



Science and Technology
Options Assessment

Science and Technology Options Assessment

Annual Report 2013

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WORDS OF APPRECIATION BY VICE-PRESIDENT OLDŘICH VLASÁK

Ladies and Gentlemen,

I would like to use this opportunity to express my deep thanks to the Chairman, members as well as the secretariat of STOA for their devoted work throughout the year 2013.

Let me stress that thanks to my studies at a technical university in Prague and my professional career in a research institute, the topic of research and innovation lies close to my heart. More than that, I personally believe that Europe's future economic growth and jobs will increasingly need to originate from innovation activity. The European knowledge-based economy cannot be just a phrase for us, but a common goal which we need to pursue in case we want to increase European competitiveness.

However, in this respect, Europe still lacks coordination of critical research mass and we have an evident problem to get our excellent research results into the marketplace. All too often, scientists face unnecessary duplications, needless competition over administrative territory and confusing bureaucracy. We have at our disposal limited reserves of capital, talent and tools, and they must work together to simplify and support the process of discovery and innovation across the EU.

For these reasons, the contribution of STOA to the long-term planning and effective support of scientific and technological innovation should be welcomed and hugely appreciated.

Kind regards

Oldřich Vlasák

Vice-President of the European Parliament
STOA Bureau Member



FOREWORD BY THE STOA CHAIRMAN

As Chairman of the STOA Panel for the second half of the 7th legislature, I am pleased to present the STOA Annual Report of 2013 to you.

2013 has been an exciting and important year for STOA. During this year we have completed several major studies which are in connection with some of the main technology-related challenges of our European society. Eco-efficient transport, sustainable management of natural resources with a focus on water and agriculture, and technology options for feeding 10 billion people, were among these. In addition, STOA organised a number of thought-provoking workshops in the European Parliament, which served as important fora for the debate between policy-makers, the research and innovation community and the public in general. Again, themes that can impact European citizens' lives were in focus: brain health and health protection in times of economic crisis, cloud computing, and methanol as a future transport fuel are some examples.

Further, at the occasion of our prime event, the STOA Annual Lecture 2013, we had the honour of having Ismail Serageldin as a keynote speaker. He is the Director of the Library of Alexandria and the former Vice-President of the World Bank responsible for Environmentally and Socially Sustainable Development. This Lecture was dedicated to the challenges of sustainability and how they can be turned to an opportunity for an increasingly globalised economy at a time of crisis.

During this year, STOA continued its solid work towards achieving its mission. New and more customized communication formats were adopted and STOA Panel meetings provided the opportunity for Members of Parliament to be involved in the debate of upcoming and pressing scientific issues.

For the future, STOA will carry on its work to provide Members of the European Parliament with solid, independent, and high-quality deliverables on the major Science & Technology areas affecting Society, in close consideration of the natural policy cycle of the European Parliament, while preserving STOA's anticipatory foresight role.

Finally, I express my gratitude for the excellent cooperation within the STOA Bureau with STOA Vice-Chairmen Paul Rübzig and Malcolm Harbour, as well as EP Vice-President Oldřich Vlasák, whose commitment and determination crucially helped me ensure the fulfilment of my task.

A handwritten signature in black ink that reads "António Correia de Campos". The signature is written in a cursive style and is positioned above a horizontal line.

António Correia de Campos MEP
STOA Chairman

THE STOA BUREAU



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From left to right:

Oldřich VLASÁK, EP Vice-President; Malcolm HARBOUR, Second STOA Vice-Chairman; António F. CORREIA DE CAMPOS, STOA Chairman; Paul RÜBIG, First STOA Vice-Chairman.

CONTENTS

WORDS OF APPRECIATION BY VICE-PRESIDENT OLDŘICH VLASÁK

FOREWORD BY THE STOA CHAIRMAN

EXECUTIVE SUMMARY.....	1
1 STOA, SCIENTIFIC ADVICE AT THE SERVICE OF THE EUROPEAN PARLIAMENT	3
1.1 Mission and activities.....	3
1.2 The STOA Panel.....	4
1.3 The STOA Panel members.....	5
2 STOA AND ECO-EFFICIENT TRANSPORT.....	7
2.1 Eco-efficient transport futures for Europe	7
2.2 Integrated e-ticketing for city based urban transport systems and tourist sites	9
2.3 Methanol: A future transport fuel based on hydrogen and carbon dioxide?	11
3 STOA AND SUSTAINABLE MANAGEMENT OF NATURAL RESOURCES	13
3.1 Sustainable management of natural resources with a focus on water and agriculture	13
3.2 Climate Change 2013: The Physical Science Basis.....	15
3.3 Interactions between climate change & agriculture and between biodiversity & agriculture.....	16
3.4 Plant breeding and innovative agriculture	17
3.5 Options for sustainable food processing	19
3.6 Options for cutting food waste	20
3.7 Recycling agricultural, forestry & food wastes and residues for sustainable bioenergy and biomaterials.....	21
3.8 Options for sustainable food and agriculture in the EU – Synthesis report.....	22
3.9 How to feed the world in 2050?.....	24
4 STOA AND THE E-SOCIETY	26
4.1 Potential and impact of Cloud Computing services and Social Network Websites	26
4.2 Security of eGovernment systems	28
4.3 State-of-the-art of Machine Translation - Current challenges and future opportunities	29
5 STOA AND HEALTH	31
5.1 Strengthening health protection in times of economic Crisis: Increasing the evidence base	31
5.2 What does it mean to have a brain disorder? European Month of the Brain 2013	32
5.3 Risk in innovation: balancing benefits and hazards	33
6 STOA AND SCIENCE & RESEARCH GOVERNANCE	34
6.1 Science Metrics - Measuring scientific performance for improved policy making	34
6.2 European innovation ecosystem for generating value	35
6.3 How to retain leadership in particle physics?	36
6.4 The European landscape of research funding	37
6.5 Financing and assessing large-scale infrastructure projects	37
6.6 Innovation in action.....	38

7	STOA ANNUAL LECTURE 2013: 'SUSTAINING SUSTAINABILITY: MAKING ECONOMICS WORK FOR THE GLOBAL ENVIRONMENT'	39
7.1	'Gross National Happiness Index' versus economic thinking	39
7.2	Large and smaller companies could prosper by working together	40
7.3	New thinking for the transition to a green economy	40
7.4	All resources are finite apart from sunshine, gravity and human ingenuity	40
8	STOA ON THE GLOBAL SCIENCE & TECHNOLOGY SCENE	41
8.1	Internet Governance Forum Conference	41
8.2	BIOVISION, 'The World Life Science Forum'	41
8.3	Visit to the CEA facilities in Grenoble and Chambéry	42
8.4	Council meeting of the STS forum	42
8.5	STOA delegation to the STS forum in Kyoto	43
8.6	STOA attendance at EPTA meetings	43
8.7	STOA at the 9th International Nanotechnology Conference in Berlin	44
9	PRESENTATIONS TO THE STOA PANEL	45
9.1	Assessing the results of science investments	45
9.2	Options for strengthening responsible research and innovation	45
9.3	Science and technology for deep-sea resource use	46
9.4	Exchange of views with the European Commission's High Level Economic Policy Expert Group 'Innovation for Growth'	47
9.5	Presentation & discussion on research collaboration and researcher mobility	47
9.6	STOA and the JRC	48
10	IMPLEMENTATION OF THE STOA EXPERTISE BUDGET	49
10.1	External scientific consultancy for STOA studies and workshops	49
10.2	New STOA framework contract for the provision of scientific consultancy	49
11	STOA TRAINEES	50
12	STOA ADMINISTRATION	51

EXECUTIVE SUMMARY

STOA mainly carries out projects that assess the impact of introducing or promoting new technologies, and identify the best possible options for action, from a technological point of view.

In 2013, STOA continued its activities on the main topics of:

- Eco-efficient transport;
- Sustainable management of natural resources;
- Security of the Internet, including e-Government, cloud computing and social networks;
- Health;
- Science policy.

Some major projects of this legislature have been completed, such as:

- Eco-efficient transport futures for Europe;
- Potential and Impact of Cloud Computing and Social Network Websites;
- The series of studies under the umbrella of 'Technology options for feeding 10 billion people', which was closed with the workshop 'How to feed the world in 2050?'

Most of the reports published in 2013 were accompanied not only by a four-page Options Brief, but also by a twenty-page Layman's Summary, in order to make the findings more accessible.

Besides presentations of the study outcomes to the STOA Panel, in relevant Committee meetings and at public workshops in the European Parliament, some ad-hoc workshops were organised, which attracted a wide audience. Examples of these are:

- A dialogue in the Parliament on the IPCC¹ report on the physical basis of climate change;
- State-of-the-art of Machine Translation: current challenges and future opportunities;
- Strengthening health protection in times of economic crisis;
- What does it mean to have a brain disorder? European Month of the Brain 2013;
- The European landscape of research funding.

The STOA Annual Lecture in 2013 on the theme of 'Sustaining Sustainability: Making economics work for the global environment' was dedicated to the challenges of sustainability and how they can be turned into an opportunity for an increasingly globalised economy at a time of crisis. The keynote speakers included Ismail Serageldin, Director of the Library of Alexandria, former Vice-President of the World Bank responsible for Environmentally and Socially Sustainable Development, Monika Kircher, CEO of Infineon Technologies Austria AG, and Hans Bruyninckx, Executive Director of the European Environment Agency (EEA).

Further, a number of STOA delegation visits took place, amongst others to the CEA (French Alternative Energies and Atomic Energy Commission) facilities in France and the Science and Technology in Society (STS) *forum* in Kyoto (Japan).

¹ Intergovernmental Panel on Climate Change

1 STOA, SCIENTIFIC ADVICE AT THE SERVICE OF THE EUROPEAN PARLIAMENT

1.1 Mission and activities

STOA stands for Science and Technology Options Assessment. It is an official body of the European Parliament, launched in 1987. STOA's mission is to ensure that European policy-making is supported by sound scientific evidence on strategic issues that the European society faces. Scientific evidence and advice are often needed to underpin decision-making, as increasingly developments in science and technology have potential implications across many policy areas, and thereby across the full spectrum of European society. When the Members of the European Parliament consider that it would be helpful in their policy-making role to seek out expert, independent assessments of the various scientific or technological options in the policy sectors concerned, then STOA is at their disposal.

STOA's activities mainly concentrate on strategic topics and societal challenges, such as:

- Future energy and transport scenarios;
- Sustainable society, covering for instance food security and sustainable agriculture;
- Developments in information and communication technologies, including ethical implications of social media and e-democracy;
- Future prospects in health and life improvements.

STOA fulfils its mission primarily by carrying out - in a neutral and independent way - science-based projects assessing the widest possible range of options to support legislators.

STOA's long, strategic and interdisciplinary record of projects shows its contribution to a wide range of research and policy areas, including but not limited to, nanosafety, e-Democracy, bio-engineering, health, transport, cloud computing, innovation, smart energy grids, climate change and sustainable agriculture. An average STOA project investigates policy options with respect to the promotion and deployment of existing and emerging technologies in a specific policy area, and assesses the impacts of these options. This ensures that MEPs are provided with state-of-the-art knowledge to reflect upon when carrying out their policy-making roles as elected co-legislators of the European Union (EU). Of course, the Members also take into account a variety of other factors when they make up their minds, such as their individual political and ethical points of view.

The projects are carried out in partnership with external experts under strict contractual agreements, in order to provide state-of-the-art and objective opinions for Members of the European Parliament. These can be research institutes, universities, laboratories, consultancies or individual researchers. All STOA studies are available for everyone who is interested, thus encouraging an open dialogue between citizens and legislators, and creating added value for studies by spreading the information to the wider public. The studies can be downloaded from the STOA website.

STOA's activities also aim at bridging the gap between the scientific community and policy-makers. This is done by stimulating dialogue and discussion forums, especially in the form of workshops. STOA organises an increasing number of accessible workshops on a wide range of topics of political interest. All these events are open to the public and their outcomes are posted on the STOA website.

The STOA Annual Lecture is the high point of STOA's activities every year and gives an opportunity to Members of the European Parliament, officials, scientists and the wider public to listen to eminent scientists – often Nobel Prize laureates – speaking about subjects featuring high on the political agenda: climate change, sustainability, the Information Society, advances in medical research, but also major discoveries in fundamental science.

A special way of enhancing mutual understanding between scientists and policy-makers is via the MEP-Scientist Pairing Scheme, which aims at a long-term, intensive cooperation between Members and experts. This scheme has a two-fold effect:

- Firstly, policy-makers gain a deeper understanding of the scientific processes, the practicalities of undertaking research and the potential of scientific knowledge;
- Secondly, practising scientists learn about the role of science in policy-making, the policy-making process itself and how to interact effectively with politicians.

STOA is finally active in Technology Assessment networks on an international level. It is a founding member of the European Parliamentary Technology Assessment network (EPTA), and maintains strong connections and actively cooperates with European institutions and organisations, including notably the European Commission's Joint Research Centre (JRC) and DG Research and Innovation. On a global level, STOA has strong links with the EuroScience Open Forum (ESOF), the STS (Science and Technology in Society) *forum* and the World Science Forum.

1.2 The STOA Panel

The STOA Panel is politically responsible for STOA's work. It is composed of 15 Members of the European Parliament:

- the Vice-President of the European Parliament responsible for STOA;
- four members appointed by the Committee on Industry, Research and Energy (ITRE);
- two members appointed by the Committee on Employment and Social Affairs (EMPL);
- two members appointed by the Committee on the Environment, Public Health and Food Safety (ENVI);
- two members appointed by the committee on the Internal Market and Consumer Protection (IMCO);
- two members appointed by the Committee on Transport and Tourism (TRAN);
- two members appointed by the Committee on Agriculture and Rural Development (AGRI).

