

Building Dutch control points through High-Tech Megacusters

- To enhance economic and technological resilience, the Netherlands must invest in technologies where it may hold unique positions—control points—in global value chains.
- The Dutch tradition of collaboration between government, industry, knowledge institutions, and investors remains a key enabler for focused innovation.
- TNO advocates for High-Tech Megacusters around the most strategic key enabling technologies and calls on the Dutch government to invest in them.
- These megacusters strengthen our earning capacity, encourage private R&D spending, and establish unique technological capabilities.



TNO innovation
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In an era where technological advancements dictate the pace of global competitiveness, the Netherlands stands at a critical juncture. The high-tech industry, a cornerstone of our national economy, not only contributes significantly to employment but also plays a pivotal role in addressing societal challenges. To maintain and enhance our economic and technological resilience, it is imperative that we invest strategically through the development of new High-Tech Megaclusters. These clusters will serve as high-impact R&D hubs, fostering innovation, accelerating commercialization, and securing the Netherlands' position as a global player in key technological domains. This vision paper outlines how these clusters strengthen national earning capacity, urging coordinated efforts from government, industry, knowledge institutes, and investors.

1. Focus on control points

Given its size, the Netherlands cannot be competitive in every technology and at every link in global value chains. R&D investments in the Netherlands are comparatively limited in absolute terms and below OECD-average in relative terms, far off the 3% agreed in the EU. Therefore, it is crucial to make strategic choices on where to allocate limited funds to generate maximum value from those investments and to encourage significant new private investment in R&D, especially from international companies.

The Dutch strategy is to focus on creating key positions, or control points, in existing and new value chains. Control points are difficult to replace and knowledge-intensive business activities in a high-tech value chain. They are founded on unique assets or capabilities that are indispensable within the value chain. Control points generate significant influence, which strengthens strategic autonomy and creates mutual dependencies. By concentrating on these control points, Dutch high-tech companies can establish distinctive technological and economic positions globally, while simultaneously creating an ecosystem that may serve as an R&D magnet for their international partners and suppliers. A prime example of a company that holds such a control point is ASML.

The Dutch government is focusing its technology policy through the National Technology Strategy (NTS) published in 2024. This strategy identifies specific technology areas for the Netherlands to focus on, creating mass in terms of direction and investments¹. With action agendas, the NTS requires practical leverage to ensure effective implementation. Capturing control points in global value chains necessitates Dutch companies build leading positions in relevant fields. This requires significant funding, integration into industry roadmaps, collaboration with internationally leading companies, and attracting top talent. In short, it demands attracting global players to invest in Dutch R&D and work with Dutch high-tech companies. To fully seize opportunities, a coherent policy is essential, aimed at developing internationally distinctive infrastructure.

2. The case for High-Tech Megaclusters

To address the urgent need for technological resilience and to secure the Netherlands' position as a global player in key technological domains, TNO proposes the creation of High-Tech Megaclusters. These megaclusters are envisioned as high-impact research and development hubs with global appeal, designed to drive technological advancements by bringing the entire value chain together.

These megaclusters must be developed over the coming years and shaped based on a long-term strategic vision, ensuring their sustainability, coherence, and alignment with national and international ambitions.

High-Tech Megaclusters aim to enable companies to collaborate on innovative projects that push the boundaries in their domain, access state-of-the-art facilities, and accelerate the commercialization of new solutions. By participating in megaclusters, companies gain early access to emerging technologies, and expand their global reach, ensuring they stay ahead in a rapidly evolving industry. Megaclusters serve as a nexus within a broader ecosystem, connecting companies, academia, research & technology organizations, and investors.

These clusters provide significant benefits, including:

- **Leverage:** More investment in innovation generally results in a higher probability of success and helps become a world leader. For a small country to play in a global competitive field requires generating maximum leverage. Every euro of public investment must generate a multiple of (international) private funding.
- **Access:** Megaclusters connect Dutch ecosystems with international value chains, indirectly providing access to interaction and collaboration with global players.
- **Derisking:** Capturing control points through R&D requires large and often risky investments. Megaclusters derisk and lower investments in innovation for individual companies.

