# Ministerial discussion themes

The discussion at the CSTP meeting of October 21-22 demonstrated the broad support of delegates to the themes selected for the CSTP ministerial [DSTI/STP(2014)22]. The CSTP made proposals and raised issues regarding the specific content of the themes; and it asked for a better connection between the overarching theme of the ministerial and the sequence of the discussion - i.e. the ordering, articulation and content of the sessions. The CSTP also noted that the overarching theme of the Ministerial, “Creating our common future through science, technology and innovation” should be reflected in a forceful and consistent way throughout the Ministerial. Accordingly, a narrative underlying the sequence of sessions could be the following.

## Creating our common future through science, technology and innovation

Our common future, as the OECD and its Member countries are striving to make it, is made of strong, inclusive and green growth. This depends to a considerable extent on tomorrow’s technologies, which will come out of today’s science and innovation. Fostering growth and wellbeing through science, technology and innovation (STI) requires national strategies which establish clear and coherent directions for all actors and are supported by stakeholders; the efficiency and effectiveness of such strategies depends on appropriate governance, design and implementation. Public research is a key component of such strategies and it needs to be strengthened, made more open and more closely connected to the demands of society and the economy. The impact of strategies, policies and public actors needs to be enhanced and assessed, to enable learning and policy adaptation over time. The success of national actions to address complex global issues, such as climate change and ageing, will require enhanced international cooperation, which raises challenges of its own, including how to ensure the fair distribution of costs and benefits or the connection between international and national research agendas. A major challenge is the effective inclusion of developing countries in global science and innovation networks.

The proposed organisation of the discussion will reflect this narrative, by addressing its various components in separate sessions. The sequence for the meeting would involve two successive sessions on broad topics, each one including three breakout sessions on three, closely related and narrower topics. The first broad session, on the first day, would discuss “Realising the full potential of science, technology and innovation” and would take three particular angles to that in breakouts: “Making Innovation Strategies Work” (on the design and implementation of National Innovation Strategies), “enhancing the impact of public Investment in science and innovation” (with a discussion on the commercialisation of public research and on impact assessment of corresponding policies), and “Science Policy for the 21st Century: Towards Open Science”. The second broad session would address “Science, Technology and Innovation for Addressing Grand Challenges”, with three breakouts: “applying science and technology to health and the environment”, “fostering international co-operation in STI for addressing global and social challenges”, and “science and Innovation for global inclusiveness” (focusing on emerging and developing countries). In addition, a lunchtime discussion would address “scientific advice for policy making”, an important issue as science is increasingly used to assist decision-making in many areas of public policy.

## Session 1. Realising the full potential of Science, Technology and Innovation

As the economic recovery is proving weak and slow in many countries, as a number of social and environmental challenges are currently aggravating, one potential contributor to addressing these issues is innovation. Innovation generates new opportunities for investment which can accelerate economic growth; innovation can also provide new solutions for environmental and societal challenges. Innovation requires appropriate economic and social framework conditions, amenable to cooperation and to competition, and it requires research, much of which will be done in the public sector including in universities. Enhancing the impact of research and innovation, on economic growth and on social and environmental issues is therefore a central challenge for government. For that purpose, a number of conditions are essential. First is direction and coherence in public policy, together with the active involvement of research and innovation stakeholders: this can be obtained by the design and implementation on National Innovation Strategies. Second is a well-resourced, well-functioning, public research sector, which can produce the science that is often needed to generate breakthrough innovations. Third is a well-structured system and set of policies for optimising the impact of science on society and the economy, including better access to data and information.

These three conditions shape the policy agenda for Ministers and they are closely interconnected. Excellence goes with openness, impact on the economy and society requires a strategy that orients public research in that direction, the ability to reach and demonstrate impact helps ensuring the proper resourcing of the system. There are also trade-offs however: a research agenda driven by societal needs will reduce curiosity driven research; strategies might overly restrain the allocation of research resources to the detriment of flexibility and novelty; short-term outputs, more easily observed and measurable, could be favoured at the expense of long term impact etc.

In considering these issues, Ministers are expected to discuss cross-cutting policy synergies and challenges and identify national good practices.

## Break-out session 1.1: Making Innovation Strategies Work

### Rationale

National Innovation Strategies (NISts) play a central role in orienting and shaping innovation policies in many countries. All OECD countries and most emerging economies have adopted a NISt over the past decade and it should be beneficial for ministers to exchange views on their country’s experience in this area, A NISt typically offer a vision of the main challenges that a national system is confronted with and the directions that should be taken to address these challenges and seize new opportunities in the future. Such strategies have multiple uses. By promoting an exchange of views among stakeholders they can help develop a common strategic vision of research and innovation. They can lead to the definition of shared objectives– and map out ways to achieve them, e.g. through institutional reforms, improved governance and dedicated innovation policies. NISts typically address a range of economic, social and environmental challenges, some of which will be covered in other sessions of the ministerial meeting. It is proposed that this session of the CSTP Ministerial focuses on the experience with the design and implementation of NISt.

