

**DIRECTORATE FOR SCIENCE, TECHNOLOGY AND INNOVATION
COMMITTEE FOR SCIENTIFIC AND TECHNOLOGICAL POLICY**

**APPLYING SCIENCE AND TECHNOLOGY TO SOCIAL AND GLOBAL CHALLENGES - POSSIBLE
ISSUES FOR DISCUSSION AT THE CSTP MINISTERIAL**

21-22 October 2014

This document outlines five topics for possible discussion at the Ministerial meeting. The five topics address different but related aspects of the application of science and technology to the solution of social and global challenges. The text describes the rationale for inclusion of each topic, the possible outcomes from the Ministerial meeting, and the implications for future CSTP work.

Delegates are invited to contribute to a round table discussion on the merits of the potential topics and outcomes of the Ministerial, with a view to establishing concrete suggestions for the agenda of the Ministerial.

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NOTE BY THE SECRETARIAT

In preparation for the CSTP Ministerial, to be held in Korea in October 2015, the 105th Session of the CSTP in October 2014 will contain five Agenda Items (Agenda Items 6, 7, 8, 9 and 10) that specifically address potential topics to be addressed at the Ministerial under the main themes and discussion items outlined in “CSTP Ministerial – Setting the Scene” [[DSTI/STP\(2014\)22](#)]. These are:

- Towards a new Innovation Strategy (Agenda Item 6);
- Enhancing the impact of investment in science, technology and innovation (Agenda item 7);
- Strengthening international co-operation in science, technology and innovation (Agenda Item 8);
- Applying science and technology to social and global challenges (Agenda item 9);
- Scientific advice (Agenda item 10).

Under each Agenda Item, a small number of topics relevant to the above themes are proposed as potential focal points for the Ministerial sessions addressing these themes. CSTP Delegates are asked to discuss these topics with a view to identifying one or perhaps two topics, or a combination of topics, that correspond to the priority concerns of members and which members feel should be discussed at the Ministerial.

This document deals with:

- Agenda item 9 – Applying science and technology to social and global challenges.

APPLYING SCIENCE AND TECHNOLOGY TO SOCIAL AND GLOBAL CHALLENGES - POSSIBLE ISSUES FOR DISCUSSION AT THE CSTP MINISTERIAL

Introduction

1. Science and technology are important to help address a range of complex social and global challenges, ranging from climate change and green growth, to health and ageing populations, energy and food security, and economic and social development itself. Yet focusing science and technology on these challenges in an effective and efficient manner remains a challenge in many areas. Fostering green innovation, for example, cannot be achieved solely by the use of framework policies such as tax or regulatory policies, but also requires a concerted effort to strengthen investment in science and innovation. In health innovation, many challenges also remain, both in the context of neglected tropical diseases, but also in the case of Alzheimer's disease and other forms of dementia, which have recently received considerable attention in the context of the G7. Specific issues on which there could be a focus in this context include:

- How can science and technology best be focused on social and global challenges and what mechanisms work? What role can bottom-up initiatives play?
- How can policy enhance collaboration across disciplines and countries, e.g. in areas such as health and environmental research? What lessons can be drawn from the various types of public/private partnerships that have been implemented across countries? What specific barriers, e.g. in appropriate regulation, need to be overcome? What actions need to be taken at the international level?

2. Five topics are proposed below for consideration for the Ministerial under the theme of *Applying Science and Technology to Social and Global Challenges*.

Topic 1: Action on Alzheimer's disease and other dementia – healthy living, healthy ageing

Description

3. Healthy ageing and the global challenge of dementia, with its social and economic impacts, are identified priorities in the broader work of the OECD. In order to enable informed decision-making, work at the OECD is examining the policies needed to support responsible research and development and the application of emerging and converging technologies. In particular, there has been a focus on addressing social and global challenges related to health, food and nutrition in areas where a significant impact is envisaged, e.g. areas where the delivery of innovative therapies could transform health care. Projects are exploring how governments can work together and learn from past experiences in dealing with new technologies, how to foster exchanges of good practice, and how to accelerate step-changes in technological developments, i.e. through a better use of big data, improved regulatory pathways and strengthened public and private funding for research and innovation. In the context of ageing populations, OECD members and resource-limited countries are suffering increasingly from the impacts of dementia and other chronic neurodegenerative diseases. Effective diagnostic and therapeutic options can potentially come from the application of enabling, emerging and converging technologies to these diseases, making this a priority for health ministers, but also a key area where science and technology ministers can make a key contribution to tackling a social and economic challenge that is affecting a growing share of the population.

