

# TNO IN BRIEF

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2010

# VISION AND MISSION

OUR THEMES >>



## VISION

Innovation has brought progress: a prosperous society and competitive industry. However, shifting relationships around the world and the scarcity of resources in areas like energy, raw materials, space and health require breakthroughs in terms of concepts and action.

Technological and social innovation are crucial to this, and the entire range of technologies has a role to play. As the boundaries that separate domains, disciplines and countries fade, national and international cooperation becomes increasingly prominent.

TNO has this combination of technologies and wants to be in the middle of society where its integrated knowledge can be put to optimum use for and with government and industry. We have the people with the right blend of curiosity, creativity and idealism to make it work.

## MISSION

TNO connects people and knowledge to create innovations that boost the sustainable competitiveness of industry and well-being of society.

## OUR THEMES

**HEALTHY LIVING**

**INDUSTRIAL INNOVATION**

**SAFETY, SECURITY AND DEFENCE**

**ENERGY**

**MOBILITY**

**BUILT ENVIRONMENT**

**INFORMATION SOCIETY**

**A DYNAMIC SOCIETY***Healthy participation in our society*

Physical and mental health are fundamental to our personal well-being and the quality of our society. Prosperity has brought us longer and more comfortable lives but has also resulted in people outside the employment process, people who consume to excess or consume the wrong things and young people that get sidelined. TNO is committed to combining technology and social innovation to enable the more healthy participation of people in our society.

**STRUCTURALLY  
COMPETITIVE  
INDUSTRY***Strong position of industry in the economy and society*

Dutch industry is indispensable not only to the (knowledge) economy but also to finding solutions for the scarcity issues that affect society, like energy, safety, care and mobility. This demands technological innovation in the production chain, innovation of products and processes in industry. TNO innovates with a view to transcending the chain and focusing on embedding industrial production in society as a whole.

**A SAFE SOCIETY***A safer sense of living*

Safety and our sense of safety are more than ever being subjected to threats that emanate from the distribution of prosperity, conflicting opinions and the increasing scarcity of raw materials. All over the world Defence organisations, emergency services and industry are helping to protect us against less and less obvious and visible threats. TNO uses technological innovation to help this work become smarter, more efficient and more protective.

**SUSTAINABLE  
ENERGY SUPPLY***Sustainably available energy*

All over the world higher standards of living and emerging economies are causing a rise in demand for energy. However, oil and gas reserves are finite, are becoming increasingly difficult to produce and CO<sub>2</sub> emissions are leading to environmental problems. TNO's technological innovations are geared to making energy available on the basis of energy efficiency, energy storage, more optimal exploration of existing sources and making sustainable energy sources profitable.

**A MOBILE SOCIETY***A mobile society*

Prosperity and urbanisation make increasing demands of mobility: it has to be safer, faster and cleaner. But mobility is a eminent concern both technology and human behaviour. So TNO is working with government and industry on technological innovation as well as the influence of human behaviour. Better infrastructure, lower fuel consumption and reduced emissions must go hand in hand with reliable traffic information systems and a restructuring of our mobility patterns.

**A VIBRANT URBAN  
ENVIRONMENT***Sustainable urban living*

The urban environment in which we live is increasingly being determined by the interrelationship between design, building and infrastructure. Government, researchers and industry are cooperating to accommodate the changing composition of the population along with health and comfort requirements. Companies within the sector will have to adjust to new issues and sustainability requirements. TNO innovation is geared to both the smarter (re)design of neighbourhoods, the use of methods and materials for sustainable construction and the availability of information on the Dutch subsurface.

**A CONNECTED  
SOCIETY***An information structure that connects citizens, industry and government*

Media and ICT are essential to our society. A new information infrastructure is emerging whereby citizens, industry and government will communicate differently with each other. The impact of this on many social and economic processes will be considerable, though as yet unknown. TNO investigates the impact of and new applications of media, supporting government and industry in identifying and applying new communication possibilities. The main challenge is to enable the information society to develop such that it is not only sustainable but that it can also boost productivity at the same time as well as solve a number of social problems without any loss of confidence in ICT.

