



# TNO Strategic Plan 2026–2029

Pushing Boundaries

The mission of TNO  
is to create impactful  
innovations for the  
sustainable wellbeing  
and prosperity of  
society.



# Introduction

In a time of significant geopolitical, climate, and economic changes, TNO presents its strategic plan for 2026–2029. The war in Ukraine and the alarming report by Draghi have once again jolted the European Union awake. The need to strengthen our strategic autonomy—both economically and militarily—is urgent and undeniable. Climate change not only demands a reduction in emissions but also requires that we adapt our society and infrastructure accordingly. The energy transition is a key factor in this: geopolitically, economically, and ecologically. Affordable, reliable, and clean energy is a ‘conditio sine qua non’ for prosperity and well-being.

Without strong and purposeful action, the gap between Europe and the United States will continue to widen, and China will surpass us—economically, technologically, and geopolitically. This puts the European socio-economic model under pressure and risks stalling critical transitions, including the energy transition. The challenges are immense, and time is of the essence. This calls for a realistic and decisive agenda from all involved parties—including TNO. Difficult choices must not be avoided.

The world is changing rapidly, and every organisation must therefore continuously reinvent itself. The question ‘what are we about’ must be asked repeatedly, considering ever-changing circumstances. The world of 1932, when TNO was founded, is fundamentally different in several key elements from the world of 2025. And this is even true compared to the start of the current strategic period. Without a doubt, the coming years will again bring major shifts. Especially for an organisation like TNO, which operates in some of the most dynamic and innovative markets in the world, flexibility is essential to remain effective and continue to make relevant impact.

In this Strategic Plan 2026–2029, we first examine the most important national and international trends that affect TNO’s work. Then, we will outline what all of this means for TNO’s work and strategy.



# Societal developments

Below, we outline several developments that significantly influence TNO's work and strategic direction. This list is not exhaustive nor comprehensive, but it does provide the essential context needed to understand the strategic course and choices that follow. The latter will be addressed in the next chapter.

## **Climate change requires structural adaptation**

To shape a liveable future, society must not only reduce climate change but also adapt to it. Even if the EU succeeds in reaching 'net zero' by 2050, the climate will continue to change. This is partly because the EU's emissions represent only a small fraction of global greenhouse gas emissions. But also because the greenhouse gases already emitted will not have been removed, not even at net zero. Therefore, alongside mitigation, adaptation is essential. As our climate changes, the guaranteed supply of several basic functions embedded in our living environment—such as drinking water, mobility and transport, and housing—will come under increasing pressure.

In addition, circularity is playing an increasingly central role, not only because it benefits the environment, but also because it contributes to the EU's strategic autonomy by reducing the need for new raw materials and resources (which are often sourced from other geopolitical power blocs).

The energy transition is a key factor in all of this: economically, geopolitically, and ecologically. Without affordable, reliable, and clean energy, serious vulnerabilities will emerge across all these domains, putting our future prosperity at risk.

**'Innovation is the market introduction of a technical or organisational novelty, not just its invention.'**

Joseph Schumpeter

Innovative solutions are needed across these topics, as existing technologies alone will not suffice to meet these goals.

## **EU has become too dependent on other power blocs**

The EU has become aware of its growing dependence on other global power blocs in critical domains such as security (defence), raw materials, production capacity in key value chains, and digital services. This dependence is particularly pronounced with respect to the United States, China, Taiwan, and several other countries (including, for a time, Russia for natural gas) without a corresponding level of reciprocal reliance. For a long time, this was not perceived as problematic, as it was seen as a natural consequence of globalisation within a stable post-World War II order, guaranteed by the US. This global order is now shifting, driven by the rise of new economic and military powers with their own agendas, and where the US seems increasingly unwilling to continue playing the role it has held since World War II. Europe is only as strong as its economy. Recent developments have made it clear that such dependencies, both military

and economic, pose significant risks under these changing conditions: risks to peace and security, to prosperity, and even to our ability to shape our own future and remain masters of our own destiny.

#### Peace and security are being threatened

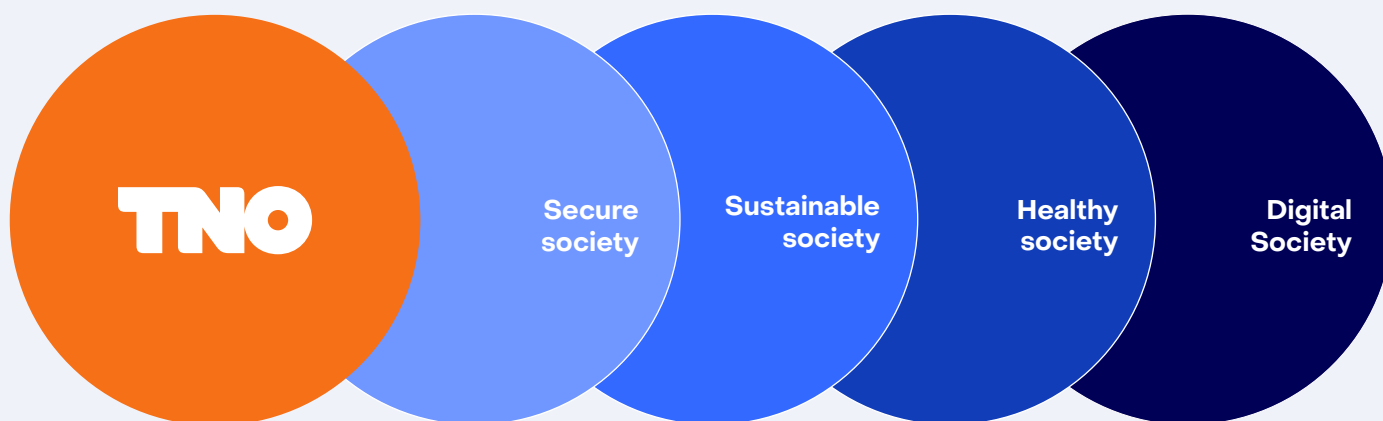
One of the most pressing defence and security dependencies is our dependence on the US. Two events have highlighted the risks of this dependency for the EU and the Netherlands: the war in Ukraine and increased US pressure on the EU to take more responsibility for its own defence within NATO. For decades, the Netherlands and the EU neglected their defence capabilities, operating under the assumption that war in Europe was something of the past and that, should conflict arise, the US would always come to aid. There were even voices suggesting that defence spending and the defence industry no longer aligned with the values of an 'enlightened' (post-)modern European society. Institutional investors turned away, partly under the banner that investing in defence did not fit within ESG policies. As a result, defence spending remained well below NATO's 2% of GDP benchmark for many years. The notion that a country must be able to defend itself—both to deter aggression and to prevail in the event of conflict—had all but disappeared from public and political discourse.

**TNO focuses on major societal challenges where (digital) technology can drive transformation.**

## What is needed is a 'whole-of-society' approach, and therefore a 'whole-of-TNO' approach.

Recent developments, particularly the war in Ukraine and the shifting stance of the US, are now reversing this sentiment towards increasing investment on defence. Part of this is meant to rebuild the European and Dutch defence industries, but also to create or adapt the necessary infrastructure. Building a resilient society requires far more than just a capable military apparatus.

For TNO, as the strategic R&D partner of the Ministry of Defence, these trends will have significant impact, already tangible today. And because this urgent build-up touches all aspects of society—from military equipment to logistics, infrastructure, advanced technologies, to the human factor—it is not only TNO's Defence, Safety and Security (DSS) unit





that must play a key role. What is needed is a 'whole-of-society' approach, and therefore a 'whole-of-TNO' approach.

This means that TNO's strategic relationship with the Ministry of Defence, documented in the TNO Act since 1947, must now broaden and deepen to fully support the Ministry of Defence in meeting these challenges. We are already seeing Defence expand its focus to new areas such as space and semiconductors. Efforts are also underway to rebuild a domestic defence industry, based on the recently published Defence Strategy for Industry and Innovation (DSII), a joint initiative of the Ministries of Defence and Economic Affairs, as well as the Defport initiative. TNO must adapt its traditional role towards Defence to meet these evolving needs.

