

# Let's drive innovation towards a new era

Discover the Netherlands' dynamic and innovative semicon sector



# NL

Netherlands

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# “Our goal is bringing forward human knowledge”

Nobel Prize laureate Ben Feringa

## Semicon driving innovation in the high-tech sector and beyond

In the last 50 years, semiconductors have revolutionised our lives. This key enabling technology is an essential component driving innovations in computers, smart devices, cloud computing, and 5G communication networks. And with the Internet of Things, 70% of semicon chips are now inside everyday consumer appliances from washing machines and fridges to self-driving electric vehicles, wearables and drones.

Companies worldwide face supply chain issues. Semicon is no exception. Extremely specialised tech companies are hampered by a global shortage in chip production. The US and China are currently leading semicon markets. Europe needs to upscale its production to meet the shortfall in supply.

The chip shortage has been exasperated by logistic problems caused by COVID-19. Meanwhile, a lack of skilled technicians and outsourcing are making it difficult for the industry to flourish in Europe. At the same time, the semicon industry faces threats to data security and possible energy shortages with subsequent rising costs.

### Sustainable chip production

The semicon industry also has to contend with national and international environmental legislation as governments tackle climate change. The industry itself requires large quantities of water and energy. This has a huge impact on the environment. In reverse, climate change negatively impacts semicon supply chains and production. All this reinforces the case for long-term investment in increasing the capacity for sustainable and innovative chip production. The Netherlands is committed to realising such long-term investment.

Although the production of semicon technology uses lots of natural resources, applying it can help tackle the Sustainable Development Goals and Climate Change. In achieving food security, big-data software for climate models and sensors help crop monitoring. In the transition towards a zero-emission economy, electronics are used for solar energy, electric vehicles and energy storage systems. And in health, miniaturised healthcare diagnostics, personalised medication and life-style applications are saving and enhancing lives.

## Why choose the Netherlands as your partner in solving global challenges



The semicon industry is a truly global industry, with products crossing borders up to 70 times. The Netherlands is one of only three countries to have all 7 steps of the value chain – from design and fabrication to packaging, testing and assembly of the end product – all within a 200-km radius. The close proximity of members of the ecosystem keeps the lines of communication short and accelerates innovation.

Similarly, in the Netherlands, governments, businesses, research and local stakeholders work together in what is known as the quadruple helix. This model reinforces the effectiveness of the ecosystem, by nurturing interaction at all levels. The lack of a hierarchical system makes it easier for quick decision-making and bottom-up ventures. Centuries of joining forces against the elements has taught the Netherlands how inclusive action provides better results and out-of-the-box solutions.

### Creating a new market at home

As early adapters with a high level of digital literacy, consumers and companies alike are keen to buy new technology creating a ready market at home. At the same time, the Netherlands is a seasoned partner in networks and international cooperation on global markets. Our proven track record in major innovations makes the Netherlands an attractive semicon partner.

The Netherlands is a leading global player with regard to knowledge on and production of semiconductors. We are the largest supplier to the automotive industry and home to the world's biggest machine builder for semicon manufacturing, ASML. Nevertheless, the semicon industry in the Netherlands is largely fed by small to medium-sized companies employing up to 50 people. As a result, the Netherlands boasts both the stability of large companies with comprehensive vertical integration and the versatility of independent operators.

Inside the Netherlands, around 200 semicon companies employ 40,000 people and have an annual turnover of 23 billion euros. Considering the Netherlands is internationally renowned with many companies active outside the country, the total turnover is much higher.