*'Now is the time for a strong knowledge economy in the Netherlands.'*

## TNO IN BRIEF 2010

*The world is changing fast – the Netherlands and Europe, too.*

*Developments in society are radical and sometimes elusive. Ageing, climate crisis, scarcity of energy and raw materials and new security issues: developments that demand measures to safeguard the foundations of our society for the long term. These are challenges that offer opportunities. For new innovations. For new technology that can help Dutch industry to stand up against the growing international competition. The result: a prosperous, clean and safe society.*

*TNO uses knowledge to help create a better world, developing innovations for the future. Because this is the way to strengthen the economy from the inside.*

### **EFFECTIVE INNOVATION, NOW IS THE TIME**

TNO was founded during the economic crisis of the 1930s on the basis of the conviction that new knowledge and technology, especially in such conditions, was absolutely vital to economic growth and social renewal. And that such investment is necessary precisely in times of crisis. These precepts are now more pertinent than ever. Now is the time for a strong knowledge economy in the Netherlands.

### **A RELIABLE KNOWLEDGE PARTNER**

TNO has been supporting government and industry for almost eighty years with scientific knowledge and innovations, initially as a largely government funded research institute and more recently as a modern application geared innovation organisation.

### **Innovating with impact**

Our vision of the future is of a society that provides prosperity and welfare for all. A society in which competitiveness and sustainability go hand in hand. A society that makes progress.

TNO contributes to this progress through using applied scientific knowledge to solve the complex issues confronted by society and using innovations to boost the competitiveness of industry. And for that we have the right mix of qualities: excellent knowledge, creativity, inquisitiveness and idealism.

TNO's strength lies in our ability to combine diverse scientific fields to create pioneering solutions, increasingly in partnership with government, industry, other knowledge institutions and non-governmental organisations both at home and abroad. The boundaries of domains, disciplines and countries are fading and making way for national and international networks. Together we combine knowledge, together we maximise our talent, and together we can innovate with impact.

### **Seize on rapid global developments**

If we want to innovate with impact, we have to seize on global developments. Developments like climate change, social-political instability, environmental issues, loss of economic competitiveness, immigration, ageing and shifting political and economic global relations. At the same time, science and technology continues to develop at tremendous speed.

Knowledge and innovation can enable us to keep ahead of threats and take advantage of opportunities, thereby strengthening the core of our economy and achieving breakthroughs in key technologies like ICT, molecular biotechnology and materials technology. We can make our surroundings more and more intelligent, technology even smaller and materials stronger, lighter and with increasingly more functional properties.

## **TNO APPROACH: FOCUS ON SEVEN THEMES**

TNO wants to innovate with impact. To generate solutions that really make a difference. Which is why we have opted to focus on seven themes. Seven focal areas of global significance that require new, creative, comprehensive solutions. Seven themes that match the pressing issues of government, industry and the knowledge infrastructure whose priorities we link to the knowledge of TNO. There is a strong degree of coherence among the seven themes, with reinforcement of sustainability and competitiveness running like a spinal cord through them. The seven research themes that form the base from which TNO works on a prosperous, safe and sustainable society are outlined on the inside cover of this brochure.

## **COOPERATING IN NETWORKS**

Our added value lies in our approach, our knowledge and our capacity to organise public-private partnerships. Efficient, geared to solutions. TNO therefore maintains close relations with virtually every Dutch government ministry. We work with customers and partners in the knowledge infrastructure and the market in a spirit of open innovation.

Innovation is an activity that produces the most and best results in partnership with others. TNO participates in a large number of partnerships with universities, knowledge institutions, organisations and companies. A total of more than seventy partnerships. While all universities and a large number of polytechnics are among the partners, the *Agentschap NL*, which is the point of

contact for *enabling the fast, proper and effective implementation of government policy on sustainability, innovation, international enterprise and cooperation.* TNO is active in all Technology Top Institutes and in many associations that target the transfer of knowledge in a wide range of fields. This cooperation is not, of course, restricted to the domestic front. We work with all the European Research and Technology Organisations (RTOs), both intrinsically and administratively in EARTO, the European organisation in which some 350 RTOs are represented. We are involved in the first three Knowledge and Innovation Communities (KICs) established within the European Institute of Innovation and Technology (EIT). TNO has a 10 per cent share in the Austrian Joanneum Research and is co-founder of the Joint Institute for Innovation Policy (JIIP). Together with other RTOs from Finland (VTT), Spain (Tecnalia) and Austria (Joanneum Research) JIIP focuses on "research based" support for policy processes for innovation. In addition, TNO collaborates closely with the Russian Academy of Sciences, TÜV Rheinland and IMEC.

