchment codex.	Vital records (births, marriages, deaths) and formal admissions of outside refugees to	Confirms civic rights, access to the commons, and voting eligibility; updated weekly

		village membership.	after communal gatherings.

Custody, Reading Rights, and Security Protocols (Village Scale)

- **Custody (3-of-3 Threshold System):** The four village registers are bound in durable covers and stored in a solid oak chest reinforced with forged iron straps. The chest is secured by three distinct padlocks requiring three unique keys. Key 1 is held by the elected village clerk; Key 2 is held by the village reeve or magistrate; Key 3 is held by a senior elder elected annually by the assembly. The chest cannot be unlocked by any single individual or pair.
- **Reading and Audit Rights:** Every adult resident has the unconditional right to access the records, *exercised exclusively during daylight hours in the open presence of all three keyholders*. Any resident has the legal right to demand that an entry concerning their land, debts, or family status be read aloud to them.
- **Physical Protection:** The chest is elevated eighteen inches off the stone floor on wooden feet inside the village's driest stone building (such as a church tower or central hall) to protect against rising damp and rodents. Inscriptions are made using iron gall ink on parchment or linen rag paper. The use of modern wood-pulp paper or water-soluble carbon inks is prohibited.

The Post-Collapse District of 3,000 (Approximately 8–12 Villages / 500–700 Households)

A district of 3,000 people covers an entire trading valley or watershed. At this scale, personal familiarity breaks down; conflicts between neighboring villages over watercourses, mill access, timber rights, and road maintenance become inevitable.

The district requires **four macro-level records**:

Register Name	Physical Medium	Content & Granularity	Custody & Access Rules
1. Cadaster of Inter-Village Bounds & Water Treaties	Vellum chirographs and boundary maps.	Delineates village boundaries, river diversions, mill-race allocations, and mutual grazing corridors.	Written as bilateral indented chirographs; held jointly by the involved village reeves and the district archive.
2. District Infrastructure Maintenance Roll	Bound rag-paper ledger.	Allocates linear rods of district roads, bridges, and defensive ditches	Inspected bi-annually by district commissioners;

		to specific villages, modeled on the Dutch *waterschap*.	failures result in public fines or loss of road transit tolls.
3. Appellate Court & Inquest Minutes	Bound vellum codex.	Records major dispute adjudications, appellate rulings, homicide settlements (*weregild* equivalents), and treaties.	Maintained by the district judicial clerk; open to inspection by village delegations during bi-annual court sessions.
4. Redundant Archival Register (Off-Site Backup)	Bound vellum codex.	Contains certified annual copies of every village's vital records and land cadasters.	Delivered every spring by village clerks to the central district masonry keep; provides disaster recovery in case of village fire.

Custody, Reading Rights, and Security Protocols (District Scale)

- **Custody:** Stored in a central stone vault or monastery keep secured by three heavy iron locks. Key 1 is held by the District Bailiff; Key 2 is held by the rotating Chair of the Council of Village Reeves; Key 3 is held by the Keeper of the District Archives.
- **Inspection:** Village reeves, legal representatives, and private citizens involved in appellate litigation possess statutory rights to inspect district rolls upon formal petition during regular court sessions.
- **Disaster Redundancy:** The district archive serves as the redundant backup repository for its constituent villages. Once per year, on the first Sunday after Easter (adopting the structural precedent of Elizabethan Canon 70), each village clerk delivers an accurate transcript of all new entries to the district archive, ensuring that local village records can be reconstructed following catastrophic fires.

Robust Findings

1. Writing functions as an administrative multiplier, detaching authority from personal presence and creating scribal power monopolies.
2. Inscription serves a dual purpose: it enables fiscal extraction from above while providing actionable legal rights from below.
3. The Australian secret ballot (1856) broke vote-buying markets by making compliance

unverifiable, reducing corrupt turnout by 7–12%[3].

