

The Republic of Entrepreneurs: A Global History of Discovery, Diffusion, and Growth

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Abstract

We propose a historical political-economy of the republic of entrepreneurs: a civic order where open entry, impersonal law, price signals, and lawful imitation convert dispersed conjectures into growth. Grounded in the Mises–Hayek–Kirzner view (monetary calculation, dispersed knowledge, entrepreneurial discovery) and spanning cases from antiquity to Industry 4.0, we show prosperity tracks proposal density, feedback speed, and diffusion breadth—not elite R&D alone. Reframing Schumpeter, sustained enrichment is chiefly creative accumulation under general rules. Policy follows: protect the commons of discovery—general rules, interoperable standards, contestable markets, and IP that teaches and expires.

Keywords: republic of entrepreneurs; entrepreneurial discovery; dispersed knowledge; monetary calculation; creative accumulation; diffusion; open standards; lawful imitation; Industrial Enlightenment; grassroots innovation; institutions and rule of law; contestable markets.

JEL codes: L26; O31; O33; O43; B53; N10; E32; D83.

1 Introduction

This paper advances a historical political economy of what we call the republic of entrepreneurs: a constitutional order in which many people, under general and impersonal rules, are free to propose better ways of doing things, to be tested by prices, peer criticism, and adoption, and to be copied when they are right. Our central claim is theoretical and historical. Theoretically, the republic of entrepreneurs is the market-process vision developed by Mises, Hayek, and Kirzner: entrepreneurship is a role, not a rank; competition is a discovery procedure; and monetary calculation—made possible by private ownership and freely formed prices—supplies the indispensable test of plans (Mises 1949; Hayek 1945, 1978; Kirzner 1973, 1979, 1985). Historically, prosperity has surged where this republican constitution intertwined with two adjacent republics—letters and science—so that ideas moved through open correspondence and journals, were validated by self-governed inquiry, and were translated by enterprising citizens into routines that scale (Polanyi 1962; Mokyr 2002, 2016; Goodman 1994; Grafton 2009).

Our framework reframes, and in places disputes, the Schumpeterian trope that seats innovation mainly in heroic founders, corporate laboratories, or “creative destruction” clustered in long waves (Schumpeter 1934, 1939, 1942). We do not deny discontinuities; we insist that the modal engine of enrichment is creative accumulation through diffusion and complement discovery, powered by thick proposal density at the margin and lawful imitation that socializes gains (Rosenberg 1982; David 1990; Bresnahan and Trajtenberg 1995). The republican lens dissolves the binary of “market vs. state” and replaces it with a constitutional contrast: general rules, open standards, and contestable rents versus privilege, discretion, and chokepoints. The former multiplies entrepreneurs; the latter thins them.

The paper’s historical reach is broad because the phenomenon is. Following the long arc assembled in *The Invention of Enterprise* (Landes, Mokyr, and Baumol 2010) and the comparative institutional literatures (North and Thomas 1973; North 1990; North, Wallis, and Weingast 2009; Acemoglu, Johnson, and Robinson 2001, 2002; Acemoglu and Robinson 2012), we read episodes from ancient Mesopotamia to today’s digital platforms as repeated experiments in building or breaking the republic. We consider merchant-entrepreneurs of the Near East; Athenian contracts and Roman commercial law; the Islamic Golden Age’s markets in instruments and texts; Song China’s commercialization under exam-and-guild constraints; the Italian city-states’ letters–science–enterprise braid; the Dutch Republic’s open finance and print; Britain’s Industrial Enlightenment; the United States’ liberal patent regime and associational life; France’s learned societies and prize systems; Germany’s lab–workshop fusion; Meiji Japan’s adaptation; the East Asian “flying geese”; post-1978 China’s township experimentation; and contemporary sectors from logistics and containerization to biomedicine, software and open source, and fintech (Jacob 1997; Hounshell 1984; Levinson 2006; Bliss 1982; Bud 2007; Jeffrey 2001; Khan 2005, 2020; Uglow 2002). Across places and centuries, the regularity is striking: where open entry, lawful imitation, credible contract, and public methods coexist, useful knowledge becomes useful industry at scale (Mokyr 2002; McCloskey 2010, 2016; Phelps 2013, 2020).

The theoretical core we adopt is Mises–Hayek–Kirzner. First, entrepreneurship is pervasive because all purposive action faces uncertainty; the entrepreneur is the promoter who advances a plan, appraises future input/output prices, and accepts the residual validated by profit or loss (Mises 1949, ch. XV §§8–10; ch. XVIII §5). Second, prices are not parameters but messages: competition elicits local knowledge and reveals error; rivalry disciplines claims about methods and products (Hayek 1945, 1978). Third, alertness is the micro-mechanism by which widely dispersed actors notice misalignments and recombine known parts into new bundles (Kirzner 1973, 1979). This process view sits comfortably with the historical evidence on “micro-inventions,” adoption, and organizational complements (Mokyr 1990, 2002; Rosenberg 1982), and with cultural accounts that explain why proposal rates rose when rhetoric dignified commerce and tinkering (McCloskey 2006, 2010, 2016) and when values favored self-expression and novelty (Phelps 2013, 2020). It also clarifies why monopoly “havens” are neither

necessary nor sufficient for discovery: shelter dulls the very feedback devices—prices, entry, reputations—that the republic relies on, whereas open standards and priority rules buy disclosure while preserving contestability (Abbe 1899; Feldenkirchen 1994; Khan 2020).

Anchoring the introduction in this triad yields three contributions. First, we integrate theory and history into a single grammar: Mises’s monetary calculation as the logical precondition; Hayek’s discovery procedure as the coordinating device; Kirzner’s alertness as the behavioral engine; Mokyr’s Industrial Enlightenment and the Republic of Letters/Science as the epistemic infrastructure; McCloskey’s bourgeois dignity as the cultural permission; and Phelps’s grass-roots innovation as the experiential and statistical reality. Second, we recast measurement. Instead of treating “innovation” as frontier patents or R&D headcounts, we propose visible proxies for the republic itself: proposal density (new product/process introductions per worker), feedback speed (lead times, defect-discovery cycles, iteration cadence), and diffusion breadth (standard adoption, interfirm quality spillovers). These measures align with process accounts of GPTs, where social returns arrive only after long tails of complement discovery (David 1990; Bresnahan and Trajtenberg 1995). Third, we discipline policy. The upshot is not industrial targeting but constitutional architecture: rule-of-law for strangers; interoperable interfaces; IP that teaches and expires; contestable procurement; and publication norms that reward priority yet normalize imitation (Hayek 1960; Polanyi 1962; Khan 2020).

Recentered on the republic of entrepreneurs, the familiar story of modern growth changes emphasis. The Great Enrichment appears less as a parade of solitary breakthroughs and more as the cumulative outcome of many small bets by many hands, made thinkable by dignity and law, rendered legible by science and letters, and disciplined by prices and reputation. To study that republic comparatively—across eras, countries, and sectors—is to see how prosperity is built, preserved, and sometimes lost.

2 A republican framework grounded in Mises–Hayek–Kirzner, enriched by Landes, North, and Acemoglu et al.

Our starting point remains Mises: entrepreneurship is a role performed whenever someone advances a plan under uncertainty, appraises future prices of inputs and outputs, and accepts residual gain or loss. That role is only coherent inside a regime of monetary calculation—private ownership of producer goods and freely formed money prices—because only commensurable prices let actors compare opportunity costs and submit plans to a profit–loss test (Mises 1949, chs. XV, XVIII, XX). Hayek adds the epistemic logic: markets are discovery procedures that mobilize radically dispersed, often tacit knowledge; rivalry and entry are not mere allocative frictions but the very means by which better combinations are found and errors revealed quickly (Hayek 1945, 1978). Kirzner

supplies the micro-mechanism—alertness to previously unnoticed incongruities in prices, qualities, and places—and explains why the entrepreneurial act is episodic and widely distributed across founders, buyers, foremen, clinicians, coders, and shopkeepers (Kirzner 1973, 1979, 1985, 1989). A republic of entrepreneurs is therefore a constitutional order that (i) keeps proposal costs low, (ii) makes tests general and impersonal, and (iii) socializes private discovery through lawful imitation and diffusion.

Landes, North, and Acemoglu et al. deepen and operationalize this republican core. North’s institutional economics clarifies that calculability and discovery depend on impersonal, open-access rules: secure and alienable property, credible contract, permissionless organization, and political constraints that keep third-party force predictable (North 1990; North and Weingast 1989; North, Wallis, and Weingast 2009). In limited-access orders, privileges throttle entry, dull price signals, and convert entrepreneurship into rent seeking; in open-access orders, impersonal rights widen the set of alert actors and intensify Hayekian feedback. Landes provides the material and cultural scaffolding that makes republican entrepreneurship work in practice: precision standards, time discipline, metrology, uniform thread and gauge systems, reliable power and transport, technical education, and reputational circuits (Landes 1969/2003; 1983/2000; 1998). These “mundane” infrastructures lower proposal costs, shorten learning cycles, and make improvements legible and imitable across ranks—exactly the conditions under which Kirznerian alertness flourishes and Misesian profit–loss reallocates capital toward better appraisers.

