The Intellectual and Institutional Origins of the Wennink Strategy

How did Peter Wennink arrive at four strategic domains?

The most interesting question raised by the Dutch Wennink Report is not whether digitalisation, security, energy and biotechnology are important. They plainly are.

The more fundamental question is:

Why these four domains?

And, more specifically:

Was the selection derived from existing scientific and strategic research through explicit criteria, or was it constructed as part of the political and stakeholder process surrounding the Wennink Report?

This question becomes considerably more important when the report is placed in its institutional context. The Netherlands and the European Union had already undertaken extensive work on strategic technologies before the Wennink Report was commissioned in September 2025. TNO and NWO had developed a National Technology Strategy; the European Commission had identified critical technologies for European economic security; the OECD had developed extensive work on industrial and mission-oriented innovation policy; and the Dutch government had already established a mission-driven innovation system based on a substantially broader technology landscape.

The Wennink Report therefore did not start with a blank sheet of paper.

It entered an already highly developed policy and research landscape.

And that makes the absence of a transparent derivation of its four domains more striking.

1. The policy landscape before Wennink

The starting point was the Dutch policy concept of “key enabling technologies”.

In 2023, TNO and NWO, commissioned by the Dutch Ministry of Economic Affairs and Climate Policy, revised the Dutch national list of key technologies. The result was a list of **44 technologies in eight categories**. The categories included advanced materials; photonics and optical technologies; quantum technologies; digital and information technologies; chemical technologies; nanotechnology; life sciences and biotechnology; and engineering and fabrication technologies.

The individual technologies were highly specific.

They included:

- energy materials;
- integrated photonics;
- photonic detection and processing;

- quantum computing;
- quantum communication;
- quantum sensing;
- artificial intelligence;
- data science;
- cybersecurity;
- software and computing;
- digital connectivity;
- process technology;
- catalysis;
- biomolecular and cell technologies;
- biomanufacturing;
- imaging;
- mechatronics;
- robotics;
- additive manufacturing;
- microelectronics;
- systems engineering.

This is important because it demonstrates that the Dutch government already possessed a sophisticated technology taxonomy before Wennink.

The policy question was therefore not simply “which technologies are important?”

That question had already been investigated.

2. The National Technology Strategy went further

In 2024, TNO and NWO produced the National Technology Strategy (NTS).

The NTS did not merely list technologies. It attempted to **prioritise** them.

The NTS identified ten key enabling technologies:

1. optical systems and integrated photonics;
2. quantum technologies;
3. process technology, including process intensification;
4. biomolecular and cell technologies;
5. imaging technologies;
6. mechatronics and optomechatronics;
7. artificial intelligence and data science;
8. energy materials;
9. semiconductor technologies;
10. cybersecurity technologies.

This is already a very different structure from the four Wennink domains.

The NTS used four explicit criteria. A technology was prioritised if it:

1. makes a major contribution to Dutch earning capacity;
2. is crucial for addressing societal challenges;
3. is important for national security; and
4. offers the Netherlands the possibility of technological leadership.

These criteria are strikingly similar to the arguments later used by Wennink.

That creates an important question:

If these criteria were already being used by the Dutch technology-policy system, why did they not produce the four Wennink domains?

The answer appears to be that the two exercises are operating at different levels.

The NTS asks:

Which technologies should the Netherlands prioritise?

Wennink asks:

In which broad strategic domains should the Netherlands organise its future investment strategy?

That distinction is legitimate.

But it should have been made explicit.

3. TNO's later analysis makes the connection even clearer

There is an additional piece of evidence that is particularly relevant.

TNO subsequently published an analysis specifically examining the technological position of the Netherlands in connection with the Wennink Report.

TNO writes that the Netherlands is losing ground in strategically important technologies and explicitly refers to the ten technologies of the National Technology Strategy, including quantum, biotechnology, AI, mechatronics and imaging technology. It concludes that these technologies are linked to critical domains such as security, climate and energy, health and biotechnology, and digital technologies.

This is perhaps the missing bridge between the NTS and Wennink.

The four broad Wennink domains appear to function as **umbrella categories** under which the ten NTS technologies can be organised.

For example:

Digitalisation and AI

can encompass AI, data science, semiconductors, photonics, cybersecurity, quantum technologies, software, connectivity and robotics.