### **The Netherlands is ageing and the healthcare system is under increasing pressure**

The healthcare system is facing growing demand from an ageing population. Chronical illnesses are increasing, and there is a greater need for long-term care. New pathogens are lurking. At the same time, costs are escalating and shortages in healthcare personnel are worsening, further straining the system. To address these challenges, it is essential to invest in innovative, technology-driven healthcare solutions and more efficient care processes. An important goal is to significantly increase labour productivity in the healthcare sector, so that we can continue to meet rising demand in the years ahead. Only through an integrated approach, leveraging innovative technologies and methods, can we ensure a sustainable and accessible healthcare system in the future.

### **Digitalisation and AI have major impact, but the EU is lagging behind**

Digitalisation has already transformed and, in many ways, improved our work and daily lives. With the rise of generative AI, that impact will grow further. AI is expected to profoundly impact business operations and earning models across many sectors, as well as other aspects of life. It offers opportunities to accelerate learning, innovation, and growth. It is highly expected that AI will significantly boost labour productivity, particularly in certain sectors.

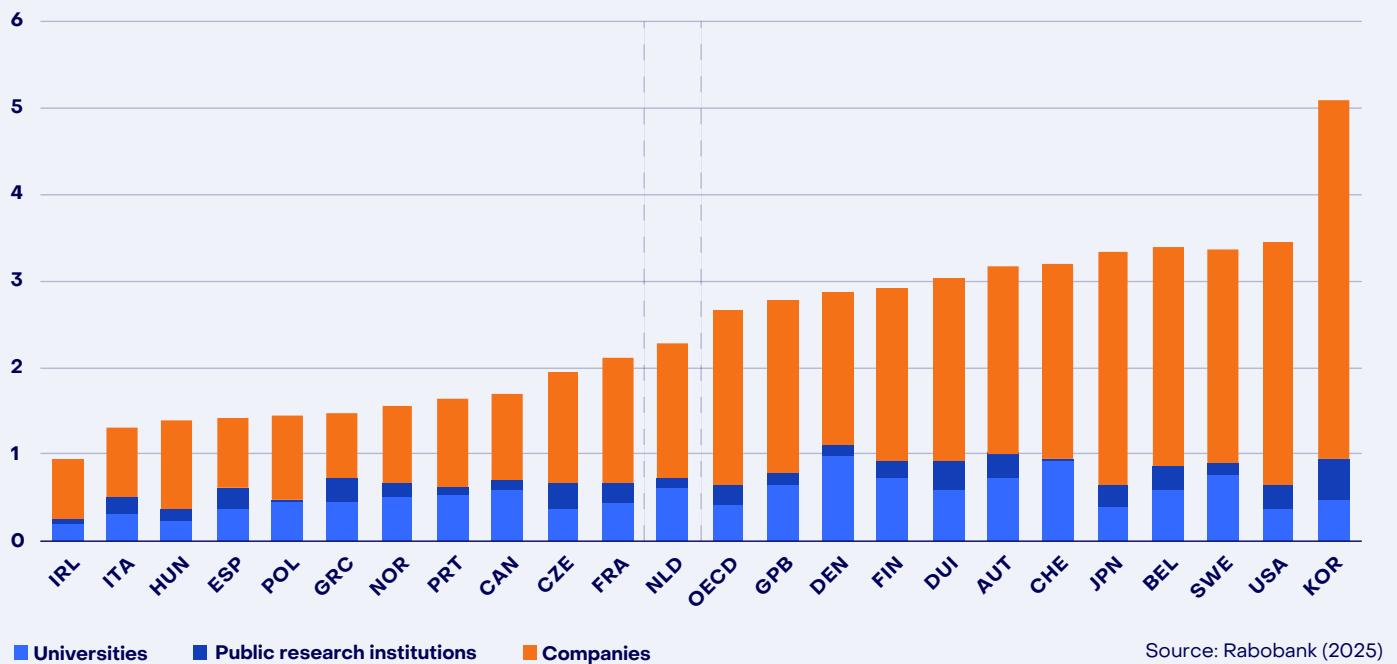
However, the EU has fallen far behind the US and China in the field of AI. This is not due to a lack of cutting-edge scientific knowledge, but rather to a lack of execution power in building AI-focused infrastructure, deploying applications, and developing a dynamic, 'full-stack' industry around the technology. Finding a natural position in these emerging value chains, reducing dependency on third parties for this critical technology, and developing applications that enhance our security and prosperity are among the most urgent challenges for the EU, the Netherlands, and also for TNO.

As with nearly all new technologies, the rapid development of AI also brings potential downsides. The effort is therefore targeted at fully harnessing the positive potential of AI and digital technologies, while actively mitigating the risks. Exactly how this balance should be achieved remains uncertain and will definitely require targeted innovation.

An important adjacent development is the massive increase in energy demand driven by AI. This has prompted several major tech giants to invest heavily in next-gen nuclear energy. This illustrates how different domains can influence one another. Given the immense innovation capacity and deep financial resources of these companies (Amazon alone spent over \$80 billion on R&D

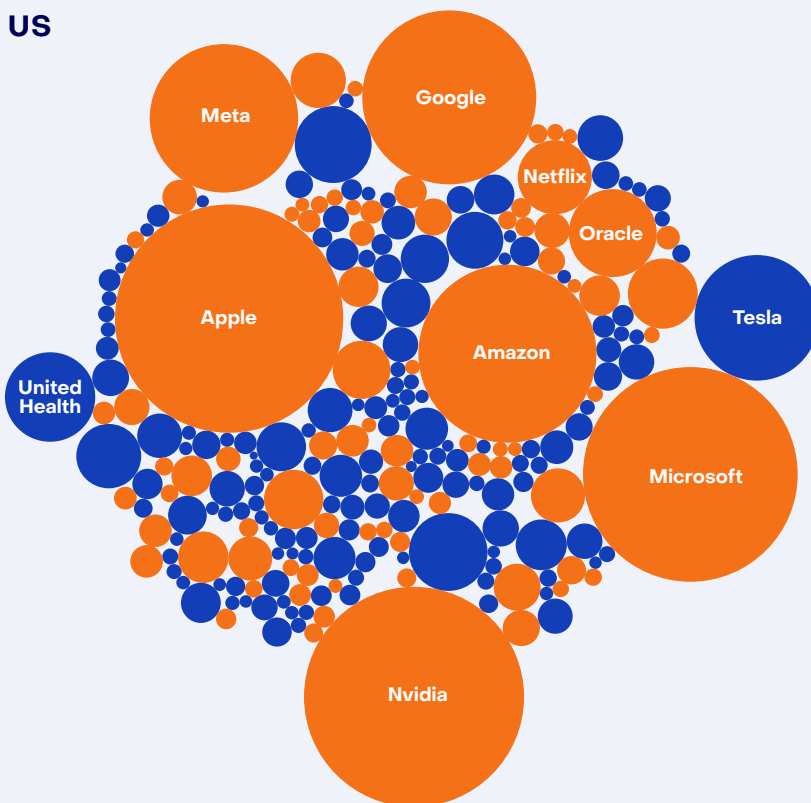
**R&D spending in the Netherlands lags significantly behind the targeted 3% of GDP.**

## R&D expenses as a percentage of GDP, 2022

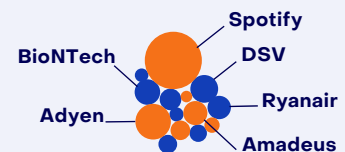


## Publicly listed start-ups founded in the past 50 years (market capitalisation > \$10 billion, 2023)

### US



### EU



Source: (McAfee, A.M. (2024), 'Public-from-Scratch US/ EU companies less than 50 years old, market cap >10 mld', MIT). Only 'pure' start-ups have been taken into account, no JVs or spin-offs. For example, the market capitalization of ASML was \$ 294 bln at the end of 2023.