A very special kind of partnership that was initiated in the year of crisis, 2009, relates to the Knowledge Workers Scheme projects. This scheme that TNO helped to conceive under the acronym BREIN (Beat REcession with INnovation) involves hundreds of highly educated company personnel being temporarily housed at universities and knowledge institutions like TNO. They come from companies hit hard by the economic crisis and this scheme means that they can restrict or prevent the

need to make their highly educated personnel redundant. These personnel work on socially relevant innovation topics and will be able to return to their own companies once economic recovery permits. The TNO topics that relate to this scheme are energy, public safety, mobility, intelligent care and energy-efficient building.

In addition to cooperating in programmes and projects with universities and polytechnics, TNO encourages exchange between TNO and scientific and higher education in another way. At the beginning of March 2010, 53 TNO personnel had university ties as professors, 5 abroad, and 10 as polytechnic lecturers. The Knowledge Centre forms a special kind of partnership with universities and, occasionally, companies. In March 2010 TNO had 20 such knowledge centres with universities, including the Cardiovascular Disease Centre with the VU Amsterdam, the Applications of Integrated Driver Assistance Knowledge Centre with Twente University of Technology and Holst Centre with IMEC and Eindhoven University of Technology.

## **TNO and SMEs**

Innovation support for small and medium sized enterprises was, is and remains one of the key *raison d'être*s for TNO. We reach out to around 10,000 SMEs annually, with projects worth more than 30 million euros in total. This makes TNO by far the major Dutch knowledge institution in terms of reach and relationship intensity with the SME sector. Rapid technological developments and the increasing international orientation of Dutch industry make it essential for us to offer

*'We work with customers and knowledge partners in a spirit of open innovation.'*

SMEs internationally competitive top knowledge and technology. TNO remains committed to supporting innovative front-runners, around 15,000 companies.

#### **TNO AS BREEDING GROUND AND SPRINGBOARD FOR TALENT**

TNO employs some 4,400 professionals, 700 of whom are at TNO Companies BV. These professionals are vital to our knowledge organisation. TNO's ambitions make a considerable call on them, presenting new challenges that demand top talent. So TNO offers a stimulating work environment, invests in talent development and operates a strong recruitment and career policy.

Top talent is scarce. TNO is already the most attractive employer for knowledge workers in several fields of innovation. The recruitment bar is high. In addition to nurturing a pool of talent for its own organisational goals, TNO emphasises its role as a provider of innovation talent to Dutch society.

#### **CORPORATE SOCIAL RESPONSIBILITY**

Corporate social responsibility is about sustainability: the balance between people, planet and profit. Corporate social responsibility and TNO belong together. Sustainability is not a separate theme in our research but runs through each theme. Examples include innovations to reduce the ecological footprint of buildings, safer and cleaner means of transport, a clean, climate-neutral energy supply, overcoming material scarcity and encouraging healthy behaviour. Since 2007 we have incorporated corporate social responsibility as an integral part of our work, such as our own programme for development cooperation.

*'TNO emphasises its role as a provider of innovation talent to Dutch society.'*

## **IMPACT, UNITY, WORLD CLASS**

### ***TNO has impact.***

Impact is the crux of everything we do: delivering a visible and demonstrable added value when it comes to the major issues that confront society and the economy. For government and industry. The success of TNO is explicitly and demonstrably linked with the national innovation agenda in which we play a leading role.

### ***TNO stands for unity.***

TNO is a close-knit organisation that cooperates internally, nationally and internationally, excelling in special areas of research.

### ***TNO has world class.***

World-class knowledge is necessary to have impact on both domestic and international fronts. We have this world-class knowledge in house in a range of fields, in the shape of top technology and top talent. In other areas, TNO hooks up to top knowledge, via international networks of and partnerships with excellent researchers.



TNO Board of Management. Left to right: J.W. Kelder, J.H.J. Mengelers M.Sc., Dr C.M. Hoymans.