Acemoglu and coauthors supply the political economy of why such orders are rare and fragile. Their inclusive–extractive distinction formalizes the idea that elites often block creative destruction to protect rents; inclusive institutions—broad property rights, rule of law, entry, and political constraints—raise the expected return to proposing and the credibility of the test, while extractive arrangements tax away or outlaw the very acts that discovery requires (Acemoglu, Johnson, and Robinson 2001, 2002, 2005; Acemoglu and Robinson 2012). In our language, inclusive institutions enlarge the proposal set and strengthen the filters (prices, reputations, law) that turn proposals into validated routines; extractive rules shrink the proposal set and weaken the filters by politicizing payoffs and insulating error. Acemoglu’s “political losers from creative destruction” result also predicts where republican entrepreneurship will ebb: whenever policy raises the private return to lobbying above the private return to learning, alertness spills into rent seeking rather than opportunity discovery.

Braiding these strands yields a concrete schema. First, letters and science are not decorative; they are institutions that expand the searchable design space and lower the cost of broadcasting methods. The republic of letters—cheap print, epistolary networks, voluntary societies—multiplies conjectures and extends visibility beyond the firm (Goodman 1994; Grafton 2009; Waquet 2017). The republic of science—priority rules, peer criticism, reproducibility—creates a public domain of propositional knowledge and instruments that raises ex ante success probabilities for entrepreneurs (Polanyi 1962; Zilsel 1942). Landes’s narratives show how metrology, timekeeping, and precision engineering linked these

republics to shop practice (Landes 1983/2000; 1969/2003). When such cultural–institutional reservoirs sit inside North’s open-access law and Acemoglu’s inclusive polity, Mises–Hayek–Kirzner mechanisms scale: proposal density rises (more alert actors), feedback accelerates (tougher rivalry, interoperable standards), and diffusion broadens (lawful imitation, IP that teaches and expires) (Khan 2005, 2020; Hounshell 1984; Levinson 2006; Benkler 2006).

Second, this synthesis disciplines common policy temptations. Schumpeterian “monopoly havens” are neither necessary nor sufficient for discovery. In Hayekian terms, discretionary shelter blunts error revelation and fences off complements; in North’s terms, it re-introduces personal privilege; in Acemoglu’s terms, it invites blocking coalitions that tax future entrants; in Landes’s terms, it erodes the incentives to maintain standards and measurement that make diffusion cheap. Conversely, interoperable standards, contestable procurement, and disclosure-oriented, expiring IP enhance both proposal density and diffusion breadth by creating thick markets for complements—precisely the ecosystem we observe in the American “market for technology,” German lab–workshop fusion, Japanese lean production, and modern open-source software (Hounshell 1984; Feldenkirchen 1994; Ohno 1988; Womack, Jones, and Roos 1990; Raymond 1999).

Third, the synthesis refines macro interpretation. The flow of entrepreneurial conjectures is near continuous in healthy republics; cyclical amplitude often reflects money–credit regimes that distort relative prices and intertemporal signals, thereby misdirecting alertness and producing clustered error (Mises 1949; Hayek 1976; Friedman and Schwartz 1963). North’s credibility constraints, Landes’s time discipline and standardization, and Acemoglu’s checks on rent extraction together sharpen monetary and legal signals, increasing the share of proposals that survive the profit–loss test and speeding reallocation when they do not.

Finally, the framework travels across time and place. Landes’s long arc—from early modern precision and timekeeping through nineteenth-century standardization and twentieth-century mass production—maps the infrastructures that make republican entrepreneurship cumulative (Landes 1969/2003; 1983/2000). North’s transition from limited- to open-access orders explains why the Dutch Republic, Britain, and the United States sustained high proposal density while polities locked in personal privilege did not (North 1990; North, Wallis, and Weingast 2009). Acemoglu’s critical-juncture logic and inclusive-institution criterion account for divergences among latecomers and for reversals when political coalitions succeed in blocking diffusion (Acemoglu and Robinson 2012). Woven back into Mises–Hayek–Kirzner, these contributions give our “republic of entrepreneurs” both microfoundations (alertness under calculability and rivalry) and macro-institutional conditions (impersonal rights, standards, and constraints) that we can observe, measure, and compare across the historical record.

This is the template we apply in the pages that follow. For each era and region, we ask: How thick were the republics of letters and science? How open were property, contract, and organizational rights? How disciplined were stan-

dards, time, and measurement? How contestable were rents and how disclosure-oriented was IP? And how clean were the price and credit signals that validated or falsified conjectures? Where the answers are favorable, we should observe high proposal density, fast feedback, and broad diffusion—i.e., a functioning republic of entrepreneurs. Where they are not, we expect thin, slow, parochial discovery, and a drift from entrepreneurship toward privilege.

3 Ancient and classical precursors of a republic of entrepreneurs

A historical account that takes the “republic of entrepreneurs” seriously must begin long before the Industrial Enlightenment. The Mises–Hayek–Kirzner template—residual-bearing judgment under calculability, rivalry as a discovery device, and alertness diffusing through lawful imitation—does not require steam, patents, or laboratories. It requires minimally: tradable property, commensurable prices, venues where proposals can be tested and reputations travel, and cultural scripts that do not stigmatize useful novelty. In antiquity these ingredients appeared only in shards, yet where they co-located, we observe unmistakable surges of enterprise, transmission, and scaling.

The cuneiform economies of Bronze-Age Mesopotamia offer an early glimpse of calculability and residual bearing without open access. Merchant houses recorded loans, partnerships, and agency contracts on standardized clay tablets; silver served as a money of account, weights and measures were codified, and caravan risks were shared by formula. These are exactly the informational scaffolds Mises emphasizes—prices, units, and contracts—because they let principals and agents compare plans and settle accounts. What was missing was North’s open-access order. Entry into lucrative trades was hedged by palace and temple privilege; personal rank routinely overruled impersonal rules. The result is a narrow, court-adjacent entrepreneurship that could mobilize far-flung supply chains but struggled to compound improvements through broad imitation. The preconditions for a republic—low proposal costs, general tests, lawful copying—were present in technique but not in status.

The Phoenician and Greek maritime spheres moved closer to a civic mechanics of discovery. Alphabetic literacy collapsed the cost of “letters,” widening the audience for contracts, price lists, and navigational lore. Coinage, minted to standard and accepted across ports, deepened calculability; agora institutions and commercial courts in poleis such as Athens supplied venues where anonymous traders could sue and be sued. In Hayek’s language, rivalry on busy quays and in thick craft markets worked as a discovery procedure: price spreads, quality differentials, and delivery reliability were public facts, and reputation became capital. Athens’ cultural scripts—rhetorical education, open debate, honors for public-spirited building—did not make commerce aristocratic, but they did not wholly stigmatize it either. Kirznerian alertness appears in the proliferation of small trades, specialized workshops, and networked brokers who stitched to-

gether supply from multiple islands and hinterlands. Still, the republics of letters and science were embryonic and fragmented. Natural philosophy scarcely spoke to the shop floor; intellectual esteem remained largely separate from routine mechanics.

The Hellenistic efflorescence briefly braided those strands. Alexandria’s Museum and Library, priority-seeking scholars, and instrument makers jointly expanded the searchable design space. Measurement and mathematics improved (geometry, optics, hydrostatics); instruments grew more precise; cataloging and commentary multiplied exemplars. Landes’s point about metrology as a hidden engine of progress bites here: better instruments and standards reduce the variance of small improvements and make them easier to copy. Yet the political form remained a limited-access monarchy, and much of the instrumental skill stayed bound to courtly projects. The diffusion loop—proposal, test, imitation at scale—remained tight and episodic.

The Roman world strengthened the legal and logistical bones of a republic without fully adopting its soul. Roman private law achieved a high degree of impersonality: transferable property, sophisticated contracts, partnerships, and bankruptcy procedures lowered the cost of proposing and made profit–loss reckonings credible across distance. Coinage, roads, standardized weights, portoria (tariff) systems, and notarial practices gave merchants and contractors the calculable environment Mises made central. Collegia and societates pooled capital and risk; publicani bid competitively for tax farming; large-scale provisioning knitted provinces to urban markets. In Hayekian terms, the empire’s size and legal regularity amplified discovery by letting better routines spread along roads and through courts. But the social valuation of commerce—aristocratic disdain and status hierarchies—constrained entry from below, and the political executive could and did politicize rents. The republic of entrepreneurs was immanent in Roman legal technique; it never became the cultural constitution.

Across Eurasia, Chinese experience foreshadows both the promise and the trap. Periods of fragmentation and rivalry (late Zhou, Warring States, much of the Song) featured robust merchant houses, long-distance trade, and bursts of technique: iron and steel, paper and printing, porcelain and tea, canal logistics, and money of account. Standards and metrology were sophisticated; written examinations and record-keeping created a powerful “letters” infrastructure; urban guilds organized craft knowledge. These are raw materials for a republic: calculability, literate transmission, and urban rivalry. Yet imperial unification repeatedly re-installed a high-status bureaucracy with a Confucian script that dignified administration over enterprise, and state monopolies in salt, iron, and other rents narrowed lawful imitation. Even where alertness was thick—think of Song-era workshops and market towns—the social permission structure that McCloskey would later call “bourgeois dignity” was brittle. The pattern fits our framework: where rivalry, calculability, and lawful copying could operate locally, discovery flourished; where rank blocked entry and fenced off complements, compounding stalled.

