Global challenges Dutch solutions



Global challenges, Dutch solutions



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Foreword

Dutch businesses and knowledge institutions together constitute the engine of innovation, and they continually make a major contribution to solutions for all sorts of societal challenges. The approach to these challenges goes hand in hand with the development of new products and services. In this context, societal challenges form key growth markets for the business community.

The solution to many of the European, or even global, challenges demand European collaboration. Prime examples are the preservation of the environment, building and maintaining an efficient and sustainable transport system or tackling flooding. These challenges do not simply stop at the Dutch border. It is therefore very important that the European Union will devote sufficient attention to these areas through its research and innovation programme, Horizon 2020. It is also important that the Netherlands' Top Sectors are connected with Horizon 2020 in order to deploy and enrich our expertise and knowledge in Europe and beyond. In other words: global challenges, Dutch solutions!

In this brochure, we show that Horizon 2020 holds significant opportunities for the Top Sectors. The match between the agendas of the Top Sectors and the societal challenges emerging from Horizon 2020 is considerable. It shows that Horizon 2020 offers a wide range of initiatives for Dutch parties to get involved in. Our starting position for successful participation in Horizon 2020 is therefore excellent. I hope that Dutch businesses, whether large enterprises or SMEs, knowledge institutions or non-governmental organisations are inspired by this brochure to seize the opportunities presented by Horizon 2020.



Henk Kamp
Minister for Economic Affairs

Modern society cannot function without the continued development of knowledge. This is widely recognised in Europe and resolutely supported by the new research and innovation programme, Horizon 2020. The pillar Excellent Science, for instance, with the ERC and the Marie Sklodowska-Curie programme, offers individual grants for top scientists to conduct ground-breaking research. Furthermore, Horizon 2020 gives scientists room to tackle key societal challenges and boost our competitive strength. In other words, the programme offers many opportunities, both for fundamental and applied research.

The various priorities within Horizon 2020 are not self-contained units. Ground-breaking research is not just exciting, but is also useful. Sometimes new insights that, at first sight, might not seem to have much relevance can unexpectedly and surprisingly fast lead to new applications. Furthermore, concrete demands from society can sometimes inspire our best researchers.

Coming together, learning from each other, collaborating and striving for excellence is what it is all about. This is also the idea behind the contribution of NWO (the Netherlands Organisation for Scientific Research) to research at the national level. Europe works in a similar way providing a stimulus to cooperation in international consortia and offering opportunities to the best researchers to convert their ideas into practical applications.

I hope that this brochure inspires all researchers seeking European cooperation, and motivates them to look beyond the boundaries of their own specific domain. Opportunities abound!



Sander Dekker
State Secretary for Education,
Culture and Science


TARO
fuel cell powered
Shell Hydrogen
europe
wij rijden op wate

Introduction

The Netherlands has an outstanding starting position to play a leading role in Europe and beyond in the field of science and innovation. We have excellent scientists and innovative businesses, who for many years have rightly played a prominent role in European research and innovation programmes. The Top Sectors' policy serves to further strengthen the position of nine economic sectors in which the Netherlands has a leading position internationally. Societal challenges play an important role in all these sectors. Companies, institutions and the government work together on the solutions.
In 2011, Dutch higher education institutions made an important step by using profiling to ensure that research in the Netherlands is better aligned with societal challenges.
In preparing their plans, these knowledge institutions must explicitly take account of how their programmes are in tune with the Top Sectors and with the societal challenges identified by Horizon 2020.

The Progress Report 'Enterprise Policy at Full Speed' (Voortgangsrapportage 'Bedrijvenbeleid in volle gang') announced that a strengthening of the link between societal challenges and the Top Sectors will be one of the priorities in the period ahead. The alignment with Horizon 2020 plays an essential role in this given the great importance of this programme for research and innovation policy, both nationally and internationally.

There are a number of reasons why it is important that the Top Sectors address the societal challenges identified by Horizon 2020. Firstly, many of these challenges have pan-European and even global relevance, and individual countries cannot deal with them alone. Secondly, it will enable the Netherlands to benefit from the knowledge available in other Member States. The opposite is of course also true: the Netherlands can also export its own knowledge. For the Top Sectors, societal challenges represent the growth markets of tomorrow. Thirdly, a lot of funding is available from Europe for innovation and research. Alignment of the Top Sectors with European themes will allow them to better cooperate internationally and successfully participate in the Horizon 2020 programmes and other European initiatives.

This publication describes the way in which the Top Sectors currently address the Horizon 2020 societal challenges. The description is organised in accordance with the themes of Horizon 2020. The research and innovation activities in the Netherlands that do not fall under the scope of the Top Sectors are not included in this publication. Some European initiatives that are not (directly) related to Horizon 2020 may be cited, such as joint programming of research by member states (JPI's). Horizon 2020 starts officially on 1 January 2014. This means that the many opportunities identified in this brochure still need to be converted into reality.

Science and innovation in the Top Sectors

The Top Sectors policy aims to strengthen the position of nine economic sectors in which the Netherlands has a leading position internationally. It sets out an integrated policy for each sector. The key basic components of this integrated approach are: research and innovation, human capital, regulatory framework and the international dimension. A Top Team with representatives from the 'Triple Helix' has been established for each Top Sector. The Triple Helix refers to the relationship between the business community, knowledge institutions and government. The Top Sectors devote a lot of their attention to cross-sector themes which require collaboration. Three of these have been specifically identified: nanotechnology, ICT and the biobased economy.

For the research and innovation aspect, each Top Sector has signed an innovation contract, setting out what the priorities of the Top Sectors are in this field and which parties are responsible for which activities. The Top Consortia for Knowledge and Innovation (TKIs) are closely involved in the implementation of these innovation contracts. Each Top Sector has one or more TKIs.

New innovation contracts were signed on 2 October 2013. These set out agreements reached between the business community, knowledge institutions and government on the priorities in fundamental research, applied research and valorisation, but also on financing. When renewing the innovation contracts, the Top Sectors were asked to pay specific attention to the link with Horizon 2020 and other European programmes.

Based on the innovation contracts, the Netherlands Organisation for Scientific Research (NWO), the Royal Netherlands Academy of Arts and Sciences (KNAW) and institutes of applied science (united under the flag of TO2), started programming their research. NWO, for instance, established its contribution for 2014 and 2015 after consultation with the Top Sectors. Care has been taken to produce substantive plans for each Top Sector that ensure proper alignment between the ambitions of the sector and the leading scientific research in that field.

Scan and read (QR-code)) Progress Report:
http://www.government.nl/issues/entrepreneurship-and-innovation/documents-and-publications/publications/2014/01/20/enterprise-policy-at-full-speed.html


84
81

Top Sectors and societal challenges in Horizon 2020



1

Health, demographic change, well-being



2

Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bio-economy



3

Secure, clean and efficient energy



4

Smart, green and integrated transport

	1	2	3	4
H&PM	●	●	●	●
AGRI & FOOD	●	●	●	●
WATER		●	●	●
LSH	●	●		
CHEMICALS	●	●	●	
HTSM	●	●	●	●
CREATIVE INDUSTRIES	●	●	●	●
ENERGY			●	●
LOGISTICS			●	●

H&PM: *Horticulture and Propagation Materials*
LSH: *Life Sciences & Health*
HTSM: *High Tech Systems and Materials*







5	6	7
Climate Action, environment resource efficiency and raw materials	*Inclusive, innovative and reflective societies*	*Secure societies*
●		
●		●
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What is Horizon 2020?

Horizon 2020 is the new European programme for research and innovation in the period from 2014 up to and including 2020. Horizon 2020 represents the merger of the Seventh Framework Programme for Research and Technological Development (FP7), the European Institute of Innovation & Technology (EIT) and the innovation-related aspects of the Competitiveness and Innovation Framework Programme (CIP) into a single programme for the financing of research and innovation. Apart from its broadened scope, Horizon 2020 also differs from the current programmes in a number of ways. The programme has a simplified set of rules, will seek increased participation from the SME sector and has increased attention for on public-public and public-private partnerships.
The European Union is committing €70 billion to Horizon 2020 over the lifetime of the programme (2011 prices). Horizon 2020 has three pillars: Excellent Science, Industrial Leadership and Societal Challenges. Around €65 billion of the total will go to these three pillars. The remaining €5 billion will be spent on horizontal programmes, EIT and the Joint Research Centre (JRC).

Table 2: the pillars of Horizon 2020

Pillar	Budget	Goal
Excellent Science	€ 22 billion	The pillar Excellent Science aims to support the best research in order to strengthen Europe's position. The funding will be made available through grants to individual scientists by the European Research Council (ERC) and the Marie Skłodowska-Curie Actions. The programmes addressing *Future and Emerging Technologies* (FET) and the creation and deployment of large research infrastructures also comes under the remit of this pillar.
Industrial Leadership	€ 16 billion	The pillar Industrial Leadership aims to increase the appeal of Europe for businesses seeking to invest in research and innovation. Furthermore, this priority should support the growth potential of European businesses and to make European industry - explicitly small and medium-sized enterprises - a world-beating force.
Societal Challenges	€ 27 billion	The Societal Challenges pillar aims to bring resources and knowledge together in diverse fields and disciplines to tackle the societal challenges faced by Europe.

Participation in Horizon 2020

Horizon 2020 mainly provides funding for individual research and innovation projects no matter the size. The vast majority of the funding is divided on the basis of calls for proposal, which are partly organised thematically. International consortia comprising knowledge institutions, businesses and other organisations can respond to these with a project proposal. The consortium with the best proposal (excellent research and largest potential impact) will be eligible for the funding. Calls are not just made for individual projects, there is an increasing number of public-public and public-private partnership programmes. The most important examples of public-private partnership programmes are the Joint Technology Initiatives (JTI). These are large-scale programmes of public and private parties concerning certain areas of technology.

Non-thematic parts of Horizon 2020, notably the European Research Council (ERC) and the Marie Sklodowska Curie programme, also provide funding for research in the Netherlands in the areas of the Top Sectors and societal challenges. Here the funding is provided in the form of individual grants, and the demands of science itself are leading. This ground-breaking research often leads to new insights and applications. Conversely, demands from the field of practical application may also inspire this kind of research.

The appendices include an explanation of the various European programmes. It also includes information on the support that government offers to Dutch parties to enable them to participate successfully in Europe.

The Netherlands in the Seventh Framework Programme

Dutch participants have performed well in FP7, the current Framework Programme for research and technological development. The Netherlands actually received more money than it contributed (7% compared to the 5% contribution to the EU budget). The success rate is also above average.

Seventh Framework Programme (FP7) (2007 to mid 2013)*

Total funding allocated	€39,834 million
Funding allocated to Dutch participants	€2,838 million
Percentage returned to the Netherlands	7.1%
Total projects receiving funding	23,105
Number of projects with Dutch participants receiving funding	4,731
Netherlands share	20%
Success rate of project proposals across the whole of FP7	17%
Success rate of Dutch proposals	23%

* The current Seventh Framework Programme runs to an end this year, but allocation of project funding will continue into 2014. The figures may therefore change slightly.
Source: Netherlands Enterprise Agency



Health, demographic change and well-being

1

The European challenge *is to improve the lifelong health and well-being of all; this means high-quality, economically sustainable and innovative health and care systems, as part of welfare systems, and opportunities for new jobs and growth. At its core is the ambition to improve the health and well-being of all.*

Horizon 2020 identifies a variety of research themes:
(1) to improve understanding of health, well-being and illness
(2) prevention (3) treatment and management of diseases
(4) active ageing and self-management of health
(5) methods and data processing (6) integrated care systems.

CONTRIBUTION FROM THE TOP SECTORS: THE MOST SIGNIFICANT CONTRIBUTION WILL COME FROM THE TOP SECTOR LIFE SCIENCES & HEALTH, WITH ADDITIONAL CONTRIBUTIONS FROM HTSM, AGRI&FOOD AND HORTICULTURE & PROPAGATION MATERIALS ON HEALTHCARE THEMES, AND ALSO FROM THE TOP SECTORS CREATIVE INDUSTRIES AND CHEMICALS.

