INTERNATIONAL MONETARY FUND

Sustaining High-Tech Leadership in a Fragmenting World

Nina Budina, Karen Coulibaly, Shinya Kotera, Santiago Previde, and Iglika Vassileva

SIP/2026/087

IMF Selected Issues Papers are prepared by IMF staff as background documentation for periodic consultations with member countries. It is based on the information available at the time it was completed on June 29, 2026. This paper is also published separately as IMF Country Report No 26/198.

2026
AUG

SELECTED ISSUES PAPER

 SIP/2026/087

IMF Selected Issues Paper
European Department

Sustaining High-Tech Leadership in a Fragmenting World, Kingdom of the Netherlands - The Netherlands
Nina Budina, Karen Coulibaly, Shinya Kotera, Santiago Previde, and Iglika Vassileva

Authorized for distribution by Fabian Bornhorst
August 2026

***IMF Selected Issues Papers* are prepared by IMF staff as background documentation for periodic consultations with member countries.** It is based on the information available at the time it was completed on June 29, 2026. This paper is also published separately as IMF Country Report No 26/198.

ABSTRACT: The high-tech sector in the Netherlands is an important source of growth, supported by innovation-driven ecosystems, globally competitive firms, and deep integration into global value chains (GVCs). Openness exposes the sector—especially high-tech manufacturing—to concentrated value-chain supply and demand shocks. In addition, domestic bottlenecks in labor, grid capacity, permitting, and some aspects of scale-up finance weigh on the sector's growth. Sustaining high-tech leadership will require easing domestic bottlenecks, leveraging deeper EU integration to support scaling, and strengthening resilience.

RECOMMENDED CITATION: Nina Budina, Karen Coulibaly, Shinya Kotera, Santiago Previde, and Iglika Vassileva, Sustaining High-Tech Leadership in a Fragmenting World, Kingdom of the Netherlands—The Netherlands. IMF Selected Issues Paper (SIP/2026/087). Washington, DC, International Monetary Fund.

JEL Classification Numbers:	O33, L52, F14, O47
Keywords:	High-tech sector, innovation, industrial policy, supply chain vulnerabilities, economic growth
Author's E-Mail Address:	NBudina@imf.org; KCoulibaly@imf.org; SKotera@imf.org; SPrevide@imf.org; IVassileva@imf.org

SELECTED ISSUES PAPERS

Sustaining High-Tech Leadership in a Fragmenting World

Kingdom of The Netherlands—The Netherlands

Prepared by Nina Budina, Karen Coulibaly, Shinya Kotera, Santiago Previde, and Iglika Vassileva[1]

[1] The authors would like to thank the Dutch authorities, the European Investment Bank, The Netherlands Organization for Applied Scientific Research (TNO), representatives of high-tech companies and industry associations, and other stakeholders for their valuable insights and discussions.

INTERNATIONAL MONETARY FUND

KINGDOM OF THE NETHERLANDS—THE NETHERLANDS

SELECTED ISSUES

June 29, 2026

Approved By:
European Department

Prepared By Nina Budina, Karen Coulibaly, Shinya Kotera, Santiago Previde and Iglika Vassileva (EUR).

CONTENTS

APPENDICES

SUSTAINING HIGH-TECH LEADERSHIP IN A FRAGMENTING WORLD[1]

The high-tech sector in the Netherlands is an important source of growth, supported by innovation-driven ecosystems, globally competitive firms, and deep integration into global value chains (GVCs). Openness exposes the sector—especially high-tech manufacturing—to concentrated value-chain supply and demand shocks. In addition, domestic bottlenecks in labor, grid capacity, permitting, and some aspects of scale-up finance weigh on the sector's growth. Sustaining high-tech leadership will require easing domestic bottlenecks, leveraging deeper EU integration to support scaling, and strengthening resilience.

A. Importance and Strategic Role

1. **The high-tech sector is anchored in innovation ecosystems that connect frontier firms, specialized suppliers, universities, and local authorities.** These ecosystems combine *capability networks*—where firms, suppliers, and research institutions build and diffuse enabling technologies such as semiconductors, photonics, precision mechatronics, and advanced materials—with *mission-oriented networks* that apply these capabilities in areas such as medical and biotech, energy and climate, defense, and digital/ICT (Table 1). Through innovation hubs, ecosystems help translate research into commercial applications and support diffusion across firms, underpinning the Netherlands' strong innovation performance (European Commission, 2025). Close interaction among firms, universities, and local authorities supports knowledge creation and technology diffusion (Brainport Eindhoven, 2026, and Wennink, 2025).

Table 1. The Netherlands: High-Tech Sector Ecosystems

Ecosystem	Scope and Activities
Capability ecosystems	
1. Semiconductors	Design; fab/process; equipment; packaging.
2. Photonics	Components; integrated photonics; optics.
3. High-tech machinery and systems	Precision mechatronics; robotics; integration.
4. Advanced materials and chemical tech	Materials; coatings; specialty chemicals.
5. Electronics and embedded systems	Power/sensors; modules; firmware/control.
Mission ecosystems	
6. Medical and biotech	Diagnostics; biotech, life sciences
7. Energy, climate and circular tech	Clean energy systems; industrial decarbonization.
8. Defense and security (dual-use)	Dual-use supply chains; sensing; cyber.
9. Digital and ICT (horizontal)	Software; data; cloud/edge; cyber.

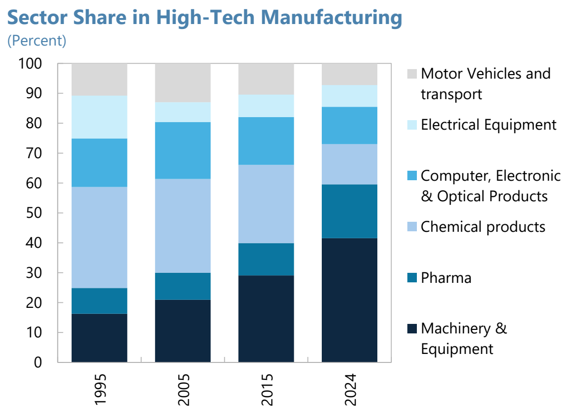
Sources: Wennink (2025); National Technology Strategy (2024); Holland High Tech (2026); NOW (2026): OECD STIP Compass (2026); Brainport Eindhoven (2026); IMF staff elaboration.

[1] Prepared by Nina Budina, Karen Coulibaly, Shinya Kotera, Santiago Previde and Iglika Vassileva (all EUR). The authors would like to thank the Dutch authorities, the European Investment Bank, The Netherlands Organization for Applied Scientific Research (TNO), representatives of high-tech companies and industry associations, and other stakeholders for their valuable insights and discussions.

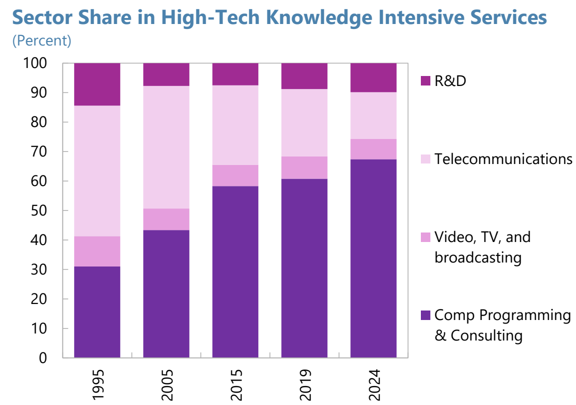
2. The analysis in the paper uses Eurostat's sectoral-level classification of high- and medium-high-tech manufacturing and high-tech knowledge-intensive services (Figure 1, Appendix I). This statistical definition covers advanced export-oriented activities—semiconductors, pharmaceuticals, photonics, aerospace—alongside a large base of knowledge-intensive services in ICT, software, and professional and scientific activities. Together, these sectors account for about 11 percent of total gross value added and 6 percent of employment. High-tech manufacturing is concentrated in machinery and equipment, led by lithography machines production and its supplier network. Computing, programming, and IT consulting dominate the services side. The combination of hardware innovation and complementary services underpins the sector's competitiveness.

Figure 1. The Netherlands: Definition of the High-Tech Sector

Machinery and equipment is the largest sector among high-tech industries.



Computing, programming, and consulting form the largest high-tech knowledge-intensive service sector.



Sources: Eurostat, and IMF staff calculations.
Note: Eurostat's NACE Rev. 2 definition, including high and medium-high tech industries, and high-tech knowledge-intensive services (KIS). See Appendix I for details.

3. The Dutch high-tech sector is an increasingly important source of growth. High-tech sub sectors—especially pharmaceuticals, machinery and equipment, and advanced manufacturing—have recorded stronger growth in gross value added (GVA) and labor productivity than the overall economy (Figure 2, upper left).[2] This performance is also reflected in firm valuations: between 2014 and 2025, the market capitalization of listed Dutch high-tech firms grew faster than in the U.S. and China, albeit from a much smaller base (Figure 2, upper right).[3] However, these gains are highly concentrated, with one leading semiconductor equipment company accounting for about 60 percent of listed Dutch high-tech market capitalization at end-2025. This underscores both the sector's strategic importance and its reliance on a narrow set of large firms.

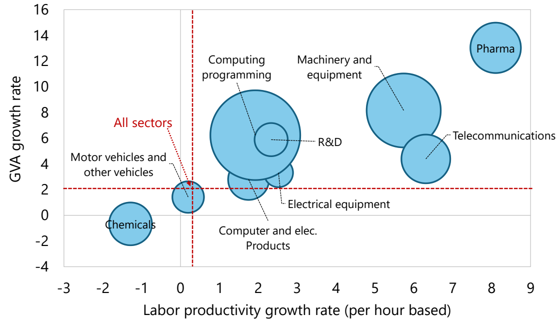
[2] See also Kappen et al. (2023) for a discussion of the high-tech sector.

[3] The market data covers 33 listed companies for the Netherlands, 2,251 for China, and 1,036 for US (as of 2025).

Figure 2. The Netherlands: High-Tech Sector: Importance and Strategic Role

The high-tech sector has played a leading role in productivity and value-added growth.

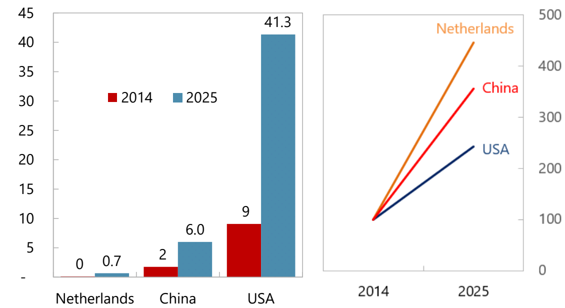
Real Output and Labor Productivity Growth in High-Tech Sectors (Percent, average of 2014-2024 growth rates)



Note: Bubble size represents real sector GVA in 2024.

Listed high-tech firms outperform U.S. and China in terms of market capitalization growth.

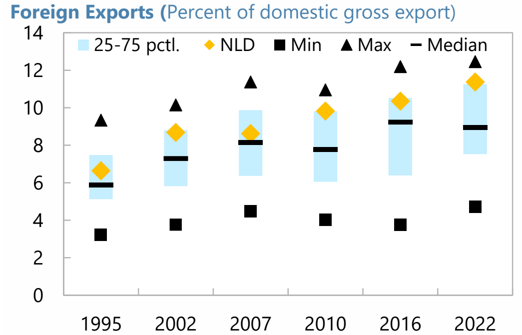
High Tech Sector Market Capitalization
(LHS USD trillion, RHS Index: 2014=100),



Note: Includes all high-tech publicly listed companies in the ENXTAM, SEHK, SZSE, NYSE, and NASDAQ.