Energy and climate

can encompass energy materials, process technology, advanced materials, catalysis, chemical technologies and parts of engineering.

Life sciences and biotechnology

can encompass biomolecular and cell technologies, biosystems, biomanufacturing and bioinformatics.

Security and resilience

can encompass cybersecurity, sensing, imaging, quantum technologies, robotics, advanced materials and dual-use technologies.

This interpretation makes the Wennink framework much more intelligible.

But it also changes the claim.

The four domains are not necessarily the result of a new technology-selection exercise.

They may instead be a **strategic aggregation of technologies that had already been selected through the NTS process**.

4. The European Union had reached a different but related conclusion

The European Commission had also undertaken its own strategic technology assessment.

In October 2023, the Commission identified **ten critical technology areas for European economic security**.

They were:

1. advanced semiconductor technologies;
2. artificial intelligence technologies;
3. quantum technologies;
4. biotechnologies;
5. advanced connectivity, navigation and digital technologies;
6. advanced sensing technologies;
7. space and propulsion technologies;
8. energy technologies;
9. robotics and autonomous systems;
10. advanced materials, manufacturing and recycling technologies.

The Commission's selection was explicitly connected to economic security, technological dependencies and the risk of technology leakage.

The Commission also established explicit criteria. Its assessment considered, among other things, whether technologies were enabling and transformative, their relevance to civil and military applications, and the risk associated with their misuse.

Again, the resulting list is not the four Wennink domains.

It contains important areas that disappear as independent categories in the Wennink framework:

- semiconductors;
- quantum;
- advanced sensing;
- robotics;
- advanced materials;
- space and propulsion.

That does not demonstrate that Wennink is wrong.

It demonstrates something more precise:

there is no obvious international consensus that the technological landscape naturally collapses into the four Wennink domains.

Different institutions, using different but explicit strategic criteria, produce different classifications.

5. The European approach is particularly relevant

The European Commission's methodology is useful because it was designed around precisely the issues that Wennink emphasises: strategic autonomy, technological dependence, economic security and geopolitical risk.

Yet the European list is considerably more granular.

This creates an analytical puzzle.

If strategic autonomy and geopolitical dependence are central reasons for Wennink's four domains, then why are semiconductors, quantum technologies, sensing, robotics and advanced materials not identified as separate strategic domains?

One possible answer is that Wennink does not intend them to disappear.

They are embedded within the broader domains.

But that means that the four domains are not really technology priorities in the same sense as the European critical-technology list. They are **policy umbrellas**.

This distinction is essential.

6. The OECD literature provides another warning

The international literature on industrial policy adds another dimension.

The OECD has increasingly studied “mission-oriented” and strategic innovation policy. The central problem is how governments can direct scarce resources toward important societal and economic objectives without simply selecting politically attractive sectors.

The literature distinguishes between identifying a societal mission and selecting particular technologies or firms.

This is not a semantic distinction.

Suppose the mission is the energy transition.

That mission does not imply that the government should select one particular technology. It may require simultaneous investment in:

- grid infrastructure;
- storage;
- energy materials;
- hydrogen;
- industrial electrification;

- nuclear technology;
- carbon management;
- process technology;
- demand-side technologies.

Likewise, a digital mission can involve AI, semiconductor manufacturing, photonics, quantum computing, cybersecurity, robotics and data infrastructure.

The mission-oriented literature therefore provides a theoretical reason to be cautious about treating broad domains as investment priorities.

A domain is not a strategy.

A strategy requires decisions about technologies, market failures, instruments, additionality and measurable outcomes.

7. The problem of “picking winners”

The international literature also contains a long-standing warning about “picking winners”.

The issue is not that governments should never prioritise.

They inevitably must when public resources are scarce.

The problem is that the government must demonstrate why a particular intervention is superior to alternatives.

This requires at least:

- a clearly identified market failure;
- evidence of additionality;
- an assessment of spillovers;
- an assessment of Dutch comparative advantage;
- an assessment of international competition;
- an estimate of future economic value;
- an assessment of strategic dependence;
- and an analysis of opportunity costs.

The OECD's work on industrial policy stresses precisely this need for an explicit policy rationale and evaluation framework.