The members of the STOA Panel are appointed at the beginning of each parliamentary term for a renewable two-and-a-half-year period. A constituent meeting is held at the beginning and the middle of each parliamentary term, in which the Chair and two Vice-Chairs are elected by the Panel members.

The STOA Bureau runs the activities of STOA and prepares the Panel meetings. It is composed of four members, namely the EP Vice-President responsible for STOA, the STOA Chair and the two Vice-Chairs.

In January 2012, Mr Vlasák replaced Mr Chichester as the EP Vice-President responsible for STOA. In March 2012 the STOA Panel members elected the rest of the members of the STOA Bureau. Mr Correia de Campos, former first STOA Vice-Chairman took over the chairmanship from Mr Rübig, who became the first STOA Vice-Chairman. Mr Harbour remained the second STOA Vice-Chairman.

The STOA Secretariat executes the decisions of the STOA Panel with the assistance of external experts and trainees (more details on this in Chapters 11 and 12).

1.3 The STOA Panel members



Oldřich VLASÁK - *ECR, CZ*
EP Vice-President
STOA Bureau member



António F. CORREIA DE CAMPOS - *S&D, PT*
Chairman
STOA Bureau member
IMCO Committee (Internal Market and Consumer Protection)



Paul RÜBIG - *EPP, AT*
1st Vice-Chairman
STOA Bureau member
ITRE Committee (Industry, Research and Energy)



Malcolm HARBOUR - *ECR, UK*
2nd Vice-Chairman
STOA Bureau member
IMCO Committee (Internal Market and Consumer Protection)



Antonio CANCIAN - *EPP, IT*
TRAN Committee (Transport and Tourism)



Regina BASTOS - *EPP, PT*
EMPL Committee (Employment and Social Affairs)



Kent JOHANSSON - *ALDE, SE*
ITRE Committee (Industry, Research and Energy)



Evžen TOŠENOVSKÝ - ECR, CZ
ITRE Committee (Industry, Research and Energy)



Giovanni LA VIA - EPP, IT
AGRI Committee (Agriculture and Rural Development)



Antigoni PAPADOPOULOU - S&D, CY
EMPL Committee (Employment and Social Affairs)



Vittorio PRODI - S&D, IT
ENVI Committee (Environment, Public Health and Food Safety)



Teresa RIERA MADURELL - S&D, ES
ITRE Committee (Industry, Research and Energy)



Csaba Sándor TABAJDI - S&D, HU
AGRI Committee (Agriculture and Rural Development)



Salvatore TATARELLA - EPP, IT
ENVI Committee (Environment, Public Health and Food Safety)



Silvia Adriana ȚICĂU - S&D, RO
TRAN Committee (Transport and Tourism)

2 STOA AND ECO-EFFICIENT TRANSPORT

The studies carried out by STOA in the field of transport are of potential interest for the European Parliament's Committees on Transport and Tourism (TRAN), Industry, Research and Energy (ITRE), and Internal Market and Consumer Protection (IMCO) through the following areas they cover: technology considerations; economic considerations; end-user behaviour and perceptions; influence of key stakeholders, such as car manufacturers or public authorities; and policy options for promoting the opportunities identified.

2.1 Eco-efficient transport futures for Europe

The STOA study on eco-efficient transport ran from January 2011 to April 2013. The Lead Panel Members were Malcolm Harbour MEP and Silvia Adriana Țicău MEP.

Transport - a complex system

Transport is a complex system, which is triggered by various kinds of demand, different preferences and different interests, with interdependencies between internal and external factors. Given this complexity, it is crucial to assess approaches to eco-efficiency in a broader context: a systemic perspective is required. Therefore, a set of scenarios on eco-efficient transport futures has been developed and combined with a stakeholder consultation to better assess the feasibility and desirability of different pathways towards eco-efficient transport.

For this project, it was assumed that eco-efficient transport encompasses all approaches that help to reduce the ecological footprint of transport-related activities. The point of reference is the amount of resources needed to fulfil a certain purpose (e.g. work, social contacts, production or purchase of a good). The general quality of life and the economic wealth of the EU should explicitly not be reduced.



Focus on road, rail, and waterborne transport

The focus of the project lay on road, rail and waterborne transport (excluding aviation). Carried out with the transport model ASTRA², scenario building was used to quantitatively simulate potential effects of different concepts, technologies and policy strategies.

All three scenarios examined were embedded into a basic set of general assumptions, explicitly assuming high rates of innovation, technological change, and diffusion in society. At the same time, scenarios were kept as simple and transparent as possible. Each of the scenarios focused on one of the following three basic strategies to achieve eco-efficiency:

Scenario I: Making transport modes cleaner

In this scenario, the same modes as today are employed for users and goods. Policy orientation is focused on research and development (R&D), regulation, and incentives to reach a fast and far-reaching market penetration of cleaner technologies (such as alternative fuels and propulsion technologies). Users do not necessarily change their mobility patterns.

² ASTRA (ASsessment of TRAnsport Strategies) is an integrated assessment model applied since more than 10 years for strategic policy assessment in the transport and energy field. www.astra-model.eu/

Scenario II: Changing the modal split

This scenario induces a shift to other transport modes for users and goods, while origins and destinations remain the same. The main technological changes are in infrastructure, encouraged by a policy orientation towards infrastructure investment and Information and Communication Technologies (ICT).

Scenario III: Reducing growth rates in transport demand

This scenario aims at avoiding or reducing the need for physical transport. The origins and destinations of passengers and goods change. One important trigger is a very high oil price (\$ 300 per barrel). The main technological driver is ICT. The policy fosters virtual mobility and eco-efficient land-use planning. Logistics are significantly improved.

Debate at the European Parliament

The final results of the STOA project 'Eco-efficient Transport Futures for Europe' were presented and discussed, and policy priorities were identified at a lunch debate held on 7 May 2013 at the European Parliament in Brussels. It was widely acknowledged that a transition to a more eco-efficient transport system is needed to cope with current challenges and the expected future developments in the transport sector. However, views differed on what desirable and feasible pathways to achieve this transformation of the transport sector should look like.

Key findings

A key finding of the project is that the assessment of the potential eco-efficiency of different approaches needs a broader and systemic perspective. Corresponding policies should not be decided in isolation. Policy packages are usually needed to cope with systemic impacts of measures. Accordingly, instead of single measures, a number of key areas were identified by the project team, based on the scenarios and the stakeholder consultation.

The following key areas are regarded as being crucial for a transition to a more eco-efficient transport system:

- Energy system,
- Cleaner cars,
- Cleaner trucks,
- Smart logistics,
- Automation,
- Integrated ticketing,
- Access instead of ownership,
- Shift to rail,
- Shift to short sea and inland shipping,
- Awareness of / making use of habit and attitude changes,
- Urban design,
- Mobility pricing.

Policy options

Based on the findings of the project, a series of policy conclusions can be drawn that are considered promising:

- Enabling progress in fuels and propulsion technologies,
- Enabling progress in ICT,
- Applying a broader systemic perspective,
- Enabling new mobility concepts,
- Considering non-technical factors,
- Considering land-use planning,
- Understanding end-users,
- Applying integrated strategies,
- Understanding new and emerging technologies.

2.2 *Integrated e-ticketing for city based urban transport systems and tourist sites*

The Lead Panel Member for this project, which ran from January 2013 to January 2014, was Antonio Cancian MEP. The study was presented to the STOA Panel during its meeting on 10 October 2013.

Combining several modes of transport on a single ticket

An important strategy to overcome the imbalance in the mode share of individual transport compared to collective transport is the development of an integrated multimodal transport system. The overarching idea of such a system is to combine all modes on a single ticket and establish interoperable fare management. Integrated ticketing for public transport has been on the agenda of EU transport policy for over a decade now. And indeed there has been increasing development of smart ticketing schemes over the past years, especially in big cities, but so far existing schemes remained relatively small and mutual acceptance is not possible. Consequently, the Transport White Paper from 2011³ proposes to “establish a framework for a European multimodal transport information, management and payment system by 2020”.

Various actors with diverging interests

Integrated ticketing schemes aim at facilitating the combination of modes and the transfer between them. Moreover, e-ticketing could be extended to major entertainment and tourist sites and thus facilitate access to major points of interest within cities, making e-ticketing specifically interesting for travellers and the tourism industry. However, a large number of stakeholders with partly diverging interests are involved in the implementation process: financial service providers, telecommunications operators, public transport authorities, and the tourism sector. Furthermore, the operation of schemes is determined by the preferences of existing and potential end-users.

Societal demand for e-ticketing

There seems to be a considerable demand, and thus a potential for integrated e-ticketing in Europe. According to the Flash Eurobarometer 312⁴, one in two citizens of the EU-27 would use public transport more often if a single ticket for all means of transport were available. Of course, this number cannot be taken for granted, as the question was hypothetical and responses are therefore likely to be upward-biased. Still, it shows the positive attitude Europeans have towards integrated

³ European Commission, White paper ‘Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system’, COM(2011) 144, 28.3.2011.

⁴ European Commission, March 2011, Flash Eurobarometer 312, ‘Future of Transport’.

ticketing solutions. The results show that a large majority of the survey respondents see a very high degree of desirability in setting up an interoperable electronic ticketing application for public transport.

Studies on peoples' perceptions of public transport show that some aspects perceived negatively by car drivers could be targeted by integrated ticketing solutions (convenience and pricing) and could help to make car drivers try out public transport. Still, additional service improvements would be necessary to actually sustain modal shift. The socio-economic perspective of the study reveals that particularly tourists would profit from integrated ticketing schemes, as they usually seek for local experiences. Public transport can be a part of this experience, especially in urban contexts.

A complex process involving a broad spectrum of stakeholders

The study emphasises that the implementation of an integrated e-ticketing system is a complex process that requires the synchronised activity of heterogeneous actors. Public transport operators and authorities, financial service providers, telecommunications operators, and the tourism sector need to work together to combine their products on a single card. Besides technological characteristics, legal and economic aspects play a decisive role. Stakeholders that are involved in the implementation of an integrated ticketing system need to agree on technical specifications as well as on institutional and governance issues. For the purposes of this study, other relevant studies, reports and surveys have been reviewed in order to provide an overview on technical and non-technical aspects on the e-ticketing environment. Such an integrated perspective is needed to understand and govern successful pathways towards integrated e-ticketing schemes. The report focuses on the interrelations between different stakeholders and on the factors that might influence their decision to engage in the implementation process, and it explains the role of each actor in the system architecture. A particular focus is placed on potential and existing end-users.

E-ticketing discussed at the European Parliament

A workshop, held on 16 October 2013 and chaired by Antonio Cancian, aimed to present a comprehensive picture of integrated e-ticketing solutions that combine public transport and touristic features and to discuss the potential of integrated e-ticketing for both sectors. There was a focus on the different actors that are important for a successful implementation and their views on future developments. Presentations included interim results of the on-going STOA project, as well as an assessment of the actual state-of-the art by representatives and scientists from the transport and tourism sector.

Policy conclusions

Experiences with integrated e-ticketing systems prove that implementation requires great efforts, since many stakeholders need to agree on standards, overall arrangements, interfaces and designs, general purpose, and revenue sharing. This is a difficult task in multi-actor contexts, and including further stakeholders in an environment that is already very difficult to govern does not necessarily simplify the implementation process. Each of the stakeholders has a different role to play, and for each of them, drivers or restraints apply in the decision to participate in the process or not. The case studies treated in the project show that the context of implementation differs across different cities and regions. The exact nature of stakeholder arrangements, as well as the geographic, socio-economic and technical preconditions, are not transferrable from one case to the other.

A one-size-fits-all solution does not seem desirable and feasible. Instead, a user interface is needed that is compatible with other applications, but takes into account the diversity of contexts. It should offer different payment options, include local fare policies, respect data privacy requirements, and should be open to further development.

2.3 Methanol: A future transport fuel based on hydrogen and carbon dioxide?

The Lead Panel Member for this study, which ran from October 2012 to February 2014, was Csaba Tabajdi MEP. The study will be published around the same time as the release of this Annual Report.

Methanol as an alternative transport fuel?

The outcomes of this study indicate that the wide-spread use of methanol in Europe would have to be based on CO₂ as a primary energy source, since secure access to fossil fuel reserves, such as coal or gas, at affordable prices is not necessarily guaranteed. The main challenge therefore consists in developing efficient processes for capturing CO₂ and turning it into methanol, preferably without the need for adding hydrogen by hydrogenation. Although hydrogenation is presently the preferred option for this process, it is not an optimal solution, as additional energy input is required and renewable sources are not likely to meet this additional demand for transport purposes. Attention should therefore be paid to alternative processes for directly converting CO₂ into methanol, but those processes are in the phase of early research and require, for the moment, scarce catalyst materials.

Questions affecting the potential use of methanol as a future transport fuel

Several questions affect the potential use of methanol as a future transport fuel:

- How will CO₂ emissions evolve over time and will there be a sustainable supply of CO₂ for conversion into methanol in the longer-term future?
- Will the new technologies used for capturing CO₂ and turning it into methanol increase their energy efficiency balance to make them economically viable?
- What will happen in relation to transport infrastructure?
- What uncertainties will remain on the price of CO₂ emission allowances in the long-term?
- What will be the basis of competition for access to CO₂ storage sites?

It is also important to note that the supply of water as a hydrogen source and renewable energy sources remain the most essential factors for methanol production from CO₂.

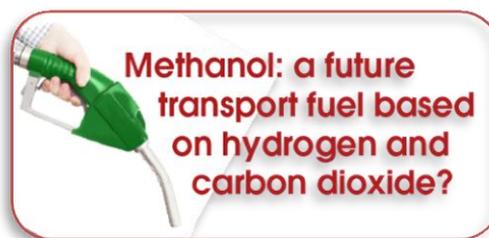
Interim findings debated with stakeholders

A working meeting on methanol as a possible future transport fuel was held on 17 October 2013 at the European Parliament in Brussels, in order to debate the interim findings of the study. The event was chaired by STOA Vice-Chairman Paul Rübzig.