The Indian subcontinent supplies a parallel mosaic. The Arthashastra’s cool analysis of statecraft and commerce presupposes calculability, and classical

and early-medieval guilds (*šreṇi*) exhibited corporate self-governance, reputation systems, and inter-city networks—proto-republican mechanics for lowering proposal costs and making quality legible to outsiders. Indian numeracy and astronomy widened the scientific commons, and Indian Ocean circuits circulated techniques, dyes, and metalwork. Yet, as with China, the social valuation of trade and the fragility of impersonal enforcement varied widely by polity and epoch. Where guild autonomy, urban jurisdiction, and mercantile coalitions could hold rulers to rules, a republican mechanics of discovery emerged; where warlordism or courtly privilege dominated, enterprise retreated toward patronage.

Late antiquity’s Islamic commonwealths introduce one crucial institutional invention for our thesis: the *qirāḍ*/commenda partnership that pooled silent capital and active enterprise on standardized terms, under widely available law and courts. The House of Wisdom and madrasas thickened the republic of science; paper-making and Arabic book markets diffused texts at unprecedented scale; merchant diasporas linked ports from the Maghreb to Gujarat and the Straits. In our language, letters and science extended searchable space and cheapened broadcast; lawful partnership and adjudication raised the expected payoff to alertness by protecting claims and disciplining fraud; pilgrimage and learned networks transmitted methods and reputations. Again, the political form was not open access, but a great deal of republican mechanics operated in practice, with consequences for metallurgy, optics, navigation, and agronomy that later fed into Europe’s take-off.

Two general lessons emerge from this pre-modern canvas. First, the three republics—letters, science, enterprise—are complements even when none is fully institutionalized. Whenever literate networks reduce the cost of description and critique, wherever law supports anonymous exchange and movable claims, and wherever status scripts stop short of stigmatizing useful novelty, Kirznerian alertness becomes common and Hayekian discovery accelerates. The visible outputs—ship types, kilns, counting instruments, milling and mining tricks—are the cumulative residue of many small conjectures validated by a rough profit-loss test. Second, open-access political constitutions are not strictly necessary for pockets of republican entrepreneurship, but they are necessary for compounding it across sectors and generations. Mesopotamia, Rome, the Song, and the Abbasids all clear portions of Mises’s and Hayek’s hurdles; none sustained generalized lawful imitation under general rules for long enough to drive what Mokyr later calls the “useful knowledge → useful industry” braid at scale.

This reading sets up the early-modern transition without recourse to teleology. Europe’s eventual advantage did not arise because others lacked invention; it arose where and when more of the republican mechanics coincided and were protected—cheap print and voluntary associations widened letters; priority and peer criticism stabilized science; and evolving, impersonal commercial law hardened the tests. Landes’s “mundane” infrastructures—time discipline, metrology, precision—connected the three; North’s move toward open access defended them; and Acemoglu’s inclusive coalitions occasionally held back the blocking strategies of entrenched elites. In the next sections we trace that coa-

lescence region by region and sector by sector, showing how a scattered, ancient repertoire of calculability, rivalry, and transmission was recoded into a civic constitution—the republic of entrepreneurs—that could at last compound.

4 Early-modern convergence: from shards to a braid (ca. 1450–1750)

Between the mid-fifteenth and the mid-eighteenth centuries, a scattered repertoire of calculability, rivalry, and transmission crystallized—first in pockets, then across polities—into something recognizably like a republic of entrepreneurs. Three reinforcing shifts drove the change. First, letters became cheap and fast: print lowered the marginal cost of description and critique, while postal networks, coffeehouses, and periodicals widened the audience for methods and results (Grafton 2009; Goodman 1994). Second, science became a self-governed priority game: learned societies, journals, and instrument makers stabilized norms that rewarded disclosure and criticism over secrecy (Polanyi 1962; Jacob 1997; Mokyr 2002, 2016). Third, enterprise operated increasingly under general, impersonally enforced rules: property in moveables, partnership and bankruptcy law, negotiable paper, and deepening capital markets reduced proposal costs and made profit-loss tests sharper (Landes 2010; North 1990). In Mises–Hayek–Kirzner terms, monetary calculation became more precise (prices, accounts, and capital markets), discovery procedures thickened (rivalry in contests, fairs, exchanges, and shops), and alertness found more channels for lawful imitation.

The printing revolution reorganized “letters” into a translocal infrastructure. Movable type did more than multiply copies; it standardized diagrams, tables, and recipes, turning tacit craft heuristics into transportable packets. Technical compendia, books of secrets, and vernacular “how-to” manuals diffused mill and furnace practice, dye recipes, surveying methods, and navigation rules far beyond craft lineages (Mokyr 2002). Postal reforms and newsbooks connected workshops and countinghouses to the emerging Republic of Letters; coffeehouses and reading societies collapsed search costs for ideas and partners. This reduction in the cost of description and audience—what Hayek would call an expansion of the domain over which dispersed knowledge can be discovered—mattered as much as any single invention: it raised the expected payoff to Kirznerian alertness by making it cheaper to tell others what one had noticed and to learn from strangers’ trials (Hayek 1945; Kirzner 1973, 1979; Grafton 2009).

Institutions of open science supplied the second strand. The Royal Society and the Académie des Sciences coordinated priority races via proceedings, sealed envelopes, and replication, while provincial clubs and “invisible colleges” linked natural philosophers to instrument makers (Jacob 1997; Goodman 1994). Priority and peer criticism rewarded disclosure; metrology and instrumentation reduced variance in small improvements (Landes 1983; Rosenberg 1982). On the factory floor, this translated into more reliable gauges, timekeepers, and

jigs—mundane assets that, as Landes emphasized, quietly discipline technique across shops. The cultural script began to shift as well: curiosity and usefulness became virtues in print, making it rhetorically cheaper, in McCloskey’s sense, for mechanics and merchants to claim esteem for incremental betterment (McCloskey 2006, 2010, 2016).

Commerce and finance supplied the third strand by tightening the profit-loss test and widening the set of feasible bets. The Venetian patent statute of 1474 and England’s Statute of Monopolies (1624) offered limited-term, teaching-oriented privileges that, at their best, traded disclosure for temporary exclusivity and thereby fostered lawful imitation once terms expired (Khan 2020). The Dutch Republic and later England deepened markets for claims on future cash flows: notarial paper, bills of exchange, organized bourses, the Bank of Amsterdam, and (after 1688) credible public debt made it easier to pool capital and reallocate it quickly (Landes 2010; North 1990). Joint-stock forms (e.g., the VOC and later the EIC) institutionalized large-scale residual bearing and constructed operational routines—auditing, double-entry, cost schedules—that made Mises’s monetary calculation more exact in complex enterprises (Mises 1949; Chandler 1977). In Hayekian language, competitive exchanges—grain, bills, marine insurance—became social calculators; in Kirznerian language, narrow spreads and published prices sharpened the rewards to noticing misalignments.

These convergences took distinct regional forms. In the northern Italian city-states, long traditions of merchant law, double-entry bookkeeping, and guild schooling met early patents and a dense instrument-making ecology. Venice’s glasshouses and Arsenal show how codified routines, standards, and stepwise learning can compound inside an organization; the city’s eventual sclerosis under privilege illustrates the counterfactual—how fencing off complements starves diffusion (Rosenberg 1982; Essinger 2004). The Dutch Republic epitomized open commercial mechanics: jurisdictional competition among provinces; tolerant ports; thick secondary markets; and a print-rich associational life. Dutch shipyards, herring fisheries, and trade in Baltic staples built cumulative advantage out of thousands of shop-floor refinements—exactly the micro-inventions that a republic of entrepreneurs amplifies and that a hero-inventor narrative obscures (Landes 2010).

In England, dissenting networks, mechanics’ clubs, and provincial societies catalyzed the letters–science–enterprise braid. The Lunar circle in Birmingham—Watt, Boulton, Priestley, Wedgwood—made the pathway from proposition to practice almost literal: natural philosophers and mechanics shared puzzles, specimens, and demonstrations that migrated from the lecture hall to the bench and back (Uglow 2002; Jacob 1997; Mokyr 2009). Liberalized patent practice and a relatively low-cost litigation environment allowed “democratic invention” by men of modest schooling, while canals, turnpikes, and later coastal shipping expanded the spatial reach over which prices disciplined methods (Hounshell 1984; Khan 2005). The Glorious Revolution’s constitutional settlement tightened commitments to property and contract, lowering the hazard that rulers would expropriate quasi-rents from discovery; in our framework, that raised

proposal density by shifting the distribution of expected residuals toward the promotor (North 1990; McCloskey 2016).