¹ National Technology Strategy - Building blocks for strategic technology policy (Ministry of Economic Affairs and Climate Policy, 2024)

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By bundling R&D resources and bringing world leaders in the entire value chain together, megaclusters enable high-impact R&D and push technology development. It is important to note that megaclusters are not just large field labs; they are mission-driven and internationally focused. The DNA of a typical megacluster includes a strong emphasis on collaboration, innovation, and commercialization.

3. How High-Tech Megaclusters work

High-Tech Megaclusters are dynamic ecosystems that drive technological innovation and commercialization. They add value by facilitating network and market development, innovation, strengthening of investment climate, and knowledge growth, fostering a vibrant and collaborative environment. Megaclusters enable companies to collaborate on high-impact R&D projects through shared research programs, bilateral projects, and pilot manufacturing lines. They provide access to diverse funding sources, including public and private investments, crucial for sustaining innovation and reducing R&D risks. Additionally, megaclusters offer state-of-the-art shared research facilities and technological infrastructure. To understand how megaclusters function in practice, it is essential to delve into their core components and operational mechanisms.

Mission-driven	Working on THE roadmap for a particular technology or application area
International	Internationally leading players in the field participate
Large	Globally (among) the largest within its scope
Unique assets	Assets that are only practically accessible for a significant target group through this High-Tech Megacluster
Demand-led	Joint innovation and collaborative research led by the demand and requirements of leading customers
Ecosystem-central	Central position in a larger relevant ecosystem
Long-term	Lifecycle in terms of decades to be able to be a fundamental driving force in a particular industry