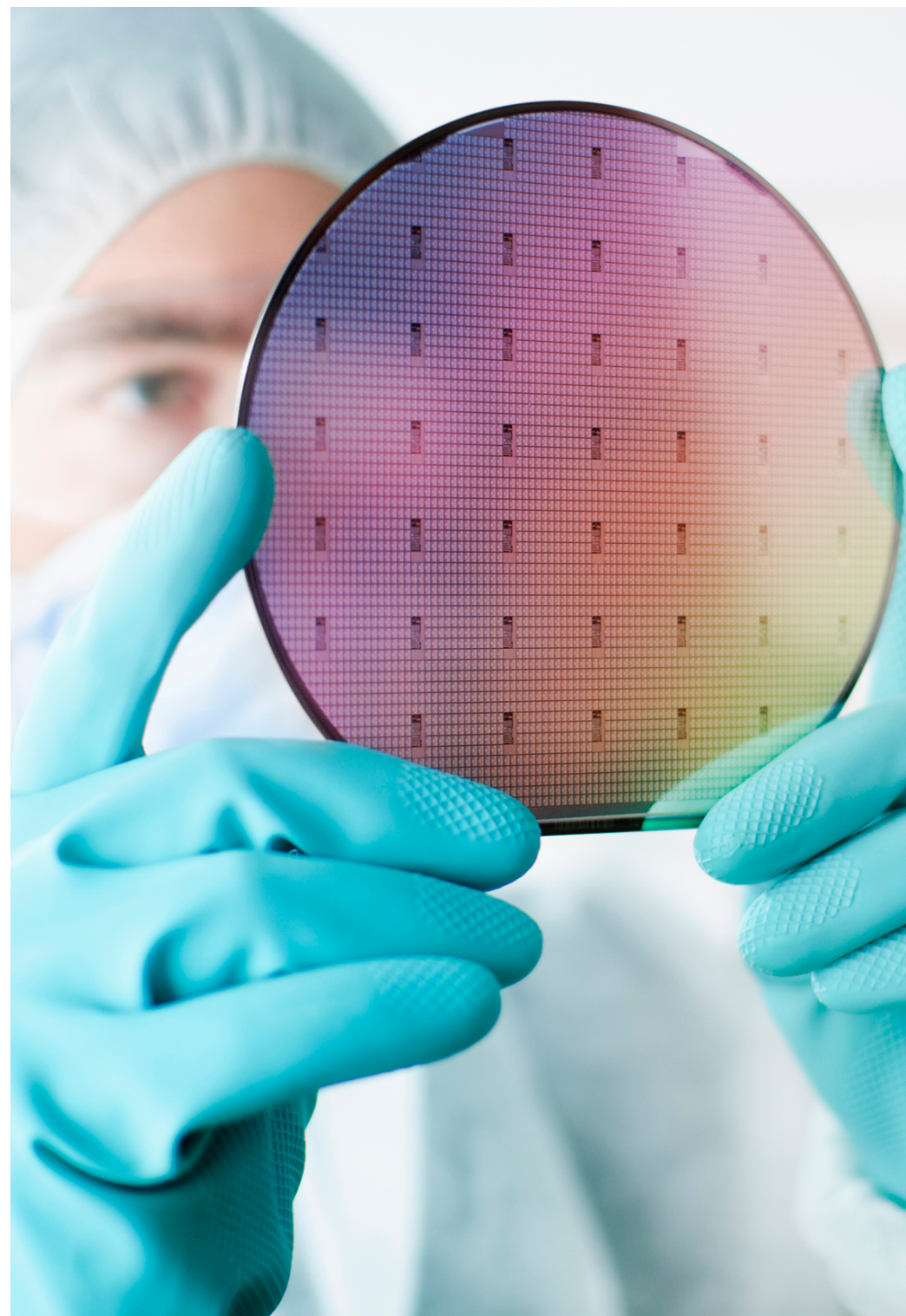
To remain competitive, independent of foreign tech giants and strategically autonomous with regard to geopolitical upheaval, the Netherlands and Europe are investing heavily in the tech sector. Dutch companies work closely with the Netherlands' technical universities and knowledge institutes giving rise to strong research and development centres (R&D).

### Strong R&D centres

The high-tech top sector's semicon ecosystem centres around technical universities in four regional clusters: Eindhoven, Delft, Nijmegen and Enschede. These clusters are supported by regional development agencies [BOM](#), [Innovation Quarter](#) and [OostNL](#) and research centres such as [TNO](#), [ECN](#), [Holst Centre](#), [Materials Innovation Institute M2i](#), and [NanolabNL](#).

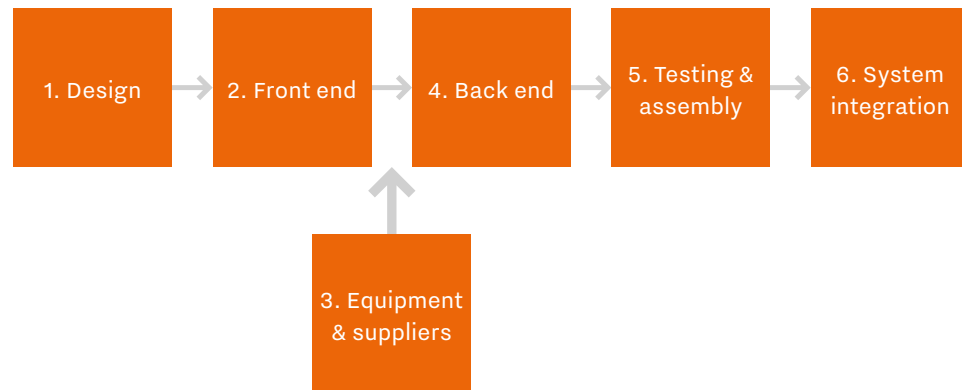
The clusters feed semicon companies with highly qualified and talented personnel, and high-tech expertise. This creates an environment where R&D departments can excel. Many semicon companies are affiliated to sector organisations such as [High Tech NL](#), [Holland Semiconductors](#) or branch organisations [Brainport Industries](#), [PhotonDelta](#), [CITC](#) and [PITC](#).