The participants comprised the authors of the study as well as more than 20 representatives from the car and energy industries, the academic world, and national and international policy-making organisations.

The workshop stimulated discussion between the participating experts in order to:

- evaluate the technical and economic feasibility of the development of an economy based on the use of methanol instead of oil;
- develop policy recommendations based on strong scientific, technical and economic considerations.



The authors of the study presented the state-of-the-art of methanol production and use, with particular emphasis on the technical and economic aspects of methanol production from CO₂.

The participating experts openly discussed the main issues arising from this analysis from their respective perspectives and interests. The workshop made it possible to identify what were, for the different stakeholders, the main obstacles blocking the long-term increase in the use of methanol for fuel transport and energy storage purposes, as well as, in this context, what were the most promising areas of development.

Some obstacles to success

- Even though there is a consensus on the need for decarbonising the European transport system and substituting other solutions for fossil fuels, it is not yet clear which of the potential substitutes (hydrogen, methanol, biofuels, electric or hybrid vehicles) will eventually perform better, considering the entire economic and environmental life-cycle. All options still face serious barriers, in terms of limited feedstock, use of scarce materials or inefficient energy use.
- The overall efficiency of the different alternatives depends on technological progress in the field of CO₂ capture and conversion, hydrogen production and transport, limiting the costs of changes to the distribution chain and the performance of new powertrain technologies.
- The use of CO₂ as feedstock is attractive, as this would help to bring down overall emissions thanks to recycling, but the long-term availability has to be secured, as other potential uses of CO₂ increase in the context of the bio-economy.

3 STOA AND SUSTAINABLE MANAGEMENT OF NATURAL RESOURCES

During this year, STOA's activities put great emphasis on the sustainable management of natural resources, climate change and food security.

Thus, STOA hosted an open discussion in the European Parliament on the Intergovernmental Panel on Climate Change (IPCC) report on the science base of climate change on 5 November 2013.

Also this year, the STOA study 'Sustainable management of natural resources, with a focus on water and agriculture' was completed and discussed with Members, stakeholders and the wider public in the context of a workshop that took place on 16 October 2013 in the European Parliament in Brussels. In addition to this, it was also presented to the ENVI Committee of the European Parliament.

Further, the main emphasis for the theme of sustainability was on the strategic STOA project 'Technology options for feeding 10 billion people'. This project was treated with a trans-disciplinary approach. The project was divided into five different studies, which were accompanied by a synthesis report that brought the five studies together, to show their interconnecting effects on each other and on the overall theme of technology options for feeding 10 billion people. The synthesis report, entitled 'Options for sustainable food and agriculture in the EU', acted as the basis for a workshop held in the European Parliament that concluded the project.

The studies described in this chapter have also been presented to and discussed with the STOA Panel, and some of them were presented to the AGRI and ENVI Committee.

3.1 Sustainable management of natural resources with a focus on water and agriculture

This STOA study was launched in August 2011 and published in May 2013. The Lead Panel Member was Csaba Tabajdi. The study was discussed during the STOA Panel meeting in May 2013.

The purpose of the study was to provide an overview of issues in the management of water as a natural resource in the EU and to recommend policy options. Over 40 % of Europe's total area is under agricultural use; therefore land management is critically important for maintaining natural resources, including water. This study focused specifically on agriculture and rural development. It covered three areas: (i) sustainable water use and water efficiency, (ii) agricultural land management with soil and water benefits, and (iii) the Common Agricultural Policy (CAP) measures to address sustainable management of water resources.

Both water quality and water quantity are important

Water resources are essential for all sectors of the European economy, particularly for agriculture. Water is a key natural resource targeted within the resource efficiency policy of the EU, as well as within the global policy frameworks of the United Nations (UN). Both water quality and quantity play an important role in the sustainable management of this natural resource. Climate change is expected to exacerbate existing pressures on water, such as more frequent and more severe droughts and floods, affecting agricultural soils, and requiring adaptation by water users, farms, regions



and Member States. This study therefore provides an overview of issues in the management of water as a natural resource in the EU and the management of natural resources linked to EU agriculture, and identifies policy options to address these issues.

Water efficiency is an issue for all sectors

The study concluded that a major change is needed in approaches to water use and water efficiency in all sectors, and in approaches to sustainable soil and water management in agriculture, to meet EU targets for good water conservation status. Depending on the level of environmental benefits provided, the technologies and practices could represent a mere compliance with the 'polluter pays' principle, could ensure a private good through maintaining soil productivity or water efficiency to businesses and farms, or could provide significant water and soil benefits that represent valuable public goods.

Priorities for water management

Six key areas for improvement have been identified, for which policy options were formulated:

- The legislative framework currently in place to protect Europe's waters needs to be implemented fully and effectively, as well as adequately enforced.
- Water priorities that have been articulated at the EU level need to be more fully integrated and well implemented within the sectoral policies at EU, national and regional levels.
- Water losses should be reduced and water savings and efficiency should be increased, in particular in agriculture and water scarce areas.
- Land and soil management approaches aimed at combating soil erosion, preventing loss of soil organic matter, sequestering soil carbon and improving water retention are critical for long-term sustainability of farming and healthy ecosystems. The CAP should play a role in promoting these approaches, but farmers and national and regional administrations should also initiate action.
- The CAP and other EU funds allocated to water priorities should be used in an efficient and effective way.
- Improved data and decision support tools relating to water and soils are essential for making informed decisions that support sustainable management of water and soil.

Debate in the European Parliament

Besides presentations of the findings to the ENVI Committee and the STOA Panel, on 16 October 2013 STOA organised a workshop to debate the outcomes of the STOA study 'Sustainable Management of Natural Resources with a focus on water and agriculture' with the participation of relevant stakeholders. This event was chaired by Paul Rübzig, MEP and first STOA Vice-Chairman.

The invited stakeholders highlighted topics of importance, and, based on these issues, formulated recommendations, to further improve water management and water policy at EU level. Based on the discussion with the Panel members and the audience, the expert panel formulated recommendations for further improving water management and water policy at EU level.

Every drop counts

In particular, the workshop noted:

- The alarming situation regarding 'water scarcity';
- The necessity (and the benefits) of introducing water partnerships to take collective action to improve water efficiency;

- The introduction of a Stewardship Scheme by the European Water Partnership (EWP)⁵;
- The ability of farmers to increase efficiency by using precision agriculture;
- The importance of educating young people in school, and how ‘training’ and ‘knowledge transfer’ can help farmers to increase resource efficiency;
- The need to change habits linked to our lifestyle, in order to reduce water consumption;
- The need to analyse the production and the consumption side of achieving resource efficiency in the food chain.

3.2 Climate Change 2013: The Physical Science Basis

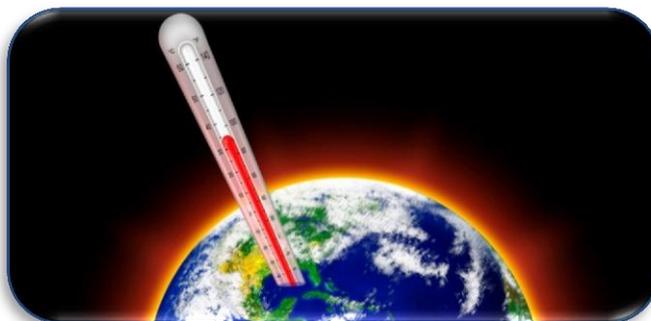
IPCC WG I Fifth Assessment Report

STOA hosted this workshop on 5 November 2013, as a side event of the International Conference of Regional Climate, to give Members and the general public the opportunity to debate the findings of the IPCC's Working Group I's Fifth Assessment Report (AR5) with some of its authors.

On behalf of STOA, Vittorio Prodi, MEP and STOA Panel member, gave a welcoming word.

IPCC: scientific assessment of climate change, its impacts and options for adaptation and mitigation

The Intergovernmental Panel on Climate Change (IPCC) is a scientific intergovernmental body, set up at the request of member governments. The IPCC produces reports that support the United Nations Framework Convention on Climate Change (UNFCCC), which is the main international treaty on climate change. The ultimate objective of the UNFCCC is to stabilize greenhouse gas concentrations in the atmosphere at a



level that would prevent dangerous anthropogenic interference with the climate system. IPCC reports cover the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation. IPCC reports contain a ‘Summary for policy-makers’, which is subject to line-by-line approval by delegates from all participating governments.

Human influence on the climate system is clear

During this workshop, which STOA co-hosted with DG Research of the European Commission and the IPCC, Gian-Kasper Plattner of the IPCC, the author of the ‘Summary for policy-makers’ of the Working Group report on ‘Climate Change 2013: The Physical Science Basis’, presented the main findings, namely that climate change is “unequivocal” and that “human influence on the climate system is clear”.

⁵ The EWP harnesses European capacity, helps to coordinate initiatives and activities in international water issues and undertakes worldwide promotion of European expertise related to water.

Climate change will have an impact on society

The presentation was followed by a lively debate between the audience and some of the authors of the IPCC's WG I AR5. Two recurring themes emerged thanks to some stimulating questions from the audience, notably how climate change impacts on society and the issue of sea level rise. The debate focused on a range of issues, including differences in climate change now compared to previous periods in history, and the perceived lack of communication among the scientific community on how to explain the science of climate change.

IPPC's on-going reports

The other two IPCC Fifth Assessment Working Group Reports and the overall IPCC Synthesis Report will be completed in 2014, according to the following timetable: The report of Working Group II, on Impacts, Adaptation and Vulnerability is expected to be released on 29 March 2014, followed by the report of Working Group III, on Mitigation of Climate Change on 11 April 2014. Finally, the synthesis report is expected to be released on 31 October 2014. This might be the occasion for STOA to organise a new debate in the European Parliament.

3.3 Interactions between climate change & agriculture and between biodiversity & agriculture



This study, framed into the wider STOA project 'Technology options for feeding 10 billion people', was launched in September 2012 and published in September 2013. The Lead Panel Members were Vittorio Prodi MEP and Giovanni La Via MEP. Firm conclusions were drawn, despite the complex nature of the subject. The study was presented to the STOA Panel in September 2013.

Agricultural intensification above all should be sustainable

The interrelated challenges of climate change and biodiversity loss lead to the conclusion that, if agricultural production is to be increased through intensification, then this must be achieved sustainably, taking into account climate and biodiversity needs in the EU and elsewhere. The term 'sustainable intensification' has been coined to describe this twin challenge of increasing the productivity of agricultural land to produce more food and more environmental services in the face of a changing climate. Substantial changes in agricultural systems are required in Europe in order to reduce the existing environmental deficit, as well as deal with new pressures, such as those associated with climate change. Changes in consumption patterns (particularly decreases in meat consumption) and a greater effort over time to reduce food wastage are also necessary.

Need for more research

EU policies, including the CAP and the European Innovation Partnership (EIP) on agricultural productivity and sustainability⁶, have key roles to play in increasing the scope, pace and

⁶ The agricultural European Innovation Partnership (EIP-AGRI) is one of the EIPs in different sectors under the 'Europe 2020' Strategy to advance EU research and innovation. It works to foster competitive and sustainable farming and forestry that 'achieves more and better from less'. It contributes to ensuring a steady supply of food, feed and biomaterials, developing its work in harmony with the essential natural resources on which farming depends. <http://ec.europa.eu/agriculture/eip/>

effectiveness of actions. Such actions should include incentives for climate resilient and biodiversity-friendly farmland management, the effective use of policy instruments, including regulations, to avoid unsustainable practices and protect important ecosystems and their biodiversity, and funding to stimulate research and adoption of innovative management options.

Options for facilitating agriculture-related climate change adaptation & mitigation and biodiversity conservation

The study resulted in a series of recommended priority options for sustainably increasing agricultural productivity, whilst supporting key actions to facilitate agriculture-related climate change adaptation and mitigation and biodiversity conservation. These are based on a review of the implications of the interrelationships between climate change and agriculture, and between agriculture and biodiversity. They further take into account the potential for using a range of innovative options to increase agricultural productivity on a sustainable basis, and are grouped in the following themes:

- Options for providing appropriate incentives for climate resilient and biodiversity-friendly farm management;
- Options for constraining unsustainable practices in Europe;
- Innovative options for a productive climate resilient agriculture that benefits biodiversity, whilst ensuring environmental safeguards for new technologies;
- Options to reduce the negative external impacts of European agriculture and biofuel imports;

3.4 Plant breeding and innovative agriculture

This study, framed into the wider STOA project ‘Technology options for feeding 10 billion people’, was launched in September 2012 and published in October 2013. Lead Panel members were Vittorio Prodi and Giovanni La Via. The study findings were discussed during the STOA Panel meeting of October 2013.

The objective of this study was to analyse how farming management concepts, practices and technologies, including plant breeding technologies, could enable sustainable intensification of crop production, with the aim to increase food production and support food security. The focus was on three central issues:



- Reducing the yield gap – sustainable intensification and improving crop management;
- Increasing the yield potential – plant breeding;
- Reducing crop losses – improving harvest and post-harvest procedures.

Sustainable intensification and improving crop management: Reducing the yield gap

Many regions worldwide show large yield gaps, which is the difference between yield potential and average farmers’ yields. Under changing environmental conditions, three objectives of improved crop production are important:

- Higher production by better exploring the (genetic) yield potential;

- Better input use by higher production efficiency;
- Increasing the site-specific yield potential by improved land productivity.

Sustainable intensification means producing more food from the same area of land, while reducing the environmental impacts, under socially and economically beneficial conditions.

Despite all differences between the crop production systems, some important trends in the frame of sustainable intensification could be identified:

- Increasing differentiation of crop management;
- Higher complexity of management concepts;
- Agriculture is becoming more knowledge-intensive;
- Shift to system approaches;
- Mainstreaming of agro-ecological approaches;
- Combination of bottom-up and top-down approaches.

