Micro- and Nanotechnologies in the Netherlands

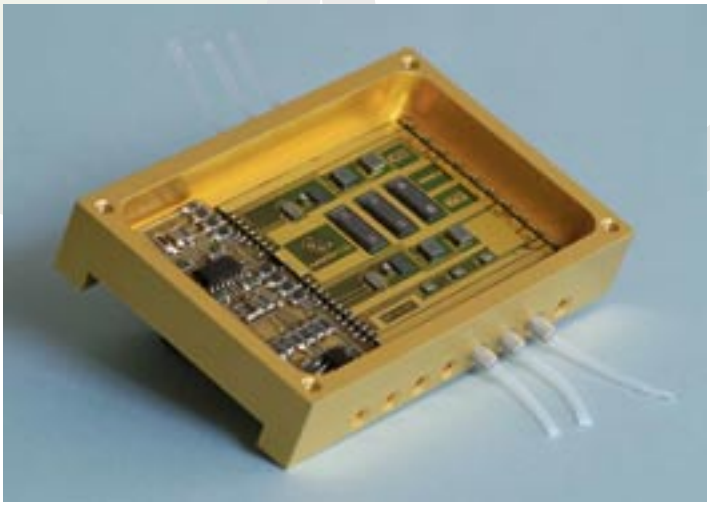
The evolution of a number of important technologies is having a profound effect on both industry and society. By enabling further miniaturisation, increased intelligence, functionality and portability of products, micro- and nanotechnologies (mnt) will stimulate innovations in a large number of markets. Potential markets ranging from consumer applications to the defence and space industries, from life sciences to broadband networks, from medical applications and transportation to food safety and home security. These technologies promise to be amongst the driving forces for the innovation-based growth of our economy and the rise in living standards.

At the moment, microelectronics and microsystems technology are already proving their importance in the market. At the same time, nanotechnology, although still in its early days as far as its potential for exploitation, promises to have a much broader impact in areas such as electronics, materials, chemistry and healthcare. Experts predict that it will revolutionise production technologies, data storage and medicine. Nanotechnology has links with many technologies, such as materials science, chemistry, electronics and biology. The convergence of these technologies will create exciting new business opportunities that will help to improve human well being.

The Netherlands play an important role in the development of these technologies. Dutch experts in micro- and nanotechnologies hold prominent positions in international research and development networks, while large industrial players like Philips, Océ and ASML lead the world in the fields of electronics, lithography and medical equipment, displays, optical storage technology and printing.
Additionally, in the Netherlands you will find great fundamental research capabilities, advanced development facilities, prototyping and manufacturing knowledge and capacities, testing and diagnostics, logistical acumen, and, most of all, a great central location amongst one of the highest concentrations of advanced and affluent customers world-wide: Western Europe. Below you will find out more about specific government initiatives, public and private consortiums that are keeping the Netherlands at the vanguard of development in these leading-edge technologies.

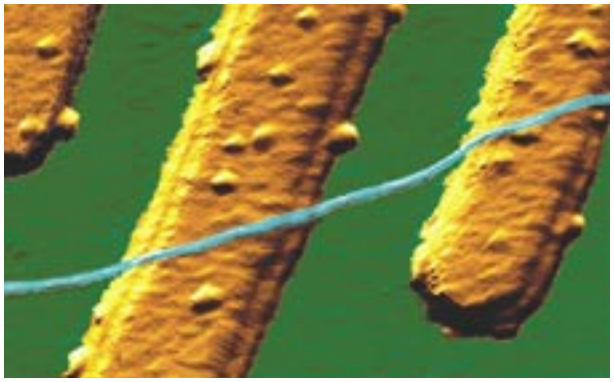
The Netherlands at the Forefront of Nanotechnology

With pioneers such as Cees Dekker, to name just one, the Netherlands is at the forefront of new developments in nanotechnology. Thanks to a wealth of knowledge, our country has an excellent starting point to obtain a more than proportional share of the future world market. Over 80 companies and 20 knowledge institutes are currently carrying out nanotechnology research or developing the resulting products. They account for a total investment of more than € 200 million in R&D each year.
Nanotechnology is closely related to other research areas in which the Netherlands excels, such as bio-nanotechnology, chemistry, electronics and materials technology.
In March 2003 the Kavli Foundation invested € 7.5 million to establish an Institute of Nanotechnology in Delft, led by Professor Hans Mooij.



Source: C2V

In order to continue our leading position in this growing field, the Dutch Ministry of Economic Affairs has encouraged the relevant players from the industry, knowledge institutes and infrastructure to formulate a joint programme with an international orientation. This initiative has resulted in the NanoNed programme.