4. Open voting (*Landsgemeinde*) generates steep social costs, depressing turnout below 10% and biasing attendance toward elite demographics[13].
5. John Stuart Mill's defense of open voting underestimates how economic leverage corrupts public voting in unequal societies[1].
6. Honest voting systems require physical, human-readable paper audit trails; paperless systems are structurally unverifiable[17].
7. Stark's Risk-Limiting Audits (RLAs) mathematically confirm paper outcomes, requiring sample sizes that scale with margins rather than populations[18].
8. Fully digital voting (Estonian i-voting) and plutocratic token voting (DAOs) remain vulnerable to malware, insiders, and capital exploits[23].
9. Split tallies and three-lock chests provide unforgeable record authentication using low-technology physical materials[40].
10. Post-collapse governance requires four basic ledgers: land, minutes, accounts, and citizenship, secured by multi-party physical custody[51].

Contested or Open Questions

1. **The Democratic Scale Limit of Open Voice:** What is the precise population threshold where direct assembly acclamation shifts from empowering local community cohesion to enforcing coercive social conformity?
2. **Public Auditability versus Statistical Complexity:** Can Risk-Limiting Audits (RLAs) maintain public trust if ordinary citizens cannot calculate non-parametric probability bounds themselves[18]?
3. **Low-Tech Ballot Secrecy in Small Settlements:** In a post-collapse village of 300 where handwriting, phrasing, and personal habits are widely known, can genuine ballot secrecy be achieved without uniform printed paper?
4. **Codification versus Customary Flexibility:** Does writing down common grazing and foraging rights protect them from external seizure, or does it crystallize communal custom into rigid boundaries that facilitate private enclosure?
5. **Long-Term Redundancy Without State Institutions:** Can independent villages sustain voluntary, mutual document redundancy over centuries without an external ecclesiastical or imperial authority enforcing compliance?

Sources to Read in Full

- **Goody, Jack (1986). *The Logic of Writing and the Organization of Society*. Cambridge: Cambridge University Press.**
  Examines how writing technologies restructured religion, law, statecraft, and economic trade, showing that administrative bureaucracy is an outgrowth of the physical written list.
- **Scott, James C. (1998). *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*. New Haven: Yale University Press.**
  Details how states deploy cadastral surveys, metric standardization, and permanent surnames to extract taxes, and how local populations systematically preserve illegibility

to protect autonomy.
- Aidt, Toke S., and Peter Sandholt Jensen (2017). "From Open to Secret Ballot: Vote Buying and Modernization." *Comparative Political Studies*, 50(5), 555–593[7].
  Econometric study evaluating the Australian ballot, demonstrating that the secret ballot caused a collapse in turnout by destroying clientelist vote markets[3].
- Mill, John Stuart (1861). *Considerations on Representative Government*. London: Parker, Son, and Bourn (specifically Chapter X, "Of the Mode of Voting")[2].
  The primary philosophical articulation of the open ballot, arguing that voting is a moral public trust that degenerates into selfish whim when shielded by absolute secrecy[1].
- Schaub, Hans-Peter, and Charlotte Rochat (2025). "Assembly Democracy Between Social Selectivity and Equality: Participation in the Swiss Landsgemeinde." *Swiss Political Science Review*, 31(1), 1–24[13].
  Empirical analysis documenting the demographic skew of open assembly voting, proving that public voting systematically discourages turnout among women, the poor, and less-educated strata[13].
- Stark, Philip B. (2010). "Super-Simple Simultaneous Single-Ballot Risk-Limiting Audits." *EVT/WOTE '10: Proceedings of the 2010 Electronic Voting Technology Workshop / Workshop on Trustworthy Elections*, USENIX[18].
  Lays out the mathematical foundations and operational procedures for using random ballot sampling to verify election outcomes with high statistical confidence[18].
- Springall, Drew, Travis Finkenauer, Zakir Durumeric, Jason Kitcat, Harri Hursti, Margaret MacAlpine, and J. Alex Halderman (2014). "Security Analysis of the Estonian Internet Voting System." *Proceedings of the 21st ACM Conference on Computer and Communications Security (CCS '14)*, 703–715[23].
  Peer-reviewed security audit proving that national electronic voting can be compromised through client malware, insider server poisoning, and procedural vulnerabilities[23].
- Salomon, Frank (2004). *The Cord Keepers: Khipus and Cultural Life in a Peruvian Village*. Durham: Duke University Press[42].
  Ethnographic study demonstrating how knotted-cord databases functioned not only as imperial Inca administrative tools but as durable, egalitarian community-level records across centuries of colonial rule[43].
- Fitznigel, Richard (c. 1179). *Dialogus de Scaccario* (*The Course of the Exchequer*). Edited and translated by Charles Johnson. Oxford: Clarendon Press, 1983[41].
  Primary source from the Royal Treasurer of England detailing the operational mechanics of split tally sticks, Exchequer auditing, and the fiscal finality of the Domesday Book[40].