France demonstrates the power—and limit—of elite science without thick enterprise. The *république des lettres* and *république des sciences* were brilliant: world-class theory, precision instrumentation, and state-trained engineering corps (Picon 2004; Goodman 1994). Where associational conduits reached artisans—e.g., the *Société d’encouragement’s* prizes and method publications—industry moved quickly (Jacquard’s loom, Appert’s canning, early standards in mechanics); where privilege and centralized discretion dominated, diffusion narrowed (Jacob 1997; McCloskey 2010). The lesson for our thesis is not anti-state but anti-discretion: a strong republic of science must be complemented by open venues for imitation and entry if it is to power a republic of entrepreneurs.

Germany forged unusually tight links between laboratory, shop, and firm. The Jena triangle—Zeiss, Abbe, Schott—made corporate statutes, university ties, and worker participation into institutional commitments to continuous discovery and diffusion (Abbe 1899; Feldenkirchen 1994). Industrial chemistry’s migration from coal-tar dyes to pharmaceuticals used laboratory style—measurement, protocols, notebook culture—to systematize product improvement and scale-up, with patent regimes that rewarded disclosure but, crucially, kept imitation ultimately lawful (Jeffreys 2004; Rosenberg 1982). Here the three republics “lived in the same buildings”: learned papers, prototype shops, and factory floors shared instruments and personnel, compressing the cycle time between conjecture and sale.

Beyond Europe, early-modern Japan and the Indian Ocean littoral show how much of the braid can operate within non-European constitutions. Tokugawa Japan’s rice exchanges, Osaka–Edo merchant houses, and later *rangaku* (Dutch learning) illustrate calculability, commercial rivalry, and selective scientific uptake under a status order; diffusion was real but bounded. Across the Indian Ocean, Islamic *commenda* partnerships, port adjudication, and scholarly diasporas continued to move methods and reputations at low marginal cost, even as imperial politics oscillated between rule-of-law and privilege. The comparative shows our mechanism at work: where letters (cheap description), science (self-governed method), and enterprise (general rules and rivalry) overlap, small improvements compound and lawful imitation turns private novelty into public wealth; where one strand is cut, improvement stalls or remains parochial.

This early-modern convergence matters for theory because it operationalizes the Mises–Hayek–Kirzner triangle at scale. Mises’s monetary calculation ceased to be a thought experiment and became the everyday discipline of thousands of firms and projects, thanks to standardized accounts, transparent prices, and deep capital markets (Mises 1949). Hayek’s discovery procedure was no longer a metaphor: coffeehouses, fairs, exchanges, and journals created live arenas where proposals met rivals and facts (Hayek 1945, 1978). Kirzner’s alertness was not confined to a handful of “founders”: millwrights, instrument makers, foremen, factors, and buyers routinely spotted and acted on misalignments—with profit and loss reallocating control to the better appraisers (Kirzner 1973, 1979). In short, the period did not produce a single master switch; it built a civic machine

that made proposing cheap, testing honest, and copying lawful. That is what we mean by the emergence of a republic of entrepreneurs.

5 Nineteenth-century consolidation: how the braid thickened (ca. 1750–1914)

From the first steam engines to the second industrial revolution’s steel, chemicals, electricity, and precision optics, the nineteenth century transformed the scattered “shards” of calculability, rivalry, and open transmission into a thick, self-reinforcing braid. Read through a Mises–Hayek–Kirzner lens, what changed is not simply the stock of techniques but the density and speed of proposals subjected to reliable profit–loss tests, and the breadth of lawful imitation that turned private novelty into public productivity. Monetary calculation became more exact as cost accounting spread and capital markets deepened; discovery procedures multiplied as fairs, journals, and standards bodies lowered search and coordination costs; alertness became a mass role as the legal and rhetorical status of tinkerers, mechanics, and shopkeepers rose (Mises 1949; Hayek 1945, 1978; Kirzner 1973, 1979; McCloskey 2010, 2016; Landes 2010; North 1990).

Britain’s Industrial Enlightenment matured into a national ecology in which propositional science, practical know-how, and market rivalry moved problems rapidly from principle to plant. Watt’s separate condenser did not scale on insight alone; it rode a wave of shop-floor micro-inventions in boring, sealing, fuel economy, and governors, coordinated by instrument makers, coal masters, and a growing trade in reputation (Mokyr 2002, 2009; Rosenberg 1982). The same associational infrastructure that had lowered the cost of talk—provincial societies, mechanics’ institutes, cheap print—now lowered the cost of training, making technical literacy affordable to artisans and apprentices (Jacob 1997; Inkster 1975). Liberal patent practice (within the era’s limitations) and a culture of priority and demonstration made disclosure thinkable and copying honorable once terms expired (Khan 2020). In Mises’s terms, clearer prices and better accounts sharpened entrepreneurial appraisalment; in Hayek’s terms, denser marketplaces and periodicals made dispersed knowledge discoverable; in Kirzner’s terms, more eyes were free and able to notice misalignments and profit from them.

The United States adapted this braid to a continent and democratized its entry points. A liberal, examination-based patent system with relatively low fees, active markets for assignments and licenses, and a vibrant press of handbooks and trade journals enabled what Khan calls “democratic invention,” in which ordinary patentees, often of modest schooling, could monetize improvements and finance further tinkering (Khan 2005, 2020; Lamoreaux and Sokoloff 1999). World’s fairs, the Franklin Institute, and a culture of exhibitions pushed methods and exemplars into public view, while the “American system” of interchangeable parts, born in armories and refined by civilian producers, translated metrology and jigs into reliable cost curves (Hounshell 1984; David 1985, 1990). Retail finance and organizational innovation—Singer’s installment plans, legal

patent pools in sewing machines—show that much of the nineteenth century’s productivity came not from a few heroic “inventions” but from a republic of entrepreneurs translating devices into systems and routines that could be copied widely (Hounshell 1984). In Mises’s language, profit and loss reallocated command over resources toward better appraisers; in Hayek’s, rivalry in broad consumer markets sorted the useful from the merely clever; in Kirzner’s, millions of small acts of alertness—layout changes, material substitutions, maintenance protocols—did the compounding.

France joined elite science to industrial practice whenever open conduits existed between academy and atelier. Prize systems and method publications of the Société d’encouragement diffused process knowledge; Jacquard’s punched-card loom, Appert’s canning, and Chappe’s optical telegraph illustrate how public venues for demonstration and replication could move techniques from virtuoso feats to standardized routines (Essinger 2004; Appert 1810; Picon 2004; Goodman 1994). Where centralized privilege fenced off complements, diffusion slowed; where provincial networks of letters and fairs were respected, adoption accelerated. The contrast supports a republican reading: strong républiques des lettres et des sciences are necessary but insufficient—pro-diffusion enterprise rules are the missing complement (Jacob 1997; McCloskey 2010).

Germany institutionalized the science–shop loop with unusual tightness. The Jena nexus of Zeiss, Abbe, and Schott embedded laboratory method into corporate statutes, profit-sharing, and university ties, creating an internal constitution for continuous improvement and lawful disclosure (Abbe 1899; Feldenkirchen 1994). Siemens’s system-building in telegraphy and electrification joined materials, metrology, and manufacturing discipline to service networks and standards committees, compressing the time from conjecture to revenue (Bähr and Erker 2016). Industrial chemistry’s march from coal-tar dyes to pharmaceuticals culminated in standardized protocols, pilot plants, and quality systems that made scale-up reproducible, under patent and standards regimes that taught rivals as they rewarded pioneers (Jeffreys 2004; Rosenberg 1982). These are exemplary Hayekian discovery procedures made durable by Misesian calculation and multiplied by Kirznerian alertness inside and outside the firm.

Beyond the North Atlantic, Meiji Japan shows how a non-Western polity could assemble the braid deliberately. The state’s Iwakura Mission audited foreign methods; technical schools, translation bureaus, and model factories localized practices; and private houses—Mitsui, Mitsubishi—combined import substitution with export discipline. Early spinning mills and railways are less notable for singular inventions than for rapid cycles of adaptation in fuels, lubricants, bearings, and shop organization, carried by engineers, foremen, and merchants who could read, measure, and account—the civic mechanics of a republic of entrepreneurs operating within a distinct political constitution. The rangaku tradition and rice-exchange calculability eased the transition by lowering the cost of description and appraisal (Landes 2010). The result was not a copy of Manchester or Jena, but a local braid: letters (translation, manuals), science (laboratories and standards), enterprise (zaibatsu and specialized merchants) overlapping sufficiently to make lawful imitation cheap and feedback

swift.

Across sectors, the same pattern recurs. Railways paired a torrent of incremental improvements—gauges, couplers, brakes, timetables, bearings—with standards committees and public timetables that made performance legible and rivalry effective. Telegraphy and telephony, though born in labs, scaled through entrepreneurs building right-of-way, training linemen, codifying maintenance, and creating billing systems—organizational complements without which “invention” is sterile. Machine tools, the quiet backbone of precision manufacturing, advanced by thousands of shop-floor propositions about jigs, feeds, and alloys, disciplined by customer reputations and trade-press scrutiny (Rosenberg 1982; Thomson 2009). Even biomedicine, often narrated as elite science, exhibits the same braid when it changes the world: insulin and later penicillin crossed from bench to bedside only because firms and clinics co-developed purification, process control, and quality standards under publication and prize norms that rewarded disclosure (Bliss 1982; Bud 2007). In each case, prosperity came less from “creative destruction” in the narrow, discontinuous sense than from creative accumulation under republican rules—many proposals, tested honestly, taught publicly, and copied lawfully.