Plant breeding: Increasing the yield potential

In the past, plant breeding made, by enabling higher yields, a major contribution to better food supply and to the fact that the increasing crop production mostly took place on already cultivated land. This part of the study gives an overview of the development of plant breeding as an applied science, the fundamental background of inheritance, the conventional plant breeding methodologies and the state-of-the-art of new approaches. In the last decade, the knowledge about the genetic background of inheritance of diverse traits for agronomically important crop has increased remarkably.

Plant breeding is confronted with a multiplicity of sophisticated breeding goals. They can be summarised by three main goals that have to be achieved for crop improvement:

- Increasing yield potential;
- Safeguarding yield;
- Quality of products.

Every plant breeding approach follows three general steps, including:

- Creation of a new initial genetic variation;
- Selection of suitable genotypes for creating new varieties;
- Testing, maintenance and reproduction of a variety.

The study concludes that modern breeding technologies open new possibilities for creating genetic variation and improving selection, but conventional breeding technologies will remain important. It lists a series of options for strengthening the plant breeding progress.

Reducing crop losses

Harvest and post-harvest losses are an important issue on the global level. In this study, food losses until the farm gate were examined, including handling at harvest and post-harvest level, storage, transport and distribution by farmers.

The study concludes that, for reducing crop losses (particularly in developing and transition countries), awareness among farmers and the other actors in the food supply chain should be

increased. Long-term strategies should be established by international bodies, national and regional authorities, as well as non-governmental donor organisations. Strategies should be tailored to their nature and causes, to the affected crops and to beneficiaries and their socio-economic characteristics.

Research on pests and diseases is required to reduce crop losses

Private and public R&D should focus on selection of cultivars resistant or less susceptible to pests, biopesticides (particularly against fungal-pest-producing mycotoxins), and small-scale technical equipment.

Necessity of exchange of good practices among farmers

Other important points are the provision of methodological guidelines and training on good practices, and the exchange of experience among farmers and information flows along food supply chains as essential elements of crop loss programmes.

3.5 Options for sustainable food processing

This study, framed into the wider STOA project ‘Technology options for feeding 10 billion people’, aimed at the publication of a state-of-the-art report on technologies for sustainable food processing.

Promising innovations in food processing

Innovations in food processing techniques can significantly contribute to meeting the needs of the future 10 billion world inhabitants with respect to quality, quantity and sustainability of their food intake. The study provides an expert judgment for the potential of new and emerging technologies to enhance sustainability in the food processing sector. It includes the following technologies: sensor technology, sustainable packaging and refrigeration climate control, non-thermal pasteurisation and sterilisation, nano- and micro-technology, innovative processes for utilisation of by-products, alternative processes requiring less energy or water, plant-based meat alternatives and information and knowledge transfer.



For each technology, the direct impact (reduced losses, energy and water use), as well as the indirect impact (food losses, suboptimal utilisation and unnecessary quality decay within the supply chain), are described, along with their contribution to the areas of improvement of the European food processing industry (new and better food products, resource efficient manufacturing processes, integrated and transparent supply chains, and enhanced innovation capacity).

Guarantee stable, safe and healthy food

The main challenge for the agro-food industry in the coming decades is to guarantee the availability of safe and healthy food for a growing global population, against the background of increasing consumer demands, sustainability concerns, as well as resource demands for biobased (non-food) applications. Climate change, the intensified competition for energy, fresh water raw

materials and land, as well as the shift in dietary patterns (increasing consumption per capita, growing meat consumption) across the world are expected to have a major impact on the food supply chains.

Within the system of food supply, food processing focuses on the conversion of agro-raw materials into (packed) food products with the desired quality and functional properties. Modern food processing techniques have the following three major aims:

- To make a sufficiently stable food product that is safe for human consumption (microbiologically and chemically);
- To give the product the required intrinsic quality aspects, e.g. digestibility, nutrient content, flavour, colour and texture;
- To add value to other aspects of the product, e.g. convenience, lifestyle and marketing.

Sustainability in the food industry

This report discusses a number of technology options that can contribute to more sustainability in the food processing sector. Given the fact that sustainability as such is not within the day-to-day focus of many food processing companies, the technology options given in the report are linked to the four areas of improvement (better products, efficient manufacturing processes, integrated and transparent supply chains, increased innovation power), thereby identifying the opportunities for innovation.

3.6 Options for cutting food waste

This study, framed into the wider STOA project 'Technology options for feeding 10 billion people', was launched in October 2012 and published in October 2013. Lead Panel members were Vittorio Prodi and Giovanni La Via. The study was discussed during the STOA Panel meeting on 24 October 2013.



Crusade against food waste

The reduction of food waste is seen as an important lever for achieving global food security, freeing up the finite resources for other uses, diminishing environmental risks and avoiding financial losses. The importance of the issue is reflected in the fact that, in its 'Roadmap for a resource efficient Europe'⁷ the European Commission has set the target to halve the generation of food waste by 2020.

The study deals with approaches for preventing food waste based on a thorough analysis of the scale, reasons and pattern of food wastage in EU-27. The focus is on measures and instruments that are considered in literature or in the current debate as particularly useful, easy to implement and/or that have already proven their effectiveness in practice. This includes, among others, the improvement and harmonisation of the data basis, the setting of reduction targets on national and regional level, the revision of existing regulations on food date labelling, the enforcement of awareness campaigns, the introduction of economic incentives, the improvement of workflows, as

⁷ COM(2011)571

well as the implementation of an integrated supply chain management in the manufacturing and the wholesale/retail sector, including technological innovations which are likely to reduce food waste.

1.3 billion tonnes of food wasted globally each year

Given the fact that over one billion people suffer from malnutrition, wasting food is particularly an ethical issue. A globally growing demand will result in higher prices on the world market, which can further weaken the purchasing power of poor people in developing countries. Rising population will exert increasing pressure on the global food supply.

Food wastage along the food chain

The study analysed the origins and reasons for food losses along the food chain, looking into losses in primary production; processing and packaging; distribution, wholesale and retail; the hospitality sector and private households. Most of the food waste is generated in private households.

Options for cutting food waste

Options for action were developed addressing European, as well as national governments responsible for their implementation, including:

- Reviewing EU legislation on food safety;
- Streamlining food date labelling and awareness campaigns;
- Combating food waste in the hospitality sector;
- Economic incentives;
- Promotion of food redistribution programmes;
- Sharing networks for surplus food;
- Assessment of the technological developments.

As the majority of food waste occurs in the households, one of the most prominent options for cutting food waste is to organise proper awareness campaigns regarding labelling practices. Further, the study recommends a reform of the food labelling system within European legislation, in order to improve the visual presentation of expiration dates.

3.7 Recycling agricultural, forestry & food wastes and residues for sustainable bioenergy and biomaterials

This study was launched in October 2012 and published in September 2013. The Lead Panel Members were Vittorio Prodi MEP and Giovanni La Via MEP. The study was discussed during the STOA Panel meeting in September 2013.

The purpose of this study was to examine and review biorefinery technology options that exist to convert biomass in the form of agricultural crop and forestry residues and waste from the whole food chain into biomaterials and bioenergy. It assesses the technological options, including the sustainability of the processes involved.



Separation and collection of residues and waste – a key issue

The study found that, in order to ensure environmental sustainability while also promoting the growth of the bio-industry by mobilising waste and residue feedstocks, we must start by making the best use of the support and advice measures available for land and forest managers. The EU must improve food waste separation and collection and revisit legislation on its use for anaerobic digestion. Future policy development should follow a regional approach to biomass development, in order to take into account regionally or locally relevant sustainable limits of residue availability and link these to the siting of bioenergy or biorefinery plants.

Need for large-scale demonstration

In order to attempt to successfully develop the biorefinery industry, there must be sufficient financing for setting up large-scale demonstration or first-of-its-kind plants. We must facilitate market-driven demand for bio-based products through standards and labels for bio-based products.

Agricultural practices must avoid depleting soil carbon and other nutrients

However, the policy framework must also ensure environmental sustainability through the introduction of environmental safeguards and respecting the waste hierarchy when using food waste for energy generation. Agricultural practices must avoid depleting soil carbon and other nutrients when mobilising agricultural crop and forestry residues. In conjunction with better farming practices, regulations should require biorefinery operators to ensure that their sourcing of agricultural or forestry residues does not impact negatively on soils and consider displacement effects on other industries and their greenhouse gas implications.

Caution required

Any policy recommendations targeted at the development of biorefinery pathways must be underpinned by clear evidence that the relevant bio-based pathways contribute towards meeting climate change mitigation targets by delivering greenhouse gas benefits or other defined environmental benefits compared to the traditional products they replace. This includes a monitoring of the displacement effects where the waste and residues used as raw material in biorefineries have existing uses. Overall, policy encouragement should be given to the sector, but with enhanced transparency of all aspects of its development, and with equally strong sustainability safeguards.

3.8 Options for sustainable food and agriculture in the EU – Synthesis report

This synthesis report was commissioned in order to present, based upon the five studies described in the preceding sections, options for sustainable food and agriculture in the EU and served as discussion document for the Workshop ‘How to feed the world in 2050?’ held on 4 December 2013, which is described in the next section.

Ideas about the future of the global food system are remarkably diverse. Some of these envisage mainly incremental changes to the present systems of food supply and the markets that accompany them. Others are more visionary, exploring options such as significant dietary change, accelerated investment in high-tech agriculture, the revival of more traditional farming systems, and the adoption of new patterns of trade. Business as usual, even with a serious effort to increase

agricultural productivity, seems unlikely to be sufficient to meet the multiple and sometimes conflicting objectives ahead of us.

This report focuses on just one segment of a very broad canvas. It considers how the EU could play a role in meeting these challenges in the coming decades and sets out some of the options which merit particular attention. Europe has many resources on which to draw. These include a productive agriculture and food system, relatively robust soils, a mixture of high- and low-intensity farming systems, strong infrastructure and support services in most countries, and a good range of research institutions. However, there are different views as to where the priorities lie. In the recent debate on the reform of the CAP there were contrasting calls for an immediate increase in European production on the one side and for stronger emphasis on sustainability and “greening” on the other.

Against this background, STOA commissioned the five studies on relevant aspects of the food and related bioenergy equation, which offer a broad analysis of our likely future production options, and this forward looking context then permits a focused exploration of some pressing contemporary issues. As described in the preceding sections, these include: the means of reversing continued declines in farmland biodiversity, the different means of achieving a significant reduction of food waste, and the options for using wastes and residues to meet biomaterial and bioenergy needs in a sustainable way. This report synthesises some of the analysis and results of the five studies, considering the state of play today and some of the key developments on the horizon, looking towards 2050.



The five studies synthesised here recognise the strengths of the EU as a major food producer with diverse and productive agricultural systems, a high level of skills and investment, major research institutions and great potential for innovation over time. Together they identified some of the key challenges that will confront Europe as it plays a part in a more robust global agri-food system. According to the synthesis report, this role is not to increase production to fill a food deficit in poorer countries, but to establish a strong and sustainable resource base with greater capacity both to produce and to conserve natural resources.

In the coming decades, the EU needs both to determine and then to demonstrate:

- How high yields can be maintained sustainably and even increased, making full use of knowledge-intensive land management;
- How policy can be better arranged to incentivise and require farmers to reduce pollution and pressure on natural resources, while increasing their provision of ecosystem services;
- How to make significant in-roads into reducing waste and harmful over-consumption, and developing healthy diets, including the moderation of consumption of livestock products;
- How to reduce Europe’s global footprint in the realm of food supply, adjusting the balance of domestic output according to a sustainability logic, as well as changes in the market;
- How to align energy policy and the role of bioenergy in particular with the demands of agricultural production and sustainable land use, utilising wastes and residues as a first choice.

3.9 How to feed the world in 2050?

This workshop was organised on 4 December 2013 to present and discuss the main findings of the studies carried out within the STOA project 'Technology options for feeding 10 billion people'. The event was chaired by STOA Panel members Kent Johansson, Vittorio Prodi and Giovanni La Via.

Options for sustainable food and agriculture in the EU

The workshop concluded the project with the presentation of the synthesis report, which brought the five studies together to present the overall picture of the issues within the project. The presentation of the project's synthesis offered an overview of the key messages arising from the studies in relation to technology and policy options for the EU in meeting the future demands of global food supply.

The critical issue is sustainability

The workshop showed that the central challenge for Europe is to pursue resource efficiency and innovation, to conserve its resources for future production and address unsustainable environmental pressures – rather than to seek a short-term increase in output. There are major opportunities to reduce wastage and to address questions of dietary change, thereby diminishing overall demand. Within this framework several topical issues arise. These include the best use of agricultural wastes and residues in the bioeconomy and energy supply, the future of plant breeding and threats to bees and other pollinators. Sustainability is a theme running through these different topics.

'We should not be afraid of new technologies'

The keynote speaker was Professor Louise O. Fresco, University of Amsterdam. Professor Fresco's strong commitment to international development, agriculture and food, as well as publishing eight books and over 100 scientific articles, gives her speeches tremendous standing and merit around the world. Professor Fresco stated that we should not be afraid of new technologies, especially with regard to new genetically modified organisms (GMOs). She recommended the kinds of approaches that are science and technology-driven and just take stock of what is possible and what is necessary, before talking about the wider implications in terms of policy, governance or social embedding. She emphasised that the concept that science and technology are the basics for progress will make our progress possible and they are both needed to continue to make our progress possible. However, a long-term commitment does not currently exist.

Food security: a long-term social contract

Professor Fresco further argued that somehow we should think about a long-term social contract. The whole emotional and cultural side of why the food chain is so much a part of our cultures touches everybody, she stressed, as without food we do not survive for more than a few days. She confirmed the need for making citizens aware of practical things, such as sustainable food shopping and cutting food waste, but, in her view, there should be an emphasis on long-term awareness through education: she firmly believes that, if we do not tackle these subjects at the level of even primary schools, then we will not solve our problem for the future.