For NISts to be effective, they need to correspond to countries’ specific needs and take account of the implementation capabilities, all of which vary according to their level of development, the structure of the economy, and innovation capabilities of firms and endowments. NISts are very varied across countries in terms of their ambitions, time horizon, scope, how operational they are, etc.. This generates a wide range of issues and experiences regarding design and implementation, thus providing ample scope for learning and the exchange of good practices.

NISts often set a multiplicity of objectives concerning the performance of the innovation system; the interplay between the business sector, universities and government labs, the public sector and other actors in the innovation system; “grand challenges”; various scientific or technical fields. However, they don’t necessarily achieve all these objectives, and sometimes don’t even implement them all. Difficulties can arise from poor design, including a lack of realism in the choice of some objectives, but also from an inadequate design process (main stakeholders not consulted, basic assumptions insufficiently examined, a poor diagnosis of what are the binding constraints that need to be removed in order to let innovation take off), or from the implementation itself. Obstacles often reside in a lack of motivation or even the resistance of certain actors, whose concerns and agendas have not been sufficiently integrated into the NISt. Obstacles can also reside in institutional settings, which do not provide the right incentives and are not amenable to the reorientation of resources required by new strategies.

The set of innovation policy instruments (innovation policy mix) has become more differentiated over time, not only in the most advanced economies. This is due partly to a legitimate effort to tackle specific issues in a targeted way, but are partly due also to competition between institutions combined with a lack of coordination. Moreover, as innovation becomes a tool to achieve a wide range of policy objectives spanning many policy areas, and as the range of ministries and public and private stakeholders involved expands accordingly, the role of NISt to provide coherence is gaining in importance. At the same time, developing a strategy that provides coherence and implementing it in a consistent way across government and between different layers of government (international, national, regional, local) becomes more challenging. Certain governments adopt experimental approaches, e.g. by encouraging platforms for self-organisation and co-ordination around sectors, technologies, and societal challenges. Ministers have also to decide on who will prepare the Strategy, with which organisation setting and what level of resources. A discussion on national experiences with the design and implementation of NISts and new approaches applied in this context can provide insights into the lessons learned and point to possible good practices in this area.

As innovation is now recognised as a strategic component in various fields, like competitiveness, environment, energy, health etc., there is a necessity to coordinate the multiple ministries and agencies involved in these areas, and which now influence innovation. That would allow to benefit from synergies, by exploiting complementarities and commonalities across the various areas, and a better alignment of the basic, multidisciplinary research agenda which aim to serve them all. The role of the ministry in charge of research vis à vis other, mission oriented ministries, is key to ensure this strategic coherence. Certain instruments, like foresight exercises, or innovation systems policy reviews, might also help in this cross-government strategic integration.

The current economic context is also affecting NISt. Many countries are facing tighter fiscal constraints while, at the same time, the need to mobilise innovation for economic, environmental and social goals is on the increase. This generates demands for greater efficiency and higher impact of research and innovation activities, based on improved steering and funding mechanisms (including through public-private partnerships) and supported by advanced monitoring and evaluation tools and methods. This also raises difficult questions on the best ways to strike a healthy balance between immediate impact and long-term orientation which is essential in important areas of science.

### Possible questions to be addressed

Ministers might focus their discussion on the following questions:

* What have been the main achievements and the main obstacles in designing and implementing the NISt? What can be done to overcome these obstacles?
* To what extent and in which ways have key private and public stakeholders, including other ministries, supported the NISt development and implementation? Are there new approaches to bringing stakeholders together?
* How is coherence ensured between innovation policies and policies focusing on environment, health and other relevant areas in which innovation plays a key role?
* How are NISt’s orientations and objectives adjusted to changes in the broader economic and social environment (e.g. the impact of the global economic crisis, or a growing focus on global challenges) while striking a balance between long-term requirements and more immediate impact?
* How is the background evidence needed to design the NISt mobilised (e.g. foresight studies, surveys, innovation policy reviews etc.)?

### Expected outcome of the CSTP Ministerial and implications for future CSTP work agendas

The sum of countries’ experiences could help illuminate the likely obstacles to the implementation of NISts that policy makers should consider; and point to possible ways and good practices to anticipate or solve these difficulties, based on international experience. The discussion could give rise to further work on the design and implementation of NISts, based on the analysis of countries’ experiences. This would provide an important input for future CSTP work, notably in areas where anticipation and strategizing are central, including work on Outlook and foresight, on green innovation, on systems innovation and on the next production revolution.

## Break-out session 1.2: Enhancing the Impact of Public Investment in Science and Innovation

### Rationale

Enhancing the impacts of publicly funded research and public support for innovation has become a central concern of policy makers. In a fiscally constrained environment, such demand is largely driven by a desire to maximise the benefits and outcomes of public investment in STI. Precise measurement of impacts is often not feasible, especially for basic research where the socio-economic benefits generally have longer-time horizons. Nevertheless, despite the measurement challenges, there is a strong rationale for evaluating the impact of STI investments, including:

*Public accountability*: There is growing public demand regarding public spending. Better public accountability creates a better-informed society and raises awareness of the contribution of research to a country’s economic and social development.