Figure 1: DNA of a High-Tech Megacluster

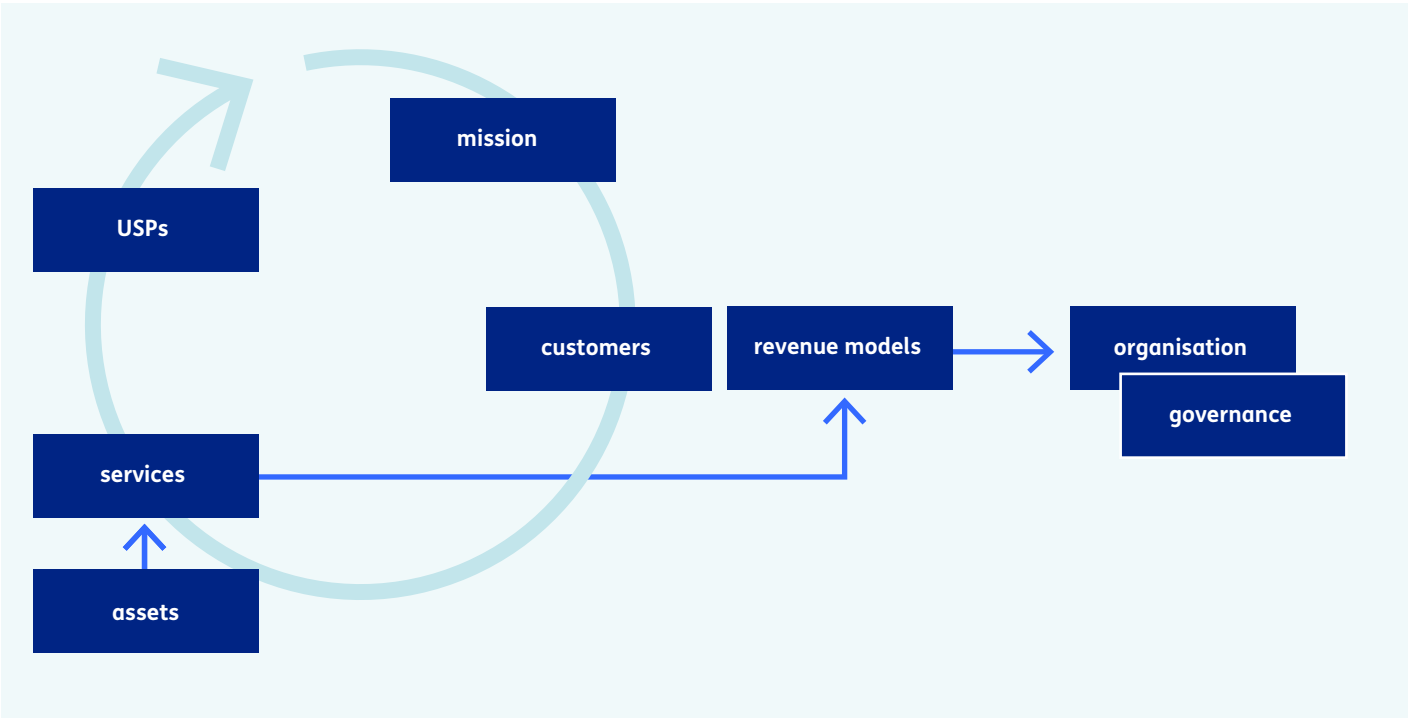


Figure 2: Core components of a High-Tech Megacluster

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- **Mission.** The primary mission of a megacuster is to be a world-leading innovation center where companies from around the globe collaborate to develop next-generation technologies. Megacusters focus on specific technology domains and markets, creating a shared vision and roadmap with stakeholders. This mission-driven approach ensures that megacusters remain aligned with industry needs and global technological trends.
- **Customers.** Understanding the distinction between direct and indirect customers is crucial for mission success and long-term sustainability. Direct customers actively engage with and utilize the Megacusters services, seeking innovative solutions, expertise, or partnerships. Indirect customers, while not interacting on a service level, are vital stakeholders supporting the network's activities. These include government bodies, funding agencies, or societal groups aligned with relevant broader objectives, such as fostering innovation ecosystems.
- **Services.** A Megacuster can offer multiple services to its partners and customers, such as R&D and providing access to finance. Depending on the needs of the specific domain, a set of services can be chosen. Figure 3 provides an overview of possible services that can be offered. It is important to start with the most essential ones and expand as the demand for other services grow.
- **Assets.** Megacusters are built around cutting-edge research facilities, robust technological infrastructure, and intellectual property. These assets are leveraged through a portfolio of services to meet the needs of the ecosystem. Initial growth starts with existing assets and expands as collaboration and success build momentum.
- **Unique Selling Propositions (USPs).** The USPs of a megacuster are closely related to its assets and the specific domain it operates in. These may include integration of R&D, education, and pilot production within a single facility. The USPs provide a competitive edge and attract global innovators. For instance: the Brainport Industries Campus articulates its USP as integrating R&D, showcasing, education, and production within a single facility.
- **Revenue models.** Megacusters generate revenue through various streams, such as membership fees, service payments, and sponsorships. However, revenue generation is only one aspect of the financial equation. Various costs are incurred in operating a megacuster, including personnel expenses, infrastructural maintenance, technology investments, and operational costs such as marketing and governance. Public funding is crucial for financial sustainability as seen in the Fraunhofer model where federal states invest in infrastructure and facilities. In the Netherlands, smaller clusters receive EFRO funding and almost all cluster-like entities secure public funding, often through Horizon or national research funding like NWO in the Netherlands, for their research programs. Balancing these possibilities and challenges is essential for the success of megacusters.
- **Organization and governance.** A megacuster operates as a program rather than a single project, requiring a dedicated team to manage its activities. Governance structures typically involve a small group of catalysts or partners, including public and private organizations. Applied research institutes such as TNO are ideally positioned to take on the role of organizer for a megacuster, ensuring an independent and objective approach to technology development.