Implementability after the Fall

Re-establishing administrative order without electricity, fuel distribution, or state authorities requires an operational toolkit scaled to local capacity.

The Minimum Viable Architecture Across Three Tiers

- **The Household (4 to 10 People):** Requires no internal written paperwork. Domestic

cooperation relies on daily voice communication, shared meals, and direct visibility. The household holds physical stock tallies received from the village storehouse for deposited grain, and keeps an indenture copy of its land allocation[40]. Lineage records (births, deaths, kin bonds) are inscribed inside the family Bible or sewn into a leather scroll.

- **The Village of 300 People (50 to 70 Households):** Governed by an open assembly paired with the four physical registers: Land Cadaster, Assembly Minutes, Barter & Labor Tally Roll, and Roll of Inhabitants. Voting is conducted using physical tokens: uniform white and black dried beans or clay balls dropped into a light-tight wooden box to preserve secrecy while avoiding the need for paper printing. Paper records are stored in a three-lock oak chest held by three separate keyholders (Clerk, Reeve, Elder)[51].
- **The District of 3,000 People (8 to 12 Villages):** Coordinated through a Council of Village Reeves meeting quarterly at a fortified stone site. The district maintains the four macro ledgers: Inter-Village Boundary Treaties (written as indented vellum chirographs), Infrastructure Maintenance Rolls (modeled on the Dutch *schouwregister*), Appellate Court Records, and the Redundant Archival Register. It houses the annual backup copies of each village's registers to ensure continuity after fires[51].

Initial Prerequisites: What Must Exist on Day One

- **Functional Literacy and Numeracy:** A minimum of three literate, numerate individuals within the settlement. If general literacy is low, the village uses physical split hazelwood tallies for economic transactions, reserving written parchment solely for boundary maps and assembly ordinances[40].
- **The Shared Calendar:** A predictable solar and lunar calendar synchronized to seasonal solstices and equinoxes. Governance breaks down if a community cannot coordinate the dates of weekly markets, Sunday public audits, seasonal planting meetings, and annual boundary inspections.
- **The Protected Meeting Ground:** A weather-resistant, defensible, neutral gathering place—such as a stone church nave, an intact masonry hall, or a covered timber barn—capable of holding all adult villagers within direct sight and earshot.
- **Material Writing Supplies:** A local supply of durable writing materials. The community must prepare iron gall ink (brewed from crushed oak marble galls, iron scrap, and fermented vinegar) and scrape animal skins into vellum[54]. Where skins are scarce, hazelwood tallies must be cut and seasoned[40].

The First Failure to Expect

The initial breakdown across all post-collapse governance occurs at the **custody bottleneck of the clerk**.

In the absence of broad literacy and institutional checks, the scribe or record-keeper becomes an indispensable administrative gatekeeper.

A Machiavellian or narcissistic individual who controls the ledger discovers that they can:

1. Slowly alter boundary descriptions,
2. Embezzle common grain allocations by manipulating credit balances, or
3. Demand private fees to record transactions.