Source: Delft University of Technology, faculty of Applied Sciences, Molecular Biophysics

NanoNed

NanoNed, the Nanotechnology network of the Netherlands, is a joint initiative of eight knowledge institutes and Philips. Its objective is the clustering of nanotechnology and the strengthening of the Dutch industrial and scientific nanotech knowledge infrastructure in a national network, in order to encourage the rapid advancement of knowledge.
It further supports advanced research projects, an infrastructure investment programme and economically relevant dissemination of knowledge and expertise, resulting in economic growth with high added value.
NanoNed focuses on medium- and long-term research timeframes, and aims to lay the groundwork for subsequent application-oriented work.
NanoNed is managed by the Dutch Technology Foundation (STW).
NanoNed focuses on:

Advanced Nanoprobing, bottom-up nanoelectronics, chemistry and physics of individual molecules, bionanosystems, nanoelectronic materials, nanofabrication, nanofluidics, nanoinstrumentation, nanophotonics, nanospintronics, quantum computation.

For more information please contact http://www.stw.nl/nanoned/ or e-mail: nanoned@stw.nl

Dutch Microsystems Technology: Advancing the Field

Dutch microsystems and micro-electronics developers are responsible numerous innovations, such as CD, DVD, Bluetooth and RFID technology, as well as manufacturing equipment made by ASML, FEI and ASM International.
A network of internationally renowned research institutes, large multinationals and small to medium sized high-tech companies forms the basis of microsystems technology in the Netherlands. A total of 3,000 employees at around 130 companies and institutes are working on R&D and the production of microsystems components and products, with the main activities concentrated at companies and research institutes such as MESA+, DIMES, Océ, Philips Electronics, Cobra Eindhoven and Wageningen University. In 2004 Philips opened its large reaearch & development facility (MiPlaza, with a total area of 5000 m^2) at the High Tech Campus Eindhoven to other companies.
The Netherlands, building on a strong and unique international standing in chemistry, agrifood, medical and life sciences, has become strong in polymer electronics, process on a chip, microfiltration and separation technology, sensors and micro-arrays. These are the markets for microsystems technology that are expected to undergo rapid development, and exponential growth is expected during the next five to ten years.
The total investment in the Dutch microsystems sector (estimated on labour cost) will be more than € 1.2 billion in 2010. Below some information is given on a large national R&D programme called MicroNed. Encouraged by the Ministry of Economic Affairs, the Dutch developers and end users of micro and nanotechnology, ranging from universities and research institutes to smaller and larger companies, have joint forces in the MinacNed cluster to stimulate innovations and applications based on micro and nanotechnologies. More information on MinacNed can be found below.

MicroNed

MicroNed is an R&D programme in the field of micro- and nanotechnology, organised by a consortium of universities, research institutes (TNO) and companies, which was formed to improve knowledge, advance the technology and stimulate growth in this area. Research fields of the MicroNed programme include the microsatellite development, smart microchannel technology and fabrication technology and modelling and microfactory. Within these clusters, research projects will address topics from fundamentals and modelling to system integration and production.

To learn more about this consortium: www.microned.nl; info@microned.nl

MinacNed

The Netherlands Micro and Nano technology cluster MinacNed, was launched in response to a need for organised collaboration, communication and facility sharing between all parties involved in Nano and Micro systems technology in the Netherlands. MinacNed encompasses both the entire knowledge chain and the whole commercial chain to ensure the scope and relevance of its activities. MinacNed will function as liaison between parties (companies, universities, government agencies, etc.), stimulate nano and microsystems research as done in the NanoNed and MicroNed programmes, stimulate knowledge dissemination, organise facility sharing possibilities, support businesses through road maps, etc. and raise awareness of nano and microtechnologies in general.

Contact information: www.MinacNed.nl ; Mr. Lombaers MSc, j.lombaers@ind.tno.nl

European Union: The Netherlands Leads the Way in Research

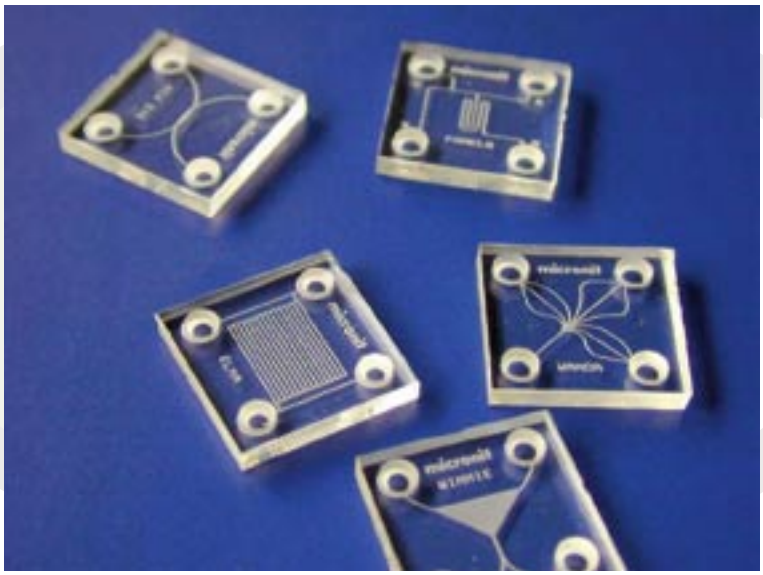
Nanotechnology is one of the focal areas for research within the EU. In the next few years, the EU will be investing € 1.5 billion in this area, while the individual European countries, as well as European companies, will be investing at least the same amount.
Dutch science is leading the pack in Europe with R&D investment in nanotechnology. Within Europe, the Netherlands has the second highest per capita spending on R&D, the second highest per capita output of scientific articles per million inhabitants, and Dutch research and scientists are cited the most internationally. In the Relative Citation Index, the Netherlands comes out highest overall for the relative prominence of scientific literature within Europe.