What is your eco-footprint?

An article linked to the workshop and entitled 'What is your food eco-footprint?' is available on the EPRS (European Parliamentary Research Service) blog (epthinkthank.eu). An increased knowledge of our food eco-footprint allows for a more informed decision-making process, which may be able to help strengthen food security through the endorsement of sustainable producer and consumer behaviour. Therefore, STOA, in collaboration with the European Parliament's Audiovisual Unit and with research assistance from of the Parliament's Eco Management and Audit Scheme (EMAS), created a short video clip entitled 'Food Eco-Footprint', which explains what a food eco-footprint is. This video clip is available on the STOA website and is also posted on YouTube.



4 STOA AND THE E-SOCIETY

The studies carried out by STOA in the field of the Information Society are of potential interest for the European Parliament's Committees on Industry, Research and Energy (ITRE), Internal Market and Consumer Protection (IMCO), Constitutional Affairs (AFCO) and Civil Liberties, Justice and Home Affairs (LIBE) through the following issues, which they address: technology opportunities; security of the underlying infrastructures; data privacy for the end-users; impact on the economy; and policy options for promoting the opportunities identified.

4.1 *Potential and impact of Cloud Computing services and Social Network Websites*

This study was carried out from April 2012 to January 2014. The Lead Panel Members were Malcolm Harbour MEP and Silvia Adriana Țicău MEP. The study was discussed during the STOA Panel meeting in January 2014.

Cloud computing - a driver for growth of our economy

Cloud Computing and Social Network Sites (SNS) are among the most controversially discussed developments in recent years. The opportunities of using powerful computing resources on demand via the web are considered as a possible driver for the growth of the European economy. However, there are also critics arguing that economic, social and technical risks prevail or even dismiss the potential of Cloud Computing and SNS.

This project sheds light on these issues and analyses, more specifically, the latest technological and economic developments, driving factors and barriers in Europe, the main actors and their respective interests, the impact on citizens, business and public administration, and a broad range of technical, economic, cultural, legal, regulatory issues and their impact. It shows that, at the moment, there is a chance to achieve multiple Cloud Computing and SNS-related goals simultaneously.



There is no contradiction between assuring European citizens secure, privacy-aware, legally certain and fair use of Cloud Computing and SNS, on the one hand, and increasing the competitiveness of European ICT industries, on the other. Moreover, it is possible to exploit the potential of Cloud Computing and SNS to the benefit of both the European economy and society at large. Based on this, a set of 16 options for European policy-makers, grouped into four themes, was derived.

Cloud computing debated at the European Parliament

In a workshop held on 2 October 2013, in the context of the 5th European Innovation Summit, STOA Members discussed with experts the potential of Cloud Computing for Europe, and more specifically the challenges and problems which need to be addressed to foster it. This event was chaired by António Correia de Campos, MEP and STOA Chairman.

During the workshop, the issues related to the privacy of citizens and the confidentiality of business data received special attention. The practice by some governments to perform 'massive surveillance of Internet users' for economic intelligence and political purposes was openly discussed from a long-term business development perspective. The debate with the experts gave

insights into the challenges faced by consumers, businesses and the ICT industry, and started exploring possible solutions.

Policy options

First theme: Make security a commodity

The study shows that, at the moment, information technology (IT) security is sometimes difficult. Solutions can be hacked or sometimes they are inconvenient to use. Therefore it is necessary to support the development of highly secure IT solutions, which are easy to use and can be adopted by all businesses, both big and small, as well as by all citizens. Policy options:

- Support the development of open and secure software and hardware, and encryption methods;
- Encourage the use of checklists and security certifications;
- Assess the economic viability of large hardware security modules;
- Initiate a dialogue on the structure and governance of the Future Internet.

Second theme: Establish privacy as a location advantage

Recent developments and the growing digitalisation of all spheres underpin the necessity of modern privacy rules. By modernising the data protection regime, Europe could not only ensure a better protection of citizens, but also serve as a model and partner for emerging markets. Moreover Europe could underpin this function as an example for a modern and appropriate privacy regime by addressing a fair and secure governance and proposing a structure of an open Internet at a global level. Policy options:

- Proceed with the modernisation of data protection;
- Establish the principles of security and privacy by design;
- Support the creation of a European Data Protection Board;
- Ensure the extraterritorial application of European data protection law.

Third theme: Build a trustworthy environment for digital business and living

The digital life of citizens and business needs legal certainty to ensure that new ideas are taken up. Since many emerging ICT create both new chances and new challenges, there is a need to continually review existing legislation and adjust it if necessary. Only if people have trust in legal certainty, will they adopt and use new technologies and exploit their potential for the economy and society as a whole. Policy options:

- Stipulate the setting of minimum requirements for contracts;
- Support the standardisation of Acceptable Use Policies and Service Level Agreements;
- Eliminate jurisdictional uncertainty;
- Support the development of cloud-specific certifications.

Fourth theme: Create an inspiring ecosystem for ICT industries

A crucial precondition for a competitive ICT industry is an inspiring ecosystem. This is illustrated by examples in other regions or other industries. Such ecosystems contain many components. Of particular importance is support for innovative and fast-growing companies, as well as the provision of sufficient framework conditions. Policy options:

- Encourage the creation of European market players;
- Support standardisation and interoperability;
- Empower people across all strata of society;
- Reconsider current broadband strategies.

4.2 Security of eGovernment systems

This STOA study ran from March 2011 to June 2013. The Lead Panel Member was Silvia Adriana Țicău. The study was presented to the STOA Panel in February 2013.

The project was aimed at assisting policy-makers in discerning policy options for meeting future challenges in securing eGovernment systems. The project focused on upcoming challenges of eGovernment security in delivering public services across borders. Through identifying key security barriers and enablers, the project pointed to promising avenues of policy development in an environment of rapidly changing ICT and changing socio-economic concerns in the EU. The project analysed and discussed security of eGovernment systems and services with special attention to the possibilities of future EU eGovernment services by gathering typical examples of existing national and international eGovernment services in Europe, analysing the most relevant security issues and possible response/solutions to these issues, debating policy options for advancing EU eGovernment services, and assessing and delivering specific policy options.

Debate on security of eGovernment systems



On 19 February 2013, an event was held at the European Parliament as a part of this study. The workshop was chaired by Silvia Adriana Țicău and Malcolm Harbour, both MEP and STOA Panel members, and was organised with presentations and discussions around four themes. The outcome was integrated into the final study report. The four themes were:

First theme: Security of European eGovernment services in a life-cycle perspective

This theme was based upon three case studies which were presented and discussed in a life-cycle perspective:

- ePassport
- eProcurement
- eHealth

Second theme: Protecting against attacks from the Internet

One of the most important overarching challenges to solve is about how to secure eGovernment services against attacks from the Internet. Main questions include:

- Based on current problems and examples of attacks from real life, what can we expect in the future?
- What are the best/most used/future technical solutions to protect against attacks?

Third theme: Privacy protection in eGovernment services

For users of eGovernment services (citizens and business) privacy is perhaps the most prominent security need. Protecting the data in the system is therefore another very important challenge. Some of the issues in this theme are:

- Current problems and examples of privacy breaches from real life;
- What are the best/most used/future technical solutions to protect privacy?
- What are the policy options for complying with this challenge?

Fourth theme: 27 Member States, one solution?

There are some specific challenges when applying eGovernment services on an EU level. Interoperability, national differences in technical solutions, legislation and implementation are examples of EU-level challenges. Another important challenge is finding a common baseline of security on EU level. To ensure well-functioning and secure EU-level eGovernment services, these challenges have to be handled. This points to a number of EU-level policy options. Some of the issues in this theme are:

- How do national differences in technical solutions, implementation, operation and legislation affect interoperability on the security level?
- How can a common security baseline improve the level of security and what are the challenges of defining a baseline?
- What are the EU-level policy options for meeting these challenges?

Need for improved privacy protection

A common European security baseline aims to raise the general level of confidentiality and privacy in European eGovernment services and systems. The development of such a baseline starts by outlining a strategy on a political level that presents a roadmap of adequate future measures for Europe.

This report shows that eGovernment systems pose significant privacy risks for citizens with regard to the collection, storage, processing and exchange of personal or confidential data. It is clear that there is a need for improved privacy protection, in terms of a better technical and legal position for citizens and other players to exercise control over their data.

Interoperability: a big challenge for cross-European eGovernment systems

Interoperability is another big challenge for cross-European eGovernment systems. Interoperability between systems and/or between countries is difficult to achieve and constitutes perhaps one of the most important barriers for European eGovernment services. In relation to security this is very much a question of the exchange of data, e.g. between different national eGovernment systems.

The decision regarding the development, and subsequently the design of an eGovernment system inherently involves political choices on safeguarding privacy, security levels, interoperability and costs. Different requirements may be at odds with each other. For example, interoperability between systems and across borders may enable function creep and privacy risks, and high levels of security and privacy typically require higher financial investments. The project results show that current policy discussions often lack a clear and explicit decision regarding these trade-offs.

4.3 State-of-the-art of Machine Translation - Current challenges and future opportunities

The STOA workshop ‘State-of-the-art of Machine Translation - Current challenges and future opportunities’, which took place on 3 December 2013, was greeted with great interest, from both within and outside the European Parliament. It was chaired by Algirdas Saudargas MEP.

Machine Translation, a key topic for the European Parliament

The final attendance and participation exceeded expectations and showed the importance and gravity given to the issues that surround modern day linguistic translation, be it human-based translation or machine-based translation. In this age of globalisation, expanding economies and improving communication technologies, one of the biggest barriers society faces is language differences.

There is a sense of urgency to further develop our capabilities to understand each other, and communicate to one another without impediment or delay. To date our main source of translation has been human translators, of which there are only around 200,000 in the world. These translators could avail of improved Machine Translation (MT) as a tool to aid them in their work.



A negative aspect of MT is that it is very costly and out of reach for the majority of businesses. MT is on the road to replacing English as the new lingua franca, through the use of more data, interoperability, metrics and developing technologies. MT is leading a paradigm shift where translation is quickly evolving from being a luxury to being seen as a utility by society.

Identifying advantages and obstacles

The workshop presented the different applications of MT today and in the longer term. It described technologies and methodologies available for MT in use today and their respective advantages and disadvantages.

The workshop identified the obstacles in the development of MT, both from a technological point of view, but also from an organisational one. It acknowledged the specific challenges in obtaining an equivalent level of machine translation quality in all 80 EU languages, including the EU's 24 official, as well as minority and immigrant, languages.

A Single Market without language barriers?

The panel of the workshop comprised experts and stakeholders from industry, academia and the EU institutions. It concluded on the need to develop a long-term vision of an integrated European society and digital Single Market without language barriers, with MT becoming the new lingua franca replacing the use of English. It also started exploring the possible options for framing the development and sustainability of such an initiative, and for improving the quality of MT, especially in the cases of less supported languages.

Quality issues of Machine Translation

Some of the major issues needed to be addressed, in order to encourage the development of MT, include analytical investigation of quality barriers; inclusion of professional translators; improvement of automatic quality estimation; specialised technologies for different purposes; creative combination of different approaches; exploitation of the best monolingual processing technologies; and putting a strong focus on semantics. There is also a danger of the digital extinction of smaller languages.

Further research and development needs

The topic of automated speech recognition technology was also discussed. This technology has tremendous potential for humanitarian deployment, or online education, as it automatically transcribes and translates verbal speech simultaneously.

The debate made it clear that the future of MT relies on research and development, which will depend on funding programmes and policy development, e.g. copyright laws and data collection. These will enable the growth of what is potentially an extremely viable industry.

5 STOA AND HEALTH

The issues of health are intrinsically connected with everyday life and policy-making. STOA therefore strives to keep Members of the European Parliament up to date on health-related science and technology issues.

STOA held three health-related events in 2013, where health issues were discussed with Members, stakeholders and the wider public in the European Parliament in Brussels in the form of workshops. These events included: a workshop on 'Strengthening health protection in times of economic crisis: Increasing the evidence base', a workshop on 'Risk in innovation: Balancing benefits and hazards' and a workshop on 'The cost of brain diseases in Europe', organised in conjunction with the European Commission's Month of the Brain 2013 awareness campaign.

5.1 Strengthening health protection in times of economic crisis: Increasing the evidence base

This STOA workshop, organised in collaboration with the European Observatory on Health Systems and Policies, was held on 21 February 2013 at the European Parliament in Brussels.

The on-going financial and economic crisis impacts on health in various ways. Not only does it affect the factors determining health, but also the financial capacity for public policies to intervene and support the population's health and social well-being.

Evidence of the impact of the crisis on health outcomes is only beginning to emerge

Data suggests that this latest recession has led to increased poor health status, rising incidence of some communicable diseases, and higher suicide rates. Further, available data are likely to underestimate the broader mental health crisis linked to increased rates of stress, anxiety and depression among the economically vulnerable.

Not only does recession affect the factors which determine health, but it also affects the financial capacity to respond. Many European governments have reduced public expenditure on health during the financial crisis, while introducing or increasing user charges. The recession has driven structural reforms, and affected the priority given to public policies that could be used to help protect population health.



Opportunity for reforming and restructuring actions

As the workshop showed, the current economic climate, while challenging, presents an opportunity for reforming and restructuring actions.

More innovative approaches to health should be developed by health professionals and by those responsible for health management. In addition, scientists and experts in public health should promote evidence-based approaches to economic and public health recovery by analysing the present economic downturn and previous crises.

However, it is governance and leadership that will mostly determine how well health systems are prepared to face the crisis and find ways to mitigate its effects.

5.2 What does it mean to have a brain disorder? European Month of the Brain 2013

This STOA workshop was held on 23 April 2013 and was chaired by António Correia de Campos, MEP and STOA Chairman.