Because the non-literate majority cannot inspect the text directly, they defer to the clerk's

reading.
To prevent this capture, the village must enforce **mandatory public oral recitations**: all entries made by the clerk during the week must be read aloud before the assembled community every Sunday after worship or council, in the presence of the other two keyholders[50].
Any detected discrepancy between the verbal agreement and the written text must result in immediate removal, loss of office, and forfeiture of the clerk's land allotment.

Principles

1. A political agreement that is not inscribed onto an enduring physical medium degrades into an ongoing negotiation determined by the immediate distribution of physical force.
2. An administrative record that can be opened, altered, or destroyed by a single person will eventually be exploited by that person for private gain[50].
3. Increasing the physical friction and number of independent actors required to modify a record reduces administrative corruption[51].
4. Total transparency in the act of casting a vote allows economic and social superiors to intimidate dependent voters[1].
5. Complete secrecy in the casting of a vote breaks transactional vote-buying by making compliance unverifiable to the buyer[3].
6. Open assembly voting systematically reduces voter turnout and biases participation toward older, wealthier, and socially dominant demographics[13].
7. Voting mechanisms that lack a physical, human-readable paper trail cannot be independently verified and remain vulnerable to capture[17].
8. Post-election audit workload is determined by the victory margin rather than the total population size[18].
9. Decoupling voting power from permanent community residency allows mobile capital to capture and liquidate communal assets[29].
10. Scribes and record-keepers will turn literacy monopolies into political power unless checked by mandatory public oral audits[50].
11. Cadastral simplification conducted by an external authority operates to maximize extraction rather than preserve local commons.
12. Distributed physical duplicates stored in separate geographical locations are the only reliable defense against the loss of legal memory through fire[51].

Works cited

1. Voting Before the Secret Ballot | History Today, https://www.historytoday.com/archive/feature/voting-secret-ballot
2. SECRET VOTING AND POLITICAL EMOTIONS JM Barbalet, https://mobilization.kglmeridian.com/downloadpdf/view/journals/maiq/7/2/article-p129.pdf
3. From Open to Secret Ballot: Vote Buying and Modernization, https://www.repository.cam.ac.uk/bitstreams/b017c730-7473-49a2-9a85-a65f7e78e1ac/download

4. Made in America: a social history of American culture and character, https://dokumen.pub/made-in-america-a-social-history-of-american-culture-and-character-9780226251431-0226251438.html
5. Usability: low tech, high security - Université Paris Cité, http://theses.md.univ-paris-diderot.fr/BLANCHARD_Enka_1_va_20190621.pdf
6. Media, Secret Ballot, and Democratization in the US*, https://www.juanfeliperiano.com/papers/media.pdf
7. From open to secret ballot: Vote buying and modernization, https://portal.findresearcher.sdu.dk/en/publications/from-open-to-secret-ballot-vote-buying-and-modernization/
8. From Open to Secret Ballot: Vote Buying and Modernization, https://www.researchgate.net/publication/228462871_From_Open_to_Secret_Ballot_Vote_Buying_and_Modernization
9. Public Voting and Political Modernization (Chapter 1), https://www.cambridge.org/core/books/secrecy-and-publicity-in-votes-and-debates/public-voting-and-political-modernization/F3CC2CABDE5B4AC04EE4263C3D39039E
10. Right to Universal, Plural and Secret Vote: On the Lib - UNIS, https://unis.kastamonu.edu.tr/yayin-detay/2_E3KqCG_46/right-to-universal-plural-and-secret-vote-on-the-liberal-and-conservative-paradoxes-of-mills-elitist-democracy/pdf=1
11. John Stuart Mill and Political Reform - OpenEdition Journals, https://journals.openedition.org/etudes-benthamiennes/6014?lang=en
12. George Grote - Spartacus Educational, https://spartacus-educational.com/George_Grote.htm
13. Assembly democracy between social selectivity and equality, https://boris-portal.unibe.ch/bitstreams/829e2073-a414-4dfc-92db-528bac353bde/download
14. Assembly democracy between social selectivity and equality, https://s3.eu-central-1.amazonaws.com/ext-linst-c5-web-liechtenstein-institut.li-2019/9517/6355/1969/Schaub_Rochat_SPSR_2025_Assembly_democracy_between_social_selectivity_and_equality.pdf
15. Die Stimmbeteiligung an der Glarner Landsgemeinde - LeGes, https://leges.weblaw.ch/it/legesissues/2018/1/die-stimmbeteiligung_caa45bdd0d.html
16. Politische Teilnahme im Kanton Glarus, https://www.gl.ch/public/upload/assets/36314/Beteiligungsanalyse.pdf
17. card-style data decrease risk-limiting audit sample sizes, https://www.researchgate.net/publication/346701921_More_style_less_work_card-style_data_decrease_risk-limiting_audit_sample_sizes
18. A Gentle Introduction to Risk-Limiting Audits | NIST, https://www.nist.gov/document/gentle-introduction-risk-limiting-audits
19. Tools for Comparison Risk-Limiting Election Audits, https://www.stat.berkeley.edu/~stark/Vote/auditTools.htm
20. Risk-Limiting Audits for Parliamentary Majorities - arXiv,