*Policy learning through monitoring and fine-tuning.* Evaluation is also used to fine-tune and improve the impacts of existing policy interventions; to identify efficiency losses or gains and to subsequently re-orient or re-allocate public investment. Evaluations of national research and innovation systems are also used to inform policy and to guide higher- level strategy making (e.g. National Innovation Strategies, National Research Strategies, etc.)

*Priority-setting and steering.* Evaluation assists governments in their decisions to prioritise resources for R&D and innovation and can help them design research programmes. *Ex ante* evaluations together with a variety of foresight tools (e.g. horizon scanning, technology road mapping, expert consultations, etc.) exercises are used to help countries determine where and how much they should invest in public support to research.

*Scientific communication and raising awareness.* Evaluations, especially impact assessments, by research funding agencies and performers (HEIs and PROs) are also being driven by the need to communicate outcomes and impacts of public investment in basic research.

Increasing impacts of STI will depend on a range of policies linked to the governance of the science system, the commercialisation of public research, the STI activities of the business sector, the development of well-functioning innovation eco-systems and networks, as well as the effective co-ordination of policies across levels of government. Certain specific instruments have been put in place by governments in order to increase the impact of public support to research and to business innovation. These include:

*Reforms to public research.* Policies and research funding instruments – such as performance-based contracts for institutional funding, competitive project funding, and research excellence initiatives - are increasingly being used to enhance the excellence and relevance of public research. Governments also want to promote applied research and the transfer of research results to the economy. This confronts governments with a number of policy trade-offs, involving for instance short term versus long term payoffs; concentration of funding versus diversity and a focus on basic research versus commercialisation. While the right balance in each case might depend on the field concerned, the institutional environment and other contextual factors, some general lessons can be drawn by evaluating the experience of countries regarding how they have managed this balance.

*A wider policy mix for business innovation.* Over the years, governments have put in place a diverse policy mix to encourage business R&D and innovation. This mix includes direct and indirect support measures such as grants, tax credits, financial support for incubators and innovative start-ups. Other policies include innovation-oriented regulations, standards or public procurement or support for technology-related networks. In practice, these policies often interact, but evaluations tend to focus on individual outcomes and programme impacts. Useful lessons learned could be drawn from evaluating the differential and joint impact of the policies in the mix.

Evaluation and impact assessment have made significant progress in many countries over the past years: evaluation standards for research and innovation activities are being designed; evaluation agencies are being set up etc. However the current scale of impact assessment in STI policy is modest: many programmes do not have a built in monitoring or evaluation system; there is no agreed set of methodologies that would allow clear conclusions to be reached; many evaluations are short on impact assessment and concentrate instead on process; access to evaluation data is often difficult so that it is difficult to conduct open and evidence-based discussions on the conclusions etc. And both objectives and assessment tend to be rather short term: because of the political calendar, and because short term impact is usually easier to measure. While short term objectives are important, they should be formulated and implemented in ways which do not compromise the long term.

Furthermore, in a context where much of the funding for directed research is being focused on global challenges, the tools for assessing societal impacts are still under-developed. Societal impacts refer to the social, cultural, environmental, and economic returns (impact and effects) from results (research output) or products (research outcome) of publicly funded research. For that purpose, new tools used (e.g. randomized control trials) could be used more systematically and new sources of data (available notably on the Internet) could be mobilised.

### Possible questions to be addressed

Ministers might focus their discussion on the following questions:

* Which policies and approaches have been successful in strengthening the impact of their investments in science and technology on economy and society, both in the medium and long term? Which approaches have not been successful?
* How can both scientific creativity and commercialisation of public research be fostered? What particular approaches and instruments aimed at enhancing the commercialisation of public research results have proven successful?
* What evidence and indicators have been most useful to guide decision making? Which other indicators would be useful? How can new data sources be incorporated more effectively to support impact assessment exercises? What role can the OECD play in supporting greater impact?

### Expected outcome of the Ministerial and implications for future CSTP work

The discussion should allow ministers to share experiences across countries regarding established and new approaches for measuring impact of public research in various contexts. The Ministerial Declaration could emphasise data needs for impact assessment: international standards for data; regulatory conditions for access and exchange of the concerned data. It might also consider the setting up of a specific instrument aimed at favouring exchanges of experience between countries and diffusion of best practices: one candidate is a “platform”, with an online, structured repository of national reports, regular exchanges between experts and possibly guidelines for conducting certain types of impact assessment.

In terms of implications for future CSTP work, the support expressed by Ministers will facilitate the projects currently developed by the CSTP and its working parties, which require the active involvement of countries and easier access to data: The NESTI work on developing new, more relevant indicators, which will culminate in the “Blue sky 3” conference of 2016; the NESTI work on assessing indirect support to business innovation requires close international coordination in terms of data use; the TIP project on assessing knowledge triangle policies (notably the impact of funding streams on research and commercialisation) requires exchange of experience between countries. The CSTP could engage in further work aimed at developing ways to assess quantitatively and qualitatively the impacts of different national science and innovation policies on socio-economic outcomes. This might include developing indicators reflecting policies implemented in countries.