# The Netherlands has a strong knowledge base but the innovation chain falters particularly in the stages after fundamental research.

in 2024—more than three times as much as the total R&D spending of the Netherlands), this trend is highly significant. The implications for, for example, the energy transition are not yet fully understood. What is clear, is that TNO must closely monitor these developments and respond effectively. The pace of change is rapid, and flexibility is crucial.

## The Netherlands is de-industrialising and the innovation chain is faltering

The most R&D-intensive sector of the Dutch economy is the industrial sector. It also accounts for roughly half of the country's exports. However, over the past decades, the industrial base in the Netherlands has been steadily eroded, ASML's industrial cluster being a notable exception. As a result, private R&D spending as a percentage of GDP significantly lags behind other countries, and the 3% target from the Lisbon agenda remains far out of reach. Without further actions, total Dutch R&D intensity is projected to fall to 2% by 2030, creating a funding gap of at least €12 billion annually—of which approximately €8 billion would need to come from the private sector. Causes of this industrial erosion that are frequently mentioned include high energy prices, disproportionately heavy regulatory burden, various forms of congestion (including grid, transport, construction, and labour), and a lack of consistent and predictable government policy.

De-industrialisation is a problem, but it is aggravated by a faltering innovation chain. Industrial renewal only partly comes from existing clusters; it often arises from the emergence of new clusters around novel technologies, startups, and scale-ups. For Research & Technology Organisations (RTOs) like TNO, this represents a change in perspective: to

contribute meaningfully to a dynamic and competitive future economy, they must not only support incumbent industrial players but also actively foster the emergence of new ones. TNO's role is not only to innovate by itself, but also to orchestrate innovation by bringing together and coordinating consortia around shared goals—both proactively and upon request.

It is worth noting that many of today's leading tech giants—such as Apple, Microsoft, Google, Amazon, Tesla, SpaceX, Nvidia, AMD, ASML, and TSMC—are relatively young companies, only a few decades old. Industrial and economic renewal cannot rely solely on established firms. It is crucial that more startups successfully scale-up and evolve into leading companies—the next ASMLs.

This is precisely what both the Netherlands and the EU are struggling with, as highlighted by Draghi and others. While the Netherlands has a strong knowledge base, the innovation chain falters particularly in the stages after fundamental research. The so-called 'valley of death' is deeper and wider in the Netherlands and the EU than in other regions. This structural weakness is the second root cause why R&D spending in the Netherlands—especially in the private sector—continually falls short of the 3% GDP target. It also largely explains the stagnating labour productivity, particularly in comparison to the US and other countries.

The consequences are severe: according to Draghi, only 4 of the 50 most prominent tech companies in the world are European.

Next steps in the innovation chain demand a sharp, focused, and business-like approach.



These large (often relatively young) tech firms are key drivers of R&D spending and productivity growth, noticeable in the US and Asia. In the Netherlands, the high-tech sector accounts for about half of all private R&D spending.

While more fundamental, academic research thrives in a certain curiosity-driven environment, the subsequent stages in the innovation chain require a sharper, more focused, and business-oriented approach. Moreover, a small country like the Netherlands cannot afford to scatter its resources. A strategy based on a clear assessment of our relative strengths and weaknesses—aimed at technology leadership and the creation of control points in value chains—is essential.

Equally important is the development of scientific and technological infrastructures around the domains where the Netherlands excels, combined with favourable conditions for entrepreneurship. These should form the

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**TNO works with  
and for both  
government and  
industry.**

foundation for mega-clusters of innovation and enterprise—clusters of mass innovation and mass entrepreneurship. For example, high-tech mega-clusters can serve as mission-driven innovation hubs where companies, research institutions, governments, and investors collaborate intensively on key technologies such as quantum, integrated photonics, and batteries. Within these clusters, companies gain access, sometimes through TNO, to modern lab facilities, high-tech equipment, and pilot production lines.

Research facilities are critical to a well-functioning innovation chain. They provide entrepreneurs with the tools to accelerate R&D, offer researchers the environment to innovate, and give regions and countries a unique competitive edge in their core technologies.

The Dutch government is now taking targeted steps to sharpen its focus through the National Technology Strategy (NTS),



# Government and industry, societal and economic interests are intertwined.

policy to which TNO contributed considerably. This strategy must now be further refined and, more importantly, implemented with a long-term perspective. That requires courage and the willingness to make choices that are sometimes difficult—not only for the Netherlands, but also for TNO. Good plans have never been in short supply in the Netherlands or the EU. Decisive execution is needed.

## Growing awareness that societal and economic interests go hand in hand

Realising major yet complex transitions and other societal goals requires the involvement of both government and the private sector. The success of the energy transition, for example, depends on private companies developing new processes and equipment, and making multi-billion-euro investments. Likewise, companies that produce recycled plastics cannot thrive if restrictive laws and regulations stand in their way, which, unfortunately, is often the case.

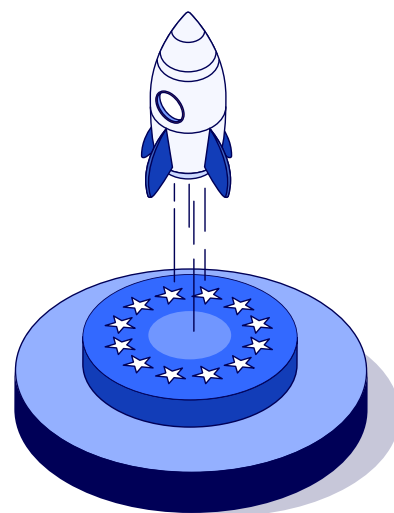
This is where government has a role to play. The government also plays a crucial role in stimulating innovation by providing early-stage funding where private investment is still too risky or premature, or by developing the physical and technical infrastructure necessary for innovation and entrepreneurship. At the systems level, public and private organisations, and societal and economic interest, are deeply intertwined. As an organisation often recognised for its systemic role, TNO does not view the public and private sectors as separate or isolated worlds, but as interconnected forces that are jointly essential for driving innovation and progress. TNO therefore works both with and for government and industry to create impact.

## Increasing demand for reliable information to support policymaking

Government agencies regularly turn to TNO's independent expertise to support evidence-based policymaking. In an increasingly complex world, effective policy must be grounded in thorough research and empirical validation through measurements, testing, and scientifically validated models. Without a commitment to a measurable, factual reality, decision-making becomes speculative—and speculation is a poor foundation for progress.

Science based policymaking is not just a best practice; it is a necessity. It ensures that resources are used efficiently, risks are managed strategically, and outcomes are assessed objectively. One of TNO's core responsibilities is to provide policymakers with reliable information, enabling them to base their decisions and policies on sound analysis and scientific insight—delivered by an independent institute. Ministries are increasingly asking TNO to fulfil this role.

In that respect some government agencies also ask TNO to maintain a specific knowledge base for the execution of statutory tasks. This is certainly true for the Ministry of Defence, as established in the TNO Act. Another example is the Geological Survey of the Netherlands (GDN), which maintains knowledge on the subsurface for various ministries. This type of work is funded through dedicated programmes by the respective government departments.