The cost of brain diseases in Europe

This workshop was organised in connection with the events of the European Month of the Brain 2013. A recent analysis of the health economic studies of brain diseases in Europe estimated a total of € 800 billion for the cost of brain disease in Europe in 2010⁸.

This cost is comparable to the total cost of cardiovascular disease, cancer and diabetes taken together. It will continue to rise as the European population lives longer.

Brain research in Europe is a rapidly evolving field. Research in neuroscience has an important role in reaching the goals of the 'Europe 2020' Strategy and the Innovation Union.

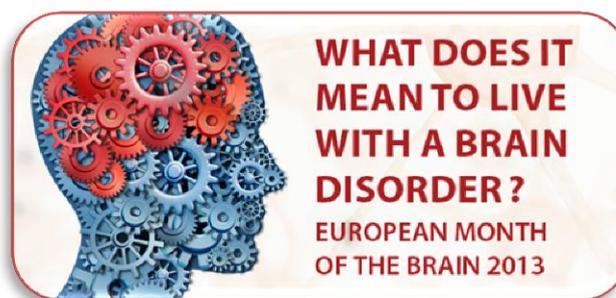
Therefore, understanding how our brain functions will be good for our health, society and also for the European industrial competitiveness. The complexity of understanding brain function and brain diseases brings responsibilities, as well as opportunities for the neuroscience community.

Brain disorders are a heavy burden given the ageing population

The workshop underlined that brain disorders are a heavy burden within the elderly population.

Neurological disorders will affect at least one third of the European population in their lifetime.

Due to our ageing society in Europe, degenerative disorders like Alzheimer's disease and Parkinson's disease will affect a large part of the population in the near future.



The increasing prevalence of neurodegenerative diseases in the elderly population

The increasing predominance of neurodegenerative diseases in people above 65 years seems to be exponential. Dementia currently affects an estimated 10 million EU citizens.

Increased strategic international co-ordination in neurodegenerative disease diagnosis and treatment is needed, as this challenge will transcend the capacities of individual Member States. There is a responsibility to develop unique tools in order to advance our understanding of the fundamental pathogenic mechanisms of the nervous system, and opportunities to generate novel therapeutic approaches.

Brain research is becoming a societal emergency

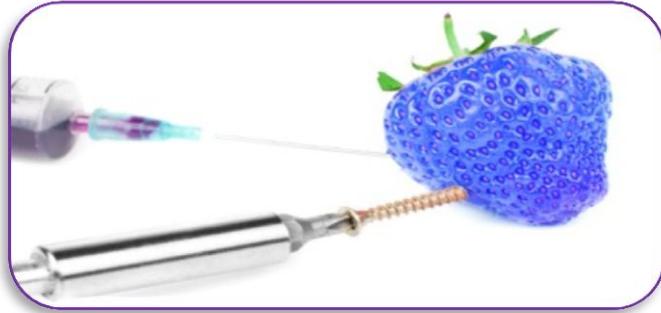
The event showed that strengthening research and developing a strong European platform for basic and clinical brain research is becoming a societal emergency.

Moreover, an enhanced international co-ordination in neuroscience is needed, as this challenge transcends the capacities of individual Member States and calls for an all-encompassing European system.

⁸ J. Olesen et al., 'The economic cost of brain disorders in Europe', European Journal of Neurology 2012, 19: 155-162

5.3 Risk in innovation: balancing benefits and hazards

This event was held on 30 January 2013 and was chaired by Paul Rübige, MEP and STOA Vice-Chairman.



Opportunities and challenges of innovation

The event took place against the background of the realisation that innovation offers potentially enormous benefits, which include enhanced medical diagnostics and drug delivery, environmental monitoring, water and waste treatment systems, and many others.

However there are significant challenges to be addressed by government, industry and society at large.

The examples of synthetic substances and nanotechnology in food

The aim of this workshop was to create a constructive debate on risk governance, through the analysis of two cases:

- The exposure to synthetic substances, which can interact with the endocrine system and are potentially responsible for its disruption (endocrines disruption);
- The current application of nanotechnology in food, and the perceived risk among the European population.

Innovators should consider how to deal with possible hazards

While sometimes successfully ignored, innovators should consider how to deal with possible hazards.

Without sufficient attention, innovators can fail to accomplish progressive objectives and support positive values in innovation.

Cultural misconceptions, paradigms used, frequently without realizing, biases in implementation and research, and unrecognized dilemmas can all contribute to the failure of innovation.

While these challenges may present risks, knowledge equips us to recognize these risks, avoid them if possible, and take conscious decisions about the best course of action.

Innovation biases, problems and dilemmas

The workshop specifically discussed innovation biases, problems and dilemmas faced by researchers conducting studies about the practice of innovation and by public servants contemplating the concrete decision whether or not to introduce an innovation.

6 STOA AND SCIENCE & RESEARCH GOVERNANCE

The world of science, research, technology and innovation is of course highly regulated and requires large-scale funding from both the public and private sectors. In the year 2013 STOA saw a wide variety of activities related to science and research governance.

The study 'Science Metrics - Measuring scientific performance for improved policy making' sought to understand the feasibility and desirability of creating a trans-national system for collecting and monitoring research performance data. This project featured a mid-term workshop.

STOA also organised several other workshops that covered different aspects of research and innovation, namely: 'European innovation ecosystem for generating value', 'How to retain leadership in particle physics?' (the world seen through the eyes of particle physics and CERN), 'The European landscape of research funding' (in relation to 'Horizon 2020' programme), and 'Financing and assessing large-scale infrastructure projects'.

6.1 Science Metrics - Measuring scientific performance for improved policy making

The study 'Measuring scientific performance for improved policy-making' was launched in June 2012 and the final report will be published after the March 2014 Panel meeting. The Lead Panel Member was António Correia de Campos, MEP and STOA Chairman.



The overall objective of this study was to identify research policy options by understanding the feasibility and desirability of creating a trans-national system for collecting and monitoring research performance data (on inputs, outputs and productivity). This would serve the public good by providing information needed for policy-making

and enabling improved research performance monitoring by researchers, research-performing institutions and funders. The scope of such a system would be European, but the study also considered how European efforts could be linked to more global ones.

A pan-European research information system

The preliminary analysis that was conducted in the context of the Science Metrics study led to the conclusion that the desire for better evidence for public management, a growing movement calling for open access to the results of publicly funded research, and the vastly increased power of computing and communications coincide to generate policy interest in steering and sharing research results and data about them. This implies that there is potentially an opportunity to implement large-scale systems that at once help researchers do their work and help the researchers, their organisations and public managers understand outputs and productivity.

A policy deficit at the European level

In recent years, Europe saw a considerable increase in the development of national research information systems, exploiting current technological developments. These information systems yield significant opportunities for all stakeholders in the national research systems and have the capacity to respond to the multiple needs of researchers, research institutions and research policy-makers. They allow for the opening up of access to data for and on research and 'horizontal'

Public-Private Partnerships to boost innovation and economic growth

The participants discussed structures based on industry initiatives to master the expected European societal challenges of sustainable growth and job creation, such as the concept of Public-Private Partnerships (PPP). In the more specific context of materials research and engineering, the relevance of materials in all programmes centred on Development and Innovation was discussed.

The speakers claimed that no laws of physics or economics required our economic growth to continue indefinitely, and stated that Europe has excels in the generation of scientific knowledge, but lacks the ability to transfer this knowledge into products and thus to help boost innovation and economic growth. The Chairman summarised the discussion with the conclusion that the utilisation of innovation and materials is the key to producing smarter, more abundant jobs. It is necessary to retain and attract brains to Europe and to promote a new model for the research infrastructures, he emphasised; better balance between basic science and innovation/applications is required.

6.3 How to retain leadership in particle physics?

On 29 May 2013, STOA, in cooperation with the Committee on Industry, Research and Energy (ITRE) and the European Organization for Nuclear Research (CERN), organised a workshop



entitled: 'How to retain European leadership in particle physics?'. The event was opened by ITRE Chair Amalia Sartori MEP and STOA Chair António Correia de Campos MEP.

CERN is a European Intergovernmental Organisation, a world leading infrastructure in Europe, and, as such, an example of what Europe can achieve when it works together. The work of CERN as a centre of research and

innovation has important implications for society. The mission of CERN is to push forward the frontiers of knowledge, to develop new technologies for accelerators and detectors, to train the scientists and engineers of tomorrow, and to unite people from different countries and cultures. Today CERN is connected with twenty Member States and employs around 3,300 people.

In fact, the STOA Annual Lecture 2012 focused on the discovery at CERN of a new particle, first predicted through the theoretical work of two of the eminent speakers at the annual event, Professor François Englert, Université Libre de Bruxelles, and Professor Peter Higgs, University of Edinburgh, both laureates of the 2013 Nobel Prize in Physics.

In this meeting, the President of the CERN Council and the Director General of CERN presented a preview of the updated European strategy for particle physics developed by the CERN Council and discussed with the audience the benefits to society of European leadership in basic science.

6.4 The European landscape of research funding

On 24 September 2013, STOA co-organised with COST a workshop on new research funding. The event was chaired by STOA Chairman António Correia de Campos.

COST is an intergovernmental framework for European Cooperation in Science and Technology, which promotes the coordination of nationally-funded research on a European level, encourages the mobility of researchers across Europe and fosters the establishment of scientific excellence.



At the turning point of two successive research funding programmes, FP7 and 'Horizon 2020', the aim of the workshop was to discuss and analyse different aspects of the European research funding landscape. Teresa Riera Madurell, the European Parliament's rapporteur for 'Horizon 2020' and member of the STOA Panel, provided an insightful overview of the subject, followed by expert presentations and a lively discussion.

The workshop was designed to examine different European research funding initiatives and instruments, among which the Public-Public Partnerships, the Public-Private Partnerships, the Future Emerging Technologies, the activities of the European Institute of Innovation and Technology (EIT), the Structural Funds and the COST Framework. The workshop explored the achievements of these instruments and tried to indicate possible improvements.

6.5 Financing and assessing large-scale infrastructure projects

Debate in the European Parliament

This STOA workshop was held on 26 September 2013 and was chaired Antonio Cancian, MEP and STOA Panel member. The event acted as a forum for a debate among policy-makers, scientists, entrepreneurs and industry representatives presenting their vision of the advantages and disadvantages of the different methods available for assessing and financing large-scale infrastructure projects, including the use of 'European Project Bonds'.

The state of the art in large-scale infrastructure projects assessment

The workshop presentations were given by representatives of NETLIPSE¹⁰, IPTS¹¹/JRC, the European Commission's DG Energy, Imperial College Business School and the European Investment Bank (EIB). They provided a complete picture of the actual state-of-the-art in large-scale infrastructure project assessment, which contributes to the efficiency development of the trans-European networks.

Along with the European Commission's proposal to invest € 29,999 million in key infrastructures as a way of generating growth and jobs across the EU and in line with the 'Europe 2020' strategy, this

¹⁰ NETLIPSE: Network for the dissemination of knowledge on the management and organisation of Large Infrastructure Projects in Europe.

¹¹ Institute for Prospective Technological Studies, JRC.

workshop presented the current state of the economic instruments available for assessing and financing large-scale infrastructure projects:

- The infrastructure development to match the demand for transport;
- The improvement of the whole broadband network;
- The establishment of digital service infrastructure platforms;
- The development of the twelve infrastructure priority energy corridors.

Limitations of the use of 'European Project Bonds'



The workshop facilitated the debate among policy-makers, scientists, entrepreneurs and industry representatives on the advantages and disadvantages of the different methods. The inherent limitations of the use of 'European Project Bonds' - despite some recent improvements - were extensively debated. Some participants argued strongly that the role of the EIB should be revisited to allow it to lend

money and even possibly to fund directly the implementation of large infrastructure projects in Europe. The current restricted role of the EIB as a provider of financial guarantees to lending institutions in order to reduce their own financial risks was openly challenged and deemed unsatisfactory.

Perspectives for-large scale infrastructure projects

A major conclusion of the event was that assessment must cover not just time and economy of the projects' implementation, but also quality and societal point of view should be brought forward, in order to truly assess if the benefits expected are materialising in all the design and implementation phases.

6.6 Innovation in action

In the context of the 5th European Innovation Summit, STOA co-organised an exhibition of five Joint Technology Initiatives (JTIs) from 30 September to 3 October 2013 and a workshop entitled 'Innovation in action' on 2 October 2013. The workshop was co-chaired by the STOA Chairman and Ms Maria da Graça Carvalho MEP. Both events were attended by policy-makers and representatives of industry, academia and research organisations. The Directors of the five JTIs (ARTEMIS, Clean Sky, ENIAC, Fuel Cells and Hydrogen, and Innovative Medicines Initiative) were present.

The exhibition and the workshop gave an opportunity to the JTIs to present their results and achievements, as well as their future perspectives under 'Horizon 2020', with a focus on the value proposition and model for innovative research they provide and their contribution to the European quality of life. A panel discussion and a Q&A session took place during the workshop with the participation, among others, of Members of the European Parliament and European Commission representatives.

7 STOA ANNUAL LECTURE 2013: 'SUSTAINING SUSTAINABILITY: MAKING ECONOMICS WORK FOR THE GLOBAL ENVIRONMENT'

The 12th edition of the STOA Annual Lecture, held on 12 November 2013, was dedicated to the challenges of sustainability and how they can be turned to an opportunity for an increasingly globalised economy at a time of crisis. The lecture was opened by STOA Chairman António Correia de Campos MEP and moderated by STOA Vice-Chairman Malcolm Harbour MEP.