The Netherlands ranks among the top in the EU in value added in foreign exports in high-tech sectors.

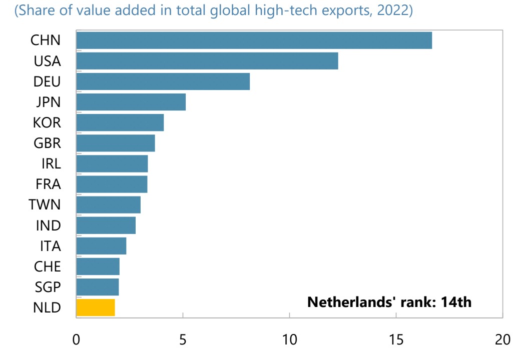
EU27 High-Tech Sector: Domestic Value Added in Foreign Exports (Percent of domestic gross export)



Sources: OECD TiVA database, staff calculations.

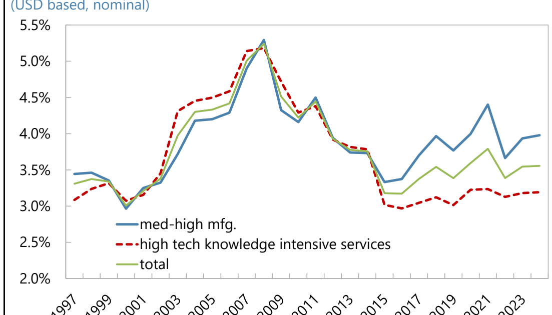
The Netherlands' high-tech footprint is large in global high-tech exports.

Top Countries Adding Value in the High-Tech Sector
(Share of value added in total global high-tech exports, 2022)



Relative to the U.S., high-tech output remains stable, although high-tech KIS output has declined.

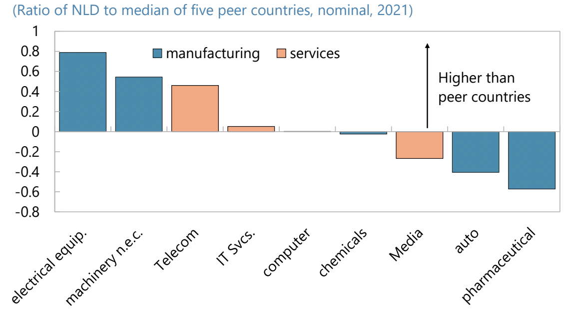
Gross Value Added in High Tech: Ratio of NLD to USA
(USD based, nominal)



Sources: OECD, Haver Analytics, and IMF staff calculation.
Note: 2024 data are estimates based on the country national account.

Medium-high-tech industries lead in intangible capital, relative to peers.

Intangible Assets per Hour Worked (High-Tech Sectors)
(Ratio of NLD to median of five peer countries, nominal, 2021)



Sources: EUKLEM and IMF staff calculation.
Note: Peer countries are AT, BE, DE, FI, and FR. IT services=computer programming & consulting+information service. Media=publishing+video, TV and broadcasting.

Sources: Eurostat, OECD TiVA, S&P Capital IQ Pro, and IMF staff calculations.
Note: See Appendix I for definitions. GVC-related data includes NACE Rev. 2 codes 58 and 69–71, 73–75 due to sectoral aggregation in the TiVA source.

4. Deep integration into global value chains is a key source of the high-tech sector's competitiveness, but also a channel of exposure to supply chain shocks. The Netherlands ranks high among the leading EU economies in domestic value added embodied in foreign high-tech exports and this share has risen faster than in peers over time (Figure 2, middle left). It is also among the top 15 global exporters of high-tech value added (Figure 2, middle right). This suggests that the high-tech sector is not only internationally competitive but also strongly export-oriented and deeply embedded in cross-border production networks, generating geographic and industrial spillovers and helping cushion domestic downturns.[4]

5. High-tech manufacturing has maintained its global market share, supported in part by intangible assets. High-tech GVA relative to that of the U.S.—used as a proxy for global market share—rose strongly before 2008, declined until around 2015, and has since recovered to broadly stable levels (Figure 2, lower left).[5] The post- 2015 recovery was mainly driven by medium-high tech manufacturing, likely reflecting growing global demand for semiconductor equipment and other advanced manufacturing. By contrast, high-tech knowledge-intensive services have shown a more limited recovery. Cross-country comparisons of intangible assets[6] point to a similar pattern: medium-high-tech industries, notably electrical and machinery equipment, exhibit a relative advantage, whereas intangible assets in high-tech KIS remain broadly in line with peers (Figure 2, lower right). Telecommunications show somewhat higher levels, but IT services—the largest high-tech KIS subsector by GVA—remain broadly comparable to peers.

B. Vulnerabilities from GVC Exposures

6. Deep global integration supports competitiveness but heightens exposure to external disruptions (Figure 3). High-tech firms rely heavily on imported inputs, specialized components, and foreign technology embedded in production networks (*backward linkages*), as well as external demand (*forward linkages*)—creating two-sided exposures, clearly evident in semiconductors, but present across high-tech industries. Foreign value added has exceeded one-third of high-tech exports in recent years and remains above the EU median, underscoring the sector's upstream dependence.

7. Foreign-input exposure varies significantly across high-tech sectors, with manufacturing most exposed (Figure 3, upper right). Chemicals and pharmaceuticals have the highest foreign value added in exports, reflecting reliance on imported active ingredients and specialized chemical inputs. Machinery, equipment, and electronics also display meaningful backward linkages, reflecting their reliance on complex, specialized, and often globally sourced

---

[4] Ru and Gan (2025) find that the collaborative agglomeration of high-tech manufacturing and knowledge-intensive services exerts significant spatial spillover effects on economic growth through innovation, value chain upgrading, and cross-regional knowledge diffusion.

[5] Across 24 OECD countries for which high-tech GVA data are available from 2005 to 2022, the share of Dutch high-tech GVA exhibits a similar trend to the measure based on its GVA relative to that of U.S.

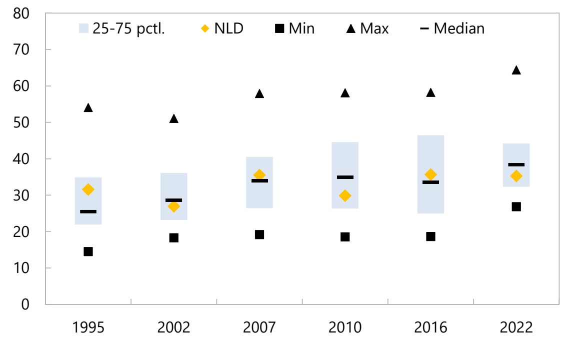
[6] Intangible assets include computer software and databases, innovative property, and economic competencies.

components. By contrast, high-tech knowledge-intensive services have lower direct foreign-input exposure, although they remain indirectly exposed through links to manufacturing.

Figure 3. The Netherlands: Exposures from Reliance on Foreign Inputs and Demand

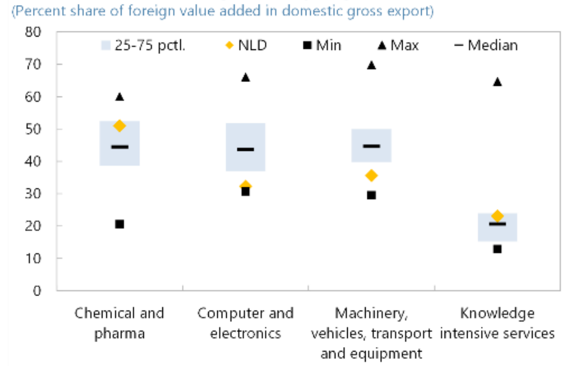
Vulnerabilities arise from high foreign value added (over a third) in high-tech exports.

EU27: High-Tech Sector Backward Linkages
(Share of foreign value added in own gross export)



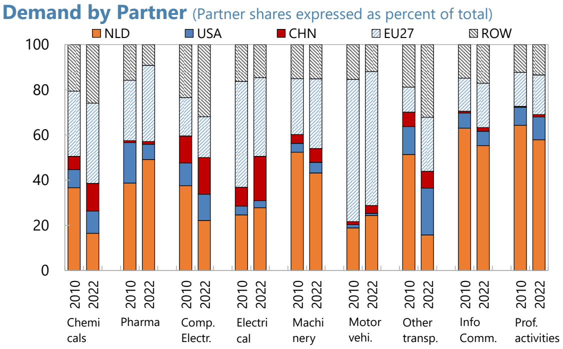
Foreign-input exposure is highest in chemicals and pharmaceuticals, and lower in high-tech KIS.

EU27: Backward Linkages in Key High-Tech Sectors, 2022
(Percent share of foreign value added in domestic gross export)



Exposure to foreign inputs is diversified, but non-EU share is rising in key high-tech sectors.

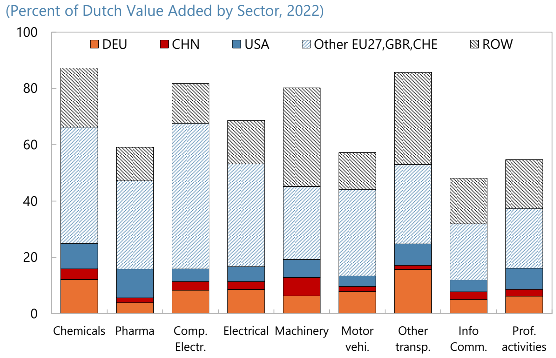
The Netherlands: Foreign Value Added in Domestic Final Demand by Partner (Partner shares expressed as percent of total)



Sources: OECD TiVa and IMF staff calculations.

Exposure to foreign demand is high (~60 percent), particularly Germany, the U.S. and China.

The Netherlands: Value Added in Partners' Final Demand
(Percent of Dutch Value Added by Sector, 2022)



Sources: OECD TiVA.

Note: GVC-related measures of vulnerability used in this paper are defined in Appendix II.

8. **Foreign-input sourcing remains diversified in domestic sectoral final demand, but the non-EU share has risen in key high-tech manufacturing sectors** (Figure 3, lower left). A decomposition of value added in high-tech domestic final demand between 2010 and 2022, indicates that services remain largely domestic, while manufacturing relies more heavily on foreign inputs. In computer, electronic, and electrical equipment, the domestic value-added share has declined markedly, alongside a rising share of China, while the share of the U.S. remained unchanged. Chemicals and pharmaceuticals show more stable domestic value-added shares, although Chinese content has increased in chemicals; the share of the U.S. has remained unchanged in chemicals but declined significantly in pharmaceuticals. Machinery shows a moderate decline in domestic content, while other transport equipment has seen a shift within Europe from Germany toward broader EU suppliers.

9. **Exposure to foreign final demand is high—60 percent of sectoral value added—and concentrated** (Figure 3, lower right). Germany, the U.S. and China are especially important markets,

reflecting the sector's role in European industrial supply chains and global electronics markets. Germany is a key downstream market for machinery, semiconductors, and lithography-related inputs, while the U.S. and China are major markets for electronics and other high-tech goods.

Channels of GVC-Related Vulnerabilities

10. GVC integration exposes firms to shocks through several channels. Geoeconomic fragmentation and strategic input chokepoints operate mainly through trade linkages—foreign-input reliance and foreign-demand exposure—while production relocation risk and dependence on non-EU capital affect where strategic activities, control, and scale-up capacity are anchored over time.[7] These channels are particularly relevant for Dutch high-tech because the sector combines deep cross-border production linkages, specialized inputs, capital-intensive scaling needs, and reliance on global technology markets. Since COVID-19, supply disruptions have also become larger, more persistent, and more frequent.