Rationale

4. Alzheimer's disease is the leading cause of dementia, and the most prevalent neurodegenerative disease in the elderly. Given that 115 million people are expected to be patients by 2050, and that the cost implications of a patient population of this magnitude are likely to be immense, urgent tasks for science and technology policy include finding ways of diagnosing Alzheimer's disease at an early stage; delaying the onset of the disease and slowing its progression; and ideally finding a cure. With the technical and molecular tools now at the disposal of researchers, the means to achieve early diagnosis and to understand disease pathology are now within reach. Current and future research is likely to lead to a better understanding of the biochemical and molecular underpinnings of brain function, and this would allow and facilitate more targeted research on the pathologies of brain disorders and the development of effective therapies for Alzheimer's disease and other dementia.

5. But turning research into a possible cure will require additional efforts. This includes a more effective use and sharing of big data, linking the massive amounts of population-based health and health care data that are routinely collected (broad data) with detailed clinical and biological data (deep data) to create an international resource for research and innovation. Moreover, current regulatory processes are ill-adapted to the specific characteristics of dementia, and there is a need to develop new biomarkers, adopt more innovative clinical trials, and encourage an adaptive regulatory process. Finally, due to these challenges of turning research into innovation, public and private funding for dementia research is limited, and not commensurate with its growing burden on society and the ageing economy.

6. Like many other chronic diseases, dementia is influenced by a complex interplay between genetic factors, life-style habits, food and nutrition. Healthy diet and active living support well-being throughout life. There is increasing scientific and clinical interest in the interactions of diet and health with respect to the ageing process and the development of chronic diseases, such as dementia, cancer, cardiovascular diseases and diabetes. Research findings suggest nutritional supplements can benefit cognitive performance and also suggest that the elderly may require special diets. Both governments and the research community have been aiming to improve our understanding of the relationship between diet and the major chronic diseases. However, data suggesting that there are positive health effects of so called functional foods, nano-foods, nutraceuticals, and personalised nutrition are often inconclusive, and more research is indicated. But developments in, for example, ‘omics’ technologies and nanotechnology could now provide the tools needed to gain better insights into dietary effects and health claims.

Expected outcomes of Ministerial

7. The Ministerial offers an opportunity to discuss the challenge of Alzheimer’s disease and other dementia and set the OECD on the path to develop agreed guidelines for dealing with the issues of healthy living and healthy ageing. While this is a cross-Directorate topic, the focus would be on highlighting the role of enabling, emerging and converging technologies for healthy food and effective therapies (including ICT and Big Data), acknowledging the work done to date and laying out a path for future work (to inform the PWB 2017-2018). One step to be considered would be a Council Recommendation on a key aspect of healthy ageing such as regulatory practice or the use of innovative mechanisms in translational research. Another important step could be to support the better integration of distributed research infrastructures related to dementia, notably in fostering the sharing of big data that are essential to identifying the determinants of this complex set of diseases. This could involve the establishment of a dedicated institute to foster such data sharing, which could involve a key role for the Global Science Forum (GSF). Ministers may also want to exchange views on the public funding of dementia research, and could commit to strengthening funding in this area.

Implications for future CSTP work agendas

8. Work being conducted under this topic would support the co-ordination of research infrastructures related to dementia (e.g., big data, open science), including activities at GSF. As an outcome of the OECD Workshop “Enhancing Translational Research and Clinical Development in Alzheimer’s Disease and other Dementia: The Way Forward”, to be held in Lausanne in November 2014, the development and implementation of innovative translational research and regulatory models will require cross-sectoral governance and policy support. Work is also underway – in co-operation with CDEP – to foster co-operation between key institutes with large data facilities related to dementia. The Ministerial would inform the future work programme (PWB 2017-2018), building on cross-agency work and informed by work underway elsewhere (e.g. World Dementia Council, the World Health Organization), to which the OECD is currently contributing through a cross-Directorate process. One step to be considered would be a Council Recommendation on a key aspect of healthy ageing through the development and application of emerging and converging technologies.