The Netherlands has a thriving ecosystem of world players and SMEs which supply to bigger companies and in turn scale up into larger companies themselves. On average 85% of the integrated circuits in all electronic devices worldwide, are made on machines designed and manufactured in the Netherlands. The strong position of Dutch companies globally enables the country's ecosystem for the semiconductor manufacturing equipment industry to contribute significantly to Europe's digital sovereignty. And to the earning power of the Netherlands.



All 6 steps of the  
semicon value chain  
take place within the  
Netherlands' borders

# Value Chain



# Equipment – a front-runner in key technologies

The Netherlands semicon equipment industry is leading in extreme ultra-violet (EUV) lithography, atomic layer deposition, advanced packaging, and metrology.

Just under 50 Dutch companies build machines for the chip industry ranging from large companies like ASML to startups like Nearfield Instruments and Solmates. Around 58 companies are involved in supplying equipment components with the largest segments in positioning systems, mechatronics, metal components, and environmental conditioning.

With an 85% share of the market, wafer-fab equipment makes up the largest segment of the total market by far. As front-runner in key technologies like mechatronics and optics, the semiconductor manufacturing equipment industry enables many high-tech and other markets. This includes equipment for bio-medical instrumentation, and space & astronomy instrumentation.

Showcase Smart Industry

## Energy saving shaped waveform bias generator

Shaped waveform bias generator  
Semicon manufacturing processes require a large amount of energy. To make the industry itself greener, tailoring the RF waveform makes it possible to reduce energy consumption during the manufacture of the semiconductors themselves and create semiconductors with smaller nodes, which also use less energy.



Showcase Smart Industry

## In Ovo egg sampler

In the poultry industry, every year 6.5 billion male chicks are destroyed as soon as they hatch, as they do not lay eggs.

The In Ovo egg sampler is a gender screening system that identifies the gender of the chick while it is still in the egg.

Eggs with the developing male chicks are separated so they are not incubated saving energy and preventing animal suffering.



# Radio frequency – controlled energy delivery

Radio frequency (RF) technology makes wireless applications possible via wifi, Bluetooth, microwave, radar and mobile devices. The Dutch strengths lie in radar and near field communication (NFC), power electronics and new technologies such as self-noise cancelling receivers.

There are up to 30 companies including large firms like NXP and Nexperia. There are also upcoming players such as Altum RF, Pink RF and Bruco IC. These companies make chips for amplifiers, filters, antennas, radar, and smart devices in the telecom, aerospace, automotive and defence industries.

Nijmegen's Novio Tech Campus has developed into a hub with research facilities for RF companies. RF energy technology makes it possible to deliver energy in a controlled manner. For example in plasma lamps, precision medical tools and start-stop engines. This reduces energy and fuel consumption and in health leads to better outcomes and faster recovery for patients.

Showcase Medical

## HandScan for fast and painless screening

The Hemics HandScan monitors rheumatoid arthritis in patients. The device makes frequent monitoring possible as it is quick and painless, and can be operated by nurses.



# Integrated photonics – next-gen technology

The Netherlands is one of the countries leading Europe in integrated photonics. Integrated photonics is a vibrant next generation technology using light instead of electric signals, which can be used for sensing and for data communication and quantum computing. By integrating multiple photonic functions on a single Photonic Integrated Circuit (PIC), data processes can be dramatically speeded up while their size, cost and energy consumption reduced.

With global data traffic doubling every two years, this innovation has huge potential for making technology more sustainable. Data centres worldwide use 200 Terawatt hours of electricity a year (more than some countries) – that's about 1% of the world's total electricity consumption. Thanks to energy efficiency measures, this figure has not grown significantly since 2010 despite the exponential growth in data traffic.