- **Geoeconomic fragmentation and trade restrictions.** Rising geopolitical tensions, export controls, subsidies, and security-driven policies can disrupt trade and technology flows, while increased uncertainty may weaken investment incentives for globally integrated firms. This applies to both forward and backward linkages.

- **Strategic input chokepoints and external dependencies.** Dutch and EU high-tech value chains rely on foreign inputs (critical raw materials, energy inputs, specialty components, and production stages), which create input chokepoints. Risks are elevated in advanced materials and chemical technology, electronics, energy technologies, and defense (Bonam et al., 2026). These backward linkages are hard to mitigate given specialized suppliers, long qualification periods, and limited short-term substitutes.

- **Production relocation risk.** Large-scale foreign subsidies, faster permitting, lower energy costs, or targeted industrial-policy packages may incentivize high-tech firms to move production increasingly abroad. This could be particularly relevant for capital-intensive deep-tech activities, including semiconductors and photonics, advanced materials, and energy technologies.

- **Dependence on non-EU capital and exit channels.** Deep-tech ecosystems (e.g. photonics, biotech, digital and ICT, and defense), can depend on foreign investors and acquisition-led exits, risking the relocation of control, intellectual property, and production, even when early-stage research and innovation originate domestically.

Assessing Vulnerability to Supply-Chain Disruptions

11. Two GVC-related vulnerability channels operating through trade linkages are examined in this section. Geoeconomic fragmentation and trade restrictions affect both access to foreign inputs and external demand, while strategic input chokepoints operate mainly through the

[7] See Bonam et al. (2026), Aiyar et al. (2023), Attinasi et al. (2025) and Pietrobelli et al. (2026).

input channel.[8] Diversified, but increasingly non-EU sourcing can expose firms to upstream disruptions—including from export controls, geopolitical tensions, transport bottlenecks, energy shocks, and shortages of critical materials—especially in manufacturing-intensive segments where substitutions might be limited. Concentrated export markets create a demand channel, linking outcomes to partner-country macroeconomic conditions, industrial-policy shifts, and movements in the global technology cycle. The semiconductor sector illustrates these mechanisms: firms rely on specialized foreign inputs and geographically fragmented production stages—such as wafer fabrication followed by testing and packaging abroad—while serving downstream automotive and electronics markets.

12. The analysis illustrates these vulnerabilities through foreign-input and foreign-demand linkages with key trading partners. Critical product categories are mapped to high-tech manufacturing sectors and weighed by supplier concentration using the Herfindahl–Hirschman Index, where higher concentration indicates higher exposure. These linkages are then traced through input–output relationships to illustrate output at risk under a stylized two-sided disruption involving key partners.[9] The framework uses a tractable input–output model augmented with international trade data and inter-country input–output tables (Appendix III). This approach is broadly consistent with Bonam et al. (2026), who identify EU supply-chain exposures in chemicals, base metals, and machinery. Results should be interpreted as structural output at risk, not forecasts or point estimates. They are illustrative only, as the framework does not include behavioral relationships, abstracts from substitution, inventories, price responses, policy adjustment, or broader macroeconomic effects. Direct supply exposures are assessed for goods trade, while high-tech services are captured through foreign-demand channels and indirect links to goods-producing sectors.

13. Illustrative simulations of a 50 percent bilateral trade disruption shock suggest sizeable output at risk, especially in chemicals, machinery and electronics and electrical equipment (Figure 4, left chart).[10] Exposure is largely supply-driven (almost half of total vulnerability), reflecting reliance on foreign inputs and concentrated supplier bases for specialized components, semiconductor-related inputs, lithography equipment components, and rare earth elements. Demand-side exposure contributes around 30 percentage points to risks in most manufacturing sectors, while indirect input-output linkages amplify initial shocks by slightly more than 20 percentage points in the most exposed sectors. Other transport equipment is an exception,

---

[8] No direct supply effects are identified for sectors C29 (motor vehicles) and C30 (other transport equipment), as none of the critical inputs used in the analysis are sourced from these sectors (see the table at the end of Appendix III). This is consistent with the nature of the framework, in which final goods such as vehicles are unlikely to be classified as critical intermediate inputs.

[9] The key trading partners include China, U.S., Germany, Korea and France. They were identified as the top 3 supplier countries and top 3 markets for the Dutch high-tech sectors, weighted by the degree of geographical concentration, where the U.S. was included in both. The geographical concentration is calculated based on global trade for each critical input, while the concentration of the markets is calculated using export data for the Netherlands.

[10] The model is a partial-equilibrium, open-economy input–output framework that measures structural exposure of Dutch high-tech sectors to bilateral (not global) supply and demand disruptions with key partners without any consideration for global macro-economic effects.

with exposure more closely associated with demand concentration and a narrower set of export markets. These results are best read as a ranking of relative exposure across sectors and partners, rather than as estimates of likely output losses.

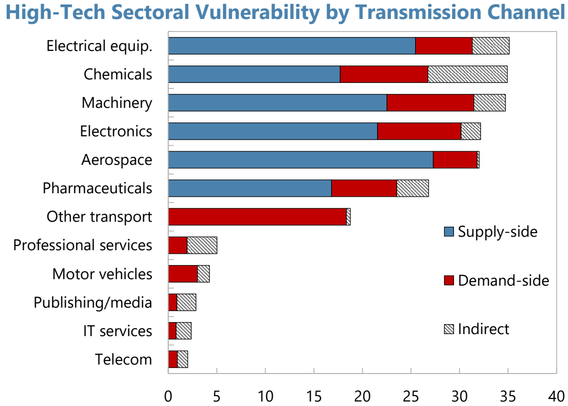
14. High-tech knowledge-intensive services show limited direct vulnerability but remain exposed through indirect effects from domestic production linkages. Their lower direct exposure partly reflects the model's goods-based supply-shock design, which uses product-level trade data and therefore captures direct supply disruptions only for goods producing sectors. Services are nonetheless affected indirectly when disruptions in manufacturing reduce demand for ICT, engineering, professional, and scientific services, illustrating the role of input-output propagation and the demand-side channel across sectors.

15. Exposure is concentrated among a small set of key trading partners. The U.S. is the single largest source of exposure for electrical equipment and electronics, chemicals and machinery, consistent with its role as both a dominant upstream supplier of advanced intermediates and a major export market for high-tech goods. China ranks as the second-largest contributor in most manufacturing sectors, with a particularly pronounced share in electronics and chemicals, reflecting the Netherlands' reliance on inputs from China in these supply chains. Germany, the Netherlands' largest EU trading partner, adds a visible but comparatively smaller layer of exposure, most notably in machinery, motor vehicles, and aerospace, where bilateral intermediate trade is dense. South Korea's contribution is concentrated in electronics, consistent with its global role in semiconductor and display supply chains, and France is mainly in aerospace value-chain links.

Figure 4. The Netherlands: Illustrative Simulations of Trade Disruption Vulnerabilities

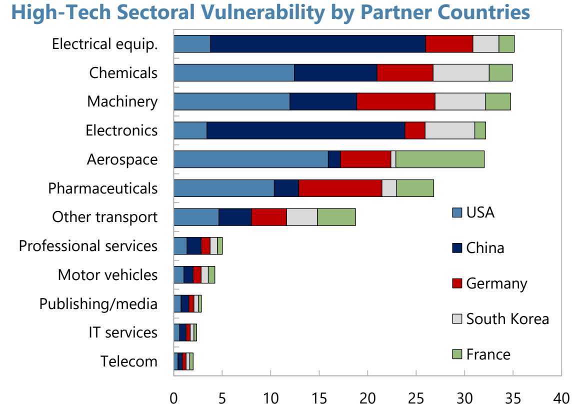
Vulnerability is concentrated in the chemical sector, machinery and electronics

High-Tech Sectoral Vulnerability by Transmission Channel



Dutch high-tech sector is most vulnerable to trade disruptions with U.S. and China

High-Tech Sectoral Vulnerability by Partner Countries



Sources: OECD ICIO tables, UN Comtrade and IMF staff calculations.
Note: Vulnerability is calculated as total loss as a percent of gross output under a 50 percent disruption of bilateral trade.

C. Bottlenecks to High-Tech Sector Growth

16. External risks are compounded by structural bottlenecks that constrain investment, scaling, and diffusion. Labor and skill shortages, grid congestion, regulatory constraints, and later-stage scale-up finance frictions in the transition from research to commercial deployment affect ecosystems differently, but together weaken the sector’s ability to expand capacity, commercialize innovation, and adapt to external shocks. The constraints are most binding for capital- and infrastructure-intensive activities, while knowledge-based activities are less directly affected.

Nonfinancial Bottlenecks

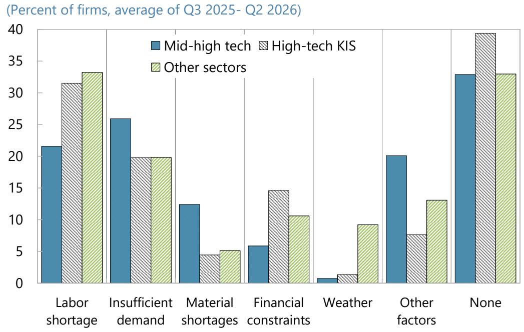
17. Labor shortages in high-tech sectors are driving technology adoption while intensifying the need for upskilling. Surveys indicate that labor shortages remain one of the main obstacles in high-tech sectors, especially high-tech KIS, and rank second in medium-high-tech manufacturing after insufficient demand (Figure 5, upper left). Shifting spending toward defense and security could intensify shortages of advanced technical skills (EC, 2025). Firms are responding by adopting new technologies and automation, including robotization and AI-based solutions, particularly in high-tech KIS (Figure 5, upper right). These technologies could ease labor constraints and raise productivity, but realizing their full benefits also requires workers to acquire relevant skills. Accordingly, skill enhancement needs are high among workers in high-tech sectors, especially high-tech KIS (Figure 5, lower left).[11] Encouraging higher enrollment in STEM fields, which remains below peer levels (Figure 5, lower right), and improving the attraction and retention of international talent is equally important.

Figure 5. The Netherlands: Labor Shortage

Labor shortage remains one of the main obstacles for high-tech sectors.

Factors Limiting Production

(Percent of firms, average of Q3 2025- Q2 2026)

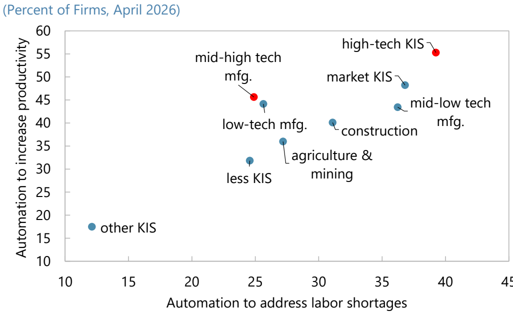


Sources: CBS and IMF staff calculations.

Automation (e.g. robotization and AI support) is the main way to address labor shortage and increase productivity, especially for firms in high-tech KIS.

Percent of Firms Focusing on Automation

(Percent of Firms, April 2026)



Sources: CBS and IMF staff calculations.