The Wennink Report contains many arguments of this type, but does not present them as a transparent scoring or portfolio-selection mechanism.

8. The Wennink report itself

The report was commissioned by the demissionary Schoof government in September 2025 and presented by Peter Wennink on 12 December 2025.

Its central diagnosis is that the Netherlands faces declining competitiveness, insufficient investment and increasing geopolitical vulnerability. The report argues that future prosperity requires higher investment and greater strategic relevance.

It subsequently organises its strategic investment agenda around four domains:

- digitalisation and AI;
- security and resilience;
- energy and climate technology;
- life sciences and biotechnology.

The logic is understandable.

These are simultaneously economic, technological, societal and geopolitical domains.

But the report does not show a table in which all relevant technology domains are scored against the same criteria and the four domains emerge as the highest-scoring portfolio.

This is the central analytical gap.

9. The 51 investment proposals

The methodology becomes particularly important at this point.

Wennink reports that his team consulted more than 1,000 people through more than 30 round tables and received 51 concrete investment and project proposals.

This is a major stakeholder exercise.

But it is not equivalent to a neutral technology assessment.

A stakeholder process tells us what companies, institutions and consortia consider important investment opportunities.

It does not automatically tell us which opportunities provide the highest social return.

The distinction is fundamental.

Imagine that a government asks a thousand people:

“What major projects should the Netherlands invest in?”

It will receive a portfolio of proposals.

That portfolio is informative.

But the fact that many proposals cluster around four themes does not prove that those four themes would have emerged from an independent comparison of every relevant technology.

The consultation process may itself influence the result.

10. This is where the composition of the advisory environment matters

The formal advisory group surrounding the report included senior figures from business, finance, government and knowledge institutions.

Among them were representatives associated with EY, Rabobank, Shell, the European Investment Bank, CPB, FME, Philips, UMCG, AWTI, SER, TNO, McKinsey, VNO-NCW, APG and DSM-Firmenich.

This is a powerful network for identifying economic opportunities, investment barriers and strategic industrial priorities.

It is not, however, a purely scientific selection committee.

That does not imply improper influence.

It means that the resulting strategy should be interpreted as a product of **strategic stakeholder deliberation** rather than as the mechanical output of an independent scientific optimisation.

The distinction is important precisely because the report is used to justify very large public and private investment flows.

11. The role of Berend Nix

Berend Nix is particularly relevant because he connects the Wennink process to the earlier technology-policy machinery.

Nix was involved in the preparation of the Wennink Report and later participated in its parliamentary technical briefing.

His previous work was closely connected to the National Technology Strategy and the question of how financial instruments could be aligned with strategic technologies.

This suggests institutional continuity.

The Wennink process was not developed independently of the existing Dutch technology-policy system.

Rather, it appears to have built on that system and reorganised it into a broader economic and investment narrative.

That makes it less surprising that TNO subsequently described the ten NTS technologies as being connected to precisely the four broad areas that became central to Wennink: security, climate and energy, health and biotechnology, and digital technologies.

12. The four domains may therefore be an aggregation rather than a selection

This is perhaps the most important conceptual finding.

There are two very different propositions:

Proposition A

The Netherlands objectively examined all relevant technologies and discovered that four domains are the optimal strategic priorities.

and

Proposition B

The Netherlands already had a set of priority technologies, and these technologies can be organised into four broad strategic domains corresponding to major societal and geopolitical challenges.

The available evidence is much more consistent with Proposition B.

The NTS provides the technology-level selection.

The European Commission provides a parallel European economic-security selection.

The Wennink Report then provides a broader strategic investment narrative.

This would explain why the four domains themselves are not supported by a separate selection model.

13. TNO's own 2026 strategy is revealing

A particularly useful piece of evidence comes from TNO's own Strategic Plan 2026–2029.

TNO now says that it has assessed where its “maximum added value” lies and asks whether it is a leading innovator in a particular field or merely one of many actors.

It specifically identifies high-tech, quantum technology, semiconductors, AI, cybersecurity and defence as areas receiving greater priority, alongside selected areas of sustainability and health.

This is instructive.

TNO itself is moving towards a more granular principle:

It is not enough that something is socially important. The question is whether the Netherlands — or TNO specifically — can add distinctive value.