Service	Activities
Community building	Scouting, brokerage, awareness creation, dissemination, ecosystem building
Strategy development	Market intelligence, market assessments, roadmapping, technology watch
Ecosystem learning	Workshops, seminars to share knowledge and experience
Representation, promotion	Representing interests during meetings & conferences, organizing (country) visits, roadshows
Strategic R&D	Joint, pre-competitive R&D, secondment from companies
Contract research	Specific R&D, technology concept development, proof of concept
Technical support on scale-up	Concept validation, prototyping, small series production
Provision of tech infrastructure	Renting equipment, low rate production, platform technology infrastructure, lab facilities
Testing and validation	Certification, product demonstration, product qualification
Incubator/accelerator support	Voice of customer, market assessment, business development, legal, IPR, location, sales strategy
Tech transfer	Identify & develop startup potential
Access to finance	Financial engineering, connection to funding sources, investment plans
Project development	Identification of opportunities, creating consortia, development of proposals
Housing	Office space and space for experimentation and pilot manufacturing

Figure 3: Services and activities of a High-Tech Megacuster

4. Prioritizing High-Tech Megaclusters

Recent developments on both national and international fronts present significant opportunities for the Dutch high-tech sector to capitalize on, but they also pose considerable threats². Opportunities include major market potential in emerging global value chains such as defence tech, cleantech, greentech, medtech, as well as advancements in AI, quantum technologies, and integrated photonics. Additionally, R&D has become a global market, with companies seeking the best cost-benefit ratio worldwide. However, the sector also faces threats such as decreasing productivity, labour market challenges, increasingly stringent regulations, and high costs and risks associated with R&D.

In this context, the Dutch high-tech sector faces major challenges that require substantial investment in technology development, including building positions in new value chains, achieving sustainable operations, significantly increasing productivity, and enhancing its overall resilience. Megaclusters can be established across all (dual-use) key enabling technologies identified in the National Technology Strategy. However, given the Netherlands' unique strengths, opportunities, and expertise, certain technologies with dual-use applications may be prioritized for megacluster development:

1. Quantum Technologies
2. Integrated Photonics
3. Battery technologies



5. Call to action

In an era defined by geopolitical uncertainty and rapid technological change, the Netherlands must take bold steps to secure its future. Establishing High-Tech Megaclusters is not just a strategic investment—it's a national imperative. These megaclusters will anchor our technological sovereignty, strengthen our economy, and position the Netherlands as a global player in innovation. Crucially, it's not how we see ourselves as a small country that matters, but how the world sees us — and why international companies come to the Netherlands. Answering that question is key to deciding where to invest.

To realize this vision, we call on all stakeholders to act together—decisively and ambitiously.

- **Act now to lead globally**

The Netherlands stands at a pivotal moment in its technological journey. To remain a global leader in key domains and ensure long-term economic resilience, we must act decisively. High-Tech Megaclusters are not just an opportunity—they are a strategic necessity. They bring global ambition and execution power to the National Technology Strategy and are essential to building Dutch control points in global value chains.

- **Unite ecosystems for impact**

TNO calls on high-tech companies, national and local governments, knowledge institutions, and investors to join forces. By aligning priorities within and between existing public-private ecosystems, we can accelerate innovation, reduce fragmentation, and create a seamless path from research to market. Together, we can build a future-proof high-tech industry that meets today's challenges and sets tomorrow's standards.

- **Attract global innovators and investment**

By positioning megaclusters as strategic hubs for R&D and commercialization, the Netherlands can attract international talent, capital, and partnerships. Megaclusters offer the infrastructure, facilities, expertise, and collaborative environment needed to turn breakthrough ideas into global solutions—strengthening the Netherlands as a magnet for innovation.

- **Embed megaclusters in national policy and funding**

To realize the ambitions of the National Technology Strategy, the Ministry of Economic Affairs can formally integrate megaclusters into its NTS action agendas. Megaclusters are a powerful vehicle for the Netherlands to reach the European goal of investing 3% of GDP in R&D. They also provide a concrete framework for translating strategic intent into measurable impact.

² High-tech industry in 2040 - New challenges for achieving long-term earning power and impact for the Netherlands (TNO, 2023)