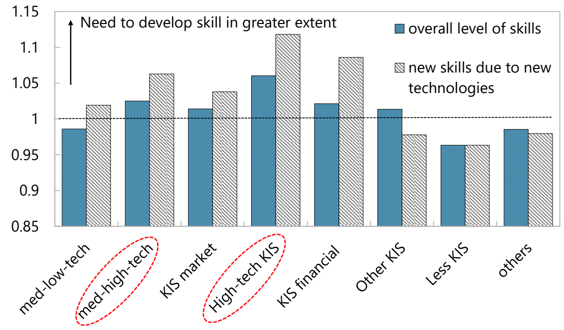
Note: Automation includes robotization or AI support.

[11] The analysis is based on the micro data from European Skills and Jobs Survey (ESJS) wave 2 (2021). Dependent variables are four-level responses on developing needs of skills. An ordered logit regression is conducted with independent variables of sectors, age, education, contract type, working hours, and the country fixed effect. The sample covers eight countries (AT, BE, DE, DK, FI, FR, NL, and SE), with reported estimates for the Netherlands. Shares of four-level responses by sector are computed using the estimated model (holding other factors constant), and the scores are derived by mapping responses from 1 to 4.

Figure 5. The Netherlands: Labor Shortage (concluded)

Skill-enhancement needs are high among workers in the high-tech sector, specifically high-tech KIS.

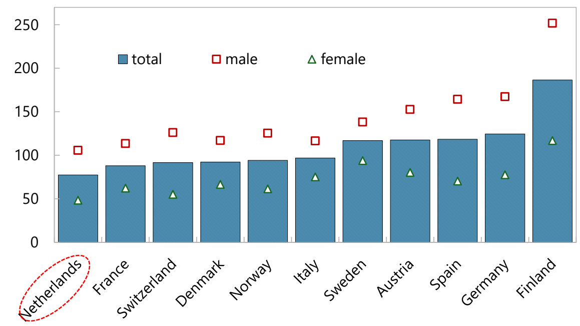
Needs for Developing Skills by Sector
(Score, national average = 1)



Sources: European Skills and Jobs Survey (2nd) and IMF staff estimation.
Note : Estimates by controlling for age, education, working hours, and contract.

STEM enrollment is low compared to peers for both males and females.

Students Enrolled in STEM Education Fields
(Per thousand of population aged 20-29, 2024)



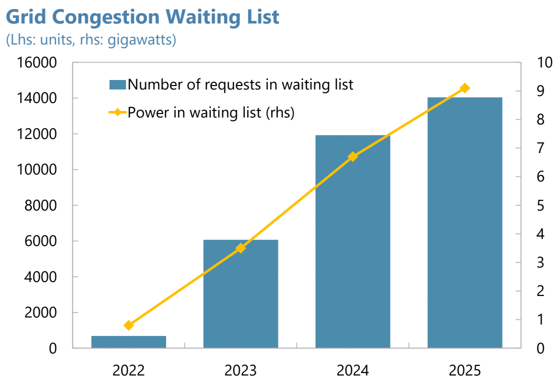
Sources: Eurostat and IMF staff calculations.

18. **Electricity grid congestion has become a binding constraint on high-tech investment, electrification, and industrial expansion** (Figure 6). Insufficient grid capacity is becoming an acute bottleneck in high-tech clusters, including in manufacturing-intensive regions in Noord-Brabant and Limburg. Long connection queues, and uncertainty over future access are delaying factory expansions, electricity-intensive production lines, and on-site renewable generation and battery storage. They also slow electrification, prolong reliance on gas, and keep electricity prices elevated relative to peers (Annex VIII, 2026 Netherlands Staff Report). While major grid investment is underway, expansion has so far lagged demand. Policy efforts should therefore prioritize accelerating permitting and delivery of network upgrades, greater demand flexibility, storage, and energy-efficiency measures to ease near-term pressures on the system.

19. **The nitrogen deadlock poses a key risk for industrial investment.** Restrictions on nature permits—required where nitrogen deposition affects protected areas—have curtailed project approvals. As of 2023, nitrogen deposition exceeded critical loads across about 70 percent of Natura 2000 area, leaving little room for new projects without breaching environmental thresholds. A 2024 Council of State ruling further limited the use of nitrogen headroom within existing permits. More broadly, fragmented responsibilities across municipal, provincial, and national authorities add to delays and uncertainty, especially for projects requiring multiple permits or located near protected areas.

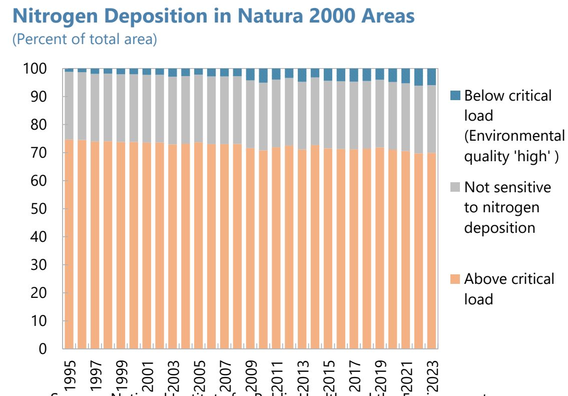
Figure 6. The Netherlands: Domestic Nonfinancial Bottlenecks

Grid congestion is increasingly binding.



Sources: Netbeheer Nederland, Wennik Report.

Nitrogen deposition exceeds critical loads in most areas.



Sources: National Institute for Public Health and the Environment

20. Fragmented permitting and regulation across government levels weighs on investments. Obtaining an industrial building permit can take an estimated 20–39 months from preparation through appeals, with objection and appeal procedures alone accounting for 10–23 months.[12] Some municipalities develop their own environmental plans, and some norms differ across provinces, multiplying compliance requirements. Pending spatial-planning cases before the Council of State have more than doubled since 2020, adding uncertainty for large, longer-horizon projects. These constraints are most binding for activities requiring physical infrastructure—such as semiconductor fabs, cleanrooms, pilot production lines, and grid connections—while software-based ICT activities are less directly affected, creating an uneven drag across ecosystems. The experience of the Eemshaven LNG terminal shows that delays are not inevitable: permitting and construction took only 200 days when the project was prioritized and coordination across government levels was effective. Easing these bottlenecks will require a more predictable, better-coordinated permitting framework, and progress in resolving the nitrogen deadlock.

21. EU internal market fragmentation remains a structural constraint for some high-tech ecosystems (Table 2). This is especially binding for medical and biotech, digital and ICT, and defense and security. In medical technologies and biotech, fragmented approval, reimbursement, and adoption processes across member states can limit firms' ability to scale within Europe. In digital activities, regulatory fragmentation due to overlapping regulations can raise compliance costs and slow cross-border expansion. In defense, fragmented procurement and uneven state-aid practices can weaken the level playing field. These frictions limit the EU scale needed for Dutch high-tech firms to grow and may reinforce reliance on non-EU markets and investors.

[12] Wennink (2025) figure 3.4.

Table 2. The Netherlands: Examples of EU Regulatory Fragmentation

Ecosystem	Regulatory Fragmentation	Impact
Semiconductors Digital and AI	5 Overlapping EU frameworks (AI Act, GDPR, Data Act, DSA/DMA, NIS2)	Increases compliance costs for Dutch firms.
Semiconductors, Defense and security (dual-use)	27 (divergent) export-control and dual-use regimes in EU	Divergent national rules for the same goods raise costs and complicate semiconductor and dual-use exports within EU.
Pharma and life sciences	27 national reimbursement regimes in EU	Reimbursement and market-access rules remain set nationally rather than at EU level, restricting Dutch pharma market access.

Sources: European Parliament (2025), European Parliament Research Service Brief (2025), European Commission (2020).

Gaps in Access to Finance for High-Tech Firms

22. The Netherlands has a strong but fragmented startup funding ecosystem. Pre-seed, seed, and series A startups are supported by public grants, venture capital (VC), and angel investors.[13] At 0.07 percent of GDP in 2025, seed and other early-stage VC investment in the Netherlands was twice as high as in France, Germany, and Belgium, and on par with investments in Sweden (0.1 percent of GDP).[14] To obtain funding, startups leverage their close ties with local world-class research institutions and regional agencies—especially in health and life sciences, agri-food, and semiconductor sectors (¶1). These tightly wound funding ecosystems around local universities and specific regions (e.g., Amsterdam, Eindhoven, Delft) offer critical financial (logistics and technical support), but are small and sector-specific, and are not nationally replicable or scalable.

23. Later-stage risk capital is uneven and insufficient in many sectors, particularly as firms transition to growth stage. Later-stage VC investment is nearly four times lower in the Netherlands (0.03 percent of GDP in 2025) than in Sweden (0.1 percent of GDP) and ten times lower than in the US (0.33 percent of GDP).[15] The limited domestic VC and private equity (PE) capital partly reflects a low risk appetite from domestic institutional investors, especially in projects with significant technical risk.[16] Series B/C+ growth capital is thus scarcer for high-capital-intensity sectors in which regulatory hurdles, need for specialized facilities and large-scale testing equipment, and supply chain complexity make the transition from lab proof-of-concept to commercial deployment especially lengthy.[17]

---

[13] Pre-seed and seed firms focus on concept proving, product development, and achieving initial market traction. They typically require €10k–2 million in funding per round. Series A firms funding needs are in the €3–15 million per round range. Their focus is on scaling a proven business model, increasing revenue, and building infrastructure.

[14] OECD venture capital investments (market statistics) data. Seed and other early-stage funding was 4 times higher in the US, at 0.29 percent of GDP.

[15] OECD venture capital investments (market statistics) data.

[16] The share of insurance sector assets invested into equity is 13 percent in the Netherlands compared to 50 percent in Sweden.

[17] Series B/C+ (growth/later-stage) firms seek €10–100+million per round to finance expansion, marketing or acquisitions.

24. Firms with products ready for early commercial deployment should be financed by domestic or European VC and PE but are not because prospects for fast, timely successful exits remain slim. The Netherlands has the second lowest number of SME IPOs per 1,000 firms in the EU.[18] Overall, IPOs make up only about 10 percent of high-tech sector (and broader tech ecosystem) exits and 1.2 percent of all exits.[19] Domestic VC and PE buyouts are more likely for immediately scalable products with clear revenue visibility. The longer the commercialization timelines, the more risk averse local investors are. Cross-border strategic mergers and acquisitions are thus by default the most common exit mechanism.

25. Raising domestic equity funding supply hinges on implementation of savings and investment union reforms to raise market liquidity and valuations. EU level efforts to promote automatic enrollment in private pensions and a review of the existing framework for pan-European private pension products and occupational pension funds that culminates in revised legal and supervisory requirements that allow for more VC investment domestically and EU-wide would be important policy elements. Implementation of the EU Listing Act, by mid-2026, as planned, would significantly improve the listing processes on regulated markets and public offerings of shares. Complementary domestic reforms to the Bankruptcy Act and securities laws would help shorten the settlement cycle and help investors reallocate capital from failed startups more quickly. Meanwhile, standardizing and simplifying procedures for smaller-denomination corporate debt securities issuance, lowering the minimum denomination that can legally be traded (or sold to retail clients) using traditional distribution channels (currently set at €100,000), making pricing more transparent, and leveraging online platforms and other dealer markets would help increase retail investor participation.[20]

26. In the interim, public offerings, including EIB venture debt will remain the life blood for many scale-ups. EIB venture debt offers substantial patient funding (typically €15 to 50 million) with very limited equity dilution, capital which is much-needed to bridge funding gaps and reach commercial scaling. The European Tech Champions Initiative (ETCI), a fund-of-funds managed by the European Investment Fund (EIF) under the InvestEU umbrella is also a significant source of funds for Dutch scale-ups. Additionally, the European Innovation Council (EIC) has supported deep tech startups with grants and equity investments of up to €30 million. The EC plans to deploy a market-based, privately-managed and privately co-financed Scaleup Europe Fund to bridge the financing gap for deep-tech scale-ups, as part of the EIC Fund and as a complement to its ETCI 2.0 initiative.

