Where the Criteria of Innovation Go Wrong

Twenty Lists, One Method, and the Measure They All Lack

J. Konstapel, Leiden, September 2026

Summary for the impatient reader

Between 2020 and 2026, at least twenty governments and blocs published lists of "critical" or "strategic" technologies. The lists converge on the same core: artificial intelligence, quantum, semiconductors, biotechnology. The convergence is not the result of twenty independent analyses. It is the result of one shared method: an interdepartmental council plus a stakeholder consultation. That method does not measure anything. It registers which institutions are already large enough to be heard. The lists therefore describe the occupied territory, not the territory where action is needed. Four domains fall through every list — water, soil and food resilience; health as a systemic condition; democratic and institutional innovation; fundamentally alternative energy routes. These are exactly the domains where societal tension is now accumulating. This essay shows the evidence, names the three failures of the current criteria, and presents an alternative: a criterion set that measures tension, passage and depth, worked out to the level of a patent generator. The data to do this exists and is free. Appendix A contains all twenty lists, their budgets, their selection processes and their sources.

I. The finding

Ask any government why artificial intelligence is on its strategic list. The answer will be fluent. Ask the same government to show the study in which AI was weighed against the alternatives, with criteria, scores and a rejected shortlist. The study does not exist. Not in the Netherlands. Not in France, Germany, the United Kingdom, the European Commission, Japan or South Korea.

This is the central finding of the research behind this essay. Twenty jurisdictions selected their strategic technologies. In at least eight of the ten largest, the selection was made by an interdepartmental council fed by a stakeholder consultation. Only four bodies use a published, quantitative scoring method. Three of those four are think-tanks, not governments. The fourth is Australia.

The result is a global paradox. Everyone claims independent strategic analysis. Everyone arrives at the same list.

II. The copy chain, with dates

The convergence can be dated document by document.

The United States published its first Critical and Emerging Technologies list in 2020, updated it in 2022 (19 categories) and again in February 2024 (18 categories). Australia published its List of Critical Technologies in the National Interest in 2022. The Australian Strategic Policy Institute launched its Critical Technology Tracker in March 2023 and states plainly that its technology set "was drawn significantly from the Australian Government's 2022 list". The tracker grew from 44 to 64 to 74 technologies and is now cited by governments worldwide. In March 2023 the United Kingdom named its five critical technologies. In October 2023 the European Commission issued Recommendation C(2023)6689 with ten critical technology areas. In 2023 Germany adopted six missions that mirror the missions of Horizon Europe. In December 2025 the Dutch Wennink Report organised the existing Dutch and European material into four domains.

That is not twenty analyses. That is one wave, moving through twenty administrations in five years. Each document cites the previous ones. None of them starts from a measurement.

III. How the lists are actually made

The processes are documented and remarkably uniform.

France 2030 (€54 billion, ten objectives) was, in the government's own words, developed "in concertation with economic, academic, local and European actors". Germany's Zukunftsstrategie was drafted "with stakeholders" and is accompanied by a 21-member forum from business, science and civil society. The UK assessed "over 50 technologies against 8 criteria" inside a council of ministers and advisers. The US list comes from an "interagency deliberative process". Japan's Council for Science, Technology and Innovation decides the Moonshot goals. Korea's twelve strategic technologies came through a Presidential Advisory Council. The Dutch Wennink process consulted more than 1,000 people in over 30 round tables and received 51 investment proposals.

A consultation of this kind has a precise property. Only actors that already exist can speak. A proposal needs an institution behind it: a company, a consortium, a research centre, a budget line. The consultation therefore returns a map of the existing institutional landscape. It cannot return anything else. The four Dutch domains coincide with the portfolios of the companies at the table. The French objectives coincide with the French industrial champions. This is not corruption. It is the arithmetic of the method.

In the image this research uses throughout: a net consists of knots and open meshes. A consultation asks the knots what matters. The knots answer with themselves. The open meshes have no voice, because an open mesh is precisely the place where no institution yet sits.