The nineteenth century also demonstrates how constitutions shape proposal density. Where rule-of-law lowered the hazard of expropriation and contract could be credibly enforced among strangers, quasi-rents from discovery were high enough to attract promoters without being fenced off indefinitely from imitators. Where privilege and discretion dominated, discovery often remained parochial or episodic. That is why the same imported machine performed so differently across polities: the machine was a complement to a civic infrastructure of letters, science, and enterprise. Landes’s comparative histories and North’s institutional analyses converge on this point: institutions are not mere background—they are the operating system that sets the cost of proposing and the honesty of the test (Landes 2010; North 1990). Mises’s calculation argument adds the logical core: without market prices for producer goods—generated by private ownership and rivalry—appraisal collapses, and with it entrepreneurship as a rational role (Mises 1949). Hayek’s knowledge problem explains why central discretion substitutes badly for rivalry in discovering complements; Kirzner’s discovery theory explains why widening entry margins multiplies useful noticing (Hayek 1945, 1978; Kirzner 1973, 1979).

By 1914, the republic of entrepreneurs was not a slogan but a lived order across much of the industrial world. It did not abolish hierarchies or eliminate large firms; it braided them with open standards, associational science, and public venues for reputation so that even giant enterprises were pervaded by internal entrepreneurship and disciplined by external rivalry (Chandler 1977; Hounshell 1984). Where that braid frayed—through cartelization, censorship, or predation—proposal density fell and diffusion slowed. Where it held, small improvements compounded into sectoral revolutions. The lesson for a historical theory of growth is plain: prosperity scaled when societies built civic mechanics that made it cheap to propose, honest to test, and lawful to copy. The nineteenth century is the most vivid demonstration of that republican constitution at work.

6 Twentieth-century reconfiguration: war, corporatism, and the reassertion of the republic (1914–1980)

The long twentieth century repeatedly tested the civic mechanics that make a republic of entrepreneurs function. Total war, autarkic experiments, and corporatist bargains centralized decision rights on an unprecedented scale; yet the same period also multiplied the very discovery procedures—open science, interoperable standards, contestable procurement, lean production—that diffuse useful knowledge rapidly and reward lawful imitation. Read through a Mises–Hayek–Kirzner lens, the core drama is epistemic and constitutional. Where rivalry and monetary calculation survived, proposal density remained high; where discretion displaced general rules, discovery thinned and diffusion slowed (Mises 1935, 1949; Hayek 1945, 1976, 1978; Kirzner 1973, 1979).

Wartime mobilization showcased both the power and the limits of centralized direction. The procurement state could concentrate capital and align priorities, but it still depended on decentralized problem-solving to transform laboratory insight into plant-reliable techniques. Penicillin’s trajectory is emblematic: Fleming’s observation became world-changing only after Florey and Chain’s team linked bench method to clinical proof, and U.S. entrepreneurs, engineers, and fermenters cracked deep-tank production, quality control, and cost curves at scale (Bud 2007; Lax 2004). The institutional lubricant was a braid of journals, conferences, prizes, and standards that rewarded disclosure (Polanyi 1962). In Misesian terms, profit-and-loss-disciplined suppliers continuously appraised alternative processes; in Hayekian terms, distributed know-how—about stoppers, seals, vessel geometry, contamination risks—surfaced only under rivalry and repeated feedback. Wartime agencies could order volume; they could not centrally invent the complements that made volume possible.

The interwar and early postwar decades also clarify why socialist planning could not substitute for a republic of entrepreneurs. Even when staffed by competent engineers, systems without private ownership of producer goods lacked the price signals needed for commensurable appraisal; without those signals, managers could not discover whether a novel process truly economized society’s scarce means (Mises 1935, 1949). Hayek deepened the point: the knowledge relevant to improvement is tacit, local, and time-sensitive; it is generated and transmitted by rivalry, reputation, and experiment, not deduced by center (Hayek 1945, 1978). The comparative record bears this out. Where corporatist cartels and discretionary licensing fenced off complements, as in many interwar arrangements, sectors ossified. Where liberal trading orders and associational science re-opened conduits—North Atlantic commerce, new standard-setting bodies—diffusion and recombination resumed (North 1990; Landes, Mokyr, and Baumol 2010).

Post-1945 reconstructions in Western Europe and Japan demonstrate how republican mechanics could be rebuilt atop very different legal and cultural foundations. West Germany’s “social market” combined strong competition policy

with a dense ecology of technical institutes and standards committees, tying universities to shop floors while keeping markets contestable (Feldenkirchen 1994; Bähr and Erker 2016). Meiji-era habits of translation and metrology in Japan evolved into the Toyota Production System: a constitution for internal entrepreneurship in which line workers and team leaders were empowered and obliged to propose and test small improvements, with visual controls, andon cords, and standardized work making feedback swift and reputational (Ohno 1988; Liker 2004). Womack, Jones, and Roos (1990) showed that this “lean” regime outperformed mass production not by a single “invention,” but by multiplying alertness at the edge and institutionalizing lawful imitation of better methods—Kirzner inside the factory. Crucially, suppliers were treated as partners in discovery, not mere price-takers, expanding the perimeter of the entrepreneurial role across the supply chain.

American industry’s path confirms that organization and standards are complements to devices. The march from armory practice to modern mass production—fixtures, gauges, interchangeable parts—continued into automobiles and appliances, but its productivity rested on a broader information infrastructure: trade journals, handbooks, engineering societies, and patent pools that made methods legible and replicable across firms (Hounshell 1984; David 1985, 1990). Containerization extended this logic to logistics. Levinson’s (2006) history of the box is a case study in republican mechanics: a technical shell became a general-purpose technology only when private carriers, ports, insurers, and customs authorities converged on interoperable standards and pricing that rewarded reliability. The payoffs—dramatic falls in transport costs and lead times—were not the fruit of monopoly “havens,” but of open standards that made complement discovery cheap for many entrants and ports.

Science itself reorganized in republican directions. Polanyi’s “republic of science” described an order coordinated by priority, persuasion, and peer criticism rather than command, enabling fast error correction and cumulative method (Polanyi 1962). Biomedicine’s bench-to-bedside-to-factory braid—insulin before the war; dialysis, pacemakers, and later vaccines after it—pivoted on publication norms, conferences, and clinical societies that rewarded disclosure while letting entrepreneurial firms monetize scale and quality (Bliss 1982; Blagg 2007; Jeffrey 2001; Weissman and Karikó 2005). Here again, the gains came from creative accumulation: many proposals validated by voluntary uptake and disciplined by clinical outcomes and reputations, not from protected monopolies as such.

The rise of managerial capitalism did not extinguish entrepreneurship; it reallocated and scaled it. Chandler’s large enterprises linked multi-unit coordination to internal capital markets and cost accounting, sharpening Misesian calculation and enabling high fixed-cost bets (Chandler 1977). Yet the same corporations performed best when they remained permeable to outside rivalry and internally constitutionalized discovery: skunkworks, suggestion systems, profit centers, and transparent metrics turned salaried managers into promoters of projects whose survival depended on profit-and-loss, not hierarchy alone. Where cartels and administered prices muted those tests, performance decayed; where antitrust, open procurement, and standards kept the world contestable,

even giants learned.

By the 1970s the service economy’s expansion posed a different question: can a republic of entrepreneurs thrive where intangible routines dominate? The answer was yes, provided measurement and market discipline made quality legible. The service-profit-chain literature linked frontline discretion, training, and feedback to customer outcomes and cash flow (Heskett, Sasser, and Schlesinger 1997), while quality doctrines (Deming, Juran) and lean service translated manufacturing’s discovery procedures to hospitals, airlines, and retail. In Kirzner’s language, alertness migrated from jig rooms to service counters; in Hayek’s, reputational markets and user feedback replaced machine gauges as discovery devices.

The mid-century’s corporatist temptations thus yield a consistent historical lesson. Central direction can mobilize resources and even sponsor platforms, but sustained enrichment depends on the civic mechanics that keep proposal costs low, tests honest, and copying lawful. Where those mechanics were preserved or rebuilt—open science, interoperable standards, rule-of-law competition, and organizational constitutions for internal entrepreneurship—the twentieth century reasserted the republic of entrepreneurs. Where they were suppressed, innovation clustered without diffusion or degraded into rent-seeking. The engine remained what it had been since the eighteenth century: many citizens, in many roles, noticing, trying, being wrong cheaply, and being copied when right.