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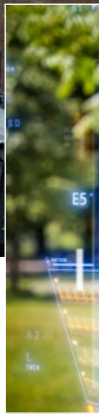


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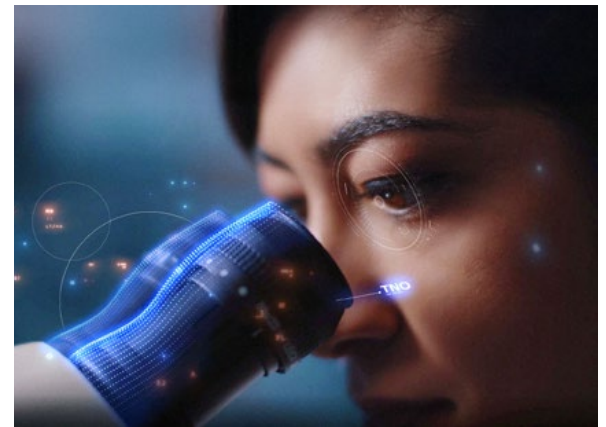


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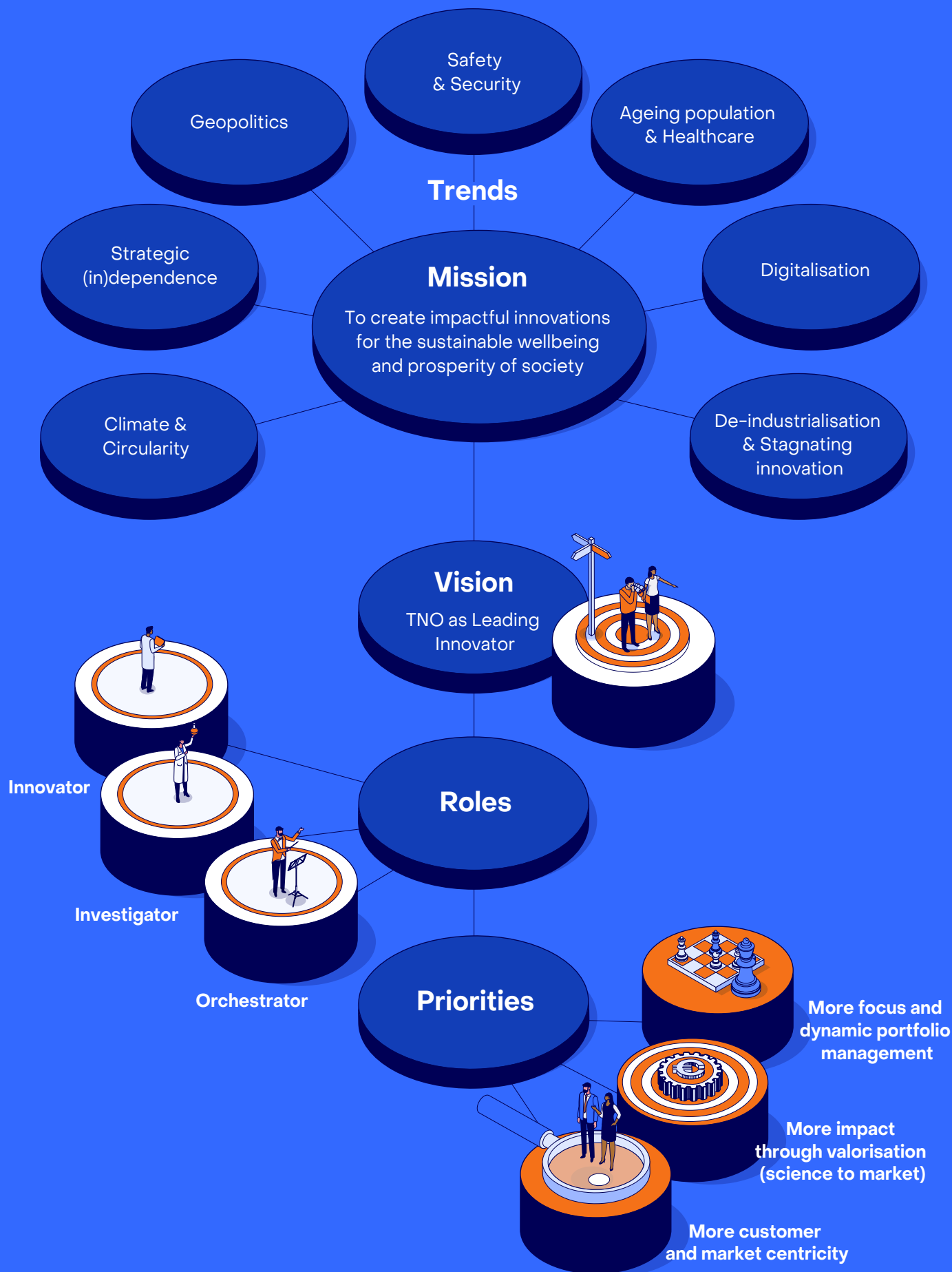
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1. In critical domains such as security, Europe aims to become more self-resilient.
2. Innovation is essential to building a resilient society.
3. Climate change requires both mitigation and adaptation.
4. Systems are becoming increasingly intelligent.
5. Ageing makes technological solutions a necessity in health-care sector.
6. Mega-clusters: mission-driven innovation hubs for scale, focus and collaboration.



7. TNO collaborates with knowledge institutions, industry, and government to create impact in transitions.
8. Effective policy is based on thorough research and empirical validation.



# Mission & Vision

**The mission of TNO is to create impactful innovations for the sustainable wellbeing and prosperity of society.**

**Innovation is crucial in realising a secure, sustainable, healthy and digital society...**

As we navigate the first half of the 21st century, we encounter several significant challenges. To shape a better future, society must limit climate change while also adapting to it. Our economy needs to foster innovation and competitiveness, while embracing sustainability, including circular practices. Our population is ageing, and we all want to lead longer, more prosperous, healthy lives—at work and at home. In a changing geopolitical landscape, marked by rising military conflicts and a greater emphasis on strategic autonomy, people are seeking greater security. Simultaneously, as societies grow more complex, there is a growing demand for reliable information to inform evidence-based policymaking and effective governance. We must harness the full potential of digitalisation and information technology to achieve these goals. Only then can we build a resilient, prosperous and future-proof society.

Technical novelties and scientific insights only have a significant impact on society and economic development if they are used, at scale, in the real world. Not every ingenious invention or insight meets a significant need or can feasibly be produced or adopted on a large scale. Therefore, a keen understanding of customer needs, international supply chains, and the broader landscape of national, European, and global market trends is vital. As global investments in research and development (R&D) surge, and value chains span multiple borders, the innovation arena is transcending national boundaries.

It is increasingly becoming a fiercely competitive landscape, in which TNO has to articulate its right to play in each of the fields in which it is active. Just like any other region, country, or organisation, the Netherlands in general, and TNO in particular, must amplify their collective innovation efforts. This means leveraging our unique strengths in specific fields—those that hold the most promise—to secure sustainable competitive advantages and establish strategic footholds (control points) within global value chains

**...With TNO as leading innovator**

TNO, as a trusted, independent, and pioneering applied science and technology organisation, plays a multifaceted role. We innovate, investigate, and orchestrate, collaborating closely with governments, universities and the private sector. We inform government on policies and empower evidence-based decision-making through rigorous investigations, cutting-edge scientific insights, and reliable measurements. By building national and international consortia and ecosystems, we drive technological and methodological breakthroughs that help to realise a secure, sustainable, healthy, and digital society, and strengthen the earning power of the Dutch economy.

TNO aims to help elevate the cumulative innovation effort in the Netherlands towards R&D investment of at least 3% of GDP, an increase of 30% (more than € 6.7 billion) compared to 2022, mainly from private contributions. Therefore, we also have to increase TNO's innovation effort, as a core part of the Dutch innovation ecosystem. To maximise the impact of our innovative efforts, we concentrate on fields where we truly excel—where we lead the way in innovation—and where our contributions therefore have the most impact. We base our decisions in this regard on a thorough grasp of societal and market needs, a realistic assessment of emerging value chains and industrial hubs in the Netherlands, as well as the international competitive landscape. These factors co-determine the success or failure of an innovative effort. We remain committed until technical and social inventions evolve into successful innovations.

Together, we will forge a more focused and responsive organisation: one that thrives on collaboration and agility, where our employees can flourish, and where they feel empowered to create truly impactful innovations that contribute to the sustainable well-being and prosperity of society.



# Strategic principles and priorities

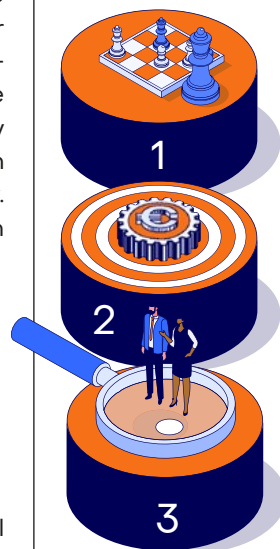
**‘Do what you love, do what the world needs, do what you’re good at, and do what you can be paid for.’**

Ikigai

TNO is committed to create impactful innovations that contribute to the sustainable wellbeing and prosperity of our society. The global developments outlined earlier call for a reassessment of our direction. They compel us to adapt our strategy, our methods, the way we generate impact, and the urgency with which we act. Below, we elaborate on the core elements of this revised strategy. The TNO Strategy for 2026–2029 is built on three key priorities:

1. More focus and dynamic portfolio management – do what you excel at
2. More impact through valorisation – science to market
3. More customer and market centricity

These elements are explained in more detail below.