IV. The real criterion: dependency

Behind the public language of "innovation" and "missions", the operative criteria are about dependency. The EU Recommendation names "technology security and technology leakage". Japan's Economic Security Promotion Act designates technologies by "criticality, dependence on the outside world, the probability of supply disruption". The EU Critical Raw Materials Act sets a hard benchmark: no more than 65 percent of any strategic raw material from a single third country. The US export-control lists are the same logic in reverse.

So the honest description of current policy is this: each bloc inventories the one-way valves it sits behind, and builds equivalent valves for others. Semiconductors are the clearest case. This is a defensible activity. But it is not a theory of innovation, and it explains the blind spots below. Whatever cannot become a valve — an exportable, patentable choke-point product — cannot appear on a valve inventory.

V. What the convergence accidentally proves

There is one thing the twenty lists get right, and they get it right without knowing why.

Every list converges on four technologies: semiconductors, quantum, biotechnology, AI. Look at what these four have in common. Semiconductors work at the nanometre scale, the deepest layer of matter that industry can currently address. Quantum technologies address phase and coherence directly — deeper still. Biotechnology addresses the reading layer of the cell. AI addresses the reading layer of language and data.

The four are the four deepest points that current technology can reach. Twenty consultations, none of which used depth as a criterion, all selected for depth anyway. The pattern held across rivals: the American, European, Chinese, Japanese and Korean lists share this core exactly (Appendix A, Table 1). An independent bibliometric comparison found 92.5 percent overlap between a machine-derived emerging-technology set and the OECD list.

The conclusion is worth stating carefully. Depth of reach is the actual selection principle of the technological world. The lists obey it blindly. A criterion that is obeyed blindly is a criterion that stops halfway. Consistently applied, it points one layer further down than quantum: to the condition of the medium itself. No list contains that layer. This is where the alternative in Section VIII begins.

VI. Three failures of the current criteria

Failure 1: they measure occupation, not tension. The best available methods — ASPI's tracker, Georgetown CSET's clustering, the Belfer index — count citations, patents and papers. These are measures of activity: how crowded a field already is. No jurisdiction measures where societal load is accumulating and where it lacks a passage. The consequence is visible in the volatility. The US Department of Defense cut its Critical Technology Areas from 14 to 6 within one year. The EU's STEP platform was proposed with €10 billion of new money and enacted with €1.5 billion. When a list can change by half without a methodological reason, it is a political clock, not an instrument.

Failure 2: they can only see institutions. Section III showed why: the consultation method returns the existing landscape. The 51 Dutch proposals could only come from parties able to write proposals. Technologies without an institutional home — however loaded the underlying problem — are structurally invisible. This is a selection bias by construction, not by intent.

Failure 3: they cannot see what cannot become a product. Four domains are absent from every list examined: water, soil and food resilience as a technology field; health as a systemic condition rather than a pharmaceutical product; democratic and institutional innovation; fundamentally alternative energy routes beyond the established net-zero catalogue. Their common feature: none of them can be framed as an exportable choke-point good. A dependency-driven method drops them automatically. Two partial exceptions prove the rule and come from outside the West: Japan's Moonshot programme includes weather control, mental wellbeing and food systems as explicit goals; China's Five-Year Plans include brain science. No Western list contains anything comparable.

VII. Who pays

The gap is not abstract. In the Netherlands alone, the loaded domains that no list can see have names and numbers. Drought years now recur; 2026 joined the driest years on record. Disability inflow among people in their twenties is rising, driven by mental-health claims. Grid congestion blocks housing and business connections across whole provinces. Housing shortage persists at record levels. These are the places where households, farmers, young workers and small firms carry the load. Meanwhile the strategic budgets — France's €54 billion, the proposed Dutch investment agenda, Korea's ₩30 trillion — concentrate on the occupied territory, where the largest firms already stand. The people inside the blind spots are not against chips or AI. They are simply not measured, and what is not measured is not funded.