27. The proposed National Investment Institution could standardize funding processes, improve coordination, provide "bridge" patient series B equity capital, and help better leverage EU financing. Invest-NL and the Ministry of Economic Affairs expanded existing initiatives to support capital-intensive ventures (e.g., in the semiconductors, photonics, quantum computing

[18] European Commission staff working document: Monitoring progress towards a capital markets union: a toolkit of indicators - 2025.

[19] European Commission 2026 Netherlands Country Report.

[20] See 2025 Article IV Staff Report, Box 3 for further discussion of needed domestic capital market reforms.

sectors), including via the €610 million Dutch Deep Tech Fund. The proposed NII could follow similar principles to design patient equity products to "bridge" the funding gap as firms progress from lab proof-of-concept to commercial deployment. The NII could also help reduce funding fragmentation across sectors and regions, simplify funding processes, and improve coordination at the national level. The institution could also help better leverage series C+ EIB co-financing and EU instruments, and ease compliance with EU state-aid rules.

28. To deliver, NII will need clear mandates, arms-length governance, and ability to crowd in private finance. Clear mandates and guidelines will ensure its focus remains strictly on addressing market failures, not substituting for private investors. Arms-length governance would guarantee independence from political pressure and signal the intent to deliver value for money to markets. Current funding plans suggest the total initial capital of the institution would be in the €3–5 billion range, likely too small to provide significant equity capital to scale-ups (many requiring €100–300 million in total funding across multiple rounds) without crowding in private capital to scale.

D. Policy Considerations

29. Sustaining high-tech leadership requires a policy agenda focusing on execution, scale, and resilience, with coordinated domestic and EU-wide efforts. The Netherlands excels at innovation but domestic bottlenecks continue to slow investment and scaling. External risks from geoeconomic fragmentation, concentrated GVC exposures, and high energy costs further underscore the need to strengthen resilience. Policies should address domestic execution bottlenecks while leveraging EU-level policies for scale and resilience. These priorities reinforce each other: greater resilience and scale facilitate the translation of ideas into innovation, while stronger execution supports both.

Execution

30. The authorities' reform agenda appropriately focuses on the need to address persistent structural constraints, but implementation remains the key challenge (Table 3). The recent coalition agreement proposes reforms and investments to ease long-standing nonfinancial bottlenecks, particularly skill shortages, grid expansion, and nitrogen constraints and support innovation-led growth. The key challenge is delivery. While national-level reform plans are in place, gaps persist, reflecting slow implementation and fragmentation across government levels. Successful initiatives— for instance, Project Beethoven, which aims to upgrade local infrastructure, expand talent pipelines, and address housing constraints—could offer useful lessons on success factors to help strengthen policy execution.[21]

[21] See Brainport Eindhoven (2024) for details.

Table 3. The Netherlands: Policy Considerations 1 – Execution

	Priorities	Policies	Gaps
	• Address **skill shortage** through reskilling and scaling STEM and international talent pipelines • Fast-track **grid expansion** in key clusters • Resolve **nitrogen** and spatial planning constraints • Priority **permitting** lanes for strategic projects • Expand **housing availability** in high-tech growth clusters	• **STEM & Reskilling** Technology Pact (*Techniekpact*), Lifelong Learning framework • **Talent attraction** 30% Expat Tax Exemption; *Kennismigranten* (fast-track residence permits for high-skilled migration) • **Infrastructure** Climate Agreement (*Klimaatakkoord*) & SDE++ subsidies for low-carbon energy to expand electricity grid capacity • **Ecosystem Projects** E.g. Project Beethoven to improve local infrastructure, talent, and housing	• **Skill shortage remains** A centralized high-tech reskilling scheme is missing. STEM pipeline expansion remains limited. • **Infrastructure bottlenecks** Progress addressing grid congestion is slow, no dedicated fast-track permitting for strategic projects or housing near tech hubs. • **Regulatory hurdles** Fragmented permitting across government levels Nitrogen rules delaying permits for housing/facilities are acute and only partially resolved by current measures

Sources: IMF staff assessment based on discussions with stakeholders. See Appendix IV for existing key policies.

Scale

31. Enabling firms in high-tech sectors to scale will require greater emphasis on demand-side conditions, particularly the EU Single Market (Table 4). Policy discussions focus on the supply-side, including public funding instruments and the proposed NII. While these initiatives are important, deeper integration of the EU Single Market is equally critical to increase market depth, lower barriers to cross-border value chains, and boost cross-border demand, thereby enabling firms to scale.[22]

Table 4. The Netherlands: Policy Considerations 2 – Scale

	Priorities	Policies	Gaps
	• Address potential later-stage **financing gap** for scale-ups • Strengthen defense-adjacent supply chains • Crowd in **private capital**, including from Dutch institutional investors and EU capital for larger tickets and more patient investing	• **Public Funding** National Growth Fund, Deep Tech Fund via Invest-NL • **Innovation Box** Innovation Credit (NEA), ROMs (9 Regional Agencies) • **Proposed NII**	• **Financing gaps remain** Domestic private equity capital and institutional investor participation are limited (especially at TRL5-6). No one-stop shop to advise on financing.
	• Deepen **Single Market**, cross-border value chains and market depth matter for scaling beyond NL demand. • Deepen **capital** markets union • Integrate **labor** and **energy** markets	**Sectoral policies, e.g., EU Chips Act 2.0** • Shift emphasis to back-end and packaging • Focus on critical inputs, not only front-end fabs • Coordinate investments to avoid subsidy races • Secure European design capability	• **EU level coordination** The Capital Markets Union remains incomplete, hindering cross-border financing at scale. Incomplete Single Market.

Sources: IMF staff assessment based on discussions with stakeholders. See Appendix IV for existing key policies.

[22] See also TNO's Draghi's analysis for the Netherlands (TNO, 2025a).

Resilience

32. **Strengthening resilience requires greater emphasis on R&D diffusion, supply-chain diversification, and energy transition at both national and EU levels** (Table 5). A broad set of national policies is already in place—including the National Technology Strategy (NTS), the new Industrial Policy 2025, and climate-related measures. The new industrial policy's focus on six strategic markets should be implemented carefully to ensure additionality, clearly identify market failures, and limit fragmentation risks.[23] Policy designs that favor horizontal measures can lift economy-wide productivity and avoid the risk of inefficiencies and misallocation.[24] Strengthening supply chain resilience would also require identifying and managing critical dependencies while leveraging strategic interdependencies. In R&D, activity remains highly concentrated in a small number of firms,[25] underscoring the need to strengthen diffusion by facilitating the adoption of new technologies and practices among smaller and younger companies. More broadly, slow grid expansion, high energy costs, and incomplete integration of energy markets at EU level point to the need for stronger coordination to enhance energy resilience.

Table 5. The Netherlands: Policy Considerations 3 – Resilience

	Priorities	Policies	Gaps
	• **Strengthen Innovation** Deepen university–industry collaboration • **Diversify Supply Chains** • **Reduce Choke Points Vulnerabilities** • **Complete Energy transition** Enhance competitiveness	• **National Technology Strategy** • **New Industrial Policy 2025** • **3% R&D Action Plan** • **Climate Agreement** • **SDE++ subsidies for decarbonization** • **TNO Mega clusters**	• **IP targets 6 strategic markets** Need to identify market failures • **Strategic supply chains** Need to identify critical dependencies • **Innovation diffusion/collab** R&D and adoption of new tech still concentrated in large companies • **Energy transition lags** Slow grid expansion. High energy costs due to heavy gas reliance.
	• **GVC resilience**: Strategic interdependence (e.g. semiconductor) • **Integrate Energy Systems** Develop EU energy blueprint Strengthen institutional frameworks and long-term planning.	• **EU Critical Raw Materials Act** • **Important projects of common European interest (PCEIs)** • **European Defense Industrial Strategy (EDIS)** • **European Economic Security Strategy** and **EU Dual Use Export Control Framework**	• **Incomplete Single Market** Regulatory fragmentation due to diverging rules and "Gold-plating". • **Fragmented Energy Market** Electricity prices are highly volatile and differ across EU countries due to weak interconnectivity.

Sources: IMF staff assessment based on discussions with stakeholders. See Appendix IV for existing key policies.

[23] See TNO (2025b) for a discussion on high-tech megaclusters around strategic enabling technologies.

[24] Brouwer and de Winter (2026) caution that prolonged broad-base support can raise misallocation, as observed during the pandemic.

[25] See TNO (2025c) for evidence of the concentration of private R&D in a small number of large firms.

E. Concluding Remarks

33. The high-tech sector is central to growth in the Netherlands, but sustaining its leadership requires adapting to a more fragmented global economy. Supported by strong innovation capabilities and dense ecosystems linking frontier firms, specialized SMEs, research institutions, and public authorities, the sector underpins productivity growth, export strength, and technological specialization across advanced manufacturing and knowledge-intensive services.

34. Its strength, however, rests on deep global integration that is also a source of vulnerability. Global value-chain linkages have supported competitiveness but leave the sector vulnerable to foreign-input disruptions and external demand shocks, especially in high-tech manufacturing. Supply chains are increasingly reliant on non-EU partners, while export demand is concentrated in key markets. Vulnerabilities are concentrated in electronics, electrical equipment, chemicals, and machinery, with exposure to a small set of key trading partners.

35. External vulnerabilities are compounded by domestic constraints that slow investment, scaling, and diffusion. Sustaining innovation requires the right conditions—skilled labor, affordable energy and grid access, predictable permitting, and sufficient patient capital. Yet skill shortages, grid congestion, nitrogen and permitting constraints, and scale-up finance frictions weigh on investment, innovation diffusion, and scaling. High energy costs risk eroding competitiveness in energy-intensive segments, while EU market fragmentation limits firms' ability to scale within Europe.

36. Sustaining high-tech leadership therefore requires coordinated domestic and EU-wide efforts focused on execution, scale, and resilience.

- **Execution:** close implementation gaps by easing binding non-financing constraints—skills, grid capacity, nitrogen limits, and permitting delays—through stronger coordination, faster delivery, and clearer accountability.

- **Scale:** improve demand-side conditions by deepening the EU Single Market, strengthening EU policy coordination, reducing cross-border barriers, and expanding the scale-up funding.

- **Resilience:** deploy industrial policy carefully by targeting clear market failures, avoiding Single Market fragmentation, and ensuring additionality; strengthen supply-chain resilience by identifying and managing critical dependencies, leveraging strategic interdependencies, while lifting productivity by broadening R&D diffusion.