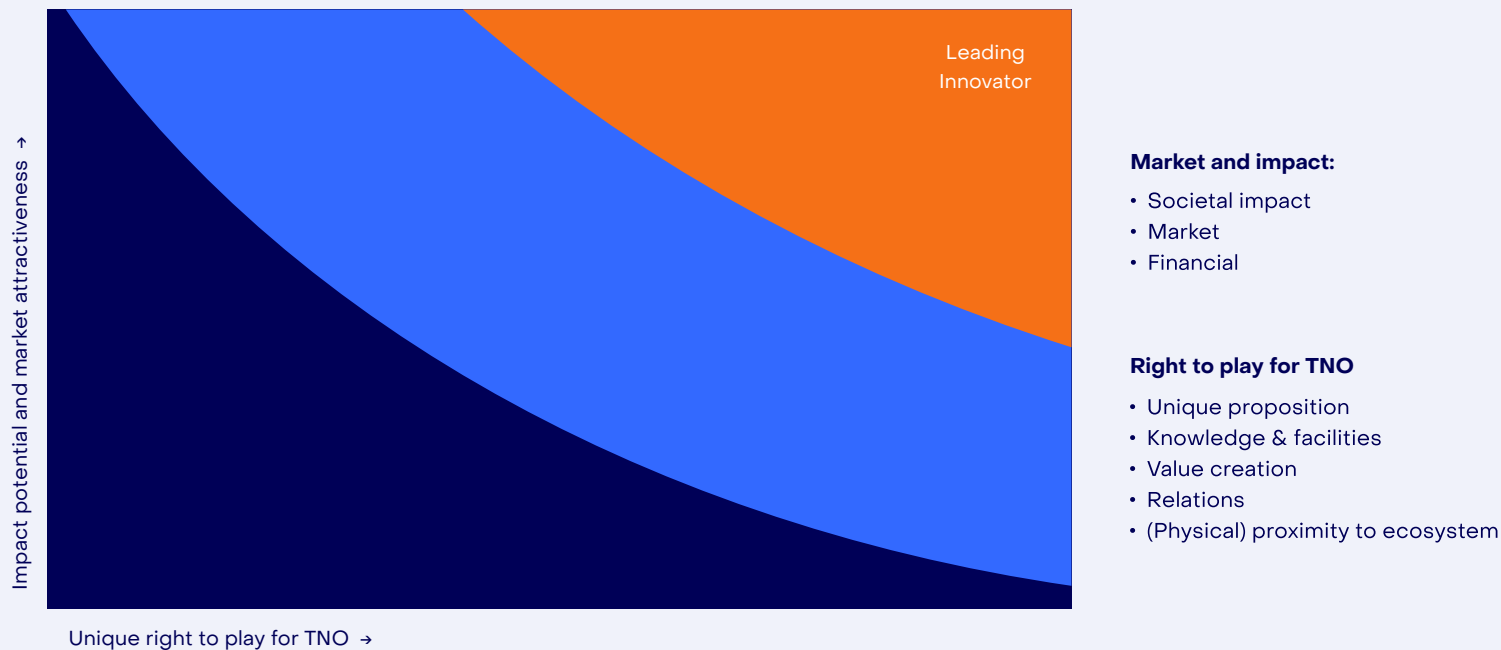


## 1. More focus and dynamic portfolio management – do what you excel at

To achieve maximum impact, TNO must deploy its scarce resources as efficiently and effectively as possible. Everything TNO does must be important, but TNO is not necessarily the most logical or best-suited party for all important initiatives. For this reason, TNO will focus, more than in the past, on domains and/or markets where there is a credible ‘right to play’—that is, domains where the Netherlands and TNO are noticeably at the forefront and where (market) conditions and ecosystems are favourable for success and impact. In other words: domains where we are, or can become, a European or preferably global ‘leading innovator’ in terms of expertise, ecosystem and facilities. In these domains, the likelihood of impact is high, whereas in other areas—where we are one of many—the chance of impact is relatively small. By focusing more sharply on innovation domains where we are leading innovator and further strengthening these domains, we can drive the growth of Dutch R&D investments and strengthen both TNO and the broader economy.

### More focus through targeted deployment of Institute Funding

In this context, focus primarily means concentrating Institute Funding (IF), which TNO receives annually as part of its government funding, on domains where we can create and expect significant impact. Since resources are not unlimited, this inevitably means that investments in other domains will be scaled back. In most cases, IF will be reduced or phased out over several years, also to allow for the fulfilment of ongoing commitments. This creates space for (partially new) domains



where TNO can have (more) impact. TNO remains a broadly oriented research organisation, and the creative interaction between different domains is one of the strengths that characterises TNO.

To implement these principles, TNO conducted a thorough portfolio analysis of all domains where IF is used. The core objective was to identify domains with the greatest potential for large-scale future impact that also require an IF injection to realise that potential. To assess this, an analysis was made of the areas in which TNO has a strong position (or potential) and a clear 'right to play'.

Several factors were considered in this context. For example, the industrialisation phase of the relevant technology, the number of patent applications and revenues from intellectual property, the number of successful spin-offs, the volume of externally funded research (contract research) commissioned by major professional players (both private and public), success in obtaining competitive funding (i.e., grants obtained in competition with other parties), the strength of the Dutch ecosystem in the relevant domain, the IF factor (i.e., the ratio between total R&D funding and the amount of IF that TNO contributes), important scientific publications (e.g., in Nature), and the influence of our reports on

**Our focus is determined by market, impact and right to play.**

government policy. Reports from external evaluation committees also played an important role.

A thorough analysis was conducted of more than 60 individual propositions that utilise IF, with each proposal evaluated individually to determine whether funding should be increased, maintained, or reduced. For example, additional IF is being invested in various promising high-tech sectors, such as photonics, chip technology, and quantum technologies. This also applies to defence-related domains, including critical voids in munitions production, high-tech defence innovations, and resilience. Digital technologies such as AI and data sharing, cybersecurity, and under-developed domains in software services are also receiving additional support. Given current global and national developments, such as the National Technology Strategy (NTS) and the need to renew and develop our industrial base, we consider these to be strategic and well-founded choices.

TNO also prioritises more substantial IF investments in targeted sustainability initiatives. Think of electrochemical technologies for industry, infrastructure and grid congestion, and climate adaptation. Improving healthcare is also a priority, with innovations in drug development and addressing critical

# Everything TNO does must be important—but need not necessarily be the most logical party for every important initiative.

gaps in the healthcare system. After the portfolio review, sustainability remains the primary focus of IF investments. Our four overarching societal themes—a safe, sustainable, healthy, and digital society—continue to guide our decisions.

In addition to evaluating existing propositions, a number of ‘white spots’ have also been identified: emerging domains that are not yet part of the current portfolio, but in which TNO could and should establish a strong position—for example, in climate adaptation, dual-use technology, labour productivity, and the healthcare domain.

It is evident that an increase in IF investments in certain domains necessarily means a decrease in others. With a shift in focus

Focus is placed not only on the support of existing industrial clusters, but also on the creation of new ones.

and possible adjustments to business and operating models, these domains may still thrive. Innovation and market developments are inherently unpredictable and dynamic. Therefore, when IF will be decreased in a domain, it is generally phased out over several years to give units and departments the opportunity to supplement a funding shortfall with other (external) funding sources, particularly contract research.

The reductions are not targeted at specific units; all units will face both increases and decreases. However, the impact will not be evenly distributed. In net relative terms, the units High Tech Industry (HTI), ICT, Strategy & Policy (ISP), and Defence, Safety & Security (DSS) will receive additional resources.