https://arxiv.org/pdf/2607.21082
21. Risk-Limiting Audits – Practical Application Jerome Lovato, https://www.eac.gov/sites/default/files/eac_assets/1/6/Risk-Limiting_Audits_-_Practical_Application_Jerome_Lovato.pdf
22. Super-Simple Simultaneous Single-Ballot Risk-Limiting Audits, https://www.usenix.org/legacy/event/evtwote10/tech/full_papers/Stark.pdf
23. Security Analysis of the Estonian Internet Voting System, https://verifiedvoting.org/wp-content/uploads/2020/07/Estonia_2014_IVotingReport.pdf
24. Identifying and Solving a Vulnerability in the Estonian Internet Voting, https://www.researchgate.net/publication/387357819_Identifying_and_Solving_a_Vulnerability_in_the_Estonian_Internet_Voting_Process_Subverting_Ballot_Integrity_Without_Detection
25. Research Paper - Independent Report on E-voting in Estonia, https://estoniaevoting.org/findings/paper/
26. Authentication with weaker trust assumptions for voting systems - 2018, https://orbilu.uni.lu/handle/10993/35917
27. Security Analysis of the Estonian Internet Voting System, https://jhalderm.com/pub/papers/ivoting-ccs14.pdf
28. card-style data decrease risk-limiting audit sample sizes - arXiv, https://arxiv.org/html/2012.03371v1
29. Explained: The Beanstalk Hack (April 2022), https://www.halborn.com/blog/post/explained-the-beanstalk-hack-april-2022
30. Revisiting Beanstalk Farms Exploit - CertiK, https://www.certik.com/blog/revisiting-beanstalk-farms-exploit
31. They Didn't Break In. They Got Elected. - daily.dev, https://daily.dev/posts/they-didn-t-break-in-they-got-elected--klhxc35dg
32. Governance Attack - Cyfrin Glossary, https://www.cyfrin.io/glossary/governance-attack
33. Governance Attacks in Smart Contracts - Firepan, https://firepan.com/vulnerabilities/governance-attack/
34. Full text of "The manor and manorial records" - Internet Archive, https://archive.org/stream/manormanorialre00hone/manormanorialre00hone_djvu.txt
35. Great Burstead - The blog of the Essex Record Office, http://www.essexrecordofficeblog.co.uk/tag/great-burstead/
36. Church and city (Part III) - Popular Protest in Late Medieval English, https://www.cambridge.org/core/books/popular-protest-in-late-medieval-english-towns/church-and-city/6589990056A77B3BF1E0862D216406D0
37. The setting (Part I) - Popular Protest in Late Medieval English Towns, https://www.cambridge.org/core/books/popular-protest-in-late-medieval-english-towns/setting/D01CA54D814DE1838290A98F065BEC40
38. Why did the Peasants' Revolt happen? What did the attempt to, https://theroseoflondon.substack.com/p/why-did-the-peasants-revolt-happen
39. 1381: The Year of the Peasants' Revolt [Illustrated] 9780674368149,