More specifically, in the field of Nanotechnology, in December 2001, the Nanotechnology Expert Group published a 'Mapping Excellence in Nanotechnology Preparatory Study', based on the request of the European Union / European Research Area. This study showed that, for instance, the Delft University of Technology was the most frequently cited European institute in a number of Nanotechnology fields. The same study also did a survey among the Nanotechnology scientists in Europe to assess the relative reputations of various European universities. Both the Technical University of Delft and the University of Twente in Enschede, with MESA+, were among the institutes most commonly mentioned as having the best reputation in their respective Nanotechnology fields.

Finally, the Netherlands is a concise country, while at the same time housing many world-renowned universities with top rated research facilities in many disciplines. Because of the short distances, the Netherlands is achieving what many other countries don't even dare to dream of: a virtual Nanotechnology laboratory that actually works. In this so-called NanoLab, all the existing research centres focused on nanotechnology are integrated.

Government Initiatives to Stimulate Nano- and Microtechnology

In 2003, the Dutch Government granted some € 130 million to micro- and nanotechnologies research projects for 2004-2009. These investments come on top of earlier investments of some € 30 million for a process-on-a-chip and a nanotechnology programme. With this investment, the government aims to strengthen the Dutch research base.
An other important aspect of the financial support from the Ministry Economic Affairs is to promote the co-operation between universities and companies. This is the key to generating economic and social value from academic research. The Ministry of Economic Affairs contributes to development programmes in the field of micro- and nanotechnology. The total estimated value of these programs is € 400 million annually.



The Netherlands are a major player in the EUREKA project MEDEA+, an industry-initiated pan-European Programme for advanced co-operative research and development in microelectronics. The objective of the industry-driven MEDEA+ clusterproject is to stimulate innovation and provide the technology platform, which will allow the European microelectronics industry to stay in the group of worldwide leaders. MEDEA+ channels private and public funding into microelectronics research & development projects. These projects associate semiconductor manufacturers, their suppliers, system companies and design houses, private research institutes and the academic world. The major players during phase 1 in MEDEA+ were France (5000 p.y), Germany (3000 p.y), and The Netherlands (2000 p.y). In total 16 countries are participating in MEDEA+. For the Netherlands Philips, ASML and ASM International are the biggest players. In 2003 the total contracted public funding of MEDEA+ projects amounted to 170 mln euro. The total funding of MEDEA+ projects by The Netherlands government amounted to 33 mln euro in 2003 alone.

In order to maintain the Netherlands' leading position in this area we strongly promote international co-operation and networking. Given our open and dynamic economy and the international nature of the micro and nanotechnologies development, an international orientation is essential. Companies and institutes are therefore encouraged to participate in European R&D programmes such as Eureka and Information Society Technologies (IST).

With a global network of Science and Technology Agents (TWA) based in Silicon Valley, Washington, Japan, Singapore and Europe, the Ministry of Economic Affairs provides companies and institutes access to leading international parties. The Netherlands Foreign Investment Agency (NFIA) attracts foreign investors and companies wanting to settle in the Netherlands, while the Economic Trade Agency supports our exporting initiatives with tools such as promotion, market intelligence, match-making, brokerages, technology and trade missions. The contact information is given at the end of this brochure.

Your Next Step in Nano- and Microtechnology

The Netherlands offer access to world-class R&D facilities with leading academics, and broad co-operation programs with other leading R&D centres in Europe, the USA and Asia, strong governmental support for micro- and nanotechnologies, and a great international environment for researchers from all over the world. As an added advantage, you will find a multidisciplinary R&D environment focussed on pragmatic solutions and high efficiency. Not only our research institutes and universities are state of the art, you will also find a broad array of supporting companies offering services that will help you go from concept to reality in no time. Companies with expertise in e.g. microfluidics, microfiltration, acoustics, magnetics, sensors & actuators, polymer electronics, lithography, telecommunications and integrated optics.

When investing your money in R&D, it is difficult to assess when your research pipeline will start paying off. That's why it makes sense to try to make the road from idea to final product as short as possible. To accomplish that you will need speed and that's exactly what the Netherlands can offer you:

- A multidisciplinary approach, with centres of excellence in a broad range of fields
- Close relationships to many of the other major knowledge centres in the world
- The greatest concentration of state-of-the-art research facilities world-wide
- Full vertical integration, including flexible prototyping possibilities

If you're interested in learning more about any of the initiatives and projects listed above, or in finding out how you can work with the Dutch Ministry of Economic Affairs on your own ideas, please contact one of the organizations below:

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