SAFETY, SECURITY AND DEFENCE

## RADAR SHARPLY IN THE PICTURE

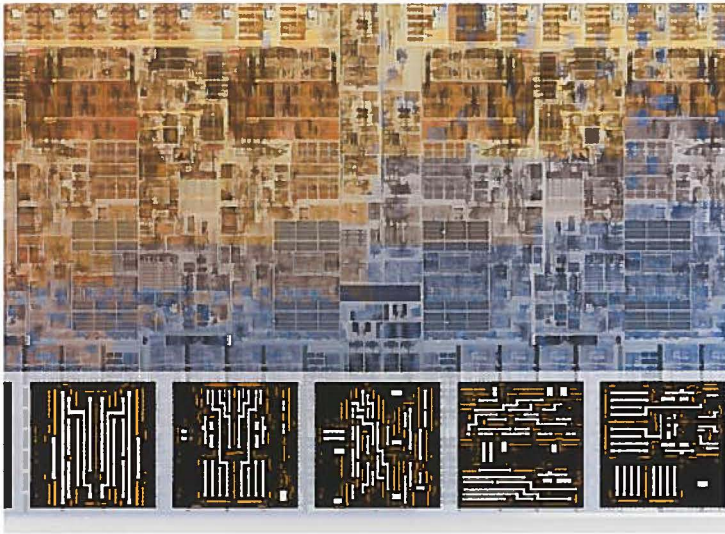
*TNO has a leading position in radar technology. A position backed by seventy years' experience. Like the first 'electrical listening device' designed by Professor Von Weiler in 1939. Nowadays TNO's radar technology knowledge is used in all kinds of fields, from sea to air. We also work in cooperation with TU Delft and Thales Nederland in various radar projects, such as radar applications to combat crime and terrorism.*

TNO's radar technology has gained an international reputation, for instance, through phased-array technology whereby a radar beam can be electronically directed and enable the surroundings to be more quickly scanned. Another breakthrough in which TNO had a major say is the much greater resolute capacity of radar systems that enables not only objects to be detected but also to be really visualised. That makes recognition possible. TNO has also been cooperating with TU Delft and the

National Aerospace Laboratory to develop the PHARUS radar system that enables pictures of the Earth's surface to be made from an aircraft.

Our extensive knowledge of radar contributes to progress in a variety of areas, like the design of naval vessels with stealth features to make them less easily detectable. Or radars like SOPRANO that can even remote detect breathing and heart rate through walls: handy for the emergency services and counter-terrorism units. ViAPache is intended to monitor traffic flow but as a derivative we also developed a radar that is able to very accurately determine the level of tank or silo contents. The TNO radar expertise group has also developed a simple, cheap radar system for smaller aircraft. This 'sense-and-avoid radar' gives private and taxi aircraft that tend to fly by sight an extra pair of eyes.

## SMALL, SMALLER, SMALLEST



*High-tech tools and TNO have been inseparable since time immemorial. As in the electron microscope that TNO and Philips developed after the Second World War to get this field off to a flying start. And our aim today is to help suppliers of systems in the automotive sector, nano and microelectronics, medical equipment builders, space and the process industry to produce more knowledge-intensive, high-tech products. TNO responds by developing high-tech tools and production equipment that are able to work at micro, nano and even pico scale and in increasingly extreme conditions. Using the very latest scientific knowledge for physical models to understand what happens at those scales and in those conditions. New sensors that measure with extreme precision in those environments and in the processing of (nano)materials: that is the focus of TNO.*

For instance, we develop precise process control for entire complex oil and gas sources. Precision readings in space or of our atmosphere are made possible by developing sophisticated optical instruments and combining them with microsattellites. TNO also gears its research to instruments for ultra precise lithography for chip production in close collaboration with ASML, one of the world's key chip machine manufacturers.

The possibilities offered by chips are continuing to grow, so the production machines for those chips must become more and more sophisticated. And so machines of this kind have a big say in how the high-tech market progresses. Since the ASML lithography machine is the most essential component of the chip production process, we develop prototypes for the very latest generation, looking at how we can, for instance, prevent contamination of the optical components in these machines.