At the heart of the **TOP SECTOR LIFE SCIENCES & HEALTH (LSH)** lies the ambition "to increase health and wealth for both our society and the economy by turning our biggest challenge into our biggest opportunity". LSH aims to develop cost-effective healthcare innovations and to ramp up the pace of the realisation of these innovations. The Top Sector is seeking a paradigm shift: while in the past innovations often increased the cost of healthcare by making more treatments possible, thus resulting in additional demand, future innovations will have to increase the quality of a longer life, reduce costs and labour in healthcare.

SAMPLE PROJECT

Rapid Disc - Too smart for bacteria

The ability to test antibiotics quickly is of vital importance, especially as bacteria are increasingly resistant to them. Testing nowadays often includes manual processing. DB Kiestra Lab Automation is developing a faster, automated system with support from the SME programme Eurostars, a partnership between the Eureka countries and the European Commission.

Vice-president Jetze Botma: "A Dutch, Danish and Swedish university wanted to develop a faster method with us. We launched the Rapid Disc project and sought the assistance of Eurostars. We were selected as best from 350 proposals. The system we are developing runs the tests entirely automatically and the cultures require a shorter standing time. This allows you to start in the afternoon and have the results the next day. You can also choose which antibiotics to test for, making it more flexible than current methods."

In the market
Development of the new testing system has started. "For our business, co-creation is an important part of innovation. The universities that we work with contribute to the design process and will soon be able to test the prototype. We also need science to guarantee the validity of the product." In two to three years, Botma hopes to be in a position to offer customers a product which enables them to test their antibiotics faster.

The Netherlands performs well in Europe in the field of healthcare. Healthcare research in the Netherlands is world class. Examples include research in the field of cancer and stem cells. In fact, an international consortium including the European Research Initiative for the Biology of Ageing (ERIBA) of the University of Groningen and the Hubrecht Institute was recently invited to establish a new institute for stem cell research.

It is important to consolidate and, where possible, improve this strong international position. The LSH innovation contract includes a number of components to ensure a powerful contribution. The Top Sector has assessed how the priorities match initiatives in Brussels and, in that context, where the strengths of the Netherlands lie. A set of criteria has been developed which themes must comply with if they are to qualify for an active lobby. This concerns the criteria of societal relevance, alignment with patients' interests, cooperation with the SME sector, opportunities for international public-private partnerships or other forms of international cooperation, opportunities to cooperate with other sectors (including HTSM, Agri&Food, Creative Industries and Chemicals), past performance, scientific excellence and the impact on the societal challenge.

The five chosen thematic priorities of the LSH Top Sector are:
- **Healthy ageing**, with an emphasis on the life cycle and vitality, and an interdisciplinary approach to allowing people to live a longer healthy life. Self-management and regenerative healthcare are at its core. The theme is well aligned with the European Innovation Partnership Active and Healthy Ageing and with the EIT Knowledge and Innovation Community (KIC) for Health which is being developed. There are good opportunities for all parties, including the SME sector, to develop innovative products, processes and services, to facilitate the innovation chain and to reduce the time to market.
- **Medical devices**, an area where several fields come together, such as ICT and enabling technologies. A Top Sector-overarching approach could be used (HTSM, Creative Industries), which could count on support from government through the LSH TKI and through existing European initiatives in the field of technology, such as ENIAC and ARTEMIS (merged to become ECSEL in Horizon 2020), the intergovernmental EUREKA programme and Eurostars. Alignment with all basic components in the new Horizon 2020 could also be sought. Within the Excellent Science basic component, for instance, Guardian Angels is the flagship of Future and Emerging Technologies (FET). This project seeks to develop technologies that can offer people smart, personal, energy-efficient electronic support from their birth to later stages of life.
- **Personalised nutrition**, with an emphasis on nutrition for infants, small children and the elderly. This theme is aligned with current initiatives, such as the European Technology Platform 'Nutrition for life', the Joint Programming Initiative (JPI) A healthy diet for a healthy life, which the Top Sector Agri&Food is focusing on, and the KIC FoodBEST. The Netherlands has a number of key private parties active in this field.
- **E-health**, this theme encompasses the use of technology to support or improve health and healthcare, including telemedicine and serious gaming, for instance. The National e-Health Implementation Agenda is aligned with the new proposals by the European Commission on *e-Health*, an issue which is high on the agenda in Brussels. It is also aligned with current EUREKA initiatives, such as ITEA (Information Technology for European Advancement) and the public-private partnership, Future Internet. The subject is also given prominent mention in the strategic agenda of the Minister for Health, Welfare and Sport.
- **Personalised medicines**, improving the use of medicines with new technologies ensures better treatments. The Netherlands has shown a strong performance in this area in the past. There are opportunities here to further activate the research field in the Netherlands. The Innovative Medicines Initiative (IMI), a European Joint Technology Initiative, is an important instrument in a public-private partnership between the European Commission and the European Federation of Pharmaceutical Industries and Associations (EFPIA). The IMI wishes to increase the pace of development of new medicines and strengthen the European biopharmaceuticals sector.

A good example of a link between the Top Sector LSH and among others HTSM and Chemicals is provided by the developments relating to *organs on a chip.*

SAMPLE PROJECT

Asthma is personal - and the treatment too

In one to two years, doctors will have a better idea of how to treat asthma patients. Personalised therapies with the Innovative Medicines Initiative (IMI).

In one to two years, doctors will have a better idea of how to treat asthma patients. Personalised therapies with the Innovative Medicines Initiative (IMI).
This is the prediction of Peter Sterk of UvA University of Amsterdam. He is leader of a European project conducting research into the forms and causes of serious asthma based on data from thousands of patients. The project provides doctors with guidelines to identify a patient's personal asthma variant, and adjust the medication accordingly.

Partners
There are 40 parties involved in the project. Patient associations are participating in the data collection. And businesses are involved too with the development of instruments to measure what type of asthma is prevalent with a particular patient. Professor Sterk is enthusiastic: "This approach takes the entire field a lot further. The results are produced in a formal partnership between the universities and industries. Due to this the Americans are looking on with some envy and great interest."
The approach is not without its problems, he explains: "IMI does not help to coordinate the contribution from businesses. Every researcher has to make separate payment arrangements with the individual businesses in the consortium. And it does happen that a business decides to follow a different course or deploy different people to the project half way down the line. This can make continuity difficult." Despite the problems, Professor Sterk is enthusiastic about IMI. He wants to continue the approach, possibly with the help of IMI-2 which is due to launch under Horizon 2020 in 2014. "Now we know more about the forms and causes of asthma, we are able to develop more precise therapies. Personalised medicine is something we are working on".

U-BIOPRED
The U-BIOPRED is part of the health offensive of IMI in which the European Union, researchers, healthcare businesses and patient associations collaborate. There is good participation by Dutch parties, who together have managed to attract €70 million or almost 12% of the IMI budget for 2007-2012.

Within the **TOP SECTOR HTSM**, the roadmap **Healthcare** is focused on the challenges faced in the healthcare sector. The roadmap uses new technologies (nanotechnology, nanoelectronics, embedded systems and mechatronics) to develop solutions for medical professionals and patients. The roadmap is working on four subjects that are also high on the European agenda:

1 improved diagnostics, including medical imaging, the use of genetic and molecular data and the creation of patient-specific models,
2 improved interventions and therapies, such as minimally invasive operation and rehabilitation techniques,
3 solutions for zero line care (provided by family or volunteers) and first line care (can be accessed without a reference), such as portable equipment for self-managed care, home automation, affordable diagnostic systems in GP care, and
4 enabling technologies for healthcare, including (implantable) biodevices, an IT infrastructure to manage the explosive growth in medical data, and robotics that deliver a contribution to cost-effective and high-quality healthcare.

Other roadmaps also contribute to improved health. In the roadmap **Space**, expertise is being developed on organisms such as pathogens and cells. While **Embedded systems** aim to improve the efficiency of medical

information systems and increase data quality, which will help prevent errors. It concerns the use of biosensor and monitoring systems, which will allow patients to stay home longer or leave hospital earlier. One of the developments in the roadmap **Lighting** is the use of light to improve health and well-being. It is an area that holds opportunities for a variety of applications, such as light-based therapies, wound healing, brain stimulation and the treatment of mental disorders. It is based on technology that is also being developed within the roadmap **Photonics**. It is also possible to use light hues to influence the moods of individuals and to increase concentration or alter the perceived temperature. The roadmap is guiding actions in all these areas.

In **Printing**, one branch of development is looking at functional inks and 'printing' biological materials with a view to printing tissue, implants and even organs in the future. **High-Tech Materials** is working on biocompatible materials for medical devices and prosthetics, and materials for targeted delivery of medication. The roadmap **Nanotechnology** includes a nanomedicines programme focusing on the application of nanotechnology on molecular biology and medicines. Themes being worked on include early virus detection, development of new research instruments to research living cells at the nano and micro scale, and development of technologies to monitor tissues and cells.

The **ICT** roadmap connects in this challenge with the theme of integrated, sustainable and patient-oriented care, with a focus on new care models to support the development of a new architecture for the healthcare system. Also being addressed are the need for better health data, data use and provision of the best available information for health policy and regulation.

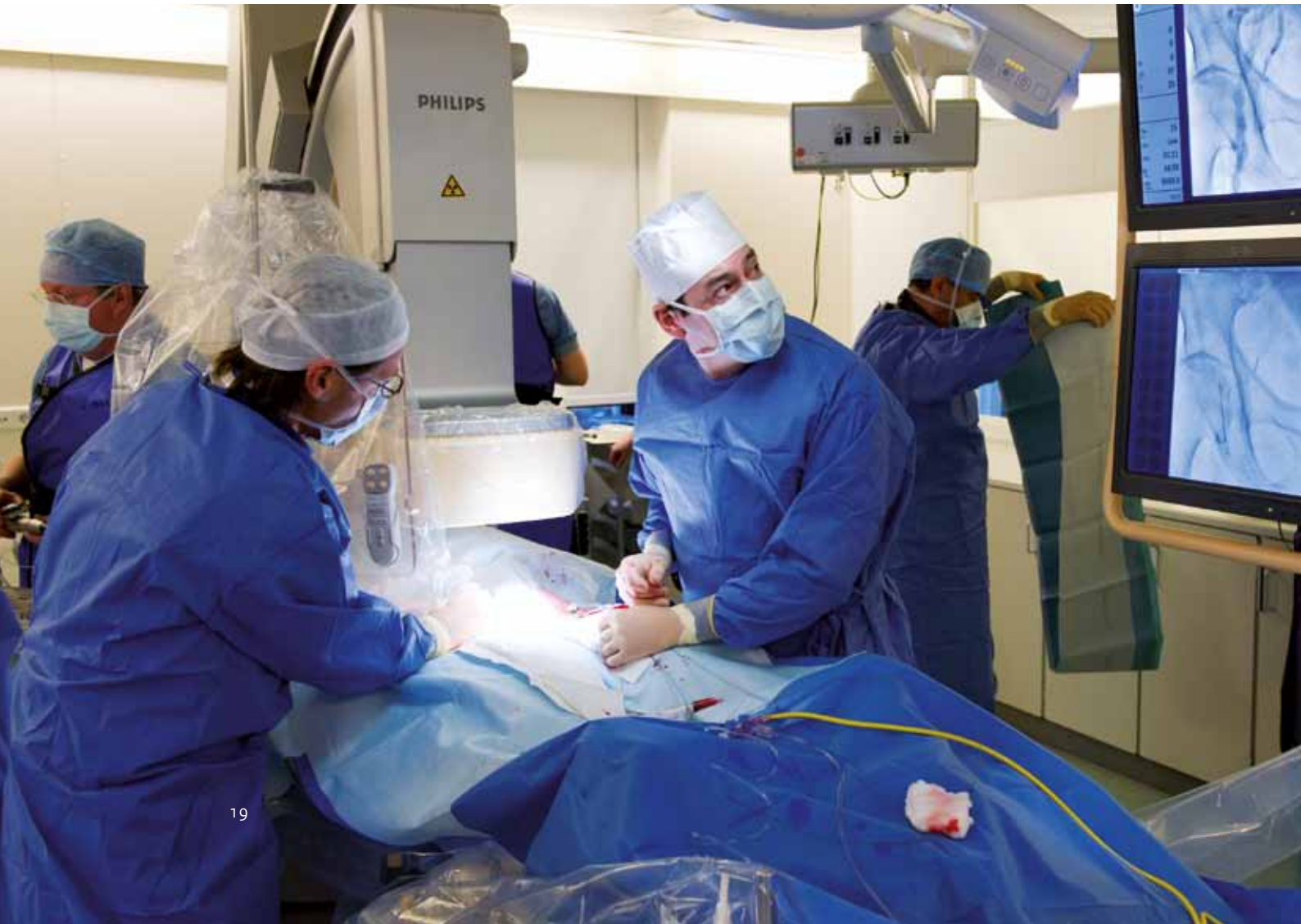
The **TOP SECTOR CHEMICALS** is also targeting health within the TKI **New Chemical Innovations** and is focusing on the use of quantitative analytical chemical methods and structure biology in the fight against cancer, to better understand the immune system, and to gain an understanding of biochemical reactions in cells. These issues form a connection between the Top Sectors Chemicals, HTSM and LSH. The TKI **Smart Polymeric Materials** also refers to medical applications in its biomaterials programme line.