## Break out Session 1.3: Science Policies for the 21st Century

### Rationale

Breakthroughs in scientific understanding are at the heart of major advances in technology, including biotechnology, nanotechnology and converging technologies. For example, the progress of robotics relies heavily on a mix of frontier technologies and new scientific knowledge - combining new materials and engineering with research on artificial intelligence. At the same time, it is clear that in many important fields the relative lack of fundamental scientific knowledge is hampering innovation. For example, the development of effective treatments for neurodegenerative diseases is being held back by our still limited understanding of how the human brain works. Scientific advances go hand in hand with progress in technology, even though the time period between specific breakthroughs in understanding and resultant applications can be long – in some cases many years or even decades. However, the value of science to society is not limited to its role in technological innovation. The role of scientific knowledge is much broader and impacts on many areas of everyday life; the educational and cultural value of science is often underestimated and largely ignored from a science policy perspective. In a world where knowledge-based capital is becoming the key source for growth and improvement in well-being, the importance of science needs to be fully recognised and supported. Fundamental research in physics, chemistry, life sciences or social sciences and at the interfaces between these and many other disciplines is providing major new insights that will help shape future lives.

The combination of new and massive data sources and more and more powerful IT-based tools, is opening up exciting new vistas for research and new possibilities for engagement between science and society: the trend towards open science involves data sharing, on-line cooperation between scientists and open access publishing (allowing easier access to scientific publications). However, maximising the benefits of big data and a new era of open science will require new policies, structures, skills and investment at multiple scales- from local to global. Competition will continue to be a major driver for advances in science, yet at the same time ‘open science’ puts the emphasis on more effective cooperation between individuals, institutions and countries. This implies new governance and funding mechanisms and provides opportunities for a more inclusive global approach in many areas of research.

The publicly-supported scientific enterprise is currently confronted by a number of significant challenges:

* Science is competitive and its history is marked by the outstanding contributions of a relatively small number of individuals. As the search for individual excellence has become central to science policies, questions have arisen regarding how to best identify and support excellent researchers and how to incentivise and reward high quality research. Both quantitative indicators and peer review processes have shown limits in the assessment of scientific performance. Increasing pressure on scientists to publish or perish is touted as one of the reasons for an apparent increase in scientific misconduct, including high profile cases of fraud and plagiarism in many fields of research.
* Linked with individual performance and the emergence of ‘open science’, a second challenge is the promotion of a research culture and environment(s) conducive to creativity: how to identify the most promising projects? What is the optimal balance between institutional and project funding? How to enhance data sharing and cooperation whilst encouraging the necessary competition? What economic model could best support open access publishing? What are the best mechanisms to support essential, and increasingly expensive, research infrastructures?
* A third challenge is the promotion of non-mainstream research: inter-disciplinary research, a major source of new ideas, is often hampered by embedded institutional structures and discipline-based norms, rules and processes; research projects based on radically new ideas are often excluded by inherently conservative, peer review selection procedures.
* A fourth challenge is the pressure for public research to target specific issues, which does not always fit easily with the academic culture and a focus on curiosity- driven fundamental research; there is a need to reinforce the complementarity between fundamental research and applied research, rather than opposing them.

All of these challenges need to be considered in the context of a global economic crisis, where there is a stagnation or reduction in budgets for science in many countries that threatens the long term sustainability of innovation-based economic growth.

### Possible questions to be addressed

Ministers might focus their discussion on the following questions:

* How best to ensure the necessary balance between basic and applied research in a context where budgetary pressure is increasing? How to ensure that there is still high quality blue skies research while science is increasingly called to target specific, short-term, issues?
* Are there good practices for assessing and rewarding research and researchers that could be shared across countries? How do these reflect long-term and short-term outputs and broader impacts of science?
* What is the experience of countries regarding research environments that promote creativity?
* How can governance be adapted in order to accommodate “non-standard” research, notably multi-disciplinary teams and projects?
* What are the main policy challenges with regards to ‘open science’ and data sharing? What incentives can be used to promote data sharing among scientists? What are the ethical or legal barriers? Are there infrastructure and skills gaps? What is the role of the private sector?

### Expected outcomes of the Ministerial meeting

Ministers could indicate their continued commitment to supporting research, including basic research, recognising that long-term and short-term investments are necessary and that the role of scientific research in knowledge societies is absolutely essential. They might identify issues and good practices that are most critical for the development of science at the moment, including consideration of the human resources dimension, funding mechanisms, research assessment processes, access to research data and promotion of open science.

The Ministerial would provide guidance to the development of a stronger program on research policy which the CSTP and Global Science Forum would implement in the coming years. It would also help shape work being conducted by the TIP on the “knowledge triangle” and by the BNCT on health research and converging areas of science and technology. Ministers might request the GSF, together with NESTI to explore challenges related to the evaluation of researchers and research institutions, and the feed-back between research assessments and scientific behaviour.