TNO's Van Leeuwenhoek Laboratory has Europe's very first ORION® PLUS Helium-ion microscope. Helium-ion microscopy, developed by Carl Zeiss SMT, is a new and extremely precise method of characterising surfaces. The microscope enables the surface of (sub)nanometer structures to be seen directly and analysed. This makes images much sharper and gives us detailed information on the composition of the uppermost layer of a substance, something that is vital for material science and the semiconductor industry. High-tech instruments, and now high-tech systems too, once began in Delft with the first Van Leeuwenhoek microscope, and today Delft is still the focal point. TNO even more so.



HEALTHY LIVING

## THE HAND THAT ROCKS THE CRADLE...

*TNO has been working on the health of children and youngsters for years. By developing, implementing and evaluating guidelines, whether for child care, maternity care or dental care, as well as by training child specialists. The aim of this is to boost the quality of child healthcare and to narrow the differences in health and care provided in the Netherlands by undertaking applied research in collaboration with parties in the field.*

Guidelines to prevent cot deaths, such as laying babies on their backs to sleep, not using quilts and not smoking in the vicinity of babies have helped to bring the annual number of cot deaths down from 200 to 11 in recent years. TNO helped to conceive the recommendations and monitored their impact. TNO is currently cooperating in monitoring the health of mothers and babies at the time of birth in 27 countries. This research has shown that there is a relatively high level of infant mortality in the Netherlands. The Dutch Minister of Health wants to take appropriate measures, partly based on this study, to reduce the preventable birth mortality by half (from 400 to 200 per year). During the coming years, too, TNO will be participating in this PERISTAT project and so contributing to improving the policy and, ultimately, the

health of mothers and babies. Dental care has been on the TNO research agenda since the 1950s. For instance, we investigated the effect of the fluoridation of drinking water, which revealed that fluoride in drinking water reduces caries without any side effects. Since then improved toothpastes have made the fluoridation of drinking water in the Netherlands superfluous. TNO still continues to study the dental hygiene, particularly of children and youngsters, to acquire insight into the effects of policy. It has become evident that since the withdrawal of dental care from basic health insurance, significant differences have emerged with respect to dental care among various socio-economic sections of the population.

TNO in Leiden trains some fifty doctors from around the country each year to become child specialists. They work at clinics and consultation bureaus with the aim of fostering the health of youngsters. From 2009 those doctors wishing to specialise in healthcare for children have been able to also train at the Brabant Medical School with whom we have joined forces to this end. In the new Centres for Youth and Family, the child specialist will have a central role to play, so TNO is keen to contribute its own knowledge development to further this educational role.

## BUILT ENVIRONMENT

# URBAN FUTURE



*The Planning Office for the Built and Natural Environment (PBL) is contemplating how our cities will look in 2040 with a view to effectively solving urban issues like sustainability, liveability and mobility. To this end the PBL needs an overview of the options and consequences. The planning office has therefore asked TNO to look into the effects of various future scenarios on a number of scales. No easy task but necessary nevertheless. Only then can policy be developed that will maximise the quality of the urban environment in the Netherlands.*

TNO has developed the interactive Urban Strategy system based on calculation models that incorporate TNO's expertise on the local environment. Where aspects like air quality, noise, accessibility, safety, parkland and water are central. Urban Strategy combines these elements and provides insight into the quality of this environment when different interventions occur. It also offers a detailed overview of the built environment.

Urban Strategy is a flexible tool that enables changes to be made interactively. Such as an extra neighbourhood, a road closure, access by environmentally-friendly vehicles only in a green zone and noise-reducing measures. The effects of these measures on the quality of the environment are revealed almost directly. Urban Strategy allows planners, developers and policymakers to plan and develop optimally and fast.



HEALTHY LIVING

## OLD AND FIT IN THE HARBOUR

*Our working lives will be extended, so the work will have to be structured such that employees remain healthier for longer and continue to enjoy a productive working life. As a good employer, the Rotterdam Port Authority wanted to find out how it could best cater to realising this and so asked TNO to identify the workload for different jobs.*

Using our workload matrix© we analysed four workload aspects: physical, environmental, psychological and perceptive (like alertness and reaction speed). For each aspect we looked at the extent of the load and the peak frequency. Port employees often run physical safety risks, such as having to transfer from one vessel to another. Neither is the work posture always good, as in small engine rooms. Finally, employees are sometimes confronted with human suffering, for instance in the attempted rescue of a drowning person or if someone jumps off a bridge.