The **TOP SECTOR AGRI&FOOD** is working proactively to improve healthy nutritional patterns. Developed countries have a rich and varied supply of food thanks to the high levels of economic prosperity in recent decades. However, the ease with which safe food with a high nutritional value is available also has a downside. Rather than diseases related to food shortages, increasing numbers of people face (chronic) diseases caused by unbalanced food choices or overconsumption.

The Top Sector Agri&Food invests in programmes that contribute to good-tasting products that are lower in salt, sugar and fat, helping to reduce heart disease. This can prevent disease, contributing to an improved quality of life and cost-savings. The sector is an active lead partner in current initiatives, such as the European Technology Platform Food for Life, the JPI A healthy diet for a healthy life, which is also a focus area for the Top Sector LSH and the KIC FoodBEST. A healthy diet for a healthy life is an important pillar in the collaboration with other European countries. The aim of this initiative is to ensure that by 2030 all Europeans have the motivation and opportunity to consume a healthy and varied diet in combination with a healthy lifestyle.

The **TOP SECTOR HORTICULTURE & PROPAGATION MATERIALS** offers opportunities to make progress on health through the consumption of fruit and vegetables. A healthier lifestyle and living and working environment can be created using innovative vegetable concepts. The value of fruit and vegetables can be increased further by increasing the availability of healthy ingredients and vegetable proteins as a sustainable and healthy alternative. The properties of food products can be given a boost by improving the genetic properties of the primary products and by processing the fruit and vegetable products.

The **TOP SECTOR CREATIVE INDUSTRIES** encompasses many areas that could contribute to health and well-being. The roadmap **Design** looks at design issues, such as ergonomics and application-oriented concepts and product-service systems. The sub-sector has identified three tracks: prevention, cure and care. Prevention focuses on the prevention of (chronic) diseases through the development of systems that enable a healthy lifestyle and provide support so that people can take control of their own healthy living. Cure and care focus on systems such as e-Health and telemedicine, including the development of services that allow patients to actively and effectively manage their own health. The roadmap **Games** encompasses research initiatives to improve and intensify the application of games for health.





Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy

2

The European challenge *is to secure sufficient supplies of safe, healthy and high quality food and other bio-based products by developing productive, sustainable and resource-efficient primary production systems, fostering related ecosystem services and the recovery of biological diversity, alongside competitive and low carbon supply, processing and marketing chains. This will increase the pace of transition to a sustainable bio-based economy.*



More specifically, the following themes will be addressed: (1) sustainable agriculture and forestry (2) a sustainable and competitive agri-food sector for safe and healthy food (3) a sustainable and competitive agri-food industry (4) bio-based economy (5) marine and maritime research

CONTRIBUTION FROM THE TOP SECTORS: THE KEY CONTRIBUTION WILL COME FROM THE TOP SECTORS HORTICULTURE & PROPAGATION MATERIALS AND AGRI&FOOD; THEY WORK TOGETHER ON THIS CHALLENGE, AT THE EUROPEAN LEVEL THEY ARE ALSO OFTEN INSEPARABLE. ALSO INVOLVED ARE THE TOP SECTORS CHEMICALS, CREATIVE INDUSTRIES AND HTSM, WHICH ARE ACTIVE IN DOMAINS SUCH AS ICT AND NANOTECHNOLOGY.

These challenges hold great opportunities for the Netherlands because the Netherlands unmistakably ranks among the global top in terms of food production and processing. Wageningen University was recently named the world's leading agriculture university. The sector makes a considerable contribution to Dutch exports, and the Netherlands is the world's second largest exporter of foods.

For the **TOP SECTOR AGRI&FOOD,** sustainable food production and the technological innovation that supports it are essential to prevent future food shortages and degradation of the living environment. The sector will be focusing on efficiency measures, recycling and reuse by individual chain partners, chains as a whole (systemic changes) and between chains to achieve improved sustainability performance.
The European Innovation Partnership (EIP) for Sustainable and Productive Agriculture aims to provide a stimulus for innovation to develop a competitive and sustainable primary sector in Europe. This initiative also aims to integrate the expertise and innovation opportunities of the Framework Programme with those of the Common Agricultural Policy. The EIP is an integral part of the European strategy of the Top Sector Agri&Food. Another theme which links into Europe's specific objective is the strengthening of innovative strengths in rural areas. Furthermore, there is also a connection with the Joint Programming Initiative (JPI) Agriculture, Food Security and Climate Change (FACCE), which is primarily aimed at agricultural research and innovation.

'More from less' is the most comprehensive of the four innovation programmes in the implementation agenda of the **TOP SECTOR HORTICULTURE & PROPAGATION MATERIALS (H&PM)**. This connects with Horizon 2020 with fundamental and applied research that aims to increase our understanding of the processes surrounding growth and the development of plants in relation to their environment. Crop yields could be improved by developing robust cultivation systems that are less adversely affected by for instance disease and climate factors.

SAMPLE PROJECT

Tomato genome sequenced

Together with their partners in the international Tomato Genome Consortium, Wageningen UR (WUR) and KeyGene have managed to unravel the tomato genome.
Sequencing the entire genome will help make it faster and more cost-effective to breed tomatoes. According to WUR and KeyGene, this will make it possible to develop new varieties which are less sensitive to disease or drought. Furthermore, the production of other crops should also benefit from this outcome. The DNA sequences of the domestic tomato and one of its wild relatives have been published in the scientific journal Nature. **http://solgenomics.net/.**

Both Top Sectors are tackling the theme of **healthy and safe eating** and the JPI A healthy diet for a healthy life, which is aimed at research into nutrition and innovation. The Top Sector Agri&Food is focusing on a possible call for the KIC FoodBEST. The aim of the KIC is to achieve progress in the food industry through innovation and by uniting education, research, enterprise and government. Agri&Food's innovation contract also covers the alignment with subjects such as food processing, consumer behaviour (explaining and influencing eating behaviour), valorisation of waste flows, resource efficiency and sustainable livestock farming.

The ambition of the H&PM sector is to produce a very high quality and healthy product; the second innovation programme of the H&PM Top Sector is therefore called **Food security and food safety**. The aim is that producers provide objective, reliable data in a controlled chain on origin, production method, transport, authenticity, content and security of the product. The chain parties have clear and transparent information on availability and quality, and everything is set up to give customers faith in healthy and safe food. Food safety also covers the reduction of residues of pesticides and measures to encourage sustainable production which minimise the use of these agents. Furthermore, the Netherlands is currently also taking part in 12 ERA networks on specific themes, such as sustainable food production, plant genomics and organic agriculture.

The efforts related to the **bio-based economy** offer opportunities to reduce greenhouse gas emissions, the security of supply of raw materials and food, and the finite supply of fossil fuels. The cross-sectoral theme 'bio-based economy' in the Top Sectors is well connected. The focus of the activities lies in the TKI **Bio-based Economy (BBE)** within the Top Sector Chemicals, but is also linked to the theme of valorisation of waste flows in the Top Sector Agri&Food. The JTI Bio-based Industries (BBI) is the European consortium which the TKI BBE is linked with. The innovation agenda of the JTI BBI encompasses research and pilots to make optimum use of biomass for materials and chemicals.
The use of waste flows has the highest priority. Valorisation of waste flows within the agri-food sector to produce biopolymers, for instance, and the recovery of phosphate and biomass from waste water has been placed in the Top Sectors Water, Energy, Agri&Food, and Horticulture.

The **TOP SECTOR CHEMICALS** has the TKI **Biobased Economy**, which has a number of programme lines that match this objective. The **chemical and biotechnological conversion technology** programme line focuses on the development of new advanced technologies to convert unprocessed or pre-processed biomass to green materials, chemicals and fuels. Conversion processes are followed by energy-efficient separation techniques. Here the cascading method is used in which the valuable ingredients are recovered from biomass first (nutrition, pharmaceuticals), then the less valuable ingredients (chemical raw products), followed by low value ingredients (fuels).
The TKI **Institute for Sustainable Process Technology** (ISPT) has a Biobased Economy programme line, covering the processes for releasing processing, separating and purifying bio-based raw materials and products

SAMPLE PROJECT

JTI Biobased Industries

Last year, the European Commission published a strategy and action plan entitled Innovating for Sustainable Growth: a Bioeconomy for Europe. The first concrete outcome from this is the Joint Technology Initiative for Biobased Industries (JTI BBI), in which public-private partnership (PPS) is seen as an instrument to build a bridge between research and the market.

A group of more than 40 innovative European businesses and clusters (including DSM, Essent, Holmen, KLM, Sappi and Copa Cogeca, the European farming industry body) have come together with the European Commission to form a public-private partnership (with €1 billion of public funding and €2.8 billion of private funding) to ramp up the pace of introduction of bio-based production in Europe in the period up to 2020. From 2014, the JTI BBI will operate as part of the Horizon 2020 subsidy programme. The first subsidy rounds relating to the JTI BBI are expected in early 2014. These calls will be open to universities, universities of applied sciences, research institutions and SME's.

for foodstuffs, pharmaceuticals and chemicals. The aim of the Biobased Materials programme line of the TKI **Smart Polymeric Materials** is to create momentum that should eventually lead to a strong increase in the use of biobased building blocks and materials. These include, for instance, development relating to biobased plastics made from renewable materials.

In the **TOP SECTOR CREATIVE INDUSTRIES**, **Fashion, Design and Architecture** lend themselves well to the promotion of products from the bio-based economy. For instance, research is being conducted into how the creative industry in the Netherlands, in particular the fashion industry, can contribute to reducing the environmental impact of clothing and fashion. Designers fulfil an essential role here, as their decisions greatly influence the environmental effects during the entire life cycle of a product. The use of sustainable materials, and especially recycled materials is an important link here. The creative sector and the Dutch textile and carpet industry could come together in this area.

The **TOP SECTOR WATER** provides answers to help improve the product efficiency of food and to deal with climate changes. The TKI **Water Technology**, for instance, is working on the theme 'more crop per drop'. This includes the development of sensors to measure the moisture levels and the nutrients in water needed for optimum plant growth, efficient irrigation, reuse of waste water and the purification of waste water. Water and delta technology is providing solutions for dealing with salinity by using smart combinations of water management, desalination and the cultivation of crops that are resistant to salt.
'Blue Growth' is relevant to all three sub-sectors of the Top Sector Water. This relates to the sustainable use of marine life, deep sea mining and marine energy options, new monitoring technologies and sustainable dredging. Cross-sector opportunities present themselves between the Top Sectors Agri&Food, Water and Energy in the field of sustainable fishery in both seawater and freshwater, and the multifunctional use of offshore platforms.