Topic 2: Towards the Harmonised Measurement of Biomass and the use of Integrated Biorefineries

Description

9. Practical guidelines are needed to facilitate the transition towards a bio-based economy through the application of STI. Tasks that would benefit greatly from such guidelines include determining the availability and sustainability levels of biomass within a bio-based economy, essential steps if many social and global challenges are to be tackled successfully. Policy guidelines are also needed to underpin the successful introduction of full-scale, integrated biorefineries that can successfully convert biomass into bio-based fuels, chemicals and plastics. The OECD-conference “Sustainable Biomass drives the next Bio-economy”, which took place on the 10-11 of June 2014 in Paris, made clear the need to provide a platform for OECD members and relevant partners and other parties to harmonise data on the availability of biomass worldwide, and the barriers that currently exist to the successful introduction of integrated biorefineries constitute significant obstacles to the development of a bio-based economy more generally.

Rationale

10. Realising the next industrial revolution in the context of addressing climate change requires actions on many levels and in many different areas. The transition from a fossil-based to a bio-based economy will rely on a sustainable and renewable biomass supply (land- and water-based), as well as industries that utilise the full potential of biomass in an efficient, cascading fashion. Biotechnology in its broadest sense (traditional as well as synthetic biology) has an important role to play in the replacement of fossil-based materials (e.g. chemicals and plastics derived from oil) by bio-based chemicals and plastics.

Expected outcomes of Ministerial

11. The Ministerial would provide an opportunity to highlight the role that enabling and emerging technologies could play in moving OECD members and other countries along the road from a fossil-based economy to a more sustainable bio-economy. Raising awareness of the importance of measurement in the development of a bio-economy, and providing specific guidance on the means to measure the resources available to sustain that bio-economy, would be of interest and value to many countries, including those with which the OECD is seeking to increase its linkages (BRIICS plus other South American and Asian countries – e.g. Argentina and Malaysia). It would also throw valuable light on the ongoing food versus fuel debate. In addition, the transition from oil-based refineries to integrated biorefineries would be enhanced if support was expressed for the production of guidelines concerning the most effective policy instruments to deploy. The Ministerial could result in an agreement to establish the proposed Platform for the Harmonised Measurement of Biomass Supply and Demand and highlight the support measures needed to facilitate the introduction of integrated biorefineries producing bio-based fuels, chemicals and plastics.

Implications for future CSTP work agendas

12. This would strengthen the visibility of the work on enabling and emerging technologies at the OECD, particularly the work on industrial biotechnology, and provide a basis on which to work with countries both inside and outside of the OECD on the global issue of biomass and its use in biorefineries. Such a forum could help to develop and reinforce international relations for the future.

Topic 3: The Potential for the Development of a Global NanoRegister

Description

13. As part of efforts to examine and explore the use of nanotechnology, there have been attempts in some countries to determine the level of market penetration of nanomaterials. These have included mandatory registries and voluntary notification schemes that typically report the products using nanotechnology and also address the issue of potential environmental and health risks. The focus of such registers is mainly on environmental health and safety and related legislation, rather than on the benefits that may be brought about by nanotechnology. Some countries have carried out surveys in order to inform a decision on whether current legislation is adequate or needs to be updated or revised. In 2013, France became the first European country to require manufacturers to identify the use of “substances with nanoparticle status” that they produce, import, distribute, or formulate. Belgium and Denmark have approved legislative proposals for mandatory registries and Norway now requires disclosure when products contain nanomaterials. Other countries are calling for action at national or wider levels. There have been several voluntary initiatives, but the perception is that this has not resulted in a satisfactory level of information gathering or participation by industry.

Rationale

14. There have been calls by Delegations for a global register of information concerning the form in which products based on nanotechnology come onto the market and what function is performed by the nanotechnology within them. There are many different claims from manufacturers and sellers of products with a nanotechnology component to encourage customers to make a purchase. The establishment of a nanoregister is seen by those supporting the concept as being an important step forward in the responsible development and use of nanotechnology, an opportunity to provide open and clear information to the consumer, and a critical step in the evolution of a responsible nanotechnology-based industry working towards the achievement of socio-economic goals.

Expected outcomes of Ministerial

15. Given its work on both nanotechnology policy and on the environmental health and safety aspects of nanomaterials, the OECD is well-placed to host a forum to discuss the potential benefits of a global nanoregister, as a first step towards its possible development. The Ministerial would be the starting point in the evolution of an accord between the science and technology policy community, the regulatory community and the agencies responsible for environmental protection to address the issue of a nanoregister.

Implications for future CSTP work agendas

16. A forum on a nanoregister could be held in late 2015 or 2016. The outcomes of the forum could result in guidelines for the establishment of a global nanoregister or an OECD Council Recommendation in this area in 2017-18.