VIII. The alternative: criteria that measure

The alternative developed in this research programme rests on a simple model, stated here in eight lines so that the essay is self-contained.

1. Reality is a net: one strand, knots, and open meshes.
2. A technology, a firm, an institution is a knot: a closed winding of the strand.
3. Tension loads the net where activity cannot pass; discharge follows where a passage exists.
4. Value lies at depth: the deeper the winding a technology reaches, the more it carries.
5. Load is measurable before discharge; the market crashes of 2000 and 2008 were measurable in advance.
6. A patent is a closure: a claim that locks one mesh.
7. A dependency is a one-way valve: a passage that works in one direction only.
8. Innovation, properly defined, is a new closure at a loaded, open, deep mesh.

From these eight lines follow three criteria that replace the consultation:

Criterion 1 — Tension. For every candidate field: is load accumulating behind it? The gauges exist and are public: food-price bands, disability inflow, grid congestion, drought indices, housing shortage. A field without load is empty regardless of how fashionable it is.

Criterion 2 — Passage. Does the field open a discharge path, or does it add another valve? Does it route around a dependency the country actually sits behind? A valve inventory (Section IV) is the input here, not the conclusion.

Criterion 3 — Depth. Which layer does the technology reach? The convergence core proves depth is the real principle; this criterion applies it explicitly instead of blindly, and therefore does not stop at the current frontier.

These criteria are operational, because the data layer that none of the twenty lists uses is free and public. The European Patent Office's PATSTAT database holds bibliographic and legal data on more than 130 million patent applications and is now accessible free of charge through the Technology Intelligence Platform, with computing capacity included. The EPO's new Data Desk (June 2026) adds curated datasets, starting with energy-transition technologies and quantum. Patents are the one record that does not measure talk: a patent family shows where a claim was actually closed, by whom, in which country.

From criteria to a generator

The criteria can be pushed one step further, to a method that produces innovation addresses rather than domain labels. It combines two well-documented sources. Genrich Altshuller, working as a patent examiner, analysed tens of thousands of patents and found that significant inventions resolve a contradiction: two requirements pulling against each other at one point. Gerhard Gentzen proved that every formal derivation can be freed of its borrowed lemmas — the "cut" — and rebuilt self-contained. Combined with the three criteria, this yields a six-step procedure:

1. In a patent class, extract the contradiction: the parameter pair that moves against itself across the corpus (capacity versus degradation, speed versus heat).

2. Find the shared cut: the assumption every existing solution imports and none derives — the term that appears as a premise in nearly all independent claims ("storage means holding charge", "cooling means removing heat").
3. Reformulate the end function without the cut.
4. Redistribute the conflict along four axes — time/phase, place, scale, condition — Altshuller's four separation principles, reduced to the four coordinates of the net.
5. Rebuild the claim as a self-contained derivation: features entail function; the derivation tree is the claim tree.
6. Test against the corpus. Novelty: the end claim does not exist. Inventive step, now measurable: the derivation uses no cut that is standard in the class. Tension: a public gauge shows load behind the field.

Every step runs on free infrastructure: PATSTAT for the corpus, the Espacenet interface for prior art, public statistics for the gauges. The rejected candidates feed back into step 1. The direction of the whole procedure is Altshuller's own law of increasing ideality — function without system — which is also the design rule of the net: set the condition so that the goal is the fixed point.

IX. What a policymaker can do now

First, ask for the missing table. For any strategic list on your desk: which alternatives were scored, with which criteria, and which were rejected? If no table exists, the list is an aggregation, and should be labelled as one.

Second, separate the valve inventory from the innovation agenda. Dependency management is legitimate and necessary. It is not the same task as selecting innovation, and merging the two produces the blind spots of Section VI.

Third, install the gauges. Publish, per candidate field, the tension reading (which public indicator, what level) and the passage reading (which dependency it routes around). This costs a fraction of one consultation round.