In 2004 a Declaration on Access to Research Data form Public Funding was adopted by OECD countries. This led to development of a set of Principles and Guidelines for Access to Research Data from Public Funding that was released in 2007. Whilst these documents are still pertinent, Ministers might request that they be updated to take into account recent developments with regards to open science (including open access publishing) and big data and to emphasise the importance of open science for future knowledge societies.

## Session 2. Science, Technology and Innovation for Addressing Grand Challenges

Science and technology are important to help address many complex global societal challenges, ranging from sustainable development and green growth, to ageing populations and health, or energy and food security. Efforts to focus science and innovation on these challenges have been expanding in many countries. This is complicated by the fact that the various grand challenges are related to each other, positively or negatively. Economic development can damage the environment in certain ways, but the lack of development can magnify other problems, such as poor healthcare systems. STI can contribute to ameliorating several challenges at once: e.g. improving the environment (by cleaner energy technology) also improves the health status of the population. Designing and implementing policies which support STI to effectively address grand challenges is currently among the major missions of Ministers in charge of research.

Most grand challenges are global in scope and require a global response, including from STI: this in turn raises issues on how to orchestrate common research and innovation agendas across countries. As countries will meet at the highest level in December 2015 for the COP21, Ministers in charge of research should assert forcefully the role(s) of STI for improving the environment at a global level, and indicate ways the global research community could be mobilised more efficiently in order to contribute solutions.

The economic success of emerging countries has demonstrated the importance of innovation in development, and the opportunities it offers for countries which are still at an early stage of development. The active involvement of developing countries in global research networks would increase the ability of these networks to identify solutions that are applicable to developing countries (e.g. with regard to tropical diseases). At the same time developing countries often have limited capabilities for designing and implementing appropriate research and innovation policies Support for scientific cooperation and for building science policy capacity are areas where OECD countries could potentially help there less developed counterparts

## Break-out Session 2.1: Applying Science and Technology to health and environmental issues

### Rationale

Focusing science and technology on societal and environmental challenges in an effective and efficient manner remains a challenge in many areas, notably the environment and health. A holistic approach is needed in both areas, which will require a mix of new regulation and framework conditions, affecting demand and behaviour, and an enhanced contribution of public research coupled with strong engagement of the private sector.

There is increasing pressure on land, water, and energy resources. The ever increasing demand for energy continues to be overwhelming met by the use of fossil fuels, accompanied by climate change due to greenhouse gas (GHG) emissions. Promising developments in STI for renewable energy and an emerging bio-economy need to be accelerated and scaled-up. The increasing demand for food, combined with environmental changes, requires that higher yields should be realised using less water and less agrochemical input. Increasing the gene pool in crops and using the available biodiversity can help to address this challenge. For energy, food and other global challenges, new technologies are required presenting both opportunities and challenges for socio-economic development.

The global public health challenge is exacerbated by population ageing, which affects to a various extent most countries. Ageing is accompanied by a significant increase in the prevalence of chronic diseases, which puts social and health care systems under huge pressure. The worldwide increase in Alzheimer’s Disease and dementia is a challenge that recently received considerable attention in the context of the G7.

Science and technology, including biotechnology, nanotechnology and converging technologies can address these global challenges, but the creation of the right framework conditions to stimulate basic and translational research and allowing the development of the right market conditions for innovative solutions is required. Such framework conditions may include tax or regulatory policies, supply and demand-side policies, but also requires a concerted effort to strengthen investment in science and innovation. One challenge is to mobilise research in a multidisciplinary manner, which often goes against the current, discipline based model of public research.

Discussions will focus on how to stimulate 2 areas: green innovation and innovation for health. Much public research is devoted to these areas and regulations are being adapted in many countries to support the uptake of new technologies at an effective cost. Public research has helped in developing disruptive technologies with potentially major impact in both these areas. This could extend to the complete overhaul of entire industries but these technologies are facing barriers in various stages of their development, notably in up-scaling and implementation.

To strengthen green growth, ongoing work aims to develop a global platform to agree on standards and to calculate the biomass available and required, as well as to calculate the potential of production systems. A mature bioeconomy will rely on new integrated biorefineries which will allow replacing a significant amount of chemicals that are now produced from fossil resources to reduce GHG emissions. In addition, the use of waste as a resource for biorefineries is likely to become more important and to contribute to sustainability. These developments will only proceed when climate change legislation forces a change, or when the cost-benefit balance is right. Policies can create the right environment to support the development towards a more sustainable bioeconomy.

As for health innovation to support healthy ageing, it is expected that large breakthroughs will be realised. Large international research initiatives are destined to understand the functioning of the human brain, in an effort that can be compared with the earlier human genome project and its revolutionary impact on STI and medical care. Understanding the brain function is a prerequisite to develop new treatments and diagnostics. New insights at single cell and at molecular level are expected also to lead also to breakthroughs in ICT and robotics. To accelerate the development of innovative solutions for neurodegenerative diseases there is a need for defragmentation of research efforts, while translational research needs to be boosted. Current business models for pharmaceutical companies are under pressure because of the cost of product development which is linked in part to the regulatory barriers for clinical testing and market authorisation. New business models may create sufficient incentives for industries to bring promising new products to the market. Such business models might also extend to other areas of public health concern, such as the development of new antibiotics.