Appendix I. High-Tech Sector: Technical Definition

Manufacturing Industries	NACE Rev. 2 codes – 2-digit level	
High-technology	21	Manufacture of basic pharmaceutical products and pharmaceutical preparations;
	26	Manufacture of computer, electronic and optical products
Medium-high-technology	20	Manufacture of chemicals and chemical products;
	27 to 30	Manufacture of electrical equipment; Manufacture of machinery and equipment n.e.c. ; Manufacture of motor vehicles, trailers and semi-trailers; Manufacture of other transport equipment
Medium-low-technology	19	Manufacture of coke and refined petroleum products;
	22 to 25	Manufacture of rubber and plastic products; Manufacture of other non-metallic mineral products; Manufacture of basic metals; Manufacture of fabricated metals products, excepts machinery and equipment;
	33	Repair and installation of machinery and equipment
Low technology	10 to 18	Manufacture of food products, beverages, tobacco products, textile, wearing apparel, leather and related products, wood and of products of wood, paper and paper products, printing and reproduction of recorded media;
	31 to 32	Manufacture of furniture; Other manufacturing

Knowledge based services	NACE Rev. 2 codes – 2-digit level	
Knowledge-intensive services (KIS)	50 to 51	Water transport; Air transport;
	58 to 63	Publishing activities; Motion picture, video and television programme production, sound recording and music publish activities; Programming and broadcasting activities; Telecommunications; computer programming, consultancy and related activities; Information service activities (section J);
	64 to 66	Financial and insurance activities (section K);
	69 to 75	Legal and accounting activities; Activities of head offices, management consultancy activities; Architectural and engineering activities, technical testing and analysis; Scientific research and development; Advertising and market research; Other professional, scientific and technical activities; Veterinary activities (section M);
	78	Employment activities;
	80	Security and investigation activities;
	84 to 93	Public administration and defence, compulsory social security (section O); Education (section P), Human health and social work activities (section Q); Arts, entertainment and recreation (section R).
Knowledge-intensive market services (excluding high-tech and financial services)	50 to 51	Water transport; Air transport;
	69 to 71	Legal and accounting activities; Activities of head offices, management consultancy activities; Architectural and engineering activities, technical testing and analysis;
	73 to 74	Advertising and market research; Other professional, scientific and technical activities;
	78	Employment activities;
	80	Security and investigation activities;
High-tech knowledge-intensive services	59 to 63	Motion picture, video and television programme production, sound recording and music publish activities; Programming and broadcasting activities; Telecommunications; computer programming, consultancy and related activities; Information service activities;
	72	Scientific research and development;
Knowledge-intensive financial services	64 to 66	Financial and insurance activities (section K).
Other knowledge-intensive services	58	Publishing activities;
	75	Veterinary activities;
	84 to 93	Public administration and defence, compulsory social security (section O); Education (section P), Human health and social work activities (section Q); Arts, entertainment and recreation (section R).

Source: Eurostat.

Appendix II. High-Tech Sector: Global Value Chains Methodological Notes

All indicators below are derived from the OECD Inter-Country Input-Output (ICIO) tables and the associated Trade in Value Added (TiVA) database. They are net of re-exports and capture both direct and indirect linkages.

- *Backward linkages* are defined as the share of foreign value added embodied in domestic gross exports as a share of domestic exports. A higher value indicates greater upstream dependence on foreign suppliers.

- *Forward linkages* measure the share of domestic value added in foreign gross exports as a share of domestic exports. A higher value indicates that domestic production is more deeply embedded as an upstream input into other countries' export activity.

- *Centrality-based comparative strength in high-tech*: Outstrength centrality in a directed, weighted network of value-added flows embodied in high-tech exports, constructed from the OECD origin-of-value-added dataset. Nodes represent countries; edge weights equal the share of value-added originating in one country and embodied in another country's high-tech exports, normalized to sum to 100 within each sector. A higher outstrength indicates that a country supplies a larger and more central share of value added in other countries' high-tech exports.

- *Value added in domestic final demand*: Composition of value added embodied in Dutch final demand, decomposed by country of origin and sector, and expressed as a percentage of total value added embodied in final demand. This captures the extent to which domestic absorption relies on foreign upstream production.

- Domestic value added in foreign final demand: Share of Dutch domestic value added generated by a given sector that is ultimately absorbed in the final demand of foreign partner economies, expressed as a percentage of total Dutch value added in that sector. This captures forward exposure to foreign demand conditions.

Appendix III. Simple Trade Exposure and Propagation Model

This section develops a tractable, transparent model to illustrate Dutch high-tech sectors' vulnerabilities to a bilateral disruption of economic linkages with key partners, defined as the top three largest suppliers and markets.

1. **A growing body of literature quantifies the macroeconomic costs of supply-chain fragmentation through input-output frameworks.** Rozenov and Zhang (2025) apply a similar product-level and general equilibrium GE approach to Ireland, focusing on foreign-dependent goods and FDI relocation channels. The present model preserves the tractability and transparency of the Leontief framework used in Bems et al. (2011) while extending it along two dimensions:

(i) explicit bilateral identification of supply and demand exposure to a specified set of shock countries and
(ii) calibrated demand-side channel that captures loss of export markets, which is typically absent from supply-only IO exercises.

2. **The model captures two channels: a supply-side channel, measuring the loss of critical imported inputs, and a demand-side channel, measuring the loss of export markets**.[1] Both channels are propagated through inter-sectoral linkages via the Leontief inverse to capture cascading effects throughout the Dutch economy. The model combines three data sources:

- The OECD Inter-Country Input-Output (ICIO) tables (2025 edition), which provide a re-export-adjusted picture of intermediate input flows across countries and sectors. The ICIO tables are constructed to be consistent with national accounts and adjust for re-exports, making them the appropriate source for the scale of inter-industry linkages.

- UN Comtrade bilateral trade data at the 4-digit Harmonized System (HS) level, which identify the geographic origin and product composition of Dutch imports and concentration in global export. It is, therefore, used to compute geographic concentration (HHI index) and the value of shock-country imports.

3. **Identification of critical product categories and mapping to high-tech manufacturing sectors.** We, therefore, define 55 critical HS 4-digit product codes and map them to 6 ICIO high-tech manufacturing sectors (C20, C21, C26, C27, C28, C301), based on Eurostat's classification of high-technology sectors and supplemented by expert review of product-level technological specificity.

4. **High-technology sectors are defined following the Eurostat classification of high-tech and medium high-tech manufacturing and knowledge-intensive services**, covering: basic chemicals (C20), pharmaceuticals (C21), computer and electronic products (C26), electrical equipment (C27), machinery and equipment (C28), motor vehicles (C29), air and spacecraft (C301),

[1] They include U.S., China, Germany, Korea and France. USA is both a key supplier and a main market.

other transport equipment (C302T309), publishing and broadcasting (J58T60), telecommunications (J61), IT services (J62_63), and professional and scientific services (M).

5. **Model calibration involves several steps:** (i) identifying which imported products are critical and hard to replace; (ii) measuring the direct supply-side exposure of each Dutch high-tech sector to shock-country suppliers; (iii) measuring the direct demand-side exposure from lost export markets; (iv) propagating the combined direct shock through inter-sectoral supply linkages via the Leontief inverse; and (v) evaluating output losses under alternative disruption scenarios.

6. **Identification of critical imports.** Not all imports are equally vulnerable to disruption. A sector that sources diversified, commoditized inputs from many countries faces lower risk than one dependent on specialized products from a concentrated supplier base. To capture this distinction, we construct a bridge mapping 4-digit HS product codes h to ICIO sectors s, and assign each product a non-substitutability weight $w_h \in [0,1]$.

7. **The weight w_h reflects how difficult it would be to source product h from alternative suppliers in the short to medium term.** We anchor this weight empirically using the Herfindahl-Hirschman Index (HHI) of supplier concentration across partner countries in Dutch import data:

$$w_h = HHI_h = \sum_p s_{(h,p)}^2$$

where $s_{h,p}$ is the share of partner country p in total Dutch imports of product h. A product sourced predominantly from a single country (high HHI) is treated as harder to replace than one with a diversified supplier base (low HHI).[2] Where the empirical HHI is unavailable—for example, for products with incomplete partner reporting—we fall back on expert-assessed weights based on technological specificity and the product's inclusion in the EU Critical Raw Materials and Strategic Technologies lists.[3]

8. **Measuring Direct Supply Exposure.** For each high-tech sector s, we compute the direct loss—the value of hard-to-replace imports from shock countries that would be lost under a disruption of magnitude $\lambda \in [0,1]$:

$$d_s^{supply}(\lambda) = min\left(\lambda \cdot \sum_{h \in H_s} v_h \cdot w_h \, , f_s^{shock}\right)$$

where:

- H_s is the set of HS codes mapped to sector s via the bridge table

[2] This approach follows the logic of revealed comparative advantage applied to supply risk: observed market concentration is a proxy for the structural barriers (technological specificity, resource endowments, scale economies) that limit substitution. See Broda and Weinstein (2006) for the relationship between supplier concentration and substitution elasticities.

[3] The expert weights range from 0.25 (easily substitutable, e.g., commodity plastics) to 0.90 (near-irreplaceable in the short run, e.g., semiconductor lithography equipment). The full bridge table is available in the supplementary materials.

- v_h denotes Dutch imports of product h from critical suppliers (in millions of USD, from UN Comtrade)
- w_h is the non-substitutability weight and
- f_s^{shock} is the total foreign intermediate inputs consumed by Dutch sector s, sourced from the identified shock countries, taken from the ICIO intermediate-use matrix Z.

9. This bilateral cap ensures that estimated supply losses cannot exceed the actual intermediate inputs each sector sources from the affected trading partners, netting out inputs from unaffected countries, re-exports, and final goods imports. Technically, the minimum operator serves a critical role for two reasons. First, the Netherlands is one of Europe's largest re-export hubs: a substantial share of goods recorded as Dutch imports in Comtrade transit through Dutch ports without being consumed by domestic producers. Second, Comtrade records include final goods that do not enter production as intermediate inputs. The ICIO tables, which are constructed to be consistent with national accounts, net out both re-exports and final goods. By capping the Comtrade-based exposure at the bilateral ICIO intermediate input level (i.e., only intermediates sourced from the shock countries) we ensure that estimated supply losses reflect actual production dependencies rather than gross trade flows.

10. Measuring Demand-Side Direct Exposure. A bilateral disruption does not only cut off imported inputs - it also closes export markets. If key trading partners restrict imports of Dutch goods, sectors that rely heavily on these markets lose revenue and reduce production, with further cascading effects on their domestic suppliers and customers.

11. We measure the demand-side exposure of each Dutch high-tech sector s using the ICIO tables directly. The total exports at risk are the sum of intermediate deliveries (recorded in Z) and final goods shipments (recorded in Y) from Dutch sector s to all shock-country sectors:

$$E_s^{shock} = \sum_{j \in shock} Z_{s,j} + \sum_{j \in shock} Y_{s,j}$$

12. Not all lost export demand is irrecoverable; some can be redirected to alternative buyers. We parameterize this with a demand-diversion difficulty coefficient $\phi_s \in [0,1]$, representing the fraction of exports lost that cannot be absorbed by other markets. Rather than imposing ϕ_s as a free parameter, we calibrate it empirically from the ICIO export structure:

$$\phi_s = \frac{export\_to\_shock_s}{total\_export_s}$$

where $total\_export_s$ is the sum of all foreign intermediate and final-demand deliveries by Dutch sector s. The economic logic is straightforward: a sector that sends a large share of its exports to the identified key trading partners faces a proportionally harder task in redirecting that demand elsewhere, because absorbing the lost volume requires proportionally larger increases in sales to all remaining partners, which becomes progressively more difficult as the share rises.

13. The demand-side direct loss is then:

$$d_s^{demand}(\lambda) = \lambda \cdot E_s^{shock} \cdot \phi_s$$

14. The combined direct shock sums the supply and demand channels, capped at gross output to ensure economic consistency:

$$d_s(\lambda) = min\left(d_s^{supply}(\lambda) + d_s^{demand}(\lambda), x_s\right)$$

where x_s is the gross output of sector s. The cap ensures that estimated losses cannot exceed the sector's total production.