Fourth, fund one blind spot deliberately. Water-soil-food resilience, health as condition, democratic passage, alternative energy routes: pick one, apply the three criteria, and compare its yield after three years with an equally sized grant in the convergence core.

Fifth, run the generator once. One patent class, six steps, free data. The result — a list of loaded, open, deep addresses with draft claims — is a different kind of document from any strategic list now in circulation. It can be checked, because every step is explicit.

X. Conclusion

Twenty governments wrote the same list in five years without a single measurement. The method guaranteed the outcome: consultations return the existing knots. The convergence on semiconductors, quantum, biotechnology and AI accidentally proves the one criterion that matters — depth — and then stops applying it. The dependency logic behind the lists guarantees the blind spots, and the blind spots are where the load now sits: in the dry fields, the disability statistics, the congested grid, the stalled democratic passage. The alternative is not another list. It is a set of instruments: tension, passage, depth, and a generator that turns them into addresses. The data is free. The method is on the table. What is missing is only the decision to measure.

Annotated references

J. Konstapel, "The Strand That Knots Itself", constable.blog, 9 July 2026. Why read? The foundation of the method in Section VIII: one strand, closure, and the seam where two tensions meet as the place of discovery. Read first.

J. Konstapel, "The Gentzen–Altshuller Fusion: Architecting Inventive Mathematical Discovery", Constable Research working paper. Why read? The formal source of the generator: contradiction finding combined with cut elimination as one discovery procedure.

J. Konstapel, "De Andere Begroting", constable.blog, September 2026. Why read? The same criteria applied to a national budget: what tension-based selection looks like chapter by chapter, with amounts.

Peter Wennink, "De route naar toekomstige welvaart", December 2025. Why read? The Dutch case: four domains, 1,000+ consulted, 51 proposals, and no selection table. The methodology section shows the aggregation method in its clearest form.

TNO & NWO, "National Technology Strategy", 2024. Why read? The Dutch technology-level selection (ten from forty-four) that the Wennink domains aggregate. The four criteria stated here return, unattributed, in every later Dutch document.

European Commission, Recommendation C(2023)6689, October 2023. Why read? The EU's ten critical technology areas and the explicit dependency criteria ("technology security and technology leakage"). The template for smaller member states.

White House OSTP/NSTC, "Critical and Emerging Technologies List Update", February 2024. Why read? The head of the copy chain: eighteen categories, interagency process, national-security purpose. Compare the 2020 and 2022 versions to watch a list drift without a stated method.

ASPI, "Critical Technology Tracker", 2023–2025 editions. Why read? The most influential quantitative tracker, its own statement that its technology set came from the Australian government list, and the finding that China leads in 66 of 74 tracked technologies. A measure of occupation, used worldwide as if it were a measure of importance.

Belfer Center, "Critical and Emerging Technologies Index", June 2025. Why read? The cleanest example of a weighted scoring method (five sectors, 25 countries) — and of what such a method still cannot see: tension and passage do not appear in it.

Mario Draghi, "The Future of European Competitiveness", September 2024. Why read? The scale of the stakes: €750–800 billion per year of additional investment recommended. The essay's question — selected by which criteria? — attaches to every euro of it.

G. Altshuller, "Creativity as an Exact Science", 1984 (orig. 1979). Why read? The method distilled from tens of thousands of patents by a man who read them himself: contradictions, separation principles, the law of ideality. The empirical ancestor of the generator.

G. Gentzen, "Untersuchungen über das logische Schließen", 1935. Why read? The cut-elimination theorem: every derivation can be made self-contained. Translated here into an operational definition of inventive step.

EPO, PATSTAT and the Technology Intelligence Platform. Why read? The free measurement layer: 130+ million applications, SQL and Python access, and (since June 2026) the Data Desk with curated energy and quantum datasets. The instrument the twenty lists never used.