### Possible questions to be addressed

Ministers might focus their discussion on the following questions:

* What approaches have proven effective in focusing science and technology on societal and global challenges such as sustainability (e.g. biomass) and health (e.g. dementia)? What types of programmes have proven particularly effective in generating disruptive technologies?
* What approaches can strengthen the relationship between research and other policies (regulatory, fiscal etc.) in the fields of health and the environment?
* What specific programmes and measures have countries set in place in order to address these challenges, e.g. demonstration projects, public private partnerships or regulatory changes? What has worked, what has not worked?
* What approaches have worked in encouraging the multidisciplinary research required for addressing global and societal challenges? How can the obstacles to multidisciplinarity in academia be overcome?

### Expected outcome of the CSTP Ministerial and for future CSTP work agendas

The Ministerial Declaration might underline the commitment of Ministers to strengthen research for addressing certain challenges like ageing and disease (possibly mentioning specifically neurodegenerative diseases) and green growth (possibly mentioning support measures needed to facilitate the introduction of integrated bio refineries). One step to be considered could be a Council Recommendation on a key aspect of healthy ageing through the development and application of emerging and converging technologies. In addition, a Council Recommendation could be envisioned to encourage the use of emerging and converging technologies for sustainable production of food, feed and biomass.

The Ministerial would inform the future work programme on health, building on cross-agency work and informed by work underway elsewhere (e.g. Bioeconomy Observatory, World Dementia Council, the World Health Organization), to which the OECD is currently contributing through a cross-Directorate process.

The Ministerial would strengthen the visibility of the work on enabling and emerging technologies at the OECD, particularly the work on industrial biotechnology and on nanotechnology, and provide a basis on which to investigate notably the issue of biomass and its use in biorefineries, and health applications.

## Break-out Session 2.2. Fostering International Cooperation in STI for Addressing Global and Societal Challenges

***Rationale***

Throughout history, international co-operation and exchange have played an important role in advancing science and technology, which are, by their nature, not confined by national boundaries. There are many factors, ranging from peer-learning to economies of scale and access to infrastructure, that spontaneously drive international cooperation even though STI is highly competitive. Global co-operation in STI is needed today more than ever before to address a range of complex and inter-related challenges, including climate change, biodiversity loss, ageing, energy and food security and access to water. In addition to these universally recognised global challenges, there are also other areas, where a coordinated strategic approach to international collaboration in STI may be required, including, for example, a number of important global health issues. The new era of ‘open science’ provides exciting new opportunities for global collaboration.

A variety of mechanisms have been developed to promote bi-lateral and regional scientific cooperation - particularly in Europe - but more global initiatives have proven to be difficult to realise. Public and private spending on STI is still largely considered in a national context by ministries or agencies that have national missions – in a large part because it is easier to justify national investment to taxpayers and the risks involved are more easily assessed. Relative to purely domestic research, international co-operation in STI involves higher transaction costs and possibly greater risk with uncertain attribution of potential benefits. Additional complications can arise when countries and institutions wish to collaborate but possess markedly different capacities. These considerations underscore the importance of good governance in international collaboration in STI. Accordingly, in the face of the need to deepen and widen international cooperation, there is a need to review the existing structures and mechanisms for international cooperation, many of which were designed without reference to today’s global challenges.

The OECD has long advocated for international cooperation in STI. Facilitating international co‑operation, including policy co-ordination, in areas such as the development of research agendas, access to scientific information and the international mobility of researchers, is part of the CSTP mandate. Several OECD recommendations from the 1980s and 1990s laid out the fundamental principles for international cooperation in science and in technology. With specific regard to global societal challenges, the 2004 Declaration on International Science and Technology Co-operation for Sustainable Development is particularly relevant, while the 2006 Recommendation on access to public research data has served as a catalyst in promoting access to research data and has been adopted by a wide range of countries worldwide. Recent CSTP work, focussed on strengthening governance of international cooperation in STI for addressing global challenges, has analysed existing mechanisms for international cooperation in terms of priority setting, funding and spending, knowledge sharing and intellectual property, outreach and capacity building. The work conducted by Global Science Forum over the past decade on international research infrastructures and collaborative networks is also relevant in this context.

This Session of the Ministerial will explore how international cooperation in STI can be further expanded and strengthened, and what role the OECD should play in this context. This will involve debating needs and opportunities, including the global implications of ‘open science’ or the role of STI in achieving the new Sustainable Development Goals and contributing to the global agenda for combatting climate change. It will also consider the barriers to international collaboration, including the distribution of costs and benefits and conflicts between national and international priorities. There is an opportunity to share experiences and practices for reconciling national strategic objectives and maintaining competitive advantage on one hand, whilst promoting international cooperation on the other. The session will examine how to mobilise and adapt or scale-up existing mechanisms for cooperation, as well as exploring novel approaches, such as the development of a global open science infrastructure.