The **TOP SECTOR HTSM** has developed the **Space** roadmap, which is looking at the use of satellite data to increase yields by precision farming. Furthermore, the data is used to measure water quality (including illegal oil spills offshore) and the quality of dykes. The **Photonics** roadmap is also working on precision farming applications. By adding the components developed within Photonics to agricultural vehicles, it is possible to measure the state of the soil and to work the land in a more targeted way. Another agricultural application has been developed for the horticultural sector; here the microclimate is adjusted based on the colour of tomatoes, making it possible to influence taste.

The **ICT** roadmap is concentrating efforts towards information chains for businesses, with efforts focused on the horticultural and Agri&Food sectors as well as health and water. The **Nanotechnology** roadmap includes the programme food , in which research is being conducted into opportunities to determine the quality and safety of food, the possible development of functional food and research into sustainable processes.



Secure, clean and efficient energy



3

The European challenge *is to make the transition to a reliable, affordable, publicly accepted, sustainable and competitive energy system, aiming at reducing fossil fuel dependency in the face of increasingly scarce resources, increasing energy needs and climate change.*



The main themes are:
(1) reducing energy consumption (2) sustainable energy production (wind, solar, geothermal, hydroelectric and biofuels) (3) a smart electricity network (4) new expertise in energy-related concepts. Public acceptance and the creation of the right market conditions are also addressed.

CONTRIBUTION FROM THE TOP SECTORS: THE CONTRIBUTION WILL LARGELY COME FROM THE TOP SECTOR ENERGY, BUT THE TOP SECTORS HTSM, WATER, LOGISTICS, CREATIVE INDUSTRIES AND AGRI&FOOD WILL ALSO BE IMPORTANT.

Production of sustainable energy in the Netherlands needs to see significant growth, and there are some interesting opportunities in niche areas, such as Offshore Wind. In the area of knowledge, the Netherlands has an excellent reputation, for instance in the field of solar energy with institutes such as FOM and ECN as well as various universities. Dutch student teams always score very well in the World Solar Challenge and last year it was won by a team from Delft University of Technology.

The **TOP SECTOR ENERGY** makes a considerable contribution to this challenge. The Top Sector will be focusing efforts on clean and efficient energy generation and on the efficient use of that energy. Ultimately, this will make the Dutch economy stronger. Energy innovation will also help to lower the cost of reducing CO_2 emissions, developing renewable energy sources and making better use of them. Energy research and innovation are the key supports of a fundamental transition to a low CO_2 energy mix in the Netherlands.

The Top Sector Energy is focusing on seven themes, which are described below. All these themes are connected with the priorities in Horizon 2020. Only on the theme of gas is the European agenda clearly narrower than the Dutch agenda. Dutch industry is active in almost all European Technology Platforms and Industrial Initiatives of the SET plan (Strategic Energy Technology) in the field of energy. For 2014, €4 million has been earmarked within NWO's contribution to the Top Sector Energy for Dutch participation in ERA networks relating to bio-energy, smart grids and solar energy. The corresponding TKI's in these areas are involved in this and have included it in their research and innovation agenda. The ECN research institute is one of the co-founders of the European Energy Research Alliance (EERA).

The TKI **Energy in the built environment** is focusing on developing ground-breaking innovations to reduce energy consumption in the built environment, not least through better regulation and control of energy performance and through local energy generation, distribution and storage. The TKI **EnerGO** is working closely with the KIC InnoEnergy, part of which is based in the Netherlands.
This theme also includes participation of parties from the sub-sector **Water Technology**. Fermenting sludge and other materials from waste water can help to make significant energy savings in the built environment. An appealing example is the 'Energy Factory' of a number of water control boards. A smart combination of existing and new technologies makes it possible to produce energy from waste water for use in the own neighbourhood.

Scan and read (QR-code)) Progress Report: http://energiefabriek.com/english

Energy savings in industry are covered by the Innovation Contract Energy, which is implemented by the TKI **Institute for Sustainable Process Technology** (ISPT), which comes under the Top Sector Chemicals. The research is aimed at lowering energy consumption and improving energy efficiency in the process technology. The ambition is to make optimum use of the energy savings potential in industry.

The **gas sector**, and hence also the energy supply sector as a whole, faces considerable challenges. The TKI **Gas** is addressing a number of connected matters: making the gas system more sustainable, gas as a temporary source when the supply from wind and solar is insufficient, and gas as a replacement for more environmentally harmful fuels. The TKI Gas is also working on smarter production and application of gas, as well as on innovations in efficiency in the entire energy mix. The TKI Gas has links with the JTI Fuel Cells & Hydrogen, given that hydrogen and natural gas technologies are closely related.

The Netherlands has an excellent position in terms of knowledge and technology in the field of **solar power**, in particular photovoltaic solar power. Furthermore, the use of solar power systems in the Netherlands has grown strongly in recent years. The TKI **Solar Energy** wants to further ramp up the pace of development and application of solar energy in the Netherlands and to maximise the added value for the Dutch economy.

Smart networks are essential if we are to integrate sustainable sources, such as wind and solar energy, and achieve a more efficient energy system. An important part of this will be the organisation of the 'ecosystem'. This refers to the network of **Smart Grids**, in which the various parties develop new products and services to make electricity, gas and heat networks more flexible, thereby helping to make the energy supply more sustainable.

SAMPLE PROJECT

E-price – reliable and efficient energy supply

These days, consumers are often "prosumers" (consumer and producer). This means that they not only consume, but also produce electrical energy. Partly because of the large-scale production of wind energy and active prosumers, energy production and consumption is becoming less predictable, which means that the essential balance between the two is more difficult and more expensive to maintain. This means that the current electricity system will soon no longer be able to cope and new solutions will be needed. The E-price project endeavours to find solutions; E-price stands for price-based control of electrical power systems. It is essentially about finding a reliable, efficient and publicly acceptable concept for the European energy market. E-price means giving all parties the right price-based stimulus to be able to guarantee the reliability and efficiency (low prices). This will ensure a market and a control concept that includes a stimulus for all participants to stand up for their own interest and at the same time meet the societal criteria of reliability, efficiency, market access and transparency. Eindhoven University of Technology coordinates this European project which unites businesses (APX, TenneT) and knowledge institutions (DNV Kema).

The ambition of the TKI **Offshore Wind** is to reduce the cost price of offshore wind energy and to strengthen the Dutch share of revenues and employment in this international sector. Besides research aimed at various innovation themes, the Leeghwater Project was also launched: a partly experimental and partly demonstration project that provides maximum support for wind park innovations.

The **TOP SECTOR WATER** has identified the theme of 'Offshore Production' within the roadmap **Maritime**. This theme focuses on sustainable raw materials and energy generation offshore, including offshore wind and deep sea mining. The maritime cluster is currently applying its expertise to the optimisation and installation of offshore wind turbines in cooperation with the sub-sector delta technology and the Top Sector

Energy. This is a theme that is perfectly aligned with the Dutch Energy Agreement. The theme is also aligned with European efforts to provide marine energy options, such as tidal energy; this is currently being worked on the **Delta Technology** sub-sector, notably by integrating tidal energy plant into dykes or subsea turbines.

In the **TOP SECTOR LOGISTICS** the roadmaps **Synchromodalitity** and **Cross Chain Control Centres** (4C) are seeking to achieve higher load rates through cross-chain bundling. This delivers a contribution to the objective of energy efficiency, as set out in the specific challenge for Europe. This also applies to the efforts made by the action agenda, which are aimed at developing and professionalising the modalities of rail and inland navigation as fully viable alternatives to transport by road.

Within the **TOP SECTOR CREATIVE INDUSTRIES**, roadmaps for **Design** and for **Built Environment** are focusing their attention on energy-saving construction. **Media & ICT** are working on ICT applications and service development in the field of Smart Grids.

The knowledge agenda of the **TOP SECTOR AGRI&FOOD** is making a key contribution to the development of alternatives for fossil-based energy technologies in agricultural production (solar, wind, biogas from manure and agricultural waste, and geothermal).

The **TOP SECTOR HORTICULTURE & PROPAGATION MATERIALS** can also produce energy from solar, biomass, geothermal and heat storage. The sector has provided a key impulse to the development of geothermal energy. Cultivation concepts developed in recent years lead to drastic reductions in energy consumption. The sector is working on developing businesses that have the potential to be net suppliers of energy.

SAMPLE PROJECT

Powerful solar panel in large-scale production

SunCycle has developed a new type of solar panel. Unlike current solar panels, the SunCycle panels use concentrated sunlight. The greatest benefit is increased energy performance. Netherlands Enterprise Agency told SunCycle about the Seventh Framework Programme (FP7) and helped the company find international partners for large-scale production.

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The basis for the new SunCycle panels lies in concentrator technology that makes it possible to concentrate sunlight arriving at the panel onto a concentrator cell using a mirror. "This cell gets much more energy from the light than the current generation of panels," says Peter Penning, co-founder of SunCycle. "The yield of our panel is more than 40 percent higher. This reduces the cost price per kWh by a significant amount and shortens the time before a panel pays for itself." Because the concentrator cell reaches a temperature of 80 Celsius, the panels also produce thermal energy, which can be used to heat water, for example. Penning says: "A key additional benefit of the mirror technology is that we need 99.9% less of the expensive semiconductor material. In our panels, we have replaced it with less expensive materials, such as plastics and aluminium. This allows us to lower the price. Furthermore, the need for environmentally harmful substances in the production process, such as hydrochloric acid and trichlorosilane, has been reduced to an absolute minimum.

Ready for the next step.
Thanks to a contribution from the Peaks in the Delta (PID) project of Netherlands Enterprise Agency,

SunCycle was able to further develop the technology used in the panels and make a working product. "For the follow-up
to large-scale production, Agency NL pointed us to the Seventh Framework Programme (FP7)," says Penning. "They also identified an international partner for us too: the Institut National de l'Energie Solaire (INES) in France. We put forward our proposal together with our existing partners Voestalpine, Radboud University Nijmegen, Neways Electronics and TNO (the Netherlands Organisation for Applied Scientific Research). "The project lasted for a good 18 months. But that's okay. It gave us something in return. If all goes according to plan, we will deliver the first panels in the second half of the year. What's more, we are also in talks with parties interested in marketing our products in the Middle East and India."

The **TOP SECTOR CHEMICALS** includes the TKI **Institute for Sustainable Process Technology** (ISPT) and TKI **Biobased Economy**, both of which are coordinating research for the Top Sectors Energy and Agri&Food. The programme concerns the development of processes and systems that lead to energy savings in the process industry. ISPT links the sectors of chemicals, oil & gas, foodstuffs, pharmaceuticals and biotechnology. This concerns the development of new or improved processes or process units, such as separation, drying and desiccation, process intensification, biorefinery and utilities. Research is also being conducted into process technologies for the application of new raw materials, such as biomass and CO_2.

The TKI **Biobased Economy** (BBE) is focusing on coordinating biobased innovation across the entire biomass value chain, from field to final product, including the recycling of industrial and domestic waste. Thanks to biorefinery, the production of sustainable energy from biomass can in many cases be combined with the utilisation of valuable components for chemical purposes or for animal feed. Together with the efforts on Green Gas, this provides a stimulus for biorefinery and conversion to energy and chemical components. Together with NWO and FOM, the TKI BBE is making additional research efforts to produce biofuels directly from sunlight (solar fuels). The Biosolar Cells programme has been generating good results with this for a number of years.
In addition, the TKI BBE also has programme lines aimed at making the dual firing or co-firing of biomass more efficient and at developing high-value energy resources. The conversion from woody biomass using pyrolysis, torrefaction or gasification makes high-value energy applications possible.
The High-value Energy Resources programme line focuses on the pre-processing of biomass to make it suitable for further refining and the production of electricity, heat and green gas. The Biorefinery programme line aims to separate vegetable and animal raw products in an efficient, ecologically responsible and economical way so that the full potential of their ingredients can be used. For the Agri&Food and Horticulture sectors, biorefinery offers an increase and a broadening, as well as integrated sustainability of the product palette, and ultimately an increase in the added value of these sectors. Biorefinery is also the concept needed for the recycling and reuse of waste and residues, and for closing the cycle.