Appendix A — The data

A.1 The lists per jurisdiction

Netherlands. TNO/NWO base list 2023: 44 key technologies in 8 categories. National Technology Strategy 2024: 10 priorities — optical systems and integrated photonics; quantum; process technology; biomolecular and cell technologies; imaging; (opto)mechatronics; AI and data science; energy materials; semiconductors; cybersecurity. Criteria: earning capacity, societal challenges, national security, potential leadership. Wennink Report (12 December 2025): four domains — digitalisation and AI; security and resilience; energy and climate technology; life sciences and biotechnology. Process: 1,000+ consulted, 30+ round tables, 51 proposals; advisory group with EY, Rabobank, Shell, EIB, CPB, FME, Philips, UMCG, AWTI, SER, TNO, McKinsey, VNO-NCW, APG, DSM-Firmenich.

France. France 2030 (announced 12 October 2021): €54 billion, ten objectives — small modular reactors; green hydrogen leadership; industrial decarbonisation; 2 million zero-emission vehicles by 2030; first low-carbon aircraft; healthy, sustainable, traceable food; 20 biomedicines plus future medical devices; cultural and creative content and immersive technologies; space; the deep sea. Transversal levers: raw materials, components, digital, talent, innovation finance. Governance: SGPI; executed by ANR, ADEME, Bpifrance, Caisse des Dépôts. Status 2024–25: €40 billion committed, ~7,000 beneficiaries, ~7,500 projects.

United Kingdom. Science and Technology Framework (March 2023, withdrawn April 2025): five critical technologies selected from 50+ against 8 criteria — AI; engineering biology; future telecommunications; semiconductors; quantum. ~£250 million initial funding for the first three. Modern Industrial Strategy (23 June 2025): eight growth-driving sectors — advanced manufacturing; clean energy industries; creative industries; defence; digital and technologies; financial services; life sciences; professional and business services. £4 billion additional; British Business Bank to £25.6 billion. ARIA as high-risk agency.

Germany. Zukunftsstrategie Forschung und Innovation (cabinet, 8 February 2023): six missions — resource-efficient circular competitive industry and sustainable mobility; climate protection, adaptation, food security, biodiversity; health; digital and technological sovereignty of Germany and Europe; space and seas; societal resilience, diversity, cohesion. Forum of 21 stakeholder members. Missions explicitly aligned with Horizon Europe. SPRIND for leap innovation.

European Union. C(2023)6689 (3 October 2023): ten critical technology areas, four highest-risk (advanced semiconductors, AI, quantum, biotechnologies); further: advanced connectivity/navigation/digital; advanced sensing; space and propulsion; energy; robotics and autonomous systems; advanced materials, manufacturing and recycling. Chips Act 2023: 20 percent world market share target by 2030. Critical Raw Materials Act (in force 23 May 2024): 34 critical, 17 strategic materials; benchmarks 10 percent extraction, 40 percent processing, 25 percent recycling, max 65 percent single-country. Net-Zero Industry Act (agreement 6 February 2024): eight strategic net-zero technologies — solar PV/thermal; onshore wind and offshore renewables; batteries and storage; heat pumps and geothermal; electrolysers and fuel cells; sustainable biogas/biomethane; carbon capture and storage; grid technologies; 40 percent domestic production target. STEP (in force 1 March 2024): three buckets — digital/deep-tech; clean and resource-efficient; biotechnologies; proposed €10 billion new money, enacted €1.5 billion (to the European Defence Fund); reprograms 11 funds; Sovereignty Seal. Draghi Report (9 September 2024): €750–800 billion per year additional investment, 4.4–4.7 percent of EU GDP. Competitiveness Compass (29 January 2025).

United States. OSTP/NSTC Critical and Emerging Technologies list, 2024 edition, 18 categories: advanced computing; advanced engineering materials; advanced gas turbine engine technologies; advanced and networked sensing and signature management; advanced manufacturing; artificial intelligence; biotechnologies; clean energy generation and storage; data privacy, data security and cybersecurity technologies; directed energy; highly automated, autonomous and uncrewed systems and robotics; human-machine interfaces; hypersonics; integrated communication and networking technologies; positioning, navigation and timing; quantum information and enabling technologies; semiconductors and microelectronics; space technologies and systems. CHIPS and Science Act 2022: NSF TIP directorate, 10 key technology focus areas; $20 billion authorised, ~$410 million appropriated. DoD Critical Technology Areas: 14 (2023) reduced to 6 (November 2025). BIS export controls as the inverse list.