***Possible questions to be addressed***

Ministers might focus their discussion on the following questions:

* What are the main emerging themes in relation to global and societal challenges that would benefit from greater international cooperation in research?
* How might national research agendas and funding mechanisms benefit from international coordination and what are the best ways to implement such coordination?
* How can international research infrastructures be better used to promote scientific cooperation? What are the coordination and infrastructure implications of open science at the global level?
* What role(s) might OECD play in facilitating greater international cooperation to address global challenges?

***Expected outcomes of the Ministerial meeting and implications for future CSTP work***

Ministers could identify what they consider to be priorities, including new or emerging opportunities, for international co-operation in STI. In so doing, Ministers would identify the constraints and opportunities for cooperation and the most important actions to be taken to achieve progress.

The outcomes of the Ministerial will provide guidance to the future work programme of the CSTP, building on previous OECD work. Elements of future CSTP work could focus on any or all of the themes identified as priorities or emerging opportunities for international co-operation, and may involve revising/updating the existing OECD recommendations on international cooperation in STI, on access to research data, and on the role of STI in sustainable development with special reference to global challenges. Future work could also explore new mechanisms for international cooperation in STI, taking into account the outcomes from the other Ministerial breakout sessions.

A basic form of cooperation is the coordination of national research agendas, aimed at reducing duplications and exploiting potential synergies. There is already some exchange of information across research funding agencies within and between countries but it is not systematic. Closer coordination has been sought in the European Research Area (notably the “Lubjana process”). There might be room for doing more at a global level in that regard. The Ministerial might request OECD to investigate ways for developing further the exchange of information regarding research projects in selected priority areas, e.g. by exploring the feasibility of common standards.

## Break-out Session 2.3: Science and Innovation for Global Inclusiveness

### Rationale

The landscape for economic development has changed significantly over the past decade. Once considered a preserve for richer countries, innovation has played an important role in supporting the growth of emerging countries, notably in Asia but also elsewhere. The adaptation of advanced technology to local conditions, and the modernisation of the local industry through integration into Global Value Chains have been important drivers of development. As a result, innovation is now also recognised as important factor for countries to stimulate or accelerate their development, complementing investment in education and infrastructure and an institutional setting that allows markets to function properly. Making use of technology and innovations to address societal challenges, whether in health or other sectors, often requires local innovation. Contextual factors, such as geographic conditions, genetic or cultural specificities, can limit the effectiveness of imported ready-made international solutions. Such local innovation is not only technological: new business models, new ways of delivering goods and services are also important. Certain countries have made significant progress in promoting “Inclusive innovation”, technological and non-technological, aimed at lifting people out of poverty by making available to them products adapted to their living conditions and by integrating them in economic circuits. Specific innovations have been developed for addressing health issues in conditions of poverty and weak infrastructure (e.g. lack of reliable transport systems or energy sources), sometimes with the support of private foundations.

The ongoing discussion in the United Nations around the “Sustainable Development Goals” is giving innovation a prominent place, mentioning it in several instances in connection with inclusiveness, with industrialisation and sustainable development.. Science and innovation policies need to be factored into development strategies, at the national level and in international cooperation. That includes both ensuring that innovation is part of development aid policies, and supporting developing countries in the development of their scientific infrastructure and their policy capabilities. Development aid is most often centred on urgent issues (natural disasters, health and food crises or on education and infrastructure): it needs also to include a greater focus on science and innovation as they provide are prerequisites for sustainable long-term development.

Developed countries and the successful emerging ones might work at sharing their policy experience with less advanced economies, to address STI policy questions, such as: how to build a strong higher education system with a research component? How to encourage businesses, formal or informal, to innovate? What STI governance structures are most useful? This requires reflection as to how innovation policy can be implemented in the context of development challenges and what types of adaptation to context need to be implemented. It must also be underlined developed countries could benefit also from the experience of emerging countries, which are building their science and innovation systems from scratch, may be less hampered by institutions inherited from the past and well placed to seize new opportunities.

### Possible questions to be addressed

Ministers might focus their discussion on the following questions:

* How have emerging countries successfully promoted innovation? What lessons could be transferred to developing countries? What can be learned from developing countries?
* What approaches can strengthen the involvement of developing countries in STI in areas such as health and environment or improving the welfare of excluded groups?
* What policies can support the creation and scaling up of inclusive innovation? What can be the contribution of universities and research centres to foster inclusive innovations?
* How could support for science and innovation be better integrated into public aid for development?

### Expected outcome of the CSTP Ministerial and implications for future CSTP work agendas

The Ministerial Declaration might underline the commitment of Ministers to strengthen direct cooperation with developing countries on science and innovation matters. The discussion could help identify specific themes where developing and emerging countries would particularly benefit from the experience of developed countries.