## Processes in the field

Innovation in integrated photonics has caused a paradigm shift in technology, where once expensive, complex, centralised processes could only be operated by experts. Today those processes can be executed cheaply in the field or at home by trained personnel or consumers.

Among the 25 Dutch companies active in this field are Smart Photonics, Lionix Phix, Effect Photonics and PhotonFirst. They are supported by [PhotonDelta](#) and the [Photonic Integration Technology Centre \(PITC\)](#).

Showcase Medical

## High-precision surgical tools

PhotonFirst's high-precision surgical tools make cardiac interventions safer and speed up patient recovery. Up to now, heart rhythm measurements relied on electricity, but by taking cardiology light measurements instead, readings can be calculated more accurately. As a result, patient outcomes improve and patients can get back to normal more quickly.



Photo: PhotonFirst



# Quantum technology – beyond traditional computing

Quantum technology exploits a new type of physics that goes far beyond the capabilities of traditional computers. Where conventional computers rely on bits that represent 1s and 0s, quantum computers use quantum bits (or 'qubits') which can be 1, 0, or both at the same time. Until recently quantum technology had been elusive and theoretical. Today quantum technology works and has the potential to radically change other technologies.

## Secure cloud applications

Although extremely fragile, qubits are used to build quantum computers, the quantum internet and other quantum devices. Quantum physics introduces a new dimension to conventional systems which are used to today. It is a gamechanger creating secure cloud applications or communication systems based on quantum laws. Economic and social sectors such as health, agriculture, climate and safety stand to benefit hugely from the potential quantum technology presents.

[QuTech](#), a research institute for quantum computing and quantum internet, founded by TNO and Delft University of Technology, has built Europe's first ever quantum computing platform – Quantum Inspire. This is the world's first system to contain a processor made of highly promising semiconductor 'spin qubits' on which the public can run their own quantum experiments. QuTech has also developed the Quantum Network Explorer (QNE), on which everyone is freely able to simulate and experiment with the quantum internet.

Public-private partnership [Quantum Delta NL](#) brings together the Netherlands' five innovative quantum hubs (Amsterdam, Delft, Eindhoven, Leiden and Twente). It creates an ecosystem for quantum technology companies, bringing together government, business, knowledge and talent.

### Showcase Smart Industry

## 3D glass printer

3D printing with glass presents a special challenge. This is because after melting at extremely high temperatures, it becomes brittle. Together with QSIL, Demcon has cracked the 'glass code' by building a robust [3D glass printer](#) for research and demonstration purposes.



# Realising EU and national ambitions

The Netherlands holds 6th position in the Global Innovation Index. We also want contribute to Europe achieving its ambition for strategic autonomy by helping to create a state-of-the-art European chip ecosystem. At the same time, we remain open to collaborative ventures with like-minded countries in and outside Europe. Our world-class research and innovation ecosystem is home to the inventors of wifi and Bluetooth. Also, Nobel Prize-winning nano scientist Ben Feringa. The Netherlands has a highly skilled, multilingual workforce and a diverse semicon industry with 50 years of knowledge and experience of the whole value chain. A broad portfolio of international cooperation.

By 2030, demand for semicon products is expected to double compared to 2020. The acceleration of the digital transition means leading-edge semiconductor technology is central to competition, data security and digital performance. While miniaturisation (Moore's law) will have reached its limits, new opportunities present themselves for emerging markets for AI, edge computing and digital transformation (More-than-Moore).

The semiconductor industry enables many markets beyond its own. So its value far exceeds the value of its own sector. As key enabling technology, it drives innovations in other high-tech industries. This in turn has a positive impact on all sectors as they become better, more sustainable and energy efficient. In doing so, the sector helps governments achieve their climate ambitions and the SDGs.

### Showcase Medical

## Fastmicro sample scanner

The [Fastmicro scanner](#) enables process quality engineers to improve cleanliness processes and consistently deliver quality products by providing reliable data. The scanner was developed in close cooperation with TNO, TBRM-group and S&T. The launching customer of the new inspection tool is chip machinemaker ASML.



# Colophon

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## Explanatory notes

This publication is intended to provide a picture of the semicon industry in the Netherlands. To this end, renowned and reliable sources have been selected. However, no rights may be derived from the contents of this publication.

[www.nlplatform.com](http://www.nlplatform.com)

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The Dutch semiconductor sector contributes to Sustainable Development Goal 9.



PhotonFirst

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