In the good tradition established in previous years, this edition featured speeches by distinguished guests, such as Ismail Serageldin, Director of the Library of Alexandria, former Vice-President of the World Bank responsible for Environmentally and Socially Sustainable Development, Monica Kircher, CEO of Infineon Technologies Austria AG, and Hans Bruyninckx, Executive Director of the European Environment Agency (EEA). Achim Steiner, Executive Director of the United Nations Environment Programme (UNEP), gave a video message and Anne Glover, Chief Scientific Adviser to the President of the European Commission, provided her reflections on the theme of the Annual Lecture.



Speakers: Hans Bruyninckx, Monika Kircher, Ismail Serageldin, Chairman: António Correia de Campos, Moderator: Malcolm Harbour

Mr Correia de Campos highlighted the efforts made by the EU to tackle climate change and create a green economy through a strategy to increase resource efficiency, and sustainable water use and food production. He also outlined the current challenges, especially the economic crisis, which is setting limitations to a successful transition to a sustainable economy. In line with that, Oldřich Vlasák, Vice-President of the European Parliament responsible for STOA, emphasised in a video message the important contribution research and innovation can make to sustainability and job creation.

7.1 'Gross National Happiness Index' versus economic thinking

In his speech, Ismail Serageldin called for "a profound rethinking, a paradigm shift in current economic thinking". He suggested that the current high levels of unemployment, especially that of young people, are related to "our obsession with GDP¹²" and that priorities must be reviewed. In his opinion, there is a strong "need for a new geometry for life and nature". Furthermore, he emphasised the fact that the Human Development Index and other indexes of the type of what he described as 'Gross National Happiness' Indexes, such as National Accounts for Well-Being of the New Economics Foundation (NEF) do not help us move towards sustainable development. As a result: "We need some new thinking; this new thinking comes at a time which is ripe for a profound



Ismail Serageldin

¹² Gross Domestic Product, i.e. the value of all goods and services produced in a country over one year.

rethinking, a paradigm shift in current economic thinking". He also spoke about the importance of implementing good policy, because good policy means that "people will live better not worse".

7.2 Large and smaller companies could prosper by working together



Monika Kircher

Monika Kircher spoke about how to create jobs with global environmental competitiveness, taking as an example innovation in the semi-conductor industry. She also highlighted the importance of large companies working together with smaller companies in a sustainable way to add value to each other's business along the production chain. She finally stressed the need to bridge the education gap, and the role of policy-makers, who should have a vision for Europe and turn this into a strategy.

7.3 New thinking for the transition to a green economy



Hans Bruyninckx

Hans Bruyninckx spoke about the importance of new thinking to achieve the transition to a green economy and highlighted the challenges involved. He then called on Europe to go beyond the 2020 agenda and focus on the 2050 agenda aiming to create a low-carbon society, a circular economy and a resilient ecosystem.

In his video address, Achim Steiner underlined the necessity for governments and policy-makers to change their attitude from an economic to an environmental perspective, and the need to refocus future priorities away from traditional fossil fuels towards renewable energies.

7.4 All resources are finite apart from sunshine, gravity and human ingenuity

The event concluded with reflections by Anne Glover, who indicated that the theme of finite resources was very much evident in all of the presentations and proceeded to explain that we live on a planet where all resources are finite apart from "sunshine", "gravity" and "human ingenuity".

She also highlighted the contradiction of achieving sustainable economic growth, claiming that, "in Europe, we use three planets worth of resources every year to sustain our lifestyle on average". This means that someone else has to have an awful lot less. We need to reassess how we look at the planet, not only in terms of physical resources, but also in terms of human resources. Ismail Serageldin's comment "if you get the wrong signals then you make the wrong policies" resonated with Anne Glover, who highlighted the importance of empowering our leaders when they listen to our voice. Professor Glover also highlighted the need to work in different ways, by allowing all citizens to provide politicians with options rather than the current system, so that politicians, "who are usually in a room on their own when making decisions", come up with a solution.

Her final words echoed the importance of citizens' active participation, in order to "get the right policy to deliver a world fit for a good life for all of us, not just in Europe, but fit for every citizen globally".



Anne Glover

8 STOA ON THE GLOBAL SCIENCE & TECHNOLOGY SCENE

8.1 Internet Governance Forum Conference



Teresa Riera Madurell (STOA Panel member), Salvador Sedo I Alabart (ITRE Committee), Sabine Verheyen (CULT Committee) and Maria Badia I Cutchet (ITRE) Committee)

The 8th meeting of the Internet Governance Forum (IGF) took place from 22 to 25 October 2013, in Bali, Indonesia. Teresa Riera Madurell, MEP and STOA Panel member, represented STOA at this meeting. Other EP delegates were: Salvador Sedo I Alabart (ITRE Committee), Maria Badia I Cutchet (ITRE Committee) and Sabine Verheyen (CULT Committee).

The main theme of this annual meeting of the IGF was "Building Bridges - Enhancing Multi-stakeholder Cooperation for Growth and Sustainable Development".

Ms Riera Madurell attended various bilateral meetings, including a meeting on Child Protection, meetings with the US Delegation and

the Internet Corporation for Assigned Names and Numbers (ICANN), a meeting with European companies and members of the European Internet Foundation (EIF), as well as meetings with EU national parliamentarians and government representatives, the Information Security Operations Center (ISOC) and the International Chamber of Commerce (ICC).

8.2 BIOVISION, 'The World Life Science Forum'

The 8th edition of BIOVISION, the World Life Sciences Forum, was held from 24 to 26 March 2013 in Lyon. STOA Vice-Chairman Paul Rübige attended the meeting. Co-organised with Lyonbiopôle, a worldwide bio-cluster, BIOVISION offers an opportunity for key stakeholders to debate over the impact of the latest scientific advances on society, share a prospective vision on how to deal with health, environment and nutrition challenges and foster innovative projects and initiatives.

Speaking at the roundtable 'Future therapies vs Bioethics: which debate?', Mr Rübige outlined, on the one hand, the need for stem cell research and, on the other, the close link to human rights and ethical issues, which must also be considered. Cell therapy applications are related to the treatment of organ-specific diseases, such as diabetes or liver diseases. Stem cell research is in its early stages of development, and the market related to cell therapy is therefore still immature, but the results achieved to date raise great expectations.

The STOA Vice-Chairman emphasised that scientific research and the use of scientific knowledge should always respect human rights and the dignity of the human being, in accordance with the Universal Declaration of Human Rights (UN, 1948) and the Universal Declaration on the Human Genome and Human Rights (UNESCO, 1997). Mr Rübige greatly appreciated participating in this high-level event, where participants obtained a unique overview of this developing sector and had an opportunity for valuable exchanges of views.



Professor Jean-Marie Lehn, Nobel Prize Chemistry 1987, Paul Rübige, STOA Vice-Chairman, Andrew Jack, Financial Times

8.3 Visit to the CEA facilities in Grenoble and Chambéry

The French Alternative Energies and Atomic Energy Commission (CEA) is a French government-funded research organisation. As a prominent player in the European Research Area, it is involved in setting up collaborative projects with many partners around the world. It has around 16,000 staff, including 4,500 researchers. Some 3,500 CEA researchers, engineers and technicians work in micro- and nanotechnologies. The CEA Laboratory of Electronics and Information Technologies (LETI) in Grenoble, with a staff of 900 and 8,500 m² of clean rooms, is one of the largest European centres in applied electronics research. CEA also has strong links to industry, especially SMEs. More than 50 CEA technology spins-off companies were created in the last 10 years, and around 550 patents have been laid down per year.

The STOA Chairman, António Correia de Campos, was joined by Claude Turmes MEP, in a visit, on 23 May 2013, to CEA Tech – a division of CEA focused on applied research in micro- and nanotechnologies, ICT, healthcare, and ‘cleantech’ – in Chambéry and Grenoble. The Members were given an overall picture of CEA activities, with a focus on the French strategy on the energy transition, including nuclear and renewable energy.



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The delegation first visited INES (Institut National de l’Energie Solaire) in Chambéry, which brings together French expertise and resources in solar energy technology (research community and industry). This visit comprised a presentation of CEA’s latest activities in renewable energies, including a presentation of the ‘EERA-PV’ programme on solar voltaics, supporting innovation in the photovoltaics industry. The delegation was also taken on a guided tour through the R&D labs dedicated to solar energy. Amongst the highlights were the efforts going into research for recyclable solar panels and the production unit of photovoltaic panels.

8.4 Council meeting of the STS forum

STOA Vice-Chairman Paul Rübzig MEP attended the Council meeting of the Science and Technology in Society (STS) *forum*, which took place on 24-25 April 2013 in Paris, as an official representative of the European Parliament. This was a preparatory meeting for the 10th Annual Meeting of the STS *forum*, which was held in October 2013 in Kyoto (see next item).

Three members of the STOA Panel, including Mr Rübzig, are currently members of the STS *forum* Council, which plays a crucial role in shaping the programme of the annual meeting of the forum. Mr Rübzig attended the official dinner in the evening of 24 April, which gave him an opportunity to convey and promote STOA’s views as to the topics and the speakers of the annual meeting, based on the European Parliament’s priorities.

8.5 STOA delegation to the STS forum in Kyoto

STOA Vice-Chairman Malcolm Harbour attended the 10th anniversary meeting of the *STS forum*, which was held from 6 to 8 October 2013 in Kyoto. STOA's presence was essential for maintaining the close links with the *STS forum*. Mr Harbour participated actively in the forum itself and had an opportunity to meet leading policy-makers from across the globe, with whom he discussed important issues concerning international cooperation in the area of Science and Technology (S&T).

Mr Harbour's main contribution to the forum consisted of:

- Participating as a speaker, along with other high-level European S&T-policy leaders, in a the 4th EU-Japan Science Policy Forum, entitled 'The Changing Map of Science - Nations and Industries in the Global Innovation System', which was organised on 5 October 2013 in Kyoto by the EU Delegation to Japan and GRIPS¹³, on the sidelines of the forum.
- Chairing the concurrent session 'Smart Cities' on 6 October 2013.



Malcolm Harbour, STOA Vice-Chairman, moderating the session on 'Smart cities' © STS Forum 2013



Professor Shinya Yamanaka, Nobel Prize Medicine 2012 © STS Forum 2013

Mr Harbour had bilateral meetings with the Irish Minister of State with responsibility for Research and Innovation, the President of the Centre national de la recherche scientifique (CNRS), the Economic and Social Research Council (ESRC) Chief Executive and President of Science Europe, the Chief Scientific Adviser of the UK Government, as well as Japanese and European industry representatives. These exchanges were appreciated by all sides, who confirmed their interest and commitment in pursuing their contacts in future forum meetings and beyond.

8.6 STOA attendance at EPTA meetings

EPTA Directors' meeting

The STOA Secretariat attended the annual Directors' meeting of the EPTA (European Parliamentary Technology Assessment) network, which took place, under the 2013 Finnish Presidency, on 27 and 28 May 2013 in Helsinki and Tallinn.

The meeting started in the morning of Monday, 27 May 2013, in the Finnish Parliament, and continued in the afternoon in the DIPOLI Congress Centre, Aalto University, finishing with dinner at Lake Kurkela, some 100 km from Helsinki.

The second day was dedicated to a working boat trip from Helsinki to Tallinn, with visits to the Finnish Embassy, the Estonian Parliament and the Estonian ICT Demo Centre, a facility of the Estonian ICT Export Cluster, which runs 'e-Estonia'. Participants included the Directors and/or other officials from most EPTA full and associate members.

¹³ The National Graduate Institute for Policy Studies is a Japanese national graduate university focused on policy studies and based in Tokyo.

EPTA Council meeting

Mr Paul Rübiger, STOA Vice-Chairman, attended the EPTA Council meeting and Conference, which took place from 23 to 24 September 2013 in Kittilä, Finland. The meeting was hosted by the Committee for the Future of the Finnish Parliament.

The EPTA Council meeting took place on the first day and was followed, on the second day, by a seminar entitled 'Nothing ordinary - The Arctic Boom', which highlighted interesting developments. The Arctic is emerging as a geopolitically important region and gaining an increasing amount of attention from a range of political actors, both within and without the Arctic zone itself. Unexploited deposits and new shipping routes are making of the Arctic the new ground, where old and new Arctic players meet and find themselves forced to collaborate, in order to create a sensible policy about this potentially rich, but surely fragile area. Russia, China, the US and Europe are now more attentive to the developments of their policy in the region.

In the Arctic there are over 20% of the undiscovered deposits of oil and gas, whose value accounts for roughly 25% of Russian GDP. It is therefore understandable that Russia has always been a first-role player in the Arctic, primarily because of the natural resources. The EU and the US have been increasing their presence in recent years, both economically and politically.

The newest Arctic player is China, whose interest should be understood as future-oriented, reflecting its aspirations to prepare for the Arctic opening and its consequences, including the exploitation of new oil and gas deposits and the use of new and cheaper maritime shipping routes.

8.7 STOA at the 9th International Nanotechnology Conference in Berlin

The organisers of the 9th International Nanotechnology Conference on Communication and Cooperation (INC9) invited the Head of the STOA Unit to deliver a keynote speech during the first day of the conference ('European Nano Day'), which took place from 14 to 17 May 2013 in Berlin with a focus on nano-electronics and its applications. He was invited in the place of Professor Anne Glover, Chief Scientific Advisor to the President of the European Commission, who was unable to attend. His keynote speech was entitled: 'Nanotechnology in Europe: Opportunities and Challenges'.

9 PRESENTATIONS TO THE STOA PANEL

In 2013 STOA continued the practice, established in the preceding year, of incorporating in its regular meetings in Strasbourg presentations on either current STOA projects or interesting developments in science and technology and related policy issues. This chapter provides an overview of the latter.

9.1 *Assessing the results of science investments*

On 17 January 2014, Julia Lane, Senior Managing Economist, American Institutes for Research, was invited to give a presentation, followed by a discussion with the STOA Panel during its regular meeting in Strasbourg. Ms Lane also holds academic and advisory positions in France and Germany. She was previously programme director of the Science of Science and Innovation Policy programme at the National Science Foundation, and co-chair of the White House interagency group on the Science of Science Policy. She was heavily involved in the development of the STAR METRICS¹⁴ programme in the United States and is currently involved in parallel efforts in France and Australia.