15. Output loss is piecewise linear and concave in disruption intensity. The supply channel for each sector saturates at a threshold $\lambda_s^* = f_s^{shock} / \sum_h v_h w_h$. Below this threshold, losses grow proportionally with λ. Above it, the sector has already lost all available inputs from the shock countries and additional disruption intensity has no further supply-side effect. The demand channel remains linear in λ. As a consequence, Leontief multipliers can vary across scenarios—they are not structural constants but depend on the composition of the shock vector.

16. Supply-Chain Propagation via the Leontief Inverse. A disruption to imported inputs does not affect only the directly exposed sector. If semiconductor imports to C26 (electronics) are curtailed, C26 produces less output, which in turn reduces its supply of intermediates to C28 (machinery), C20 (chemicals), and downstream service sectors, triggering cascading output losses throughout the economy. We capture these indirect effects using the standard Leontief input-output framework. Let A denote the matrix of technical coefficients derived from the ICIO intermediate-use matrix:

$$A = Z\hat{x}^{-1}$$

where $\hat{x}$ is the diagonal matrix of gross output and the Leontief inverse is $L = (I - A)^{-1}$. Thus, the element $L_{i,j}$ gives the total output required from sector i (in any country) to deliver one unit of final output from sector j, accounting for all rounds of inter-industry feedback.

17. Total output loss vector across all sectors and countries for a disruption intensity of λ is then:

$$\Delta x(\lambda) = L \times d(\lambda)$$

where $d(\lambda)$ is the vector of total direct losses, with $d_s > 0$ only for Dutch high-tech sectors and zero elsewhere. The total loss for Dutch high-tech sector s is the s-th element of $\Delta x(\lambda)$ restricted to Dutch sectors.

18. The Leontief multiplier for a group of sectors G is defined as:

$$\mu_G(\lambda) = \frac{\sum_{s \in G} \Delta x_s(\lambda)}{\sum_{s \in G} d_s(\lambda)}$$

19. Vulnerability indicator. To illustrate vulnerability of the Dutch high-tech sector to such disruptions in foreign input and foreign demand, the vulnerability of sector s is defined as the total loss of 50% disruption as a share of gross output:

$$V_s(0.5) = \frac{\Delta x_s(0.5)}{x_s}$$

Model Limitations

- **Fixed technical coefficients.** The Leontief framework assumes fixed technical coefficients—each sector uses inputs in fixed proportions, with no possibility of substituting one input for another or switching suppliers in response to a shock. In practice, firms would adjust along several margins—through input substitution, supplier switching, inventory drawdown or even price increases.

- **Comparison of two static states of the economy.** The model compares a pre-disruption equilibrium with a post-disruption counterfactual, without modeling the transition path. In reality, the economic impact of a supply disruption depends critically on its duration, the speed of inventory depletion, and the time profile of firms' adjustment responses.

- **No services in the product-to-sector bridge table.** The bridge table maps HS product codes, which cover goods trade, to ICIO sectors. Consequently, knowledge-intensive service sectors show zero direct supply exposure by construction. Their losses in the model arise entirely through demand and indirect channels.

- **No re-routing of imports.** The model assumes that imports from shock countries are lost in proportion to λ, with no possibility of rerouting through third countries. The non-substitutability weight w_h partially captures this effect (products with low HHI are easier to reroute).

20. The model simulation results are for illustration purposes only, best interpreted as a vulnerability rather than a forecast of realized output losses. On balance, the omission of general equilibrium feedback, price adjustments and spillovers suggests that the model captures the first-order structural exposure but understates the full economic impact of a prolonged disruption. The fixed-coefficient and no-rerouting assumptions work in the opposite direction but are likely dominated by the omitted channels.

Appendix III. Table 1. The Netherlands: Identified Critical Inputs for Dutch High-Tech Industries

HS Code	Product	w[1]	Comment
C26 — Electronics			
8542	Electronic integrated circuits (chips, processors)	0.14	Core semiconductor components.
8541	Diodes, transistors, semiconductors	0.27	Discrete semiconductor devices essential for power electronics and sensor systems
8534	Printed circuits (PCBs)	0.33	Substrates for virtually all electronic assemblies
8517	Telecom equipment (incl. smartphones, transmission apparatus)	0.33	Critical for telecom infrastructure and re-export hub
8471	Computers & data-processing machines	0.31	Key import for IT infrastructure and integration activities
8473	Parts for computers & office machines	0.28	Components for assembly and maintenance of computing equipment
8523	Storage media (optical, magnetic, semiconductor)	0.10	Data storage components for electronics manufacturing
9001	Optical fibres, lenses, prisms (unmounted)	0.10	Precision optics (directly relevant to ASML's lithography supply chain)
9002	Mounted lenses, prisms, mirrors (for instruments)	0.18	Assembled optical elements for semiconductor and scientific instruments
9013	Liquid crystal devices, lasers, optical appliances	0.16	Laser and display components for advanced manufacturing and metrology
9030	Electrical measuring instruments (oscilloscopes, etc.)	0.12	Test and measurement equipment for chip fabrication and quality control
9027	Physical/chemical analysis instruments	0.11	Laboratory and process-control instruments for high-tech manufacturing
9031	Other measuring/checking instruments	0.09	Metrology equipment used across precision manufacturing
C27 — Electrical Equipment			
8507	Electric accumulators (batteries, Li-ion)	0.25	Battery cells for EVs, energy storage.
8504	Transformers & static converters	0.22	Power management for industrial equipment, renewables, and data centres
8506	Primary cells & batteries	0.19	Disposable power sources
8516	Electric heating apparatus (industrial/consumer)	0.19	Heating elements for industrial processes
8532	Electrical capacitors	0.18	Passive components essential for all circuit boards
8533	Electrical resistors	0.17	Ubiquitous passive components
8536	Switching/protection apparatus (switches, fuses, relays)	0.11	Circuit protection for industrial and consumer equipment
8538	Parts for switching apparatus	0.09	Replacement and integration parts for electrical systems
C28 — Machinery & Equipment			
8457	Machining centres & unit construction machines	0.20	Precision multi-axis machining for complex parts
8486	Semiconductor manufacturing machinery	0.16	Directly supports chip-equipment cluster
8456	Laser/ultrasonic/plasma machine tools	0.15	Advanced material processing for aerospace and semiconductor parts
8460	Grinding, sharpening & polishing machines	0.12	Surface finishing for precision components
8483	Transmission shafts, gears, bearings	0.10	Mechanical drivetrain components for all industrial machinery
8466	Parts & accessories for machine tools	0.09	Maintenance and upgrade parts for the machine-tool base

Appendix III. Table 1. The Netherlands: Identified Critical Inputs for Dutch High-Tech Industries (concluded)

HS Code	Product	w[1]	Comment
8479	Machines with individual functions, n.e.s.	0.09	Catch-all for specialised industrial machines
8487	Machinery parts, n.e.s.	0.08	Generic but essential replacement parts
C21 — Pharmaceuticals			
2941	Antibiotics (bulk)	0.22	Active pharmaceutical ingredients
3002	Blood products, antisera, vaccines	0.11	Biologic inputs for vaccine and immunotherapy manufacturing
3004	Medicaments in measured doses	0.08	Finished pharma products for distribution and repackaging
C20 — Chemicals			
3707	Photographic chemical preparations	0.37	Photoresists and developers
2805	Alkali/alkaline-earth/rare-earth metals	0.32	Critical raw materials for magnets, catalysts, electronics
2846	Rare-earth compounds	0.18	Rare-earth oxides for high-tech applications
2836	Carbonates (sodium, lithium, etc.)	0.25	Lithium carbonate for batteries; soda ash for glass/chemicals
2818	Aluminium oxide (corundum, alumina)	0.18	Abrasive and refractory material for precision manufacturing
2843	Colloidal precious metals & compounds	0.18	Catalysts for chemical and pharmaceutical processes
2903	Halogenated hydrocarbons	0.15	Specialty solvents and refrigerants for industrial use
2901	Acyclic hydrocarbons (ethylene, propylene)	0.15	Basic petrochemical feedstocks
2811	Other inorganic acids & compounds	0.13	Process chemicals for semiconductor and chemical manufacturing
2833	Sulphates (incl. alums)	0.12	Industrial chemicals for water treatment, paper, textiles
2804	Hydrogen, noble gases, other non-metals	0.10	Noble gases (neon, argon, krypton) critical for chip fabrication lasers
3824	Prepared binders, chemical products n.e.s.	0.09	Specialty chemical mixtures for industrial processes
3901	Polymers of ethylene (polyethylene)	0.07	Bulk polymer for packaging and industrial use
3907	Polyacetals, epoxide resins, polycarbonates	0.07	Engineering plastics for electronics and automotive
C301 — Aerospace			
8803	Parts of aircraft & spacecraft	0.34	Structural components, landing gear, avionics housings
8802	Powered aircraft & helicopters	0.26	Complete aircraft for airlines and modification/MRO centres
8407	Spark-ignition engines (piston)	0.11	Engines for light aircraft and auxiliary power units
8409	Parts for piston engines	0.08	Engine maintenance and overhaul parts

[1] The weight reflects the empirical HHI (Herfindahl–Hirschman Index) of Dutch import sourcing for each HS code, i.e., how concentrated supply is across partner countries. A product with w = 0.37 (photographic chemicals) means a few suppliers dominate, making substitution difficult in a disruption. A product with w = 0.07 (polyethylene) has diversified sourcing and lower vulnerability.

Source: UN Comtrade (trade data, HS 4-digit level); Eurostat correspondence tables (HS–CPA/NACE mapping). Weights are IMF staff calculations based on UN Comtrade data. Sectoral criticality assessments draw on European Commission and OECD analyses of strategic dependencies and global value chains.

Appendix III. Table 2. The Netherlands: Top 10 Suppliers and Key Markets for the High-Tech Sectors

Top 10 suppliers by vulnerability-weighted imports			Top 10 markets by concentration-weighted exports		
Partner	Imports (USD mn)	Weighted imports* (USD mn)	Partner	Export (USD mn)	Weighted export** (USD mn)
China	1003882	240351	Germany	25658	3313
USA	361126	54704	France	19353	1885
South Korea	307850	51887	USA	14961	1126
Japan	215464	34599	Belgium	14042	992
Germany	240658	32122	Italy	10430	547
Malaysia	155972	27806	UK	9238	429
Vietnam	98686	24393	Ireland	8709	382
Singapore	124811	19953	Rest-of-world	6478	211
Thailand	79011	15882	Taiwan Province of China	6294	199
France	85936	12974	Spain	6181	192

Source: IMF staff calculations based on UN Comtrade data.

* The vulnerability-weighted imports is constructed by weighing Dutch imports by partner and HS product with a product-level supplier concentration index, calculated using the Herfindahl–Hirschman index. This approach assigns higher weight to products with highly concentrated sourcing patterns and lower weight to those with more diversified supplier bases.

** The concentration-weighted export measure equals total Dutch high-tech exports to each partner (intermediate and final demand from the ICIO), weighted by that partner's share in total exports. This implies that exposure scales with the square of bilateral export shares, corresponding to each partner's contribution to an HHI of export concentration.