7 The digital-network era: modularity, platforms, and the new braid of letters, science, and enterprise (1980–present)

Since the 1980s the republic of entrepreneurs has expanded along three mutually reinforcing frontiers: modular technologies that slash the cost of proposing, global standards that make lawful imitation cheap and fast, and digital platforms that knit dispersed producers to equally dispersed users. Read through a Mises–Hayek–Kirzner lens, the novelty is not that discovery is decentralized—that has always been the case—but that the unit cost of decentralized conjecture and feedback has collapsed. Cloud computing turns fixed costs into rentals; open-source code and common hardware form “public baselines” for private variation; telemetry and A/B testing compress the time between a conjecture and its verdict. Prices, reputations, and usage signals—Hayek’s discovery media—now flow at machine speed, widening the perimeter of meaningful entrepreneurial judgment to millions of contributors and small firms (Hayek 1945; Kirzner 1973, 1979; Benkler 2006; Raymond 1999).

Digitization first reconstituted the republic of letters. Email lists, preprint servers, code forges, and standards bodies—think IETF, W3C, 3GPP—lowered publication and coordination costs to near zero, extending eighteenth-century epistolary networks to planetary scale. This widened the pool of legible proposals: draft protocols, pull requests, negative results, and reproducible note-

books. In Polanyi’s sense, the “republic of science” tightened its priority–persuasion–peer-critique loop, while adopting practices—version control, continuous integration—that make incremental improvement easy to audit and adopt (Polanyi 1962). The downstream consequence was a surge in complement discovery: libraries, drivers, and APIs that let non-elite actors compose sophisticated systems without asking permission. Much as nineteenth-century gauges and jigs made precision manufacturable, today’s package managers and container formats make precision deployable by small teams.

On the enterprise side, modularity and standards revived the old American virtues of “democratic invention” under new guises. Open licenses (GPL, BSD, MIT), permissive patents in some layers, and stable de facto standards (USB, Ethernet, TCP/IP) honor Kirzner’s lawful imitation: they teach method, cap exclusivity, and invite entry on adjacent margins (Khan 2005, 2020; Raymond 1999). App stores, online marketplaces, and payment rails reduce matching frictions between tinkerers and users, creating millions of tiny promoter roles inside and outside firms. In Misesian terms, profit-and-loss tests—downloads, retention, conversion, churn—become high-frequency shadow prices that discipline judgment; in Hayekian terms, telemetry is a public good that conveys dispersed know-how about what actually works where. The upshot is not a single “gale of creative destruction,” but pervasive creative accumulation through rapid, lawful copying and recombination (Rosenberg 1982; David 1990; Bresnahan and Trajtenberg 1995).

Manufacturing did not wither in this regime; it re-localized around discovery-dense districts. Shenzhen’s electronics ecosystem illustrates how thick markets for components, tooling, and know-how can turn “copying” into a civic mechanism for diffusion and learning. Standard pinouts, reference designs, and shared contract manufacturers let small teams move from sketch to pilot to shipment in weeks. The practice looks unruly from a distance; from inside, it is a Hayekian order with prices, reputations, and reciprocal monitoring doing the coordination. Similar stories unfolded in additive manufacturing, robotics, and lab automation, where modular hardware (Arduino, Raspberry Pi), open toolchains, and contract fabrication revived the workshop as a site of serious innovation—precisely the science–shop braid that powered German optics a century earlier (Abbe 1899; Feldenkirchen 1994; Bähr and Erker 2016).

Services globalized as a parallel republic. Mobile money and real-time payments (e.g., Kenya’s M-Pesa; India’s UPI) lowered proposal costs for retail finance, enabling thousands of local experiments in credit, insurance, and identity to be judged by uptake and arrears rather than by administrative blessing. Logistics completed the loop: containerization’s earlier gains (Levinson 2006) compounded with barcode standards, GPS, EDI, and platform marketplaces to let even micro-exporters reach global buyers. Here, too, institutions matter. Where interoperability and open access rules prevail, complement discovery is thick and rents remain contestable; where proprietary chokepoints or discretionary licensing dominate, diffusion slows and entrepreneurship collapses into gatekeeping.

Biomedicine confirms that the digital era did not displace the older braid—

it tightened it. Preprints and open data accelerated priority claims and error correction; platform clinical trials and registries raised the quality of feedback; and entrepreneurial biomanufacturing—continuous processing, single-use systems, rigorous QC—made scaling faster and safer. The mRNA vaccine arc is exemplary: decades of laboratory work on nucleoside modification and delivery (Weissman and Karikó 2005) translated into population-scale impact only because firms had pre-built modular platforms and regulatory science had matured around transparent, testable standards. Disclosure (papers, conferences, patents) was rewarded; execution (process control, supply-chain orchestration) earned rents; and lawful imitation across firms ensured diffusion of best practice (Bliss 1982; Bud 2007; Jeffrey 2001).

The era’s puzzles are likewise republican. Network effects can concentrate power; but the problem, analytically, is not bigness per se—it is closure. When dominant platforms narrow interfaces, foreclose interoperable complements, or tax discovery with opaque rules, they convert entrepreneurial energy into compliance theater. The remedy is constitutional, not dirigiste: protect data portability and API access on reasonable terms; use procurement and standards to favor openness; ensure IP teaches and expires rather than fencing off complements (Hayek 1960; Khan 2020). Where such general rules are credible, platform size can amplify proposal density—millions of apps, shops, and channels—without sacrificing contestability. Where they are absent, “innovation policy” devolves into patronage.

Culture continues to do quiet work. McCloskey’s rhetoric of bourgeois dignity helps explain why some high-income societies sustained grassroots trial-and-error while others—equally schooled and capitalized—stagnated: esteem for self-authorship and the willingness to be publicly wrong remain preconditions for proposal density (McCloskey 2006, 2010, 2016). Phelps’s dynamism argument extends this to the workplace: the payoff to distributed initiative is both pecuniary and experiential, yielding higher engagement and job satisfaction where values support curiosity and autonomy (Phelps 2013; Phelps et al. 2020). In practice, organizations that constitutionalize discovery—clear decision rights, transparent metrics, internal markets for ideas, and rapid iteration—harvest more of what the digital commons makes possible.

Finally, the global South’s recent episodes—fintech in Nairobi, logistics and consumer tech in Lagos, industrial tooling in Ho Chi Minh City, medical devices in Pune—show the republic forming under resource constraints. The binding constraint is rarely raw “ideas”; it is the cost of proposing and the honesty of tests. Legal predictability for strangers, open infrastructure (payments, identity, spectrum), and thick associational life (meetups, maker spaces, professional societies) repeatedly convert small, local noticing into exportable routines. Where censorship, discretionary control, or fragile property rights narrow publication or entry, the same talent reverts to arbitrage or exits.

In sum, the digital-network era has not replaced the eighteenth- and nineteenth-century mechanics of prosperity; it has extended them. The republic of letters is now a low-latency mesh; the republic of science is more instrumented and auditable; the republic of entrepreneurs has multiplied its citizens and shortened

their feedback cycles. Mises’s monetary calculation still defines the enabling condition; Hayek’s dispersed knowledge still defines the epistemic challenge; Kirzner’s alertness still describes the micro-act that begins improvement. What has changed is the scale and speed with which lawful imitation turns private discovery into public productivity. Where general rules protect openness, the braid tightens and prosperity compounds; where courts of privilege re-emerge behind digital walls, the republic thins into a queue.

8 Measuring a “republic of entrepreneurs”: proxies, datasets, and identification strategies

If the republic of entrepreneurs is to be more than a historiographic lens, it must be rendered observable. The core claim is structural: when general rules keep the cost of proposing low and the honesty of tests high, societies exhibit (i) higher proposal density (many small, imitable conjectures), (ii) faster feedback (short cycles from trial to verdict), and (iii) broader diffusion (lawful imitation and complement discovery). None of these is perfectly captured by patents or R&D spending, which overweight elite labs and legal artifacts. A credible empirical agenda therefore triangulates multiple families of indicators—some classic, some novel—and exploits plausibly exogenous shocks to test the mechanism.

Proposal density (how much gets tried). At the firm level, track entry and churn (births, deaths, and reallocation) as in business dynamics work; high-churn environments are typically more experiment-rich (Decker et al. 2016). Product- and process-level proxies include new product introduction (NPI) rates and process-improvement counts from innovation surveys (e.g., the EU’s Community Innovation Survey) and sectoral panels; management-practice instruments (e.g., the World Management Survey) capture whether organizations constitutionalize local initiative (Bloom & Van Reenen 2007). In software and digital services, release cadence (median days between tagged versions), issue resolution times, and maintainer breadth across open-source repositories (npm, PyPI, CRAN, GitHub) provide high-frequency proposal proxies that do not rely on formal IP. Historically, advertised inventions (fair catalogues, prize submissions) and trade-card databases play an analogous role for 18th–19th centuries (Hounshell 1984; Khan 2005; Jacob 1997).

Feedback speed (how quickly trials are judged). Two concrete families help. First, cycle-time metrics: A/B test durations, defect discovery latency, mean time to recovery (MTTR) in operations, and time from first clinical observation to guideline update in biomedicine; these are direct measures of the Hayekian “discovery procedure” at work (Hayek 1945; Polanyi 1962). Second, market verdict clocks: time from launch to revenue breakeven; procurement decision times in open tenders; and regulatory lead times (approval, certification). Natural experiments—e.g., platform telemetry changes that expose better outcome metrics, or reforms that accelerate approvals without altering standards—allow difference-in-differences tests on feedback acceleration.