To get a good picture we look not only at the workload aspects but also at sickness absence data, employee satisfaction and information from RI&Es. This generated a number of recommendations for the Rotterdam Port Authority to reduce the load, such as shifting some of the nightly tasks to daytime, job rotation and a wider age spread of those working on the vessels so that the heavier work can be better distributed.

# KEY FIGURES

(in EUR x million)

	2009	2008	2007
<b>TNO (TNO organisation including group companies)</b>			
Knowledge as power			
<i>Within the themes</i>	51,3	47,1	50,8
<i>Across the themes (KAVOT)</i>	27,7	27,2	26,2
Policy and application geared knowledge investments	123,9	120,4	119,4
<i>Total income from government funding</i>	202,9	194,7	196,4
Market income	373,3	405,0	382,5
<b>Income</b>	576,2	599,7	578,9
Net income <sup>1)</sup>	493,6	504,6	501,9
Added value <sup>2)</sup>	400,7	407,8	401,8
Operating result before extraordinary depreciations	-12,0	-5,3	8,1
Extraordinary depreciations of tangible fixed assets	-4,7	-5,3	-
Operating result	-16,7	-10,6	8,1
<b>Net result</b>	-14,2	-5,7	12,3
Net result as % of market income	-3,8%	-1,4%	3,2%
<b>Number of employees (effective average)</b>	4.424	4.572	4.634
Number of employees (effective year end)	4.337	4.580	4.658
Net income per employee (effective average) in EUR x thousand	111,6	110,4	108,3
Added value per employee (effective average) in EUR x thousand	90,6	89,2	86,7
Personnel expenses per employee (effective average) in EUR x thousand	85,4	82,8	78,2
<b>Personnel expenses</b>	377,7	378,6	362,5
Working capital	10,1	31,5	33,3
Equity	187,0	201,1	206,7
Cash flow <sup>3)</sup>	26,8	53,9	56,5
Investments of TNO organisation	29,5	38,3	53,9
Investments of group companies	12,9	19,7	6,5
Current ratio	1,06	1,19	1,22
Solvency	0,43	0,44	0,48

<sup>1)</sup> Net income = income – direct project costs

<sup>2)</sup> Added value = net income + other operating income – other operating expenses

<sup>3)</sup> Cash flow = result + depreciations + disinvestments + mutation in equalisation account for investment funds

	2009	2008	2007
<b>TNO Organisation</b>			
Knowledge as power			
<i>Within the themes</i>	51,3	47,1	50,8
<i>Across the themes (KAVOT)</i>	27,7	27,2	26,2
Policy and application geared knowledge investments	123,9	120,4	119,4
<b>Total income from government funding</b>	<b>202,9</b>	<b>194,7</b>	<b>196,4</b>
Market income	291,7	316,9	307,7
<b>Income</b>	<b>494,6</b>	<b>511,6</b>	<b>504,1</b>
Operating result before extraordinary depreciations	-10,1	-6,0	5,0
Extraordinary depreciations of tangible fixed assets	-4,7	-4,2	-
Operating result	-14,8	-10,2	5,0
<b>Result (excl. result of group companies)</b>	<b>-12,7</b>	<b>-6,6</b>	<b>9,1</b>
Operating result TNO core areas	-1,8	1,7	7,5
Net result TNO core areas	-0,5	4,2	10,2
Number of employees (effective average)	3.743	3.833	4.003
Number of employees (effective year end)	3.660	3.813	4.033
Term of work in progress and debtors in months (TNO core areas)	1,5	2,1	2,0
Solvency	0,47	0,47	0,51
<b>Group companies</b>			
<b>Income</b>	<b>85,8</b>	<b>92,8</b>	<b>79,7</b>
Operating result	-1,9	-0,4	3,1
<b>Net result</b>	<b>-1,5</b>	<b>0,9</b>	<b>3,2</b>
Number of employees (effective average)	681	739	631
Number of employees (effective year end)	677	767	625





# << IMPACT IN THE MARKET

## COLOPHON

### Editorial and production

Communication

### Text

Communication

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Bureau Lorient Communicatie B.V., Valkenburg