https://dokumen.pub/1381-the-year-of-the-peasants-revolt-illustrated-9780674368149-0674368142.html
40. Tally Sticks: Historical Significance | PDF | Hm Treasury | Debt - Scribd, https://www.scribd.com/document/824432602/Numbers-Through-the-Ages-Graham-Flegg-eds-Z-Library-Compressed-14
41. Exchequer - Wikipedia, https://en.wikipedia.org/wiki/Exchequer
42. Ramos, Gabriela - Yannakakis, Yanna - Indigenous Intellectuals, https://www.scribd.com/document/410031716/Ramos-Gabriela-Yannakakis-Yanna-Indigenous-Intellectuals-knowledge-power-and-colonial-culture-in-Mexico-and-the-Andes-Duke-University-Press
43. (PDF) Khipus, Khipu Boards, and Sacred Texts: Toward a Philology, https://www.researchgate.net/publication/352412780_Khipus_Khipu_Boards_and_Sacred_Texts_Toward_a_Philology_of_Andean_Knotted_Cords
44. Khipus, Khipu Boards, and Sacred Texts: Toward a Philology of, https://www.cambridge.org/core/journals/latin-american-research-review/article/khipus-khipu-boards-and-sacred-texts-toward-a-philology-of-andean-knotted-cords/61B91DF0E21873EFE260B7B61A1B8AF9
45. A Scholar and His Saints. Examining the Art of Hagiographical, https://library.oapen.org/bitstream/handle/20.500.12657/103760/9783961473519.pdf?sequence=8&isAllowed=y
46. Rulership and Rebellion in the Anglo-Norman World, c.1066-c.1216, https://dokumen.pub/rulership-and-rebellion-in-the-anglo-norman-world-c1066-c1216-essays-in-honour-of-professor-edmund-king-1472413733-9781472413734.html
47. Early accounting: The Tally and checkerboard - eGrove, https://egrove.olemiss.edu/cgi/viewcontent.cgi?article=1335&context=aah_journal
48. How Tally Sticks Worked in England's Exchequer - Relatable History, https://relatablehistory.com/tally-stick-exchequer-system-history/
49. LIVING THE HISTORY: Tallying it all up. - Elizabeth Chadwick, http://livingthehistoryelizabethchadwick.blogspot.com/2011/04/tallying-it-all-up.html
50. The Earliest Parish Registers of the Diocese of Canterbury, https://www.kentarchaeology.org.uk/journal/135/earliest-parish-registers-diocese-canterbury-some-observations-questions-and
51. History of Parish Registers in England - FamilySearch, https://www.familysearch.org/en/wiki/History_of_Parish_Registers_in_England
52. The parish registers of England, https://archive.org/download/cu31924029579657/cu31924029579657.pdf
53. HISTORY OF PARISH REGISTER IN ENGLAND, https://www.exploreyourgenealogy.co.uk/history-of-parish-register-in-england-844
54. Secrets of Historical Spycraft Techniques | PDF | Espionage - Scribd, https://www.scribd.com/document/930815737/2024-Spycraft-NAkkerman-PLangman
55. Parochial Records Bill HI - Hansard - UK Parliament,

https://hansard.parliament.uk/Lords%E2%80%8F/1976-02-19/debates/201c85ed-441a-4349-ae5a-e55aa3d0a7a7/ParochialRecordsBillHl
56. Scientific examination of questioned documents 9780849320446, 0, https://dokumen.pub/scientific-examination-of-questioned-documents-9780849320446-0-8493-2044-5.html