The **TOP SECTOR HTSM** includes the roadmap for **Lighting**, one key strand of which concerns lighting components and systems. Efforts are also being made towards more efficient LED technology and its widespread introduction. The savings potential is huge. In the roadmap **Nanotechnology**, this challenge is being addressed by the energy programme. Here the focus lies on sustainable energy and high-value solar cells, as well as the efficient use of energy by secondary energy conversion. Finally, the roadmap for **ICT** will also devote some attention to this. Energy systems need ICT to be able to function. Security and safety play a vital role in utilities such as water and energy. This is especially true for the smart energy grids of the future.





Smart, green and integrated transport

4

The European challenge *is to achieve a European transport system that is resource-efficient, climate and environmentally-friendly, which functions safe and seamless for the benefit of all citizens, the economy and society.*



On the one hand, Europe must meet the growing demands for mobility and transport of goods, but on the other hand make a significant contribution to reducing greenhouse gas emissions and other forms of pollution, including noise pollution. The dependence on oil must be reduced, but at the same time we must maintain a high level of efficiency in the transport system. This will require radical changes to the system, based on smart, green and safe transport solutions. The focus for this societal challenge is on: (1) environmentally friendly transport that makes efficient use of energy and other raw materials (2) greater mobility with less congestion (e.g. traffic jams on motorways) and improved safety.

CONTRIBUTION FROM THE TOP SECTORS: AN IMPORTANT CONTRIBUTION IN THIS AREA WILL COME FROM THE TOP SECTOR LOGISTICS. FURTHERMORE, THE TOP SECTOR WATER WILL PLAY A SIGNIFICANT ROLE IN THIS DOMAIN, AS WILL THE TOP SECTORS HTSM AND ENERGY. FINALLY, THERE ARE SHARED AREAS OF INTEREST BETWEEN THE TOP SECTORS OF CREATIVE INDUSTRIES, AGRI&FOOD AND H&PM.

TOP SECTOR LOGISTICS: Two roadmaps are particularly important for the European objective of environmentally friendly transport and the reduced use of energy and other raw materials. The roadmap **Synchromodality** is developing new transport concepts to make optimum use of the various modes of transport (road, rail, water, etc.) within an integrated transport solution that makes it possible to switch between modes of transport without problems. This could lead to a much more efficient and sustainable use of the transport possibilities and infrastructure. Better use of and coordination between the various modes of transport and combining loads during transport and storage will mean that unnecessary empty transport runs are reduced, which in turn leads to reduced emissions of CO_2, NOx and particulate matter. This is also connected with the ambition to shift 30% of the freight that is currently transported by road to rail, sea or inland navigation by 2030.

The roadmap for **Cross Chain Control Centres** is working on developing centres to jointly coordinate and control multiple supply chains (including financial and data flows) using the latest technology and software. This makes smarter and more sustainable transport possible. These roadmaps are also contributing to European efforts to make more environmentally friendly and more energy efficient transport possible in large urban areas.

SAMPLE PROJECT

CO3 project: reducing running empty

On average, only 57% of the load capacity of trucks, goods trains and barges is actually used. And 1 in every 4 vehicles drives through Europe completely empty. We need to improve efficiency.

For this reason, the FP7 project entitled Collaboration Concepts for Co-modality (CO3) aims to increase the utilised load capacity and reduce empty running by encouraging logistics partnerships among businesses. Carpooling for cargo: towards a sustainable European transport sector. "There is a structural under-utilisation of capacity in the European freight sector," says Dirk 't Hooft, coordinator of the FP7 project and Director of the Holland International Distribution Council. "Largely because large shippers, such as Unilever and Procter & Gamble, but also carriers, do not cooperate as much as they should. Businesses that bundle their logistics can achieve significant cost benefits of up to 20 percent. Our job for this to happen is to remove the practical obstacles."
The project has partners in a number of European countries, including universities, government agencies and shippers.
http://www.co3-project.eu/

As well as the roadmaps already mentioned, other roadmaps are important for the European objective of improved mobility and less congestion, especially when it comes to developing new concepts for freight transport and logistics. The **Neutral Logistics Information Platform** (NLIP) is working on a system in which economic operators and government agencies can exchange data in a standardised format, so that the available information can be put to optimum use.
The roadmap **Trade Compliance and Border Management** is working to facilitate trade by streamlining and simplifying the clearance process in a way that is unique in Europe. The roadmap **Service Logistics** is developing expertise in the logistics activities needed to ensure optimised operation of capital-intensive systems throughout their life cycles until they are decommissioned or reused.

The European Technology Platform (ETP) ALICE (Alliance for Logistics Innovation through Collaboration in Europe) was recently established and there is active participation by Dutch parties. The contribution from this ETP is used by the European Commission to programme research within this societal theme in Horizon 2020.

The **TOP SECTOR HTSM**: The key contribution from this Top Sector lies in the area of the automotive industry and aircraft construction. The roadmap for **Automotive** is aligned with the research agenda of the European Technology Platform ERTRAC (European Road Transport Research Advisory Council). The objectives of the sector are to cut emissions by half, largely by increasing efficiency, and a considerable improvement in safety. The Dutch roadmap also includes a specific focus on reducing congestion. Two technology themes will be leading: smart mobility based on intelligent roads and vehicles, and improvements in the efficiency of drive systems. There are cross-linkages with other roadmaps, such as ICT. Examples of projects include coordinated driving and traffic flow prediction.

The roadmap **Aeronautics Manufacturing and Maintenance** will contribute to making transport greener through the development and application of lightweight materials (composites), the development of efficient engine parts and energy-efficient systems, helping to reduce fuel consumption. There will also be a focus on lowering maintenance costs, for instance, by monitoring the condition of the aircraft. This lowers unplanned maintenance and reduces delays in air transport. The roadmap **Photonics** is also working on systems to monitor the maintenance situation of the means of transport (aircraft, vehicles). Integrating an "optical nervous system"

into the means of transport would increase availability and improve mobility.

The roadmap **Space** is important because of the role that space sector has as a provider of data, the focus will be on navigation and tracking & tracing applications. The roadmap **Solar Energy** is partly focused on the development of photovoltaic applications that could easily be combined with electric vehicles. The roadmap **High Tech Materials** is working on lightweight materials for aircraft and road vehicles, but also on strong, lightweight materials that can mitigate damage in the event of a collision.

Physical transport structures depend heavily on ICT. Take, for instance, the monitoring of transport throughout the chain by means of system platforms. Standardisation is an important part of this. The roadmap **ICT** makes a significant contribution to research in this area. Also interesting is the POLLUX project as part of the Joint Technology Initiative ARTEMIS (embedded computer systems), which is working on the development of an electric vehicle through the integration of software and nanoelectronics. Important aspects are reductions in energy consumption and CO_2 emissions, and improvements in safety.

The **TOP SECTOR WATER**: Transport by sea is gaining in significance as a mode of transport. In view of the climate challenges and ecologically responsible transport with minimal harm to aquatic organisms, the maritime sector will be focusing on **Clean Ships** as one of the key themes of its roadmap. This theme will focus on developing technology to lower fuel consumption, alternative fuels, exhaust gas scrubbing, reductions in resistance, reductions in underwater noise and the clean production of raw materials for shipping. Societal needs are expressed in more stringent demands in relation to emissions to air and water and the increasing importance that is attached to reducing the harmful effects of underwater noise on marine mammals. The sector wants to transform this development into a competitive advantage by offering effective solutions and at the same reducing operating costs (fuel costs). The theme corresponds with European efforts towards smart, green and integrated transport, in which one of the key issues focuses on the design of cleaner and quieter vehicles and ships. An appealing example of a cleaner vehicle is the principle of the dolphin tail propulsion system developed by O-foil in the SME sector. Instead of the usual screw propeller, propulsion is provided by a wing that moves in the same way as a dolphin's tail. The system results in huge fuel savings and a reduction in noise pollution.

The innovation themes of **Smart and Safe Shipping** and **Effective Infrastructure** of this Top Sector also have shared elements with the European approach with their efforts towards issues such as innovative logistics and the development of an intelligent infrastructure, and the services tailored to this. The fact that the connection is close is demonstrated by the sub-themes of the roadmap, which are focused on optimised and sustainable use of the river delta (ports and shipping routes), on innovative designs for ports and shipping routes, and on new concepts for freight clearance. Expertise in these themes will contribute to the strengthening of the economic position of the Netherlands through ports and shipping routes, with Rotterdam leading the way as Europe's largest port. To further bolster this position, closer coordination of ports, shipping routes and ships is needed. This will require the integration of expertise and systems. Minimum handling times and costs, improved use of the infrastructure and a more important role for inland navigation are key issues in this.

The Dutch maritime sector is well connected to the European collaborative networks. To avoid fragmentation of the research and related budgets, the European Technology Platform WATERBORNE has instigated a strategic research agenda. The key issues in relation to this challenge are 'Green, safe and competitive transport with intelligent use of the infrastructure' and 'Understanding the ocean', which is aimed at reducing the consequences of our use of the sea, for example because of emissions and underwater noise.

The **TOP SECTOR ENERGY** is closely aligned with this challenge in the TKI for **Smart Grids** (integration of electric transport) and the TKI Biobased Economy. The programme lines of Bio-energy and Green Gas are focused on developing a new generation of biofuels.

In the **TOP SECTOR CREATIVE INDUSTRIES** the roadmap for **Design** focuses on the design issues and application-oriented concepts for mobility. By creating an integrated test location, smart mobility solutions could be simulated and then tested. Application will largely be concentrated in niche markets, but also to other markets in due course.

The **TOP SECTOR AGRI&FOOD** is developing relevant expertise aimed at more efficient agrologistics through investments in new preservation methods and packaging concepts which will extend the shelf life of products and reduce product perishability and waste.

In the **TOP SECTOR HORTICULTURE & PROPAGATION MATERIALS** the focus is on maximising the efficient and sustainable transport of perishable products. Multi-modal transhipment points and conditioned international multi-modal networks are part of the plans. Information management in horticulture chains is another way to increase the efficiency and effectiveness of the transport of vegetable products.


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Climate Action, environment, resource efficiency and raw materials

5

The European challenge *is to achieve a resource efficient and climate change resilient economy and society, and a sustainable supply and use of raw materials in order to meet the needs of a growing global population within the sustainable limits of the planet's natural resources and eco-systems.*

The main themes are:
(1) climate action: taking all possible action on climate change and, where necessary, adapting to the effects of this (2) protection of the environment and sustainable management of natural resources, including water and biodiversity (3) assurance of the availability of sustainable raw materials (4) transition towards a green economy through eco-innovation.
The activities will also contribute to increasing the competitiveness of Europe. For 2014-2015, important focus areas are: Waste and Water Innovation.

CONTRIBUTION FROM THE TOP SECTORS: THIS CHALLENGE FACES A COMPLEX SET OF RATHER DIVERSE YET RELATED THEMES. IT WILL THEREFORE COME AS NO SURPRISE THAT ALMOST ALL TOP SECTORS ARE INVOLVED, WITHOUT ONE STANDING OUT. THERE ARE GREAT OPPORTUNITIES TO BE HAD FOR THE NETHERLANDS IN A VARIETY OF AREAS BECAUSE WE POSSESS SOME UNIQUE KNOWLEDGE AND ABILITIES.

The **TOP SECTOR WATER** is aligned with this societal challenge with measures to ensure we use less water and to provide clean drinking water. Dutch delta technology is renowned worldwide for its innovative solutions and the integrated approach. Dutch knowledge institutions and businesses are active all around the world. In the field of water technology, the Netherlands is rapidly building a good standing, with Wetsus, the centre of excellence for sustainable water technology, as its pearl.

The roadmap Delta Technology focuses on offering ecologically responsible and efficient water engineering and water management solutions to climate issues (rising sea level, flooding, drought, salination) and the conjunction of these with the issues of delta urbanisation.
The detailed themes are equally important for the availability of sufficient water for safe food production, adapting food production to salination and the responsible use of water by industries that are heavy users of water.