Topic 4: Skills Spotlight on Emerging, Enabling and Converging Technologies

Description

17. The skills environment is becoming increasingly challenging, particularly with regard to new and emerging disciplines and applications. The Ministerial is an opportunity to draw on expertise across the OECD Delegations to explore the ways in which countries are addressing this challenge. Informed by OECD statistics and policy work, including that on nanotechnology and industrial biotechnology, the topic could produce fruitful outcomes for future work. For example, this work will be informed by the WPN project on Skills and Education and by WPB reflections on mechanism such as iGEM.

Rationale

18. Realising the potential of emerging, enabling and converging technologies to address social and global challenges requires an appropriate and adequate skills base. Many research and business situations require a knowledge and ability to communicate across and apply scientific, technological and engineering skills. In addition, skill sets may need to be complemented by competence in areas such as intellectual property management, regulation, market awareness and public engagement. A variety of approaches are being adopted by governments in the area of skills and education for technology.

Expected outcomes of Ministerial

19. Discussion of the topic would raise awareness of some of the challenges that exist in the skills and training environment with respect to emerging, enabling and converging technologies. It would enable an exchange of good practice between countries based not just on the work on public initiatives in this area but also on the review of actions by industry, agencies and public-private partnerships.

Implications for future CSTP work agendas

20. The item would be based on the work conducted since 2013 from both a nanotechnology and a biotechnology perspective, as well as other work around the OECD. In addition to strengthening the visibility of existing work on skills and education, a discussion could potentially inform the PWB 2017-2018.

Topic 5: The Socio-economic Impact of Emerging, Enabling and Converging Technologies

Description

21. Ongoing support by both public and private sector actors for the responsible development and application of technology can best be justified if the return on investment can be measured and downstream impacts assessed and compared with initial expectations, i.e. with the original objectives underpinning the provision of the support. In national contexts, these objectives can be associated with the acquisition of fundamental knowledge; technological development; the commercialisation of novel technologies and products; industrial competitiveness; economic growth; or the attainment of a host of societal goals related to public health, care for ageing populations, environmental concerns etc. Understanding and measuring impacts thus requires significant activity in the development of appropriate methodologies, indicators and databases, and is particularly difficult when dealing with new, emerging, enabling and converging technologies about which little is known and data are scarce. Recognising this, recent OECD work has focused on this domain and future work would build on NESTI work on Key Biotechnology Indicators (KBIs)¹, Key Nanotechnology Indicators (KNIs)²; on the WPN 2013/14 PWB paper on statistics and indicators expected later this year³; and on the international symposium on *Assessing the Economic Impact of Nanotechnology* that took place in the United States in March 2012⁴.

Rationale

22. Governments are working to ensure that scarce resources are used effectively and efficiently in support of social-economic goals across a wide range of possible areas of investment including science, technology, research, development and innovation. Emerging, enabling and converging technologies have significant potential to help societies achieve the shared goal of improving efficiencies and accelerating progress in a range of economic sectors, including biomedicine and health innovation, industry and manufacturing, and energy and natural resources. Understanding their potential and actual impacts is thus important.

Expected outcomes of Ministerial

23. The aim would be to increase awareness and understanding of the challenges associated with assessing the impact of technology, challenges that are particularly acute when dealing with technologies that are emerging and those that are enabling (having applications across broad economic sectors and with impacts along the entire value chain from development to commercialisation). The need to develop good practice models capable of dealing with the specificities and complexities of emerging, enabling and converging technologies needs to be recognised at the highest level if adequate resources are to be devoted to this critical task.

¹ OECD (2009), *OECD Biotechnology Statistics 2009*, OECD Publishing, doi: 10.1787/9789264073937-en

² http://www.oecd.org/sti/biotech/KNI_KBI_Nov_2013.pdf; oe.cd/kbi; <http://oe.cd/kni>

³ See also the STI Working Paper on “Nanotechnology Statistics and Indicators” 2009 at <http://www.oecd.org/sti/inno/43179651.pdf>

⁴ <http://www.oecd.org/sti/nano/international-symposium-on-assessing-the-economic-impact-of-nanotechnology.htm>

Implications for future CSTEP work agendas

24. This is a significant part of the ongoing work programme requested by Delegates in order to justify public investment in science and technology, particularly new and converging technologies, but satisfactory results will only emerge if adequate support is forthcoming.