Ministers could reiterate the importance of collaboration with developing countries in the area of STI for a more inclusive approach to science. They could ask OECD to define principles for co-operation on innovation matters and set up a joint global innovation agenda aimed at enhancing contributions of science and innovation to global well-being, integrating the needs of countries at different stages of development and different groups across society. A variety of possible ways for enhancing global inclusiveness could be discussed, including: supporting international co-ordination and inter-operability in open science initiatives; examining how to use large international research infrastructures – funded from abroad – to enhance local scientific capacities; exploring how to better use ODA (Official Development Aid) to enhance science capacities in poor countries; raising and, assessing the best ways of managing interaction between institutions from different countries having different baseline capabilities. The Ministerial would inform the future work of the CSTP and its Working Parties (together with other OECD committees) on “innovation and inclusive development”. It could point to the inclusion of specific modules for developing countries in broader thematic projects of the OECD (e.g. relating to the impact of new technology).

## Lunchtime Discussion. Scientific Advice for Policy Making

### Rationale

Increasingly Governments are turning to the scientific community to provide advice and evidence that can inform decisions and policies across a range of issues, from short-term public health emergencies through to longer-term challenges, such as energy security. Such advice can be a valuable, or even essential, input to policy-making but its usefulness depends on how it is formulated and communicated as well as how it is perceived by its target policy audience and by other interested parties. It is rare that scientific evidence is the only consideration in a policy decision and, particularly for complex issues, many interests have to be balanced in situations where the science itself may be uncertain. The rapid evolution of information and communication technologies and moves towards more participative decision-making have put additional pressure on science to help provide answers and solutions, whilst opening up the academic enterprise to surveillance and criticism. Whilst science advice used to be most often formulated behind closed doors, the new norms for science advisory systems are openness, transparency and accountability.

In order to meet the increasing policy demands, a large variety of different advisory structures – involving a range of actors – have been established at different scales (local to national to global). An important distinction can be made between those structures whose principal focus is policy for science, e.g. national councils for science and technology, and the diversity of permanent and ad hoc structures whose main focus is on science for policy. It is in the latter domain that the main challenges and opportunities for improvement exist. Here also, there is an important distinction to be made between bodies that are mandated by governments to provide advice and independent bodies, such as science academies or think-tanks, that may provide unsolicited, but nevertheless valuable, scientific advice in areas of policy concern. In addition to these collective advisory structures, individual science advisors or counsellors play an important role in many countries. In some cases this is formalised with the appointment of Chief Science Advisors at central government and/or ministry levels. This ‘dynamic ecosystem’ of science advisory structures and processes is different in each nation. Likewise, at the international level, a variety of different mechanisms exist, ranging from global science assessment processes in areas such as climate, biodiversity or energy to more technical product risk assessment mechanisms targeted at regulatory processes.

One area in which scientific information and evidence is particularly valuable is the risk analysis and management of emergencies, including those linked to natural hazards and disease pandemics. These are also situations in which the inherent uncertainties in scientific knowledge are apparent and in which there is high public interest. Following the prosecution of seven scientists in Italy in 2012 because of their role in risk assessment and communication prior to the tragic L’Áquila Earthquake, the global scientific community has been re-evaluating its role(s) and responsibilities with regard to providing science advice. There is concern that scientists will either refuse to participate in advisory processes or will become so cautious in formulating their assessments that their value will be reduced.

The science advice that is required and the timeframe in which it must be provided, in either major acute crisis situations or addressing longer term global societal challenges, is very different. However, what is in common is that the effects and the policy requirements are manifest at different geographic scales – from local to global. Likewise the associated scientific advisory structures and processes also operate at different scales and may address similar or very different questions using the same scientific knowledge. In areas of high public interest - and complex and often equivocal scientific knowledge - the potential for confusion is enormous. Contradictory science-based policies and decisions from different nations and international bodies can undermine effective actions in situations where concerted international action is required.

### Possible questions to be addressed

Ministers might focus their discussion on the following questions:

* What is the role of formal scientific advisory bodies and less-formalised structures in your country? What are the policy issues for which scientific advice is most needed and/or valued?
* Are there good practices in providing science advice that could be emulated across countries? When, how and why is civil society involved in various national science advisory processes?
* What mechanisms and procedures are in place for dealing with major crises? Have they been tested? What are their strengths and weaknesses?
* What kind of mechanisms and procedures should be considered for coordinating and improving science advice on issues with a significant international dimension, including short-term crises and longer-term global challenges?

### Expected outcomes of the Ministerial meeting and implications for the future CSTP work

Under the aegis of GSF, CSTP has already initiated an initial project on Scientific Advice for Policymaking and Consequences for the Role and Responsibility for Scientists, as discussed above. This work provides a solid foundation for future CSTP work in this area. In addition, if science advice for policy is considered by Ministers to be an important outcome of public investment in science, then CSTP might consider how this might influence its work on impact assessment and, the development of new indicators.

Depending on the views of Ministers a key outcomes that CSTP/GSF might take forward, working with other partners, including a nascent network of senior science advisors, is the development of a new OECD declaration on science advice. This would lay out an international framework of principles and provide a foundation for improving national advisory mechanisms and international cooperation. Further work on science advice, including international coordination mechanisms, in crisis situations (and/or longer–term global crises) may also be appropriate. Finally, the issues of public engagement and trust in science advisory processes may also merit further work from OECD, including, for example, a more systematic analysis of national experiences and lessons learnt.