That is precisely the question that is underdeveloped in the broad Wennink domains.

“Energy” is important.

But that does not tell us whether the Netherlands should prioritise:

- grid technology;
- nuclear technology;
- hydrogen;
- storage;
- industrial process technology;
- materials;
- offshore energy;
- or something else.

The actual policy decision occurs one level below the broad domain.

14. What the strategic research actually tells us

When the major sources are put together, a surprisingly coherent picture emerges.

TNO/NWO says:

Focus on technologies where earning capacity, societal relevance, national security and Dutch technological leadership intersect.

The European Commission says:

Focus on technologies that create strategic economic-security risks and dependencies.

The OECD says:

Strategic and mission-oriented policy needs explicit objectives, rationales, governance and evaluation rather than simply selecting attractive sectors.

TNO's later analysis says:

The Netherlands is losing ground in the very technologies identified by the NTS, and these technologies underpin security, energy and climate, health and biotechnology, and digitalisation.

Wennink says:

These broader domains should become the focus of Dutch strategic investment.

These statements can be reconciled.

But they do not prove that the four Wennink domains are an independently derived optimal portfolio.

15. The missing counterfactual

The most important missing element is a counterfactual.

Suppose the Netherlands has €10 billion of additional public resources.

Why should it allocate €2 billion to one domain rather than another?

To answer that, one needs to compare alternatives.

For example:

Portfolio A: AI, biotech, energy, defence.

Portfolio B: semiconductors, photonics, quantum, robotics.

Portfolio C: advanced materials, chemical technology, process technology, energy systems.

Portfolio D: a diversified portfolio across the ten NTS technologies.

Then calculate, under transparent assumptions:

- expected economic return;
- employment;

- productivity;
- export potential;
- technological spillovers;
- strategic autonomy;
- national-security contribution;
- additional private investment;
- probability of successful scaling;
- and opportunity costs.

Nothing in the publicly available Wennink material demonstrates such a comparative exercise.

Without it, one cannot scientifically establish that Portfolio A dominates the alternatives.

16. Why this matters politically

The issue is not academic.

The Wennink Report proposes very large additional investment.

If the government is going to concentrate public financing around selected strategic domains, the opportunity cost becomes substantial.

Every euro directed toward one strategic technology is potentially a euro not directed toward another.

Therefore the relevant question is not:

“Is AI important?”

Of course it is.

It is:

“Is marginal public investment in AI in the Netherlands expected to produce more strategic and social value than marginal investment in photonics, quantum technology, advanced materials, semiconductors or another field?”

That is a much harder question.

It is also the question that a rigorous industrial strategy ultimately has to answer.

17. A possible explanation for the four domains

The evidence suggests a plausible reconstruction of the origin of the four domains.

The process may be understood as follows:

Existing Dutch technology strategy

→ 44 key technologies

→ NTS selects ten strategic technologies

→ TNO and other institutions analyse Dutch strengths and weaknesses

→ Wennink conducts a very large stakeholder consultation

→ more than 50 investment proposals are submitted

→ proposals and existing technologies are clustered around major societal and geopolitical challenges

→ four broad domains emerge

→ the four domains become the organising structure of the Wennink investment strategy.

This would explain the apparent discrepancy between the highly specific NTS and the much broader Wennink categories.

It also explains why the four categories seem obvious after the fact but are difficult to derive analytically from the report itself.

They may have been **constructed as an organising taxonomy**, rather than **discovered as the result of an optimisation exercise**.

18. What would be needed to settle the question?

There is now a straightforward empirical research programme that could settle this issue.

The 51 investment proposals should be reconstructed.

For every proposal we should identify:

- the submitting organisation;
- the consortium;
- the technology involved;
- the relevant NTS technology;
- the Wennink domain;
- the requested investment;
- the private investment;
- the public investment;
- the strategic justification;
- and the expected economic or societal return.

We should then map these proposals against the complete 44-technology NTS universe.

The result would reveal whether the four domains emerge naturally from the distribution of Dutch technological capabilities and investment opportunities.

It would also reveal which technologies were absent.

That last point is essential.

If photonics, quantum, semiconductors, robotics and advanced materials were represented substantially in the proposals but subsequently disappeared into broader domains, then the issue is merely one of taxonomy.