The roadmap Water Technology focuses on efficient and sustainable use of water. The innovation themes are:
- *Water for All:* production of drinking and industrial water and purification of waste water at the lowest possible cost; future-proofing the water transport and storage infrastructure.
- *More Crop per Drop:* high-value (sustainable) freshwater supply for the production of food and among others the recovery of nutrients.
- *Water & Energy:* sustainability of the energy-producing industry processes; new forms of clean energy based on water technology.

- *Water & ICT*: increasing the efficiency of extraction, purification and transport of water through sensors & monitoring of water quality and process control.

An important framework for strengthening cooperation on these topics within the European context is the Strategic Implementation Plan (SIP) from the European Innovation Partnership on Water (EIP Water). Various groups in the Netherlands are actively involved in the formulation and development of the SIP and its follow-up initiatives.
The alignment with Dutch expertise is significant, as evidenced by the so-called Priority Areas defined in the SIP, which include water re-use & recycling ; water treatment and services for drinking water, industrial water and waste water, including the recovery of scarce raw materials and the relationship between water and energy (for instance, energy saving and production in the water cycle from drinking water to waste water), water as a source of energy and water and new energy sources such as shale gas. In the Netherlands unique structures exists that are aligned with the EIP commitment, such as the Residues Union (Reststoffen Unie) of the water companies, and the idea proposed by the water control boards of a Raw Materials Factory (Grondstoffenfabriek). There is also a connection in the roadmap to the activities of the Nutrients Platform that is trying to extend the recycling potential of phosphate in the EU.

In both the fields of delta technology and water technology Dutch groups, such as knowledge institutions, water companies and water control boards are very active either as leaders or as participants in larger European projects. There is also an effort to build on the current cooperation in the Joint Programming Initiative Water (JPI Water), in which Spain and the Netherlands take the lead, to turn it into a true joint-research programme and partnership between member states. Another European initiative concerns the European Knowledge and Innovation Community (KIC) Climate. This sees various knowledge institutes work actively with companies and universities to develop innovations and establish them in the market.

SAMPLE PROJECT

Urban Flood project

More than two-thirds of European cities face the risk of flooding. This risk is expected to increase. Early Warning Systems can play a crucial role in curtailing this risk.

The preceding Dutch IJkdijk project saw sensors developed in dykes that can predict floods. Computer systems were needed, however, to process the information from the sensors and make it visible in emergency rooms to show what the dykes were picking up and how a city is flooding. The development of these systems on the basis of artificial intelligence was the goal of a European project Urban flood led by TNO, which ran until 2012.

Results
Monitoring dykes led to savings and deferred investment from water authorities. Less clay needs to be used in the construction of dykes because the flood forecast system (Early Warning System) is able to effectively find where weaknesses are located in the dyke. These points can be temporarily reinforced when there is a flood threat, with sandbags for instance. The commercial project partners are now trying to market this technology.

The objectives of the **TOP SECTOR ENERGY** are directly linked to climate targets. The Top Sector Energy focuses on the development and integration of renewable energy sources and energy conservation. This is done to achieve a substantial reduction in CO_2 emissions. For a detailed description of the contribution of this top sector, see the notes under challenge 3.

In the **TOP SECTOR AGRI&FOOD** sustainability plays an important role, particularly in the sustainability of agricultural business cycles with regard to the handling of raw materials. Ensuring this sustainability involves increasing the efficiency with which the means of production are deployed and reducing the losses and emissions from the production process - and where possible re-using leftovers and side products, and thereby closing the production cycle. The goals include:

- Emission-neutral production of minerals by 2030
- A significant reduction in emissions of ammonia and particulates from livestock farming
- A reduction of energy use and greenhouse gas emissions and an increase in renewable energy production
- An increased use of fertilisers that meet the Nitrates Directive, Water Framework Directive and Marine Framework Directive
- A good, sufficient water supply for agriculture and an efficient use of water.

A main theme of the innovation contract of the **TOP SECTOR HORTICULTURE & PROPAGATION MATERIALS** is delivering more products with less resource use and reduced impact on the climate. This can be achieved by the genetic improvement of source materials (seeds, seed potatoes, etc.). Efficiency in mineral and water use is needed to meet resource efficiency targets. Attention is also going to energy conservation, the efficient use of energy and the use of renewable energy. Lower CO_2 emission will reduce the greenhouse effect on crops. The sector is gearing itself more to the role of producer of raw materials for the bio-based economy.

A lot is happening in the **TOP SECTOR CHEMICALS** that is relevant to this challenge. For instance, the TKI **Smart Polymeric Materials** has a programme line aimed at closing the chain so no input of new materials is needed in the production process. Initially, closing the production chain focused on the re-use of materials based on fossil fuels, but closing the chain to non-biodegradable bio-based materials will be of increasing importance. In the programme line of 'superior materials', the objective is to realise discreet improvements on conventional solutions and available materials, resulting in materials and application techniques that have a lower environmental impact. The TKI **Institute for Sustainable Process Technology** (ISPT) is engaged with the theme of material efficiency. This is focused on the development of processes in which the direct benefit of the material flows is high on the one hand, and on the other hand on processes that achieve high purity of (semi-) products in such a way that they can be handled efficiently together with the product further on in the production chain. The previously described cross-sectoral theme of a **bio-based economy** is part of this challenge, particularly in the sub-theme of eco-innovation. The purpose of a bio-based economy is to sustainably replace fossil fuel sources with directly renewable natural resources from biomass. These bio-based replacements (materials, fuel, etc.) are more sustainable and more energy-efficient in production stages.

SAMPLE PROJECT

Artificial leaves

In the study of artificial photosynthesis, nature has provided an example for the construction of *artificial leaves*. These artificial leaves contain catalysts, light antennas and other components that are 'copied' from the natural photosynthesis system.

In theory, these artificial leaves can convert solar energy into chemical energy with a very high efficiency of more than 40%. They are therefore about 100 times more efficient than natural leaves. In the first instance, the chemical energy will take the form of hydrogen gas. The next step is also being worked on, where atmospheric CO_2 is joined with the hydrogen to make methanol. Methanol can then be used as a raw material, which in standard chemical processes can be converted into kerosene, for example. The Dutch programme Biosolar cells, led by Wageningen University has linkages with various European initiatives under the 7th Framework Programme and the European Advanced Materials and Processes for Energy Applications programme (AMPEA) – part of the framework of joint programming.

In the **TOP SECTOR LOGISTICS**, the roadmaps of **Synchromodality, Neutral Logistics Information Platform** and **Cross Chain Control Centres** (4C) are seeking to achieve higher load rates though cross-chain bundling. This will help contribute to the objective of CO_2 reduction in the transport system.
The Top Sector focuses in the **Service Logistics** roadmap on all logistics activities that are needed to allow often capital-intensive systems to work well and undisturbed. This allows logistic services to achieve a longer life cycle for products and to ensure optimal usage with less waste of materials, energy and resources. Service Logistics offers opportunities here to derive benefit from the circular economy.

Within the **TOP SECTOR CREATIVE INDUSTRIES**, the roadmaps for **Fashion** and **Design** have seen research into the application of recycling technologies and processes in the fashion and textiles industry (Recycling in Design). The aim is to continue with the European Open Garments project. The decisions of designers have a major influence on the environmental impact of a product throughout its entire life cycle. With Recycling in Design a start was made on developing sustainable design based on recycled fibres. The roadmap **Built Environment** also pays attention to recycling materials and energy-efficient buildings.
Within the **Cultural Heritage** domain, reusing and finding a new purpose for historic buildings is an important issue linked to commodity recycling and climate-neutral/energy-efficient building. Preservation of heritage and links to new designs and new technologies will also create new business opportunities. The linking of social value to commercial opportunities contributes to sustainable solutions.

Within the **TOP SECTOR HIGH TECH,** various roadmaps are actively engaged with this societal challenge. In the roadmaps **Automotive** and **Aeronautics**, there is a direct link to the battle against climate change through the ambition to lower CO_2 emissions and emissions of other harmful substances. Furthermore, it is vital for Automotive industries to reduce their dependence on fossil fuels. In the roadmap **Space**, very valuable optical instruments are being developed to map climate change from space. Dutch groups play a prominent role in this, both in terms of the hardware and the use of the data. Attention is also devoted to the monitoring of tropical forests and the melting of polar ice.

The roadmap **Printing** includes 3D printing, which may lead to a new manufacturing technology that requires little material, does not generate any waste material and brings significant energy benefits, thereby contributing to a better and more efficient use of basic raw materials. The roadmap **Mechatronics/Manufacturing** aims to contribute to increased efficiency in the use of energy and materials in the manufacturing industry. More

efficient production is also being looked at. The roadmap **Solar Energy** obviously contributes to the reduction of CO_2 and to the reduction in climate impact.

The roadmap High Tech Materials is working on lightweight materials in vehicles, which will reduce fuel consumption and as a consequence emissions, as well as providing less waste in construction and alternatives to scarce resources.

The 'clean water' programme in the roadmap **Nanotechnology** focuses on nanotechnology applications in water, and in particular ensuring clean water. Innovation in **ICT** and innovative use of ICT contributes to a more efficient use of raw materials (e.g. more digitisation means less paper) and more efficient production. Through the action line called "data, data, data" research is being done for improved processing of large amounts of data. This is important for simulations in climate models, among other things.





inclusive, innovative and reflective societies

6

The European challenge *is to foster a greater understanding of Europe, provide solutions and support inclusive, innovative and reflective European societies in a context of unprecedented transformations and growing global interdependencies.*



This challenge has a broad scope and covers a wide variety of issues. Research is being done, for instance, into the social and economic impact of globalisation and the promotion of inclusive societies, where no one is left by the wayside, and also the way in which globalisation leads to new business models. To this end, issues of integration and migration are being addressed, and research is done into the development of shared European values and cultural, historical and linguistic diversity in Europe.

CONTRIBUTION FROM THE TOP SECTORS: THIS CHALLENGE IS DIFFERENT IN NATURE TO THE OTHER SIX. WHILE THE SIX OTHER SOCIETAL CHALLENGES IN HORIZON 2020 HAVE A CLEAR LINK TO A SPECIFIC THEME. A BROAD RANGE OF RESEARCH AREAS ARE BROUGHT UNDER A COMMON DENOMINATOR. THE ALIGNMENT WITH THE AGENDAS OF THE TOP SECTORS IS THEREFORE ALSO LESS EXPLICIT. THE RELATIVELY MOST IMPORTANT TOP SECTOR FOR THE CHALLENGE IS THE CREATIVE INDUSTRIES. THERE ARE ALSO SOME CONNECTIONS TO THE TOP SECTOR HTSM.

The focus is on research in non-technical disciplines such as social sciences and humanities, but multi-disciplinarity is of paramount importance. Attention is also paid to the common ground with technological developments, such as the digital society.
This challenge is also linked to policy-supporting research related to the whole Horizon 2020 programme - for example, the promotion of creativity and innovation - focused on knowledge-sharing between member states within the framework of the European Research Area.

TOP SECTOR CREATIVE INDUSTRIES: The roadmap **Creative Industries Next**: **Creative Business Innovation** covers general topics such as new business models and the deployment of 'Creative Thinking' for an innovative economy and society. Research is therefore being done on the innovation practices of creative enterprises located in multi-tenant business premises. The goal is to gain insight into how creative businesses can be encouraged to collaborate, innovate and grow.

The **Cultural Heritage** roadmap focuses on the development of new technologies and systems to make cultural heritage available and accessible to society. The integration of ICT and media plays an important role in this. The 'Time Capsule' project, for instance, is working on a systematic connection and exchange between ten different digital databases of heritage data. Through intensive cooperation between historians, linguists, pharmacists, biologists and information experts, new possibilities will be developed to make historic digital data on plant-

SAMPLE PROJECT

New business models in fashion

Making garments for the individual consumer. This is the goal of the Open Garments project. A new business model is being developed for this, which enables a new way of designing, manufacturing and selling clothing designed by consumers.