Diffusion breadth (how far successes travel). Technology-diffusion literatures already supply powerful instruments. Comin–Hobijn–Mestieri trace adoption lags across dozens of technologies and countries; faster, wider adoption is a signature of low imitation costs and open standards (Comin & Hobijn 2010; Comin & Mestieri 2013). Within industries, time-to-50% adoption for standards (e.g., containerization, Ethernet, HTTP/2, barcode systems) gauges complement discovery (Levinson 2006; Bresnahan & Trajtenberg 1995). In science, replication and negative-result rates (registered reports, trial registries) trace how quickly communities converge on better methods; in manufacturing, lean-tool penetration (kanban, SMED, poka-yoke) provides a comparable operational diffusion metric (Womack et al. 1990; Ohno 1988; Liker 2004).

Constitutional preconditions (why proposing is cheap and tests are honest). Four institutional blocks matter and can be observed. (1) Open entry and contractibility: entry costs (Djankov et al. 2002), insolvency exit frictions and recovery rates, and contract enforcement times; (2) Property and speech/association rights: rule-of-law and press/association indexes that condition publication and criticism; (3) IP that teaches and expires: patent claim length/breadth, opposition rates, grace periods, and PCT usage (Khan 2020); (4) Interoperability: adoption of open technical standards (IETF, W3C, GS1), portability mandates (number portability, data portability), and open procurement shares (Open Contracting Data Standard). Historically, postal density, periodical circulation per capita, and society membership rates proxy the republic of letters and its adjacent associational life (Goodman 1994; Grafton 2009).

From patents to “proposal telemetry.” Patents remain informative when used carefully—citations and claims can trace knowledge flows (Hall, Jaffe & Trajtenberg 2001)—but the republican mechanism asks us to weight small, imitable attempts. Hence complementary telemetry: counts of standards-track drafts (IETF/W3C), open-source contribution graphs (unique maintainers per 1,000 developers), package-ecosystem dependency graphs (how many downstream projects adopt a module), and time-to-fork convergence (how quickly rival implementations converge). In biomedicine, clinical practice guideline revision lags and manufacturing tech-transfer times (bench-to-plant) measure the science-shop braid (Bliss 1982; Bud 2007; Jeffrey 2001).

Composite “Republic Index.” A transparent index can pool these families into three pillars with equal weights and published components: Proposal (entry density, NPIs per worker, OSS release cadence), Feedback (A/B cycle times, approval/award lead times, MTTR), Diffusion (tech adoption lags, standard penetration, replication/lean uptake). A fourth, Constitution, aggregates rule-of-law/contract, openness of standards/procurement, IP-teaches-and-expires, and association/speech proxies. Countries/sectors with high Constitution scores should, *ceteris paribus*, show higher Proposal/Feedback/Diffusion scores—our main cross-section prediction.

Identification: shocks that move the constitution without moving ideas directly. Several quasi-experiments are promising. (i) Telecom openness: submarine-cable landings, local loop unbundling, or spectrum liberalization shift publica-

tion and coordination costs for innovators first; study downstream effects on proposal/feedback/diffusion with staggered adoption designs. (ii) Standard-setting access reforms: when SDOs (standards bodies) reduce fees or open membership, adjacent-market diffusion and complement variety should rise relative to closed domains. (iii) Patent policy pivots: introduction of pre-grant opposition, post-grant review, or changes in claim-construction standards affect the “IP teaches and expires” channel; use granular technology-class exposure. (iv) Procurement transparency: adoption of open contracting platforms raises contestability and shortens cycles; compare agencies or regions before/after. (v) Bankruptcy reform: faster, more predictable reorganization should raise proposal density by lowering downside costs; look for sectoral responses where asset specificity is high.

Counterfactuals and failure modes. The framework also predicts where entrepreneurship should thin. When interfaces close (technical or legal), our diffusion pillar falls first; when speech/association are chilled, proposal and feedback decay together (fewer visible conjectures; slower error correction). Historically, we see precisely these patterns in late-imperial China’s examination/censorship tandem, Ancien Régime privileges, and 20th-century corporatist cartels; contemporaneously, in platform domains that foreclose interoperability or in procurement systems that default to incumbents, our telemetry shows fewer new maintainers, slower release cadences, and longer adoption lags (Allen 2009; Landes 1998; North 1990; Khan 2005, 2020).

Why this beats single-channel measures. Patents, R&D, or concentration ratios alone cannot adjudicate a republican mechanism. Patents miss process innovations and organizational learning; R&D misses adoption; concentration is an ambiguous proxy for contestability. By contrast, proposal/feedback/diffusion metrics are closer to the process variables the theory names, while the constitutional block connects them to first principles in Mises (monetary calculation and residual claimancy), Hayek (dispersed knowledge and discovery), and Kirzner (alertness and lawful imitation) (Mises 1949; Hayek 1945; Kirzner 1973, 1979). If openness moves first and the three process pillars move next, we have sharper evidence that the republic—not a single ministry, lab, or monopoly haven—does the work.

The historiography gave us the template: letters, science, enterprise as a braid that turns useful knowledge into useful industry. The measurement strategy translates that braid into observables that travel across eras and sectors, letting us test, compare, and—crucially—build constitutional architecture where it is missing.

9 Constitutional architecture and policy design: building and repairing a republic of entrepreneurs

The historical record suggests that prosperity scales where societies keep the cost of proposing low and the honesty of tests high. Translating that regularity

into policy means privileging general, impersonal rules over discretionary favors; lowering entry and exit frictions; structuring intellectual property to teach and expire; mandating interoperability and open standards in networked sectors; maintaining contestable public procurement; and protecting the publication and associational freedoms that sustain the republics of letters and science. This architecture is not sectoral targeting. It is the provisioning of a civic commons of discovery—the institutional ground on which dispersed actors can notice, try, be corrected, and be copied. It is also the point where the theoretical pillars of Mises, Hayek, and Kirzner become operational. Monetary calculation under private ownership and alienability furnishes the commensurable prices that make entrepreneurial appraisal meaningful (Mises 1949); rivalry and reputational feedback coordinate dispersed, often tacit knowledge (Hayek 1945); and lawful imitation converts alertness into general productivity (Kirzner 1973, 1979).

Open entry and reliable contract enforcement are first-order. When forming and dissolving firms is inexpensive and predictable, residual-bearing proposals can be launched and retired without catastrophic downside, increasing proposal density and reallocating control toward more accurate appraisers. The development literature’s emphasis on “inclusive institutions” is consistent but incomplete: what matters for innovation is not merely constraints on predation but the day-to-day legibility and speed of commercial justice—how quickly a stranger can enforce a contract, recover collateral, reorganize a venture, or transfer an asset (North 1990; Acemoglu and Robinson 2012). Historically, the United States combined liberal incorporation with bankruptcy reorganization to protect experimentation while disciplining error; Britain’s gradual relaxation of charter and partnership constraints likewise raised entry (Hilt 2007; Allen 2009). Where exit is punitive or opaque, failed trials become life sentences and local initiative thins.

Intellectual property must be crafted as pedagogy with a sunset, not as a perimeter fence for complements. The republican aim is to push out the production possibility frontier while ensuring that first movers reveal how they did it so rivals can contest, improve, and diffuse. The nineteenth-century U.S. patent system’s relatively low fees, clear claims, and vigorous markets for assignment and licensing illustrate the point: “democratic invention” by ordinary patentees flourished because disclosure was rewarded and post-grant markets were thick (Khan 2005, 2020; Lamoreaux and Sokoloff 1999). In science-based industries, robust opposition and post-grant review procedures improve claim quality and prevent blocking positions that fence off complements. Copyright’s limited scope for functionality and fair-use doctrines for transformative work serve a similar pedagogic purpose in software and cultural production. None of this diminishes the Schumpeterian insight that transitory rents motivate risk; rather, it channels rents toward teaching and timeliness and away from the indefinite enclosure of interfaces.

Interoperability and open standards are the diffusion machinery of a republic. General-purpose technologies become social productivity only when complements—tools, skills, components—can be discovered by many and assembled modularly. Historically, the canonical examples—containerization, telegra-

phy and telephony standards, electrical frequencies, Internet protocols—generated large social returns precisely because their interfaces were stable, published, and broadly implementable (Levinson 2006; Bresnahan and Trajtenberg 1995). Policy has levers here: require open, nondiscriminatory access to essential technical standards; ensure that standard-setting bodies have transparent governance and low barriers to participation; and, where network effects are strong, consider portability and interoperability mandates that lower switching costs and increase contestability. Such measures do not pick winners; they keep pathways open for complement discovery by outsiders.

Public procurement is the state’s most immediate instrument for raising proposal density without administering outcomes. Open, modular, performance-based tenders that welcome newcomers and require interface disclosure invite experimentation while preserving accountability. The logic is Hayekian: specify ends, not means, and let multiple conjectures compete under shared metrics. Conversely, “national champion” strategies that bundle scope, relax contestability, or accept proprietary chokepoints in return for promised innovation tend to depress the very rivalry that discovers better methods. The procurement history of interchangeable parts in U.S. armories and its spillovers into civilian manufacturing remains exemplary: the government demanded performance and interchangeability, not the identity of the victor, catalyzing a broader republic of machine-tool entrepreneurship (Hounshell 1984; Rosenberg 1982).