## More flexibility and effectiveness through dynamic portfolio management

A new element is that halfway through the strategy period (i.e., in 2027), an internal mid-term review of the above described IF allocation will take place. This evaluation will allow room for new opportunities and unforeseen breakthroughs, as well as for further adjustments to the portfolio. On the one hand, the aim is to assess whether changes in external circumstances require adjustments to the IF allocation in a particular domain. Given the rapid developments in technology, markets,



# Next steps in the innovation chain demand a sharp, focused, and business-like approach.

and geopolitical relations, periodic reassessments are always essential. Think of COVID-19, the war in Ukraine, advances in AI, and political shifts in the Netherlands and the EU. On the other hand, throughout the entire strategy period—and in greater detail during the mid-term review—progress and performance will be analysed in domains where IF has been invested.

It is important to clarify that final results are not anticipated in every instance by 2027, nor does this imply that only short-term outcomes will be targeted. It often takes years for disruptive technologies to break through. Instead, the mid-term review will assess whether sufficient progress has been made on the factors described above in our portfolio analysis, and whether interim milestones have been reached that justify further IF investment. This will also consider the funding needs of other important activities.

## Subsidies, Institute Funding and the Valley of Death

Government subsidies, from the Netherlands or the EU, can play an important role in bridging the 'valley of death'. They can provide a boost when the market is not yet ready to step in, or not quickly enough. They can also support the development of innovation infrastructures that benefit the entire innovation ecosystem.

However, the ultimate goal is always to cross the 'valley of death'—the difficult mid-TRL levels in the innovation chain—with an activity that is self-sustaining and can stand on its own. Subsidies should therefore primarily be regarded as a strategic and temporary impulse for a domain, as a catalyst, not as permanent support. This principle applies not only to TNO but also to the broader Dutch innovation ecosystem. This is especially relevant for TNO in the context of IF and other

subsidy instruments, such as the National Growth Fund programs. The goal of an applied research institution is always to arrive at valuable application outside the lab and in the real world.

TNO will use IF mainly as an initial measure, characterised by a defined start and finish. Additional investments may follow if the development proceeds positively and further progress is justified. Follow-up investment will be evaluated more frequently and more rigorously than before. The key question is whether it results in practical use by government or industry. This includes assessing whether societal stakeholders find the development valuable enough to co-finance it. The goal: to pull innovations out of the subsidy circuit and out of the 'valley of death', and into a mature position in the market and society.

## 2. More impact through valorisation – science to market

Technological innovations and scientific insights only gain real significance for society and economic development when they are applied at scale and add value in practice. Innovation does not end with fundamental research, the publication of a scientific article, or even the creation of a prototype. Not every invention or discovery, however ingenious, meets a real need or lends itself to large-scale production and application.

The 'T' in TNO stands for 'Toegepast' (i.e. 'Applied'), and it is our mission to ensure that knowledge is translated into concrete actions, solutions, and societal and/or economic value. The path to implementation is often long, highly complex, and accompanied by numerous practical obstacles.

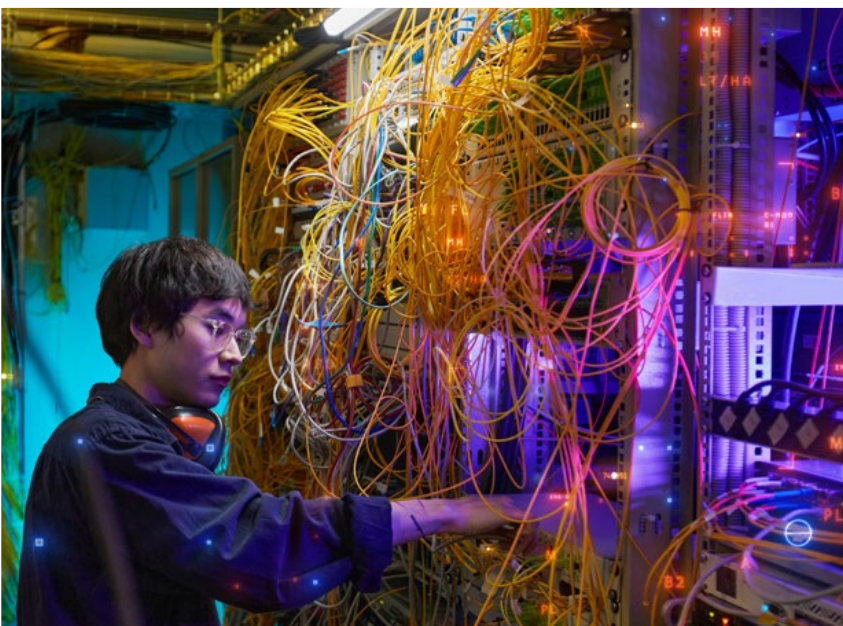
To prevent TNO's work from being shelved, it is essential to both recognise and understand the challenges our partners face. Equally important is actively supporting partners in the private and public sectors as they work to overcome these obstacles.

For this reason, TNO will strengthen its role in the latter phases of the innovation chain, by more actively supporting both private companies and public organisations in applying and valorising new technologies, methodologies, and insights, so that they can be deployed at scale.

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1. Bias-free recruitment enabled by ObjectiveEye, a TNO spin-off.

2. Digital technology supports societal transitions.

3. Climate adaptation is becoming increasingly important.

## Bridging the Valley of Death: science to market

TNO's activities will continue to span a large part of the TRL spectrum: from early-stage exploratory research to valorisation and implementation, with a strong emphasis on the mid-range TRL levels, the so-called 'valley of death'. This is TNO's *raison d'être* in the innovation chain and should therefore remain the focus.

For a successful innovation chain, smooth transitions between low, mid, and high TRL levels are crucial. Since TNO focuses particularly on the mid-range TRL levels, the valley of death, it is essential to build and strengthen close-partnerships with both academia (low TRL) and the government, the private sector, and funding institutions such as Invest-NL and Venture Capital funds (high TRL). In other words, TNO operates in a 'quadruple helix' of knowledge institutions, industry, government, and funders like Invest-NL and venture capital.

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The Technology Readiness Level (TRL) scale used in innovation chains ranges from 1 (fundament) to 9 (market introduction). The mid-TRL levels range from 4 (lab validation) to 6 (prototype). At levels 7 (demonstrator) and 8 (ready for production), more valorisation takes place.

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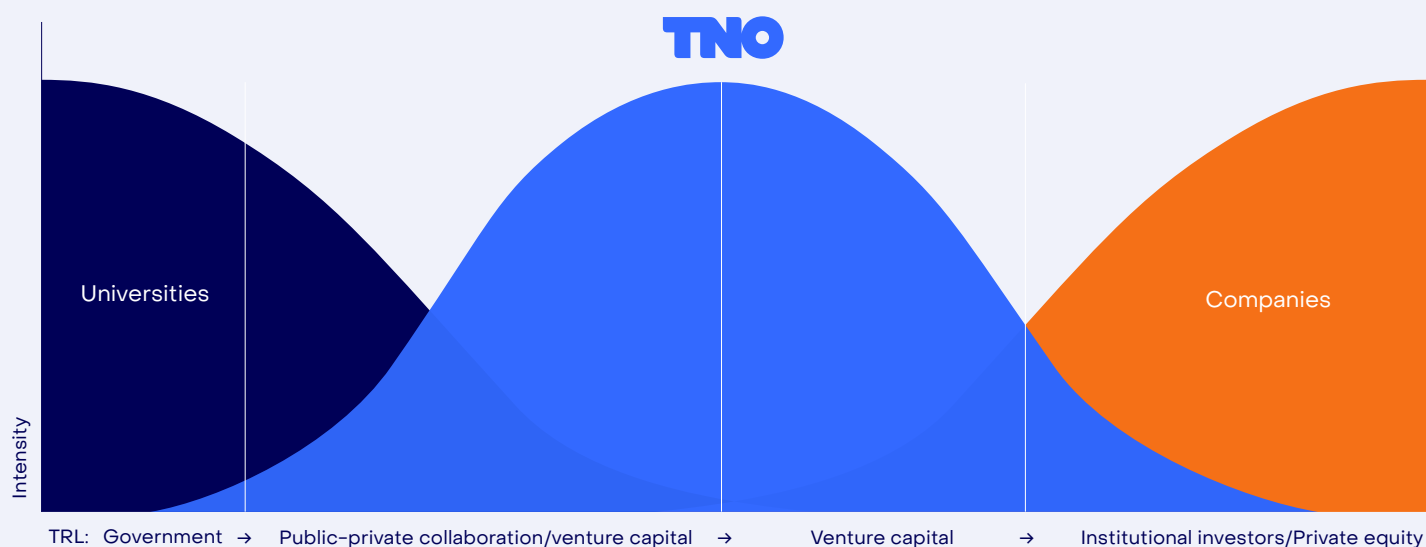
**For a successful innovation chain, smooth transitions between low, mid, and high TRL-levels are crucial.**

All these parties are essential for a well-functioning innovation chain.