Adopting new business models can boost the position of the European textile industry. The goal of this project was to develop business models that reflect consumers' wishes and creativity as best as possible. This is referred to as the 'Manufacturing Service Provider (MSP) Business Model'. Among other things, use is made of production techniques where small companies are empowered in virtual communities on the internet ('open manufacturing'). Three groups in the Netherlands took part in the project that was financed by the Seventh Framework Programme: TNO, Boondoggle and Max Juwelier & Edelsmederij. **http://open-garments.eu/**

based medicines available to universities, companies and the general public. The ambition is to set a new standard of sustainably presenting and using our heritage in the digital age.

In the **Gaming** framework, experiments are being done to see how educational computer games – in and outside school – can help enhance children's education.

TOP SECTOR HIGH TECH: in the framework of the roadmap **ICT**, against the background of a huge growth in data and the trend that companies are continually wanting to react more to the wishes of individual consumers, research is being conducted into how new software can contribute to new developments in the storage and processing of large amounts of data. Within this roadmap, the action lines 'ICT and society' and 'Reliable ICT' connect with developments concerning privacy, reliability and electronic signatures. This is relevant for the interaction between this challenge and the research infrastructure of the first pillar Excellent Science.



Secure society

7

The European challenge *is to foster secure European societies in a context of unprecedented transformations and growing global interdependencies and threats, while strengthening the European culture of freedom and justice. Threats are caused by humans and by nature.*



CONTRIBUTION FROM THE TOP SECTORS: THE TOP SECTOR HIGH TECH SYSTEMS AND MATERIALS (HSTM) IS MAKING A PARTICULAR CONTRIBUTION, AS ARE THE TOP SECTORS LOGISTICS, WATER, CREATIVE INDUSTRIES AND AGRI&FOOD. A NUMBER OF THEMES IN THIS CHALLENGE ARE NOT REFLECTED IN THE TOP SECTORS, BUT DO HAVE THE ATTENTION OF THE MINISTRY OF SECURITY AND JUSTICE. THE NETHERLANDS CAN PLAY AN IMPORTANT ROLE IN THIS AREA, NOT LEAST BECAUSE WE ARE ABLE TO CONNECT DIFFERENT DOMAINS TOGETHER SMARTLY, FOR INSTANCE, LINKING THE TECHNOLOGY USED IN HTSM TO CREATIVE INDUSTRIES.

TOP SECTOR HTSM: The roadmap **Security** focuses on the technological challenges relating to threats to the security of our society. These occur within the following domains: system of systems, cyber security and sensors. Solutions are being worked on that both contribute to the prevention and the containment of force, as well as solutions that minimise the adverse effects of catastrophes (crises, disasters). These subjects correspond well with the themes of this challenge. Cyber security is a subject that is specifically relevant for this challenge.

SAMPLE PROJECT

BRIDGE: working together on safety

The aim of the BRIDGE project is to increase the security of the residents of Europe in times of crisis. This is achieved using technological and organisational innovations. The key lies in interoperability, harmonisation and collaboration between the parties involved in the crisis.

Dealing with a crisis caused by natural disasters, accidents or terrorist attacks often requires the involvement of various parties, sometimes even across borders. The crisis response will benefit from systems and organisations that are in tune with each other. This project contributes to this by developing software, 3D simulations and advanced technologies for interaction between humans and computers. The Dutch parties involved in this project are Almende, Thales and Delft University of Technology.
http://www.bridgeproject.eu/en

The roadmap **Embedded Systems** focuses on improving data privacy for users and improving personal data security. The roadmap **Printing** includes the development of applications to allow new security features to be printed on documents and packaging, thereby improving security in the supply chains.

The roadmap **Aeronautics** focuses on the development of new concepts, such as unmanned systems. Systems like these can be used to protect the population against crime and terrorism.

The roadmap **High Tech Materials** is working on materials for use in protective clothing and materials that can withstand the impact from explosions.

The contribution from **ICT** to a secure society is crucial. Almost all research themes in the ICT roadmap make a contribution to this societal challenge. The roadmap covers subjects such as Access Control and the role of ICT in the protection of critical infrastructure.



In relation to the **Neutral Logistics Information Platform** of the **TOP SECTOR LOGISTICS** there are also items that are relevant to this challenge. Optimised linking of information to flow of goods will give both private and public stakeholders better insight into where flows of goods are currently located. The owner of the logistics information decides who has access to the information. This allows improved detection of illegal flow of goods.



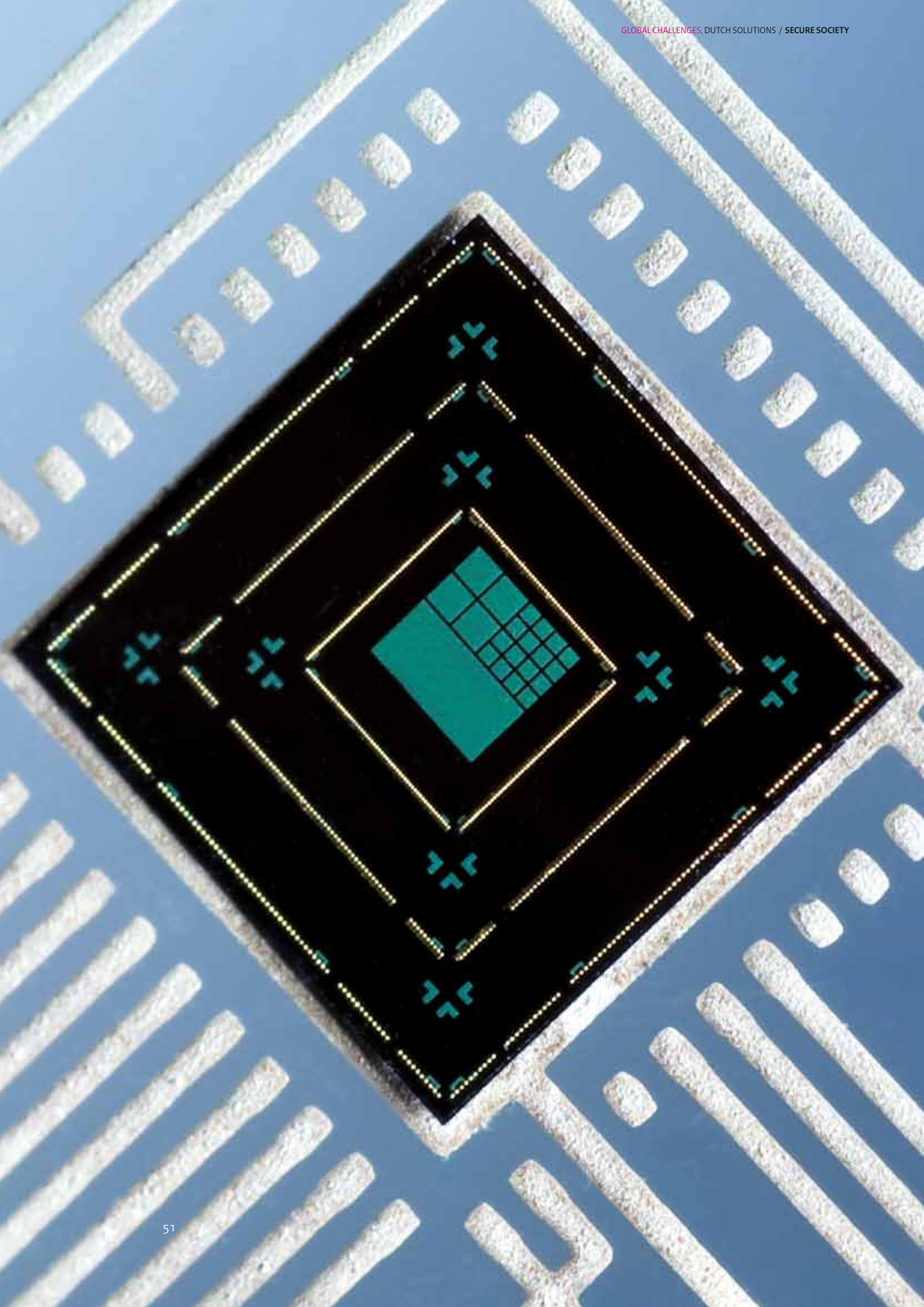
THE TOP SECTOR WATER: Important parts of this programme are disaster resilience and climate change. In relation to water, the Netherlands leads the way with its Delta Programme. Important themes for the Top Sector Water are water security and fresh water supply. As indicated at challenge five on climate action, the roadmap **Delta Technology** focuses on water management solutions for climate issues, such as flooding. This also concerns the use of data and in for example warning systems and crisis management. NWO is also working on the JPI Climate.



With the **Design** roadmap, the **TOP SECTOR CREATIVE INDUSTRIES** is working on the application of light design for a safer built environment and crowd control. Research is developing lighting scenarios that make a contribution to de-escalation in emergency situations. The roadmap **Games** is focusing on *serious games*, which involves training and simulation to prepare for threatening situations; this is an important part of training for people working in the security sector.



Finally, the **TOP SECTOR AGRI&FOOD** is also focusing on protection against possible terror attacks within the theme of food security.



ABBREVIATIONS AND DEFINITIONS

A&F: Top Sector Agri&Food

Netherlands Enterprise Agency: the government agency that provides services to businesses with sustainable, innovative or international ambitions. Subsidies, knowledge and partner matching services are available

BBE: Biobased Economy, An economy in which crops and residual products from agriculture and the food industry are used for non-food applications. Green raw materials or biomass are used as materials, chemicals, transport fuels or to generate energy (electricity and heat)

CIP: Competitiveness and Innovation Framework Programme. A European programme to provide a stimulus for innovation and competition. The programme is targeted towards businesses in the SME sector in Europe and is divided across the components of ICT policy support programme, intelligent energy Europe and eco-innovation

EIP: European Innovation Partnership (see Appendix 1)

EIT: European Institute of Innovation & Technology. Part of the European Union with a mission to promote sustainable growth and competition in Europe by utilising innovative capacity in Europe and facilitating transitions (from concept to product, from lab to market, from student to entrepreneur)

ERA: European Research Area

ERC: European Research Council. The European Council supports the very best visionary academics and scientists, both young and more experienced, with subsidies (e.g. a personal grant) for primarily fundamental research

ETP: European Technology Platform. Businesses and research institutions establish a joint strategic research programme for a specific area of technology, with the industry party leading the initiative

EZ: Ministry of Economic Affairs

HTSM: Top Sector High Tech Systems and Materials

H&PM: Top Sector the Horticulture & Propagation Materials

JPI: the Joint Programming Initiative aims to ensure that national and European research agendas on a given societal theme are better aligned in order to achieve better research outcomes and better use of budgets

JRC: Joint Research Centre

JTI: Joint Technology Initiative

KET: Key Enabling Technologies

KIC: Knowledge and Innovation Communities, communities in which higher education, research and enterprise in areas facing large societal challenges, such as climate change, ICT and sustainable energy, come together

FP7: Seventh Framework Programme. European research programme with various components that issue calls, including cooperation, people and capacities

LSH: Top Sector Life Sciences and Health

MIT scheme: SME Innovation Stimulus for Top Sectors. Scheme to support SMEs in matching the innovation activities within the Top Sectors

NWO: Netherlands Organisation for Scientific Research

OCW: Ministry of Education, Culture and Science

PPS: public-private partnership

R&D: Research and Development

Roadmap: Under the innovation contracts, the Top Sectors have drawn up roadmaps in which businesses, TO2 institutes, NWO, and relevant departments and scientists at universities set out their joint ambitions

SME: small and medium-sized enterprises

TKI: Top Consortium for Knowledge and Innovation. TKI's combine excellent public-private partnerships with research and innovation by the Top Sectors

TKI allowance: a subsidy for Top Consortia for Knowledge and Innovation. The TKI allowance provides a stimulus for public-private partnership within the TKI programmes by providing a boost for private contributions to the TKI programmes

TO2: Since 2010, TNO, the National Aerospace Laboratory of the Netherlands (NLR), the Energy Research Centre of the Netherlands (ECN), the Maritime Research Institute Netherlands (MARIN) and Deltares have been working together under the flag of TO2

Appendix 1

EXPLANATORY NOTES ON HORIZON 2020 ACTIVITIES.