### Design

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### Printing

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### Photography

Cheers to your Eyes | Jeronimus van Pelt & Ilya van Marle

Except for:

Chip: ASML

Toekomst in de stad: TNO

Rotterdam harbour: Arie Kievit

TNO.NL

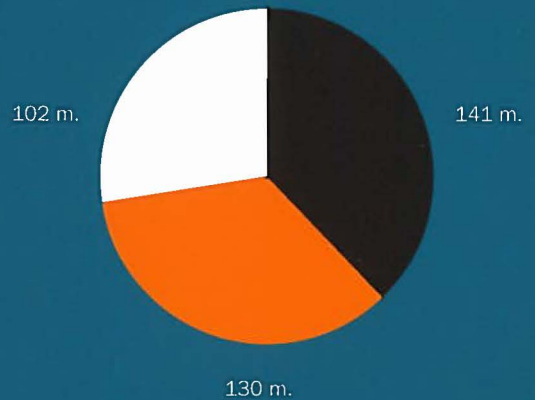
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## >> IMPACT IN THE MARKET

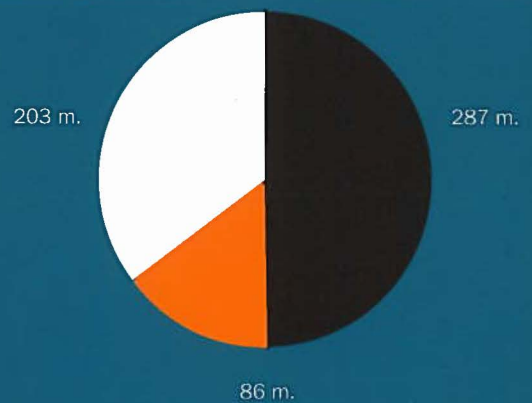
CONSOLIDATED MARKET INCOME 2009 (EUR 373 MILLION)

- Dutch industry
- International
- Dutch government



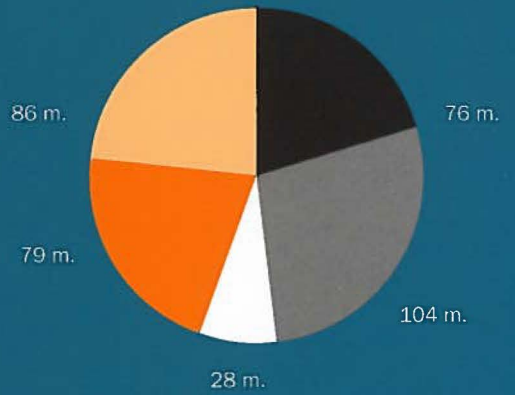
INCOME DISTRIBUTION BY CORE ACTIVITIES 2009 (EUR 581 MILLION)

- Application of knowledge, external income
- Commercialisation of knowledge, TNO Group companies
- Programme funding from government for knowledge development and legal tasks



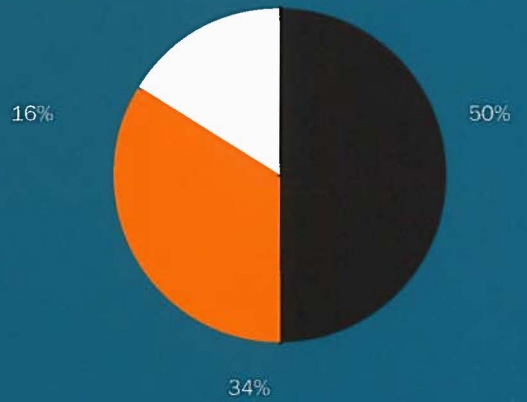
IMPACT IN THE MARKET 2009 (EUR 373 MILLION)

- Foreign assignments
- Dutch industry
- External funding
- Government assignments
- Commercialisation of knowledge (TNO Companies)



INCOME FROM DOMESTIC INDUSTRY

- Large companies
- SMEs
- Other



SME = fewer than 250 employees

# INTERESTED IN TNO?

If you are looking for a solution to a specific problem or want to know whether TNO can help you, just contact the TNO Infodesk.

Our Infodesk can tell you the next step to take and ensure that you get in touch with the right person at TNO. This will allow you to experience our expertise, enthusiasm and commitment for yourself.

## **TNO Infodesk**

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