TNO operates at the intersection of academic research and the valorisation, application, and industrialisation of emerging knowledge. Especially in the industrialisation and spin-offs of TNO, the funding agencies are important partners. TNO must therefore understand and bridge different worlds, despite significant cultural differences. Navigating this process—from curiosity-driven fundamental research to targeted and focused product development and valorisation—is a core task of TNO. But it is a core task that, due to its complexity, requires more attention.

## Technological breakthroughs and the ERP programme

In TNO's Exploratory Research Programmes (ERPs), teams work on emerging technologies, models, and methodologies that can be deployed to solve complex societal challenges. To force technological breakthroughs, the ERPs will be strengthened, and collaboration and partnerships with universities at lower TRL levels will be deepened. This will partly be achieved by more focus, in line with portfolio choices. A larger number of initial ERP proposals will also be eligible for a first round of funding at the start of the process. However, at the same time, and in line with dynamic portfolio management,



# TNO will take a more active role guiding and supporting startups towards rapid growth and success.

the selection for follow-up investments will become stricter and more frequent. In that selection, a more explicit evaluation will be made of whether the proposed technology or method has a realistic chance of generating significant impact.

Especially within the ERP programme, but also more broadly, TNO will actively seek collaboration with peer institutes, both in the Netherlands (e.g., through cooperation with the TO2 institutions and universities) and abroad, within the framework of the European Association of Research and Technology Organisations (EARTO).

## Technology transfer, valorisation and industrialisation

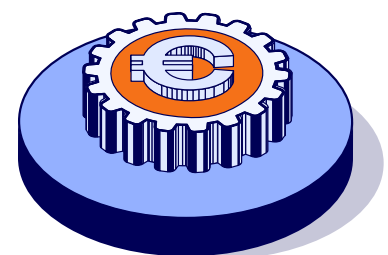
At the same time, TNO will place greater emphasis on technology-, methodology-, and knowledge transfer (valorisation) at the higher TRL-levels. As stated, impact is only realised when technical innovations are adopted and applied on a large scale. Therefore, TNO will, if preferred, provide support and remain involved during the valorisation process, even though other parties, such as companies or governments, are primarily responsible in these latter phases. Simply passing the baton at TRL 6, moving on, and hoping for the best is not a strategy that leads to maximum impact. Too much of TNO's work would then remain an unfulfilled promise. This is a persistent weakness in the Dutch innovation system. When TNO is not closely aligned with practical applications, it may fail to fully appreciate the inherent complexities associated with generating meaningful impact. The dynamics, rhythm, and forces of the market and government then remain abstract.

This also implies that TNO will pay more explicit attention to the market conditions and -structure in which innovations must ultimately land when formulating innovation

challenges, as well as to the manufacturability or applicability of inventions. For example, an invention may be technically or methodologically sound but far too expensive, unrealistic in practice, or difficult to produce with existing manufacturing resources. Regulations may also impose limiting requirements or make the introduction of the innovation unrealistic or too costly. Such factors should preferably be considered from the outset of the innovation process 'by design'. What is a reasonable price point? Are there obstacles to production and application? Can it be manufactured, or would an entirely new production infrastructure be required? Are there regulations that hinder implementation? And so on. There may also be social barriers that hinder the adoption of new technology. Innovating with real impact in mind means taking such factors into account. This is what TNO is committed to.

Although TNO is engaged in applied research, it focuses on a different segment of the innovation chain than, for example, commercial engineering- and consulting firms. Engineering firms typically operate at higher TRL levels than TNO and are hardly active in the 'valley of death', the phase mentioned above in which promising technologies struggle to bridge the gap between fundamental research and commercial application. It is precisely in this relatively risky mid-segment of the TRL spectrum that TNO plays a crucial role, as it represents a weak spot in the Dutch innovation ecosystem.

At the same time, more attention to valorisation also means that TNO will increasingly engage in short-cycle innovation, particularly at the request of key stakeholders such as the Ministry of Defence and SMEs. However, when activities align more closely with traditional engineering services, we often opt for a spin-off, license intellectual property, or refer to (or collaborate with) commercial firms.



## Strengthening and accelerating the innovation chain – from startup to unicorn

One of TNO's core tasks is to strengthen the earning and competitive power of the Dutch economy. In this context, TNO will take a more active role in addressing gaps and weaknesses in the innovation chain. We do this, among other things, by building on our strong track record in launching innovative spin-offs based on in-house innovations. In the coming period, TNO will again launch a significant number of spin-offs with the potential to grow into major Dutch technology companies.

In addition, TNO will play a more active role in guiding and supporting these spin-offs toward rapid growth and success. A new development is that deep-tech startups and scale-ups that did not originate from TNO but align with TNO's portfolio and strategy will now also be eligible for such support, where appropriate. If the cash position of vulnerable startups does not allow them to engage TNO, which is often the case, TNO Ventures B.V. (a private subsidiary of TNO) may take a temporary equity stake in exchange for research efforts or other support from TNO. This creates more flexibility for startups and scale-ups to enter strategic collaboration with TNO without incurring a significant negative cash flow during a vulnerable phase of the startup.

To further strengthen this effort, TNO is partnering with InvestNL and Techleap. This collaboration is also aimed at increasing the number of startups that grow into successful tech companies and accelerating the pace at which this happens. For the same reason, TNO will also strengthen its cooperation with Regional Development Agencies (ROMs), Venture Capital funds, pension funds, and other relevant organisations to help create a mature quadruple helix. Financing the innovation chain is one of the most critical areas in need of reinforcement, and the traditional triple helix is no longer sufficient.

With these and other measures, TNO will make a significant contribution to bridging the 'valley of death' in the innovation chain.

## A small country like the Netherlands cannot afford to scatter its resources.



The EU has fallen far behind in the field of AI.



An important goal is to significantly increase labour productivity in the healthcare sector.



The goal is always to scale promising innovations more frequently and more rapidly from research to widespread practical application. The expertise TNO has built in this domain (tech transfer and venture building) will be actively shared with peer institutes, universities, and other knowledge institutions. If desired, TNO is also open to carrying out such activities on behalf of other knowledge institutions.

## 3. More customer and market centricity

Only with a solid understanding of the complex context in which TNO's private and public customer and partners operate can TNO further increase its societal impact. In practice, being customer-oriented means that we must thoroughly understand the fundamental needs and challenges of our



customers (companies and (semi-)public authorities), while at the same time maintaining a clear, pragmatic, and independent view of the forces that influence their decisions and actions. The path to applying research and innovation is often complex and full of practical obstacles. It is essential to not only know and understand these challenges, but also to actively support our customers—both in the private and public sectors—in overcoming them. The more customer-, society-, and market-oriented TNO is, the more impact can be realised.

#### **Doing what is important (mission critical) for customers**

For government, this means that TNO must have a deep understanding of both policy issues and their interconnections. At the same time, insight is needed into the practical bottlenecks that arise in the execution of statutory tasks or in the rollout of new policies and technologies. It must also be clear how that execution can be made smarter, more

effective, and more efficient—for example, utilising new technology.