China. Made in China 2025 (2015): ten sectors — next-generation IT; robotics and CNC; aerospace; ocean engineering and ships; rail; new energy vehicles; power equipment; agricultural machinery; new materials; biopharma and medical devices. 14th Five-Year Plan (2021–2025): seven frontier technologies — AI; quantum information; integrated circuits; brain science and brain-inspired computing; genomics and biotechnology; clinical medicine and health; deep space, deep sea and polar exploration. 15th Five-Year Plan (2026–2030): "new quality productive forces"; core: semiconductors, AI, robotics, biotechnology, quantum computing, 6G; low-altitude economy; AI Plus policy. Little Giants programme: 17,600+ national-level firms (November 2025), ~80 percent at critical supply-chain positions. Manufacturing share: ~28–29 percent of world value added ($4.66 trillion, 2023).

India. National Quantum Mission (approved 19 April 2023): ₹6,003.65 crore to 2030–31. IndiaAI Mission: ~₹10,372 crore; 45,000+ shared GPUs (June 2026). India Semiconductor Mission: ₹76,000 crore phase one. Anusandhan National Research Foundation; RDI fund ₹1 lakh crore (Budget 2025–26). BioE3 biomanufacturing policy; National Deep Tech Startup Policy; DRDO priorities.

Japan. Economic Security Promotion Act (11 May 2022): specified critical technologies; K Program started with 27 technologies in four domains (oceans; space/airspace; cyber and inter-domain; bio), later ~50 areas; ~$3.5 billion support; JST and NEDO funds of ¥250 billion each; five cross-cutting technologies: AI, quantum, robotics, advanced sensing, advanced energy. Designation criteria: criticality, external dependence, supply-disruption probability, need for stable-supply measures. Society 5.0 (2016). Moonshot Program (2018, ¥100+ billion): ten goals including weather control, mental wellbeing, disease prevention, fault-tolerant quantum computing by 2050, fusion.

South Korea. Twelve National Strategic Technologies (2022; Special Act 2023; First Basic Plan 2024–2028): semiconductors and displays; secondary batteries; advanced mobility; next-generation nuclear; advanced bio; aerospace and marine; hydrogen; cybersecurity; AI; next-generation communications; advanced robotics and manufacturing; quantum. Budget: ₩30 trillion over five years announced; ₩6.8 trillion (~$4.9 billion) in 2025; target 35 percent of government R&D by 2027.

Australia. List of Critical Technologies in the National Interest (2022; revised 19 May 2023 to seven fields): advanced manufacturing and materials; AI; advanced information and communication technologies; quantum; autonomous systems, robotics, positioning, timing and sensing; biotechnologies; clean energy generation and storage. Published two-step methodology (RANDsupported); three pillars: national security, economic prosperity, social cohesion; AU$1 billion via the National Reconstruction Fund.

Multilateral. NATO Emerging and Disruptive Technologies (2021): nine areas — AI; data; autonomy; quantum-enabled; biotechnology; hypersonics; space; novel materials and manufacturing; energy and propulsion; DIANA accelerator and NATO Innovation Fund. AUKUS Pillar 2: quantum, AI, hypersonics, cyber, autonomy, undersea. Quad Critical and Emerging Technology Working Group.