If important technologies were scarcely represented because their institutional constituencies were not part of the consultation, then the process may have generated a selection bias.

Only the project-level data can distinguish these possibilities.

Conclusion

The four strategic domains of the Wennink Report did not emerge in an intellectual vacuum.

They sit on top of a substantial body of Dutch and European strategic technology research.

Before Wennink, TNO and NWO had already identified 44 Dutch key technologies and selected ten priorities according to explicit criteria concerning economic value, societal challenges, national security and technological leadership.

The European Commission had independently identified ten critical technology areas on the basis of economic-security considerations, including semiconductors, AI, quantum, biotechnology, advanced connectivity, sensing, space, energy, robotics and advanced materials.

TNO's subsequent analysis for the Wennink process then showed that the Netherlands was losing ground in several of these strategically important technologies.

The Wennink Report reorganised this landscape into four broad domains.

That is a defensible strategic framing.

But it is not equivalent to demonstrating, through a reproducible comparative analysis, that these four domains are the optimal national investment priorities.

The distinction matters.

The evidence supports the statement:

The four Wennink domains contain many technologies that previous Dutch and European strategic analyses had already identified as economically, societally or strategically important.

The evidence does not establish the stronger statement:

A systematic comparison of all relevant technological opportunities demonstrated that these four domains should receive priority over all alternatives.

The first is well supported.

The second remains unproven.

The most plausible explanation is therefore that the Wennink framework is a **strategic aggregation of existing technology priorities, societal transitions and stakeholder-generated investment opportunities**, rather than a new scientifically derived ranking of national technologies.

That interpretation also explains the central puzzle that motivated this investigation: why it is so difficult to find the study, model or table in which the four domains are actually selected.

There may be no such study.

The selection appears to have occurred through a combination of existing technology strategy, geopolitical analysis, economic diagnosis and an extensive stakeholder process.

That is not necessarily illegitimate.

But it is important to call it what it is.

It is **strategic policy construction**, not a demonstrated scientific optimisation.

And if the Dutch government is going to use that construction as the basis for concentrating very large amounts of public and private capital, the missing analytical step is obvious: a transparent comparison of the four-domain portfolio with the alternative technological portfolios that the existing TNO, NWO and European evidence makes possible.

Until that analysis is made public, the question "Why exactly these four?" remains only partially answered.

Principal sources

TNO & NWO, *National Technology Strategy: Building blocks for strategic technology policy* (2024). This is the most important pre-Wennink Dutch technology-selection document. It explicitly identifies the ten priority technologies and the four selection criteria.

TNO, *Nieuwe basislijst met sleuteltechnologieën voor de toekomst van Nederland* (2023). Establishes the broader universe of 44 technologies in eight categories from which the NTS was developed.

European Commission, Commission Recommendation C(2023) 6689. Identifies ten critical technology areas for EU economic security and sets out the relevant risk criteria.

European Commission, *Economic Security Strategy* material and subsequent impact assessment. Provides the wider European strategic-autonomy and technology-dependency framework.

TNO, *Cijfers achter Rapport Wennink: Nederland zakt weg op technologiegebied* and *Looking under the hood: Examining the technology position of the Netherlands*. These analyses connect the NTS technologies directly to the four broad strategic areas used in the Wennink process.

TNO, *Strategic Plan 2026–2029*. Particularly useful because TNO itself now emphasises sharper selection according to where Dutch actors can genuinely provide distinctive value, rather than simply treating every important societal issue as a priority.

Peter Wennink, *De route naar toekomstige welvaart* (2025), including its methodology, investment proposals and four strategic domains.

Mazzucato, M., "Mission-Oriented Innovation Policies: Challenges and Opportunities", *Industrial and Corporate Change* 27(5), 2018. Provides the theoretical background for distinguishing missions from sector selection.

OECD, work on mission-oriented innovation policy and industrial policy. Relevant to the methodological problem of defining objectives, selecting interventions and avoiding unsupported "picking winners".

The key conclusion from bringing these sources together is therefore methodological rather than political: **the Netherlands already had sophisticated mechanisms for identifying strategic technologies before Wennink. The distinctive contribution of the Wennink Report is not a new evidence-based technology-selection algorithm, but the construction of a broader strategic investment framework around four domains.**