Working with the private sector requires sharp insight into the strategic context of customers and partners, and the dynamics and challenges of different market segments. TNO must understand what drives companies: their objectives, their supply chains, their customers, their innovation needs, and the factors that determine their success. At the same time, this must be effectively matched with TNO's capabilities and knowledge, with the explicit aim for TNO to regularly surprise its customers and partners with unexpected breakthroughs or solutions. Not a 'technology push' in the hope of finding a buyer, but push and pull and where possible, co-creation.

For all organisations that TNO works with—(semi-)public or private—it is essential that we can clearly answer the following question: what is 'mission critical' for that organisation, and how can TNO's support be precisely aligned? This requires a deep understanding of the world in which TNO's customers,

# The more customer-, society-, and market-oriented TNO is, the more impact can be realised.

partners, and stakeholders operate. In the new strategy period, customer awareness and customer orientation will be further strengthened.

## Attention for large companies and SME

With regards to the private sector, there is a significant difference between the innovation needs of large technology companies like ASML on the one hand, and small start-ups, scale-ups, and the broader SME (Small and Medium Enterprises) sector on the other. While companies like ASML expect universities and TNO to deliver technological breakthroughs that they can incorporate and commercialise, tech startups are often frantically working to make their innovative product market-ready and tested. For this latter group, it is a constant race against time and a draining cash flow. They often lack the funds to pay TNO. Innovation cycles are shorter. The search for potential customers and new investors dominates. The future is uncertain. For TNO, large, well-known companies are less risky, the projects are larger, and the cumulative acquisition costs are lower, so there is a natural tendency to focus on this group. However, it is precisely the tech startups and scale-ups that need TNO's help and that can stimulate industrial renewal.

This means that TNO must consider the fact that different customer segments require different approaches. For this reason, TNO will continue its SME policy vigorously and deploy new instruments to actively support tech startups and scale-ups.

## Internationalisation

Most of the technologies in which the Netherlands and TNO excel are located 'upstream' in the value chains. Think, for example, of the production of high-end, low-volume machines or production tools. This means that in these areas we are part of

global value chains and that the customers of such companies are international players. The same applies to TNO's spin-offs and the other startups TNO supports. To secure a position in these value chains and gain a technological edge, it is essential that TNO collaborates with European and global players, including international businesses and peer institutions. The ultimate goal is to create knowledge, infrastructure, and economic activity in the Netherlands which are well-positioned within international value chains.

TNO is, however, cautious about setting up expensive laboratories abroad. In most cases, the work done with or for international players can be carried out at one of TNO's locations in the Netherlands. In this way, international work leads to volume, knowledge, infrastructure, and economic activity in the Netherlands. This is TNO's commitment.

## System approach and orchestrating innovations

Many societal challenges are so complex and intertwined with other issues that they require an integral system approach involving a broad group of stakeholders. Coordinating and orchestrating such collaborations—focused for example on innovation for complex transitions—is a role that is valued, suits TNO well, and is one that we will continue to pursue. In the past strategic plan period, a collection of methods has been developed to guide such processes effectively. These methods are being disseminated within the organisation so that all units have the relevant knowledge and skills.

## Avoiding boom-and-bust scenario

Government subsidies, with exception of defence-spending, are expected to come under increasing pressure in the coming years. The discontinuation of the National Growth Fund means that from 2027, TNO may face a potential annual loss of tens of millions of euros in revenue. In addition, the Ministry of Economic Affairs has imposed cuts on IF, further increasing the financial challenge. Other ministries are also facing significant budget cuts, which may also affect TNO.

TNO will face a significant decline in revenue if this future loss is not offset by using existing subsidies to create sustainable value propositions that can stand on their own. Without action, this could lead to a further reduction in cumulative R&D efforts in the Netherlands, and also to reduction at TNO.

A boom-and-bust scenario looms.

To avoid this scenario, various actions will be taken. The Netherlands is already significantly behind in terms of cumulative national R&D investments, mainly because private spending lags. The last thing the Netherlands needs is a further reduction in private R&D spending. TNO will therefore focus a significant part of its efforts on this.

As previously mentioned, subsidy instruments such as the National Growth Fund are intended to catalyse new developments in the difficult early phase of the innovation chain. These instruments are not meant as permanent support. In line with this principle, TNO will make a strong effort in valorisation of the knowledge and expertise developed with the support of these subsidy instruments. Not only was this the original intention of these instruments, but it can also partially or fully compensate for the loss of subsidy income

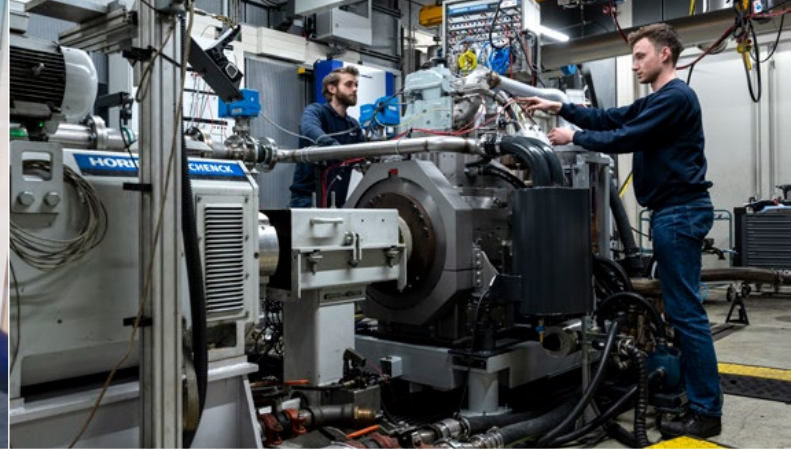
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**The National Technology Strategy (NTS) is an important foundation for future innovations.**

through work carried out directly on behalf of customers (government or business). Also here, a significant strengthening of customer orientation will make the difference.

Further, work commissioned directly by external stakeholders often aligns better with practical needs because the demand and problem definition are clearer. This enhances the relevance and impact of research and innovation. Direct external funding for delivered work is also a powerful indicator of the value that government and businesses put on that work. On the other hand, if after years of research and development supported by IF, insufficient external parties are willing to (co-)invest in the work, TNO must critically examine what the underlying reasons are and whether continued IF support at the same level is justified.





# To conclude

The strategic shifts outlined in this strategic plan will have a significant impact on our organisation and operations in the coming years. Our people are and will remain the heart of TNO, and we aim to continue offering an inspiring environment in which everyone can excel, in a respectful, inclusive, and equitable environment. We also continue to take our societal responsibility and exemplary role seriously: we practice what we preach. These organisational aspects will be detailed separately, with this strategic plan as foundation.

With this strategic plan, TNO heeds the recommendations of the TNO Evaluation Committee. In this respect, TNO is purposefully sharpening its research portfolio to future-proof the organisation—even in a scenario where NGF (National Growth Fund) revenues disappear. At the same time, further responding to the evaluation, TNO is intensifying its focus on the valorisation of research results, deepening and strengthening relationships with (private) partners. This collaboration extends beyond the national domain and is explicitly shaped within a European and broader international context. This element is also embedded in the new strategy. Realising this strategy requires access to leading research facilities and the ability to attract and retain outstanding talent, as emphasised in the evaluation. Artificial intelligence will play an increasingly prominent role, acting as a catalyst for innovation within TNO's core domains. To systematically monitor the effectiveness of this strategy, TNO is further strengthening the methodology for measuring both output as well as societal and economic impact.

TNO stands at a pivotal moment in its history. In an era of profound economic, geopolitical, and societal change, our role as innovator, researcher, and orchestrator is essential. The challenges ahead are significant, but so are the opportunities. TNO is not a bystander, but is at the forefront, working on solutions that will shape the future. Together with our partners, we embrace this responsibility—with a strong sense of independence and integrity, and with more collaboration and entrepreneurship. In doing so, we are pushing boundaries.

With independence  
and integrity, through  
greater collaboration  
and entrepreneurship.  
That is how we push  
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