A.2 Comparison table

Technology	US CET	EU (10)	UK (5)	FR 2030	DE (6 missions	CN FYP	JP K-prog	KR (12)	AU (7)	NATO EDT (9)
Artificial intelligence	X	X	X	(digital lever)	X	X	X	X	X	X
Quantum	X	X	X	X	X	X	X	X	X	X
Semiconductors	X	X	X	X	X	X	X	X	(in ICT	—
Biotechnology	X	X	X	X	(health)	X	X	X	X	X
Advanced materials	X	X	—	(lever)	—	X	(sensi	—	X	X
Advanced manufacturing /	X	X	—	X	X	X	X	X	X	X
Clean / net-zero	X	X	(IS-	X	X	X	X	X	X	X
Space	X	X	—	X	X	X	X	X	—	X
Advanced	X	X	X	—	—	X	—	X	X	(data)
Hypersonics / directed energy	X	(space & prop.)	—	—	—	X	—	—	—	X

Convergence core: AI, quantum, semiconductors, biotechnology on effectively every list. Bibliometric confirmation: 92.5 percent overlap between a machine-derived emerging-technology set and the OECD list (Cosmos 1.0, arXiv 2505.10591). Independent comparison: DLR Projektträger, comparing EU, France, Canada, Netherlands, Australia and the US, finds AI, quantum, biotechnology, robotics and energy technologies "in virtually all analysed lists".

A.3 The copy chain

2020: US CET first edition. 2022: US CET update (19 categories); Australian list. March 2023: ASPI Critical Technology Tracker, technology set "drawn significantly" from the Australian 2022 list; UK five critical technologies. October 2023: EU C(2023)6689. 2023: German six missions, aligned with Horizon Europe missions. February 2024: US CET update (18 categories). December 2025: Dutch Wennink Report, aggregating NTS and EU material. ASPI editions: 44 technologies (2023) → 64 (2024) → 74 (2025); China first in 66 of 74 (2020–24 edition, December 2025).

A.4 Selection processes and methods

Council-plus-consultation (no published scoring): Netherlands, France, Germany, United Kingdom, European Union, United States, Japan, South Korea. Published quantitative methods: Australia (two-step, three pillars, patent-informed); ASPI (top-10-percent citation shares); Georgetown CSET/ETO (bibliometric research- and patent-clustering, ~60 datasets); Belfer CETI (weighted sector index: semiconductors 48 percent, AI 35 percent, biotech 25 percent, space 20 percent, quantum 15 percent; 25 countries).

A.5 Volatility indicators

DoD Critical Technology Areas: 14 (2023) → 6 (November 2025). STEP: proposed €10 billion new money → enacted €1.5 billion. UK Science and Technology Framework: published March 2023, withdrawn April 2025, replaced by an eight-sector industrial strategy. NSF TIP: $20 billion authorised, ~$410 million appropriated. Interpretation threshold used in this research: a list changing more than 30 percent within 24 months without a stated methodological reason is politically, not analytically, driven.

A.6 The free measurement layer

EPO PATSTAT: bibliographic and legal event data on 130+ million patent applications from 100+ patent offices; reference database for OECD, World Bank, European Commission, IEA; 6,000+ academic publications reference it. Access: free through the Technology Intelligence Platform (browser, Jupyter/Python, SQL, computing capacity included); PATSTAT Online and bulk data by subscription (Global: 28 tables, ~459 GB unzipped). EPO Data Desk (launched June 2026, VivaTech Paris): free curated datasets, initially energy-transition technologies and quantum computing. Prior-art checking: Espacenet and the Open Patent Services interface.

A.7 Caveats

Some figures are authorisations, not expenditures (NSF TIP; STEP). The Critical Raw Materials benchmarks are described as non-binding by the European Parliament's research service and as binding by some commercial sources. China's Little Giants count is a moving target (roughly 9,000 in 2022 to 17,600+ in November 2025). Japan's K Program grew from 27 technologies to ~50 areas. ASPI leadership counts depend on edition and time window. The absence analysis (Section VI, failure 3) describes what is not on the lists; absence is by nature harder to source than presence, and is documented here by exhaustive listing of what is present.

All list contents, dates and figures in this appendix derive from the primary documents and official publications of the respective governments and bodies, gathered September 2026.