Appendix IV. Key Policies, Initiatives, and Regulations to Support the High-Tech Sector

Policy	Scope	Type	Collaboration	Fiscal implication	Description
Research and Development Promotion Act (WBSO)	National	R&D tax credit	-	Revenue forgone	Payroll tax relief for R&D labor costs (32–40% first tranche; 16% thereafter), with standardized allowance for other R&D costs; used by 20,000 firms last year.
Innovation Box	National	CIT reduced rate regime	-	Revenue forgone (cyclical, several €bn in strong years)	Reduced effective CIT rate (9%) on profits from qualifying self-developed IP, aligned with OECD nexus rules.
Innovation Credit (Netherlands Enterprise Agency)	National	Innovation/product development credit	-	Maximum of €50 mn for 2026, and maximum funding of €10 mn per project	Government financing for businesses with risky innovative projects, pre-commercial R&D projects; repayment conditional on success.
Seed Capital Scheme (Netherlands Enterprise Agency)	National	Co-investment for venture capital	Public-private	Maximum of €42 mn for 2026, and maximum funding of €12 mn per project	NEA provides interest free loans for a maximum of 12 years to a Fund where at least three shareholders contribute the same amount. There is a separate tender for dual-use (civilian and military) technology.
TO2 Applied Research Institutes (incl. TNO)	National	Public research funding	Public-private-universities	Structural budget funding	Applied and translational research bridging academia and industry, especially in high-tech manufacturing.
Project Beethoven	National & regional	Targeted public investment in Brainport Eindhoven	Public-private-universities	Multi-year public investment with a focus on supply side bottlenecks (€2.5 bn, public-private)	Investments in skills, housing, and infrastructure to alleviate capacity constraints in the semiconductor ecosystem.
ROMs (Regionale Ontwikkelings-maatschappijen)	Regional	Dev agencies to stimulate innovation collaboration	Public-private-universities	Operating budget via EZK, investment via equity contributions.	Nine ROMs invest risk capital using equity and subordinated loans. More than €200 million invested in 2023 and 2024 in the pre-VC and early VC segment.
Invest-NL (incl Deep Tech Fund)	National	Financing Scale-ups and Deep Tech	Public-private	Budget, via EZK, complements INVESTEU, private VCs.	InvestNL invests directly in companies and projects and via funds. Deep Tech: €610 million fund dedicated entirely to high-risk investments in deep tech startups/scale-ups.

Policy	Scope	Type	Collaboration	Fiscal implication	Description
New Industrial Policy – Six Strategic Markets (Industriebrief 2025)	National	Industrial policy / strategic focus	Public-private	To be determined; replaces top sectoral PPS matching funds	New focused industrial policy replacing the mission-driven top sectoral innovation policy. The policy identifies six strategic growth markets: (1) semiconductors, (2) biotech, (3) defense, (4) digital, (5) high-tech equipment, (6) chemical industry. Aimed at strengthening Dutch earning capacity and strategic autonomy.
3% R&D Action Plan	National	R&D investment target / action plan	Public-private	Multiple instruments; fiscal and spending measures (details TBD per sub-measure)	Target of investing 3% of GDP in R&D by 2030. Contains 9 focus areas to mobilize more private investment in technology and innovation. Key proposed measures include: NADI (an innovation agency), NII (National Investment Institution), support for regional campuses, and new public-private partnership incentives (PPS-i). Companion report notes the Dutch R&D gap is growing relative to peers.
National Technology Strategy (NTS)	National	Strategic technology roadmap	Public-private-universities	Indirect (guides allocation of R&D and innovation budgets)	Identifies key technologies of strategic importance to the Netherlands and sets priorities for research, development, and valorization. Accompanied by Action Agendas (Actieagendas) developed by KIA Key Technologies, translating strategic priorities into concrete programs across technology domains.
Action Plan for Green and Digital Jobs	National	Skills / STEM labor-market action plan	Public-private	Through existing ministerial budgets and underlying action plans	National action plan coordinating the ministries of Economic Affairs, Climate and Green Growth, Social Affairs and Employment, and Education to expand the technical and digital workforce. Succeeded the Techniekpact (2013) as the national vehicle on 1 January 2025, incorporating the Aanvalsplan Techniek and the ICT-shortage action plan.
30% Expat Tax Exemption	National	PIT incentive reduced rate	-	Preferential PIT treatment for eligible workers	Tax facility allowing qualifying highly skilled foreign workers recruited from abroad to receive up to 30% of gross salary tax-free.
Highly Skilled Migrant scheme (Kennismigrantenregeling)	National	Fast-track residence	-	No direct fiscal cost	Fast-track residence/work-permit route administered by the IND for high-skilled migrants meeting an annually indexed salary threshold.
European Chips Act	EU	Industrial policy / state-aid framework	-	EU funds + national budgets; no fixed annual envelope	Framework to support semiconductor R&D, pilot lines, manufacturing, and skills; enables coordinated state aid.
Important Projects of Common European Interest	EU	Coordinated state aid	-	National fiscal cost approved by EC	Cross-country projects allowing targeted support for strategic technologies like microelectronics.

Policy	Scope	Type	Collaboration	Fiscal implication	Description
EU AI Act	EU	Regulatory act	-	No direct fiscal cost	Adopts risk-based approach to regulating AI activity, with gradual implementation from 2025-2027.
Horizon Europe / EIC	EU	Grants & blended finance	-	EU budget	Research funding and scale-up finance for innovative and deep-tech firms.
InvestEU / EIB financing	EU	Loans & guarantees	-	Contingent liabilities	EU-backed loans and guarantees for innovation, digitalization, and scale-up investment.
Digital Single Market	EU	Regulatory integration	-	No direct fiscal cost	Harmonized rules enabling cross-border scaling of digital services.
EU Skills Agenda	EU	Skills & labor mobility	-	EU budget	Support for digital skills, STEM training, and cross-border labor mobility.
Green Deal industrial policies	EU	Industrial & climate policy	-	EU and national budgets	Incentives for clean-tech and energy-efficient advanced manufacturing (Net zero industrial act, critical raw material act, state-aid flexibility)

Sources: IMF staff compilation based on information from Dutch government, RVO, European Commission, and related policy documents.
Note: The table includes policies in place at the time of writing.

References

Aiyar, S., J. Chen, C. Ebeke, R. Garcia-Saltos, T. Gudmundsson, A. Ilyina, A. Kangur, T. Kunaratskul, S. Rodriguez, M. Ruta, T. Schulze, G. Soderberg, and J. P. Trevino (2023), *Geoeconomic Fragmentation and the Future of Multilateralism*, IMF Staff Discussion Note No. 2023/001, International Monetary Fund, Washington, DC, Geo-Economic Fragmentation and the Future of Multilateralism; Staff Discussion Note No: 2023/001; January 15, 2023.

Attinasi M.-G., L. Boeckelmann, R. Gerinovics and B. Meunier (2025). "Unveiling the hidden costs of critical dependencies", ECB Economic Bulletin, Issue 5/2025, https://www.ecb.europa.eu/press/economic-bulletin/articles/2025/html/ecb.ebart202505_01~c93c71e372.en.html.

Bems R., R.C. Johnson and K.-M. Yi (2011) "Vertical Linkages and the Collapse of Global Trade", American Economic Review: Papers & Proceedings 2011, 101:3, 308–312, http://www.aeaweb.org/articles.php?doi=10.1257/aer.101.3.308.

Bonam D., J. Demmers, G. Goy, J. de Grip, B. Heerma van Voss, D. de Leeuw, C. Mehlbaum, A. Smadu, R. Swierstra (2026) "Global supply chains and European economic vulnerabilities", DeNederlandscheBank, https://www.dnb.nl/media/d5xopy4u/dnb-analysis-global-supply-chains-and-european-economic-vulnerabilities-1.pdf.

Brainport Eindhoven (2024), *Project Beethoven 2024: Strengthening the Microchip Industry and Quality of Life*, https://brainporteindhoven.com/en/strategy-organisation/agenda-with-the-government/project-beethoven-2024.

Brainport Eindhoven (2026), *Innovation Campuses in Brainport Eindhoven*, brochure, https://brainporteindhoven.com/fileadmin/user_upload/Campussen/Innovation-campuses_in_Brainport_Eindhoven_brochure-2026.pdf.

Brouwer and de Winter (2026) Healthy Markets, Healthy Growth: Dynamics, Market Power and Misallocation in the Dutch Business Sector, De Nederlandsche Bank, DNB Analysis " Healthy firms, healthy growth".

European Commission (2026), Country Report — Netherlands, Directorate-General for Economic and Financial Affairs, https://economy-finance.ec.europa.eu/economic-surveillance-eu-member-states/country-pages-including-country-reports/country-report-netherlands_en.

European Commission (2025), European Innovation Scoreboard: Country Profile — Netherlands, European Commission, Directorate-General for Research and Innovation, https://ec.europa.eu/assets/rtd/eis/2025/ec_rtd_eis-country-profile-nl.pdf.

European Commission (2025), *EU Defence Industry Transformation Roadmap: Unleashing Disruptive Innovation for Defense Readiness*, COM (2025) 845.

European Commission (2025), Staff Working Document: Monitoring progress towards a capital markets union: A toolkit of indicators.

European Commission (2020), Public Health — Pharmaceutical Strategy for Europe.

European Parliament (2025), "Interplay between the AI Act and the EU digital legislative framework".

European Parliament Research Service Brief (2025), "Dual-use export controls as tools of EU economic security".

Holland High Tech (2026), *Innovation Domains*, https://www.hollandhightech.nl/en/innovation/innovation-domains.

Kappen P., T. van Bree, C. Stolwijk, A. Yagafarova and T. van der Horst (2023), High-Tech Industry 2040: New Challenges for Long-Term Earning Capacity and the Impact for the Netherlands, TNO. White paper High-tech industry in 2040. White paper High-tech industry in 2040.

Ministry of Economic Affairs and Climate Policy, TNO, and NWO (2024), *National Technology Strategy: Building Blocks for Strategic Technology Policy*, https://repository.tno.nl/SingleDoc?docId=66780.

NWO (2026), *Key Enabling Technologies*, https://www.nwo.nl/en/key-enabling-technologies.

OECD STIP Compass (2026), *Mission Driven Top-Sector and Innovation Policy*, https://stip.oecd.org/moip/case-studies/3.

Pietrobelli C., M. Delera and N. Geri (2026) "Navigating a fragmenting global economy: What GVC reconfiguration means for future industrial development", UNIDO policy brief No. 28/2026.

Rozenov R. and Z. Zhang (2025) "Geoeconomic Fragmentation: Implications for Ireland". IMF Selected Issues Paper (SIP/2025/089). Washington, DC, International Monetary Fund, https://www.imf.org/en/publications/selected-issues-papers/issues/2025/07/07/geoeconomic-fragmentation-implications-for-ireland-568367.

Ru J. and L. Gan (2025), "Analysis on the Economic Growth Effects of Industrial Clustering in High-Tech Manufacturing and Knowledge-Intensive Service Industries," Sustainable Economies, 3(1).

TNO (2025a). "Dutch competitiveness in the light of the Draghi report: Draghi analysis for the Netherlands." TNO 2025 R10842, Dutch competitiveness in the light of the Draghi report.

TNO (2025b), *Building Dutch Control Points through High-Tech Megaclusters*, Building Dutch control points through High-Tech Megaclusters.

TNO (2025c), R&D Top 50: The Netherlands' Top Research and Development Spenders, rapport-2025-r&d-top50-eng.pdf.

Wennink, P. (2025), *The Route to Future Prosperity: A Strong Netherlands in a Relevant Europe*, independent advisory report, https://www.rapportwennink.nl/en/.