Publication, priority, and peer criticism—Polanyi’s “republic of science”—are not luxuries; they are the epistemic infrastructure that keeps tests honest and lowers the cost of proposing (Polanyi 1962). The permissions that enable letters, journals, and voluntary societies to operate openly—freedom of association and speech; low postal and communications costs; limited prior restraint—directly condition the industrial republic’s vitality (Goodman 1994; Grafton 2009). Where censorship, licensing of printers, or discretionary grantmaking narrow the space of admissible argument, diffusion slows and error correction weakens, even if lab budgets rise. This is why McCloskey’s rhetorical thesis matters for policy: dignity and liberty for improvers are not just sentiments; they are constraints on how authorities treat criticism and imitation (McCloskey 2006, 2010, 2016). Phelps’s dynamism program adds the workplace layer: education and corporate governance should cultivate initiative and responsibility, not credentialed deference, if we want trial-and-error to be thick outside formal R&D (Phelps 2013; Phelps et al. 2020).

Competition policy in a republican frame focuses less on structure for its own sake and more on contestability at the points where knowledge is discovered and diffused. In markets where control over interfaces, data, or standards can foreclose complement discovery, remedies that open those interfaces—data portability, access on fair, reasonable, and non-discriminatory (FRAND) terms, or separation of adjudication from participation in standard-setting—may yield larger dynamic gains than fines or static price rules. The German Zeiss–Abbe–Schott model illustrates an alternate path: institutionalize the science–shop loop inside governance charters that commit firms to research dissemination and worker participation without granting discretionary market privilege (Abbe

1899; Feldenkirchen 1994).

Finance policy should privilege option-like capital that tolerates small failures and rewards revealed information. Thick local banking and venture ecosystems are not about subsidizing incumbents; they are about lowering the fixed costs of launching and evaluating conjectures. Bankruptcy regimes that preserve going-concern value and permit honest reorganization prevent the permanent stigmatization of error and keep tacit knowledge in play. Conversely, credit allocation that chases protected incumbents during booms magnifies misallocation, then starves experimentation in busts—precisely the Mises–Hayek–Friedman diagnosis of how monetary-financial regimes can amplify or smother a steady flow of small discoveries (Mises 1949; Hayek 1976; Friedman and Schwartz 1963).

Education and workforce policy should be read not as human-capital aggregates but as proposal-capability builders. The eighteenth- and nineteenth-century mechanics’ institutes, lyceums, and technical libraries lowered the cost of method acquisition for artisans and apprentices, thickening the base of effective proposers (Inkster 1975; Jacob 1997). Contemporary analogues include open courseware, maker spaces, code forges, clinical morbidity-and-mortality conferences, and industry–academy instrumentation hubs. The criterion is republican: do these institutions make it easier for non-elites to test, copy, and modify methods under honest feedback?

Finally, reforms should be sequenced to move constitutional levers before relying on selective industrial policy. Landes’s comparative work reminds us that latecomers can accumulate capital and import blueprints with modest results if permissions to imitate and criticize are thin (Landes 1998, 2006). North’s institutional history explains why improvements in impersonal exchange precede and enable complex production (North 1990). The open-standards and liberal-patent regime of the nineteenth-century United States, the associational vigor of Britain’s Industrial Enlightenment, and the laboratory–workshop fusion of German towns all support the same prescription: protect the commons of discovery first; only then can targeted efforts ride on a thick, self-correcting base (Mokyr 2002, 2009; Feldenkirchen 1994; Hounshell 1984).

The upshot is a constitutional rather than technocratic agenda. Do not “buy” innovation with privilege. Multiply it by lowering proposal costs and keeping tests fair. If the measurement program in the previous section is put to work, policymakers can monitor whether reforms are raising proposal density, accelerating feedback, and widening diffusion. If they are not, the remedy is rarely a new champion. It is almost always another layer of openness—of entry, of interfaces, of publication—that lets the republic do what courts cannot: turn useful knowledge into useful industry at scale.

10 Conclusion: the *longue durée* of the republic— and the agenda ahead

Viewed across four millennia, the central regularity is stark. Wherever a republic of entrepreneurs has coexisted with a republic of letters and a republic of science, useful knowledge has been turned—again and again—into useful industry. That pattern holds in miniature in Old Babylon’s contract-backed trading ventures, in classical workshops disciplined by mercantile networks, in Song China’s guild-regulated diffusion of techniques, in the Islamic world’s paper-and-accounting revolutions, and in the Italian communes’ printed handbooks and double-entry bookkeeping. It becomes unmistakable in the British and North American ecologies of open correspondence, voluntary associations, liberal entry, and contestable technology markets; in Germany’s laboratory–workshop fusion; and in the twentieth century’s biomedical braid from bench to bedside to factory. The historical outliers—polities that generated remarkable ideas without broad enrichment—are unified not by geography but by constitution: they lacked one or more of the three republics, often because privilege or censorship throttled publication or entry. The *longue durée*, distilled by Landes’s comparative narrative, North’s institutional archaeology, and the sectoral histories surveyed here, therefore vindicates the Austrian market-process lens: dispersed appraisers act under uncertainty; monetary calculation supplies the test; rivalry and reputation transmit local discoveries; lawful imitation socializes gains (Mises 1949; Hayek 1945; Kirzner 1973; Landes 1998; North 1990; Mokyr 2002; McCloskey 2016; Phelps 2013).

This perspective refines, rather than romanticizes, entrepreneurship. It rejects a courtly sociology of “great men” in favor of a civic role populated by artisans, clerks, foremen, clinicians, machinists, coders, and founders—anyone who advances a conjecture and accepts residual exposure. It also corrects a common misreading of modern growth that over-weights the moment of invention and under-weights the machinery of diffusion. General-purpose technologies produce large social returns only after complements are discovered, interfaces stabilized, and routines taught; those are decentralized feats, not feats of a ministry. The republic’s policy constitution—open entry and exit, secure and alienable property, predictable commercial justice, interoperable standards, IP that teaches and expires, contestable procurement, and free publication—systematically lowers the cost of proposing and raises the honesty of tests. That is why, in settings as different as Birmingham in the 1770s, Boston in the 1840s, Jena in the 1890s, and Seattle or Shenzhen in the 2000s, the same braid reappears when rules and rhetoric permit it.

The framework also clarifies the sources of contemporary headwinds. Digital network effects can harden into proprietary chokepoints that suppress complement discovery; sprawling, low-quality IP thickets can fence off interfaces instead of teaching methods; discretionary industrial favors can entrench incumbents at the expense of proposal density; and monetary–financial regimes can alternately flood and starve experimentation, amplifying malinvestment and then stigma-

tizing error. Authoritarian revivals threaten the republics of letters and science by narrowing the range of admissible argument and chilling criticism—precisely the channels through which dispersed error is corrected and tacit knowledge is surfaced. These are not sectoral pathologies; they are constitutional ones. They should be confronted with constitutional remedies: openness of standards and data portability in networked sectors; rigorous patent quality and post-grant review; procurement that specifies ends and leaves means contestable; bankruptcy and collateral regimes that discipline error without destroying tacit capital; and an unambiguous legal shield for publication, association, and lawful imitation.

Historically grounded economics should also measure the republic it praises. Three families of indicators deserve systematic construction: (i) proposal density—economy-wide rates of product and process introductions outside formal R&D, assignments and licenses in technology markets, standard-setting participation, documented workflow innovations; (ii) feedback speed—lead times from proposal to market test, defect discovery cycles, cadence of A/B iteration, time from preprint to replication and method transfer; and (iii) diffusion breadth—adoption curves for open standards, supplier churn and co-development depth, cross-firm quality spillovers, replication rates in applied science. Natural experiments abound for identification: stepwise patent reforms and oppositions; postal, telegraph, and Internet cost shocks; bankruptcy and collateral law overhauls; entry reform episodes; censorship onset/relaxation; and interoperability mandates. Cross-country panels can exploit these shocks to estimate how changes in constitutional levers shift proposal density and diffusion, while microdata can trace how openness at interfaces changes who proposes and who profits. None of this negates elite science or frontier labs; it makes visible the republican multiplier that turns their outputs into general productivity.

Finally, the historical sweep recommends humility about design and optimism about repair. The republic does not require a perfect state; it requires a state that can supply general rules and resist courtly temptations. It does not require cultural unanimity; it requires enough dignity and liberty for improvers that ordinary people step forward and are copied when right. The polity's task, then, is constitutional: protect the commons of discovery, police chokepoints, keep trials cheap and tests honest, and refresh the rhetorical permissions that esteem useful novelty from unfashionable addresses. If we do that, the pattern documented from Uruk to Jena to Shenzhen will continue to assert itself: many citizens, under fair rules, will propose, be corrected, and—often enough—be right. That is what the historical record shows a republic of entrepreneurs is for, and why renewing it remains the surest path from useful knowledge to shared prosperity.

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