Instruments within the Framework Programme relating to the funding of research and innovation activities:

- Public-public and public-private partnership projects in consortia made up of knowledge institutions and businesses in multiple countries. This typically includes projects addressing societal challenges and industrial technologies. As in the previous Framework Programmes, in Horizon 2020 this will form the major component. Potential participants submit proposals following publication of a Call for Proposals for a given theme; a *peer review* then takes place to determine the excellence of the proposal, its impact and its correspondence with the challenges in the call; this process results in a winning bid. The EU subsidy will not cover all the costs: participants must share some of the costs *(matching)*.
- *Grants*, often to individual researchers, the most important of which are the grants of the European Research Council (ERC), targeted at excellent scientists, and the Marie Sklodowska-Curie grants to promote international mobility among researchers within knowledge institutions and companies. Here too, the criteria are focused on excellence and impact, and it is expected that the business or research institution where the researcher works will match the grant.

Public-public partnerships in research programming in larger networks:

- ERA-networks: these are primarily focused on partnerships and alignment of research programmes in the member states and, in a number of cases, joint implementation (joint calls for proposals). ERA-nets take a bottom-up approach and participation is supported by Dutch research funders (such as NWO and various ministries). The European Union can support an ERA-net from the FP7 - soon to be Horizon 2020 - budget; this could take the form of a top-up of the budget for a call for proposals that an ERA-work publishes.
- Article 185 initiatives: These are research programmes that are partly financed from the 7th Framework Programme and are followed up with funding from Horizon 2020. The contribution from the Commission is based on co-financing by the member states. The majority of these initiatives originated in the ERA-nets. Of the current initiatives, the only one not supported by the Netherlands is the Baltic Sea Programme. This is a programme with a regional focus and will not be continued in Horizon 2020. The other programmes in Horizon 2020 that are supported by the Netherlands through co-financing are focused on metrology, active and assisted living, a European-African partnership for clinical trails, and Eurostars-2 (an SME innovation programme).
- Joint Programming Initiatives (JPIs): The creation of these was one of the flagships of the design of the European research area. The JPIs are focused on better coordination of the national research programmes and are not directly related to the Framework Programmes in terms of content or budget. As with the ERA-nets, this concerns the research activities of the member states, with a focus on societal challenges. The European Union can support a JPI from the budget for FP7, and soon Horizon 2020; this could take the form of a top-up of the budget for a call for proposals issued by a JPI.

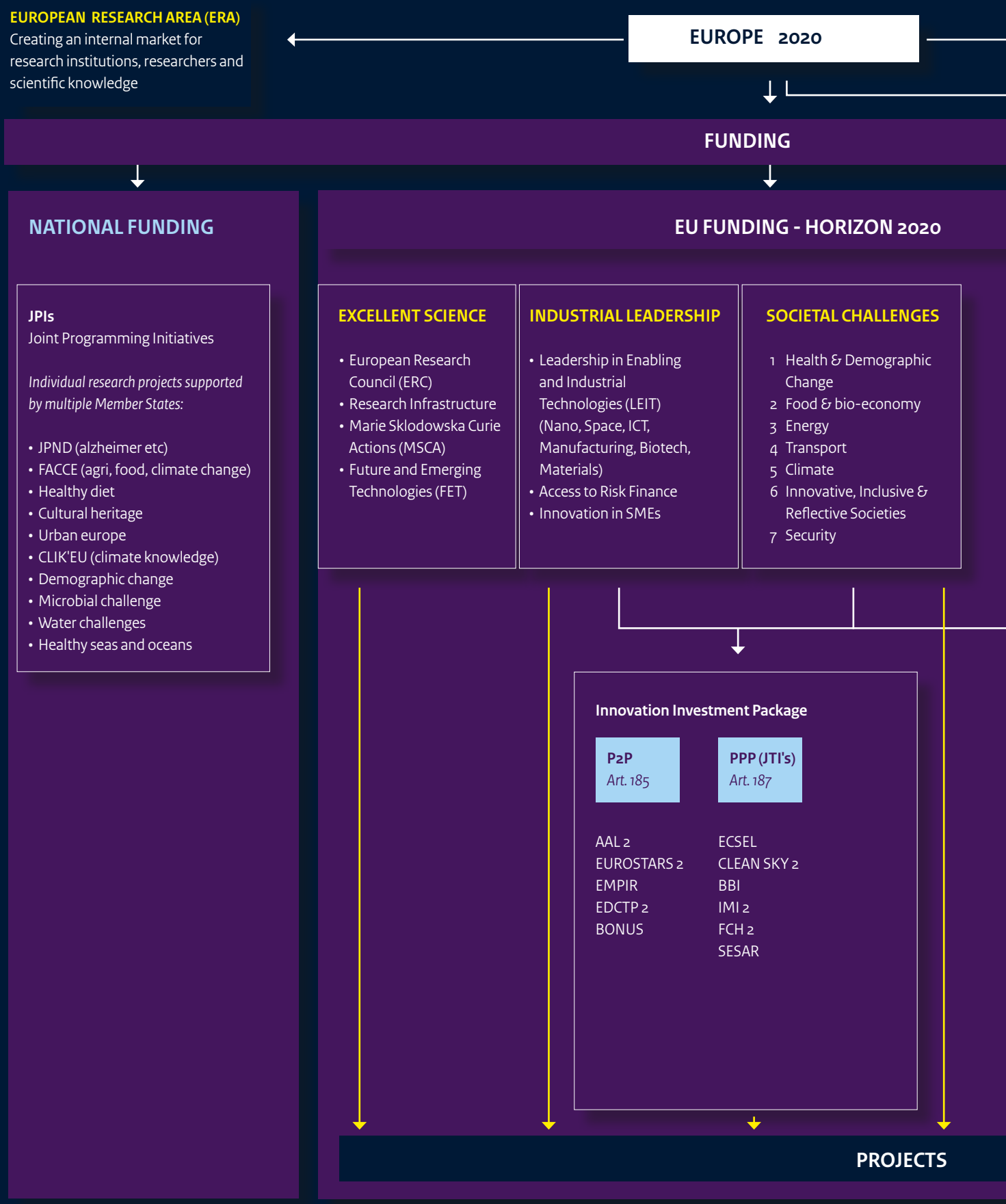
Instruments to promote public-private partnerships in larger networks:

- European Technology Platforms (ETPs): This is a form of partnership between the business community, knowledge institutions and government to formulate research priorities and plans. They provide input for the work programme of the Framework Programme to ensure better alignment with the needs of industry. Participation thus exerts influence on European research programming. In terms of budget, they are not linked to the Framework Programmes. In common with the ERA networks, these platforms take a bottom-up approach and the business community takes a lead role.
- Joint Technology Initiatives (JTIs): These are research programmes, most of which have their origin in an ETP. These programmes are largely financed by the business community and partly from the 7th Framework Programme, and soon from Horizon 2020. In Horizon 2020, there are five JTIs, one of which also requires co-financing by the member states. This is the JTI for nanotechnology and embedded computer systems (ECSEL), which is funded by the Ministry of Economic Affairs.
- Knowledge and Innovation Communities (KICs): For three themes, the European Institute for Innovation and Technology (EIT) has set up a KIC in which research, education and companies come together. The EIT contributes a small part of the cost (20-25%) from the European budget. In the coming seven years, this budget will come from Horizon 2020. The Netherlands has co-locations for all three networks to ensure alignment with smart specialisation strategies at the regional level, which in part receives support from the European Structural Funds. The majority of the budget comes from the participating knowledge institutions and companies.

European Innovation Partnerships (EIPs): actors from the entire innovation system around an over-arching theme are brought together to implement innovative solutions that address societal challenges more quickly. The creation of EIPs is included as an action in the flagship: Innovation Union (2012). Five partnerships have now been established, and the Netherlands is an active participant in all of these.

2 House of Representatives, session year 2013–2014, 22 112, no. 1692

DIAGRAMMATIC REPRESENTATION OF HORIZON 2020



INNOVATION UNION
Creating an innovation-friendly environment within the EU

POLICY

A: AT EU LEVEL

ETP — *Formulating strategic research agendas*

EIP — *(European Innovation Partnership) Roadmaps for innovation*

- Active and healthy ageing
- Raw materials
- Sustainable agriculture
- Water
- Smart cities & communities

B: AT NATIONAL LEVEL

ERA-NET — *Aligning national research agendas*

ESFRI — *Priorities for research infrastructure*

ERIC — *Legal framework for European Research Infrastructures*

EIT

KIC's

Current
- Innoenergy
- ICT Labs
- Climate KIC

From 2014
- Healthy living
- Raw materials

From 2016
- Added value manufacturing
- Food 4 future

From 2018
- Urban Mobility

EURATOM

P2P: public-public partnership
PPP: public-private partnership

Appendix 2

UNIVERSITIES IN HORIZON 2020

Table 3: Relationship between the profiling of universities and the societal challenges in Horizon 2020.

	Health, demographic change, well-being	Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bio-economy	Secure, clean and efficient energy	Smart, green and integrated transport	Climate action, resource efficiency and raw materials	Inclusive, innovative and reflective societies*
Erasmus University Rotterdam	●			●	●	●
Leiden University	●	●	●		●	●
Radboud University	●	●			●	●
University of Groningen	●	●	●		●	●
Tilburg University	●				●	●
Delft University of Technology	●		●	●		
Eindhoven	●		●	●		
University of Technology	●	●	●	●	●	●
Maastricht University	●		●	●	●	●
University of Twente	●	●	●		●	●
Utrecht University	●	●	●	●	●	●
UvA University of Amsterdam	●	●	●	●	●	●
VU University Amsterdam	●	●	●		●	
Wageningen University.						

Source: AWT, 2013, 'Waarde creëren uit maatschappelijke uitdagingen' (Creating value from societal challenges). This table was prepared when the challenge of 'secure societies' was still combined with the challenge of 'inclusive and innovative societies', in line with the original proposal by the European Commission.

Appendix 3

SUPPORT WITH PARTICIPATION IN EUROPEAN PROGRAMMES

Role of the ministries and Netherlands Enterprise Agency

The Ministry of Economic Affairs and the Ministry of Education, Culture and Science work closely together with other ministries to ensure that in the run-up to Horizon 2020 the research themes and other topics, such as SME participation, are formulated in a way that benefits Dutch parties. Netherlands Enterprise Agency provides a stimulus and support for Dutch participants in Horizon 2020, as it did under the Seventh Framework Agreement.

Central government funds the general support to (potential) participants through the set up at Netherlands Enterprise Agency. The support is provided in the form of information, training and advice. Special sessions are also organised in cooperation with the ministries, Top Sectors, NWO, universities and other stakeholders.

Focus groups

Focus groups have been established in the Netherlands for various parts of Horizon 2020. These bring together government, knowledge institutions, the business community and other stakeholders, including patient associations, for instance, in order to discuss the position of the Netherlands when shaping the programmes. This takes place on a larger scale and in a more structured way than in previous Framework Programmes. Civil servants representing the Netherlands in European programme committees, and who are responsible for implementing Horizon 2020, use the focus groups to establish their position, and they work closely with colleagues from other member states.

Activities by knowledge institutions and the business community

Various universities in the Netherlands and larger businesses have their own EU desk or a designated subject matter expert (sometimes based in Brussels) to help their researchers. These desks work closely with a designated section within the Netherlands Enterprise Agency. These institutions and businesses can influence the EU through direct contact with the European Commission or through European umbrella organisations such as EUA (universities), ScienceEurope (NWO), EARTO (large technology institutes united in TO2) and Business Europe (large businesses). Furthermore, the research community in the Netherlands (universities, other third-level institutions, regional education centres (ROCs), NWO, KNAW and TNO) is working together to develop its positioning within European research and innovation policy via Neth-ER, its representation in Brussels, which is in part funded by the Ministry of Education, Culture and Science.

Further information

For more information on Horizon 2020, the support activities of Netherlands Enterprise Agency and the focus groups, please see:

http://english.rvo.nl/subsidies-programmes/horizon-2020-research-and-innovation

Colophon

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