Ms Lane expressed the view that the current approach of assessing science results, based on the publication of documents at the end of research projects, is flawed. Instead, she advocates that science investments should be assessed based on a 'conceptual framework' that is centred on the activities of scientists and their networks. Data about the activities of scientists and their networks should be automatically collected by adequate information systems and shared with the industry and the general public. It should then be possible for the general public to build customised 'views' on scientists' activities, depending on various centres of interest.

She gave the example of the different systems being tested in the USA, Australia (STAR METRICS) and France (HELIOS) for that purpose. She explained that there is a need for on-going information about how much was spent, where, for what projects, for what purpose and by whom. For this approach to succeed, funding agencies must be able to provide a proper description of their activities in such a way that it is understandable to the general public and the industry. It is essential that public authorities, industry and the general public be able to visualise and follow up the work of scientists and the results they obtain based on the public investments made. The creation of ideas, and their transmission and adoption should be a transparent process for the general public and should be used to assess the results of science investments. The speaker recommended creating an adequate instrument to track the implementation of 'Horizon 2020' following the above approach and agreed with a statement from the audience that the European Institute of Innovation and Technology (EIT) would be in the most natural position to drive the implementation of this programme across Europe.

9.2 *Options for strengthening responsible research and innovation*

On 14 March 2013, the STOA Panel listened to a presentation, by the Chair of the Expert Group on the State-of-Art in Europe on Responsible Research and Innovation and an official of the European Commission's DG Research and Innovation, of the report 'Options for Strengthening Responsible Research and Innovation'¹⁵ delivered by the Expert Group in February 2013.

The presentation addressed in particular the value of linking more closely research and innovation to societal needs and demonstrated the need to establish a comprehensive approach for that

¹⁴ See, for instance, 'Let's make science metrics more scientific', by J. Lane, *Nature*, Vol. 464 | 25 March 2010, p. 488.

¹⁵ http://ec.europa.eu/research/science-society/document_library/pdf_06/options-for-strengthening_en.pdf

purpose. Responsible Research and Innovation (RRI) refers to the collective, inclusive and system-wide approach of performing research and innovation, so that all stakeholders involved are aware of the consequences of their actions and the range of options open to them. The RRI approach is based on mutual learning and active cooperation of all stakeholders. This methodology is currently followed as part of the 'Horizon 2020' programme and the challenge now is to roll out implementation at the national level.

During the discussion with the Panel members, it was recognised that the implementation of the RRI concept was important for sustaining the democratic process, and that this concept could be incorporated in Impact Assessment (IA) work. IA studies use both quantitative and qualitative methodologies, in varying degrees, to assess the potential effects of proposed legislation. The planned updating of the European Commission's IA guidelines and indeed the EP's own IA Handbook over the coming year offered an opportunity, including for STOA, to contribute to this process.

It was explained that implementing RRI in practice could be done by reframing ethical considerations into technical requirements that researchers can use at the start of a project.

The discussion was concluded with the statement that there is a need for a more transparent society and for a new approach, where qualitative indicators are taken properly taken into account in the legislative process, even if they sometimes conflict with quantitative ones.

9.3 Science and technology for deep-sea resource use

During the STOA Panel meeting of 18 April 2014 in Strasbourg, the German Marine Research Consortium (Konsortium Deutsche Meeresforschung) was invited to give a presentation on the role for the EU in supporting science and technology for deep-sea resource use.

Presentations were given on 'Potential biological impacts of deep-sea resource extraction' and on 'Seafloor mineral deposits in European and international waters'. The speakers presented the potential for substantial growth in the marine resource economy given the forecast increase in world population in the next 50 years and the scarcity of land resources, such as rare earths and cobalt. They explained that this would require developing the technologies needed for digging deeper and ever more intensively into the oceans with the support of scientists specialised in the exploration of deep-sea resources. The challenge for Europe would then be to balance competitiveness in this new economic sector with legitimate ecological concerns of EU citizens. Only 5% of the seafloor had been explored, and a reasonable target should be to increase this to 50%.

During a lively discussion with the Members, it was emphasised that the US and Asia were investing intensively in the development of adequate technologies for exploiting deep seafloor resources. For Europe to take the lead, a common EU approach had to be developed and adequate resources had to be freed. The value chain was missing in Europe and this was what had to be developed at EU level. From a technical standpoint, the key was the development of non-human maritime operations, which would be feasible if funds and resources became available.

As a result of this discussion, STOA later decided to carry out, starting 2014, a study in this area.

9.4 Exchange of views with the European Commission's High Level Economic Policy Expert Group 'Innovation for Growth'

STOA invited representatives of the European Commission's High Level Economic Policy Expert Group 'Innovation for Growth' (i4g) for a presentation and discussion during the STOA Panel meeting on 13 June 2013 in Strasbourg.

i4g was established in 2011 by Commissioner Máire Geoghegan-Quinn to provide the best possible economic advice on research and innovation (R&I) policy to the European Commission. The group is composed of a Bureau of 15 members and corresponding experts. Its mandate will last the full term of the Commissioner and includes:

- assessing the socio-economic impact and the potential of R&I actions to deliver welfare to European citizens,
- reviewing best R&I cases and practices, and
- making suggestions for R&I policies.

After the presentations, a debate was held with the STOA Panel. The final remarks pointed to:

- the need to further explore the bridge between research and industrialisation, even though EU universities and research centres have a lot of potential and produce added value through creativity, e.g. in the exploitation of renewable energies;
- the importance of focusing on the macro-level, on clusters for innovation and on assessing whether the difficulties are the consequence of too much rigidity;
- the need to look at several cases of 'mergers' between universities (e.g. Lisbon University and Technical University of Lisbon), before drawing general conclusions.

9.5 Presentation & discussion on research collaboration and researcher mobility

For its meeting in Strasbourg during the parliamentary plenary session of November 2013, the STOA Panel invited experts from Elsevier, Science Europe, DG Research and Innovation of the European Commission and Luigi Berlinguer, MEP and member of the ITRE Committee, to discuss with the Panel the report 'Comparative Benchmarking of European and US Research Collaboration and Researcher Mobility' recently published by Science Europe and Elsevier.

This report was the outcome of collaboration between Science Europe and Elsevier and provided an analysis of European and US research collaboration and researcher mobility patterns, as reflected in the Scopus database. The report explored both the extent to which academics collaborate and the amount of researcher mobility in Europe and the US.

On this occasion, Luigi Berlinguer presented briefly, also on behalf of Ms Amalia Sartori, Chairwoman of the ITRE Committee, the manifesto 'European Research Area: A Maastricht for Research', underlining that collaboration was not equivalent to establishing a European scientific citizenship. Mobility was not understood in the same way when one moved from Sienna to Florence, as when he moved from Sienna to Berlin. In the latter case researchers become foreigners. He went on to stress the growing potential of China in research, which needs to be taken into account. He further stressed that the manifesto was presented to the European Commission, which has the creation of a European Research Area (ERA) and the free circulation of researchers high on its political agenda.

As summarised at the end, the debate demonstrated the need to focus on what the EU had achieved, what it was doing best with the available resources, and how it could develop a more powerful framework in the next seven years, taking into account the social forces acting bottom-up.

9.6 STOA and the JRC

David Wilkinson, Director of Scientific Policy and Stakeholders Relations at the Joint Research Centre (JRC), represented the JRC Director-General, Dominique Ristori (since 1 January 2014, Director-General for Energy), in a presentation and discussion of JRC activities and the prospects of further cooperation with STOA during the STOA Panel meeting of 18 December 2013 in Strasbourg.

He spoke of the importance of having a science-based legal framework, while coping with the challenges simultaneously facing society, such as the growing need for food, water and energy, along with the need to protect the environment, fight climate change and create growth and jobs in an increasingly competitive environment. Against this backdrop, the collaboration between the JRC and STOA could help raise awareness and provide the scientific evidence needed. He went on to point out the main achievements of JRC-STOA cooperation, inter alia: the MEP-Scientist Pairing Scheme, which helped bring together MEPs and leading members of the scientific community, including JRC scientists; joint participation in the EuroScience Open Forum (ESOF) 2012 in Dublin; several visits of Members to JRC laboratories, as well as valuable participation of Members in JRC initiatives. Through their cooperation, STOA and the JRC have done their utmost to put science at the heart of the political debate and develop evidence-based policy-making, as well as to enhance the links between science and society, science and industry, and science and policy-makers.

The JRC representative concluded by expressing the wish to maintain the excellent relations and continue the dialogue with STOA.

10 IMPLEMENTATION OF THE STOA EXPERTISE BUDGET

10.1 External scientific consultancy for STOA studies and workshops

The STOA projects decided upon by the STOA Panel (including the workshops that are part of a project) are carried out by the STOA Secretariat with the help of external experts.

In 2009 STOA signed with six different contractors a multi-annual Framework Service Contract for the provision of scientific technological and scientific expertise to STOA (IP/A/STOA/FWC/2008-096) in the following areas:

- Energy
- Transport
- Environment (including Climate Change)
- ICT and Information Society
- Nanoscale science and technology (including industrial applications)
- Life-sciences and human well-being
- Agriculture, food and biotechnology
- Science, Technology and Innovation Policy

For the execution of its activities in 2013, STOA committed 94.51% of its budget.

10.2 New STOA framework contract for the provision of scientific consultancy

During 2012 STOA prepared and launched a new invitation to tender in order to enable the European Parliament to continue to fulfil the mission and objectives of STOA over the next legislature. Eighty five (85) offers were received and evaluated during 2013. A total of 45 contracts were signed in early 2014. This represents 30 different tenderers, 39 joint tenderers belonging to consortia, 44 sub-contractors and 27 Member States. The new multi-service contract will be valid until the beginning of 2018.

Compared to the previous edition awarded in 2009, the 2014 one will make it possible to open competition for every new STOA study between up to 5 different contractors (with the objective to avoid vendor lock-in and maximise value for money).

It will also include the new research field on assessment of 'Safety and security technologies'.

This new domain covers the expertise needed to:

- (a) assess the impact of technologies used for safety and security purposes, and understand their advantages/disadvantages, in order to avoid incidents or attempt to reduce their impacts if unavoidable,
- (b) identify what are possible control mechanisms (including policy-related ones) to strike an appropriate balance between the advantages and disadvantages identified above,
- (c) draw conclusions about overall relevance, feasibility, implementation costs and long-term sustainability of technologies used for safety/security purposes, taking into account the possible optional control mechanisms identified above.

This new field of STOA research applies potentially to any domain where technology can be used to save lives, avoid major availability disruption of public services, detect illicit or illegal human behaviour, preserve the intellectual property rights and copyright of authors, or preserve the integrity and the confidentiality of sensitive information to protect privacy.

11 STOA TRAINEES

STOA actively uses the Schuman scholarship scheme to offer vocational training to several high-potential recent graduates. In addition, the unit accepts those who seek a traineeship as part of their studies or for the advancement of their careers.

Each trainee works closely with a STOA administrator and so becomes involved in most of the tasks and challenges they face: participating in meetings with Members of the European Parliament and other stakeholders, and organising workshops and studies on science and technology policy. They are also able to go on a mission to the European Parliament in Strasbourg and attend the monthly plenary session. Trainees thus become acquainted with the whole EU policy-making process.

During 2013, the following trainees worked at STOA:

- **Antoine Haarscheer** (BE, October 2012 - February 2013): Antoine obtained an MSc in Applied Physics from the Université Libre de Bruxelles (2011) and then continued with an MPhil in Technology Policy from the University of Cambridge (2012). He specialises in the field of energy.
- **Johanna van Vrede** (NL, October 2012 - February 2013): Johanna obtained a BA in Geography from the University of Durham, UK (2008) and an MSc in International Relations from the University of Amsterdam (2011). She specialises in renewable energy policy, geopolitical energy relations, sustainable development and climate change.
- **Nadezda Zivenko** (BE, October 2012 - February 2013): Nadezda graduated from the North-West Institute of Printing Arts of the St. Petersburg State University of Technology and Design, Russia (2000). She is a philologist and text editor and specialises in scientific texts.
- **Cristian Felice** (UK, March 2013 - July 2013): Cristian graduated with a Bachelor's degree in Political Science from Providence College, US (2011) and completed an MSc in Energy and the Environment at Lancaster University, UK (2012). He focuses on environmental politics, climate change and sustainable development issues.
- **Laura Rolo** (ES, April 2013 - September 2013): Laura obtained a MEng in Civil Engineering after studying at University of La Laguna, University of Alicante, Spain, and University of Miami, USA (2013). She specialises in the field of energy.
- **Elleke Arnold** (NL, March 2013-July 2013): Elleke holds a BA (2010) in International Relations and International Organization and an MA (2012) in International Political Economy from the University of Groningen, The Netherlands. She specialises in International Political Economy, drug policies and public health.
- **Eoin McCarthy** (IE, September - December 2013): Eoin graduated from the University of Limerick with a BA in History and Politics (2005) and an MA in European Integration Studies (2006). Eoin is interested in EU policy related to agriculture, climate change and other environmental issues.
- **Stephen Nicholas O' Sullivan** (IE, October 2012 - February 2013): Stephen obtained a BA in Geography and History (2010), and an MA in European Development Studies (2011), both from University College Cork, Ireland. He specialises in renewable energy policy, as well as climate change and environmental sustainability.

12 STOA ADMINISTRATION¹⁶

Following the internal reorganisation of the European Parliament's administrative departments, which took place on 1 November 2013, the STOA Secretariat is now part of the Directorate-General for Parliamentary Research Services (DG EPRS).

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¹⁶ STOA administration at the moment of completion of this report

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