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The Role of Science, Technology and Innovation Policies to Foster the Implementation of the Sustainable Development Goals (SDGs)

Report of the Expert Group "Follow-up to Rio+20, notably the SDGs"

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Report of the Expert Group "Follow-up to Rio+20, notably the SDGs"

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EXECUTIVE SUMMARY

Background

The independent Expert Group on the "Follow-up to Rio+20, notably the Sustainable Development Goals (SDGs)" was established by the European Commission with the purpose of providing advice on the role of science, technology and innovation (STI) for implementing the new sustainable development agenda ("2030 Agenda").

The Report presents, as indicated in the Terms of Reference, "a reference framework in which research and innovation policy and related implementation measures are seen as engines of a transformative agenda built around universally applicable sustainability goals". Moreover, the Report provides recommendations, both in terms of general policy orientations and concrete areas of engagement, for EU STI policy to contribute to the implementation, in Europe and beyond, of the 2030 Agenda, as well as for possible engagements in international initiatives concerning STI. Finally, the annex contains proposals to better align the Horizon 2020 tracking system to the SDGs.

Science, technology and innovation is a key tool for moving the world onto a sustainable path

In September 2015 the United Nations agreed on a new global Agenda to take the world on a sustainable pathway. To be implemented, the new "2030 Agenda" will require a fundamental change in the approaches followed so far. In particular:

- The new Agenda is based on principles of universality (including the "no one will be left behind" principle but also the principle of "action in all countries for all countries") and integration, whereby environmental, social and economic dimensions are no longer separate pillars but intertwined to form an indivisible whole.
- The SDGs mark a shift in the economic and political relationships between developing, emerging and developed countries. This requires significantly rethinking not only the EU's external action, including development cooperation, but also domestic ones.
- The new Agenda calls for a new cooperative paradigm based on the concept of "full global partnership". As the transition towards a sustainable path of development requires time and the mobilisation of all citizens, stakeholders, business and policy makers, these processes obviously need to be conducted in a participatory manner.

STI is a fundamental tool to implement the new Agenda, as it allows improving efficiency in both economic and environmental senses, developing new and more sustainable ways to satisfy human needs, and empowering people to drive their own future. In the SDGs framework, STI features strongly both in Goal 17, as well as a cross-cutting one to achieve several sectoral Goals and Targets. Fostering innovation is part of Goal 9 related to resilient infrastructure and inclusive, sustainable industrialisation, while Target 9.5 elevates the role of research and innovation policy well beyond STI as one of the Means of Implementation. Moreover, the Addis Ababa Action Agenda (AAAA) has identified concrete STI policies and actions as key for meeting the SDGs. Finally, the negotiations for the Paris climate COP21 in December 2015 address STI issues, proposing a framework for enhanced action on technology development and transfer.

STI policies are vital to make the EU the global frontrunner of sustainable development

In line with the "universality" of the SDGs, the EU has already committed to moving towards a sustainable Europe where people are "living well within the limits of our planet", but it needs to prepare adequate responses to the pressures on its economies, environment and quality of social life caused by global megatrends. The Report argues why the EU has both the *imperative* and the *opportunity* to become the global frontrunner of sustainable development (SD), also thanks to its strength in STI, recognised not only as one of the main drivers behind productivity increases and a key long-term lever for economic growth and prosperity, but also for environmental sustainability.

To do that, STI policies should be enhanced and aligned with the aspirations of the 2030 Agenda, making STI for SD policies (STI4SD) a key asset for the EU. The Report recommends the following three key avenues for change that cut across the specific recommendations proposed below:

- **switch the focus**, reorienting mindsets and behaviours towards SD, reframing the EU's STI challenges, and refocusing from technology transfer to building innovation capacity;

- **strengthen partnerships**, enhancing engagement with developing countries in existing EU instruments, engaging all stakeholders (especially the private sector), developing tailor-made international STI initiatives;
- **"walk the talk"**, addressing causes of implementation gaps, ensuring domestic integration of the SDGs in/with STI, improving policy coherence, building up opportunities to benefit from the "data revolution", and setting up monitoring, evaluation and assessments of STI4SD.

Recommendations

Some of the recommendations can be implemented in the short-run, building on existing policy tools and instruments, others require more time to be carefully designed; some can be carried out at technical level, other require a political commitment about the orientation of EU policies, also vis-à-vis the rest of the world. More than fifty specific recommendations are presented in the Report, clustered and summarised in the following groups:

- In terms of **general policy orientations**, the Report recommends:
  - to undertake a stock-taking and analysis of current EU strategies, to assess how STI policies could help in addressing these issues, and to adopt a Communication on STI4SD, to describe the proposed framework and to illustrate a concrete action plan in this field.
  - that the EU applies for itself and advocates for specific levers and investment in STI4SD accelerators selected by the AAAA (as the Least Developed Countries' Technology Bank and the Multi-stakeholder Forum on Science Technology and Innovation for the SDGs), moving beyond technology transfer and towards a broader emphasis on innovation systems;
  - to promote international efforts for capacity building and education for innovation and entrepreneurship, strengthen the use of aid flows for STI purposes, consider capacity building and early inclusion of social innovation as part of the initial investment projects evaluations by Multilateral Development Banks and International Financial Institutions;
  - to promote an initiative to ensure that the global intellectual property regime is consistent with the aims and action mechanisms of the 2030 Agenda,
  - to use tools such as Horizon 2020, LIFE and the EU structural and innovation funds in a synergetic way to make EU cities as STI breeding grounds for experiments;
  - to develop a strategy to make businesses and people benefit from the "Data revolution", making Europe a champion in the digital world.
- **To improve the orientation of STI policies towards SDGs**, the Report recommends:
  - to integrate in the future Horizon 2020 work programmes the SDGs framework and language, increase the share of Horizon 2020 funds allocated to SDGs oriented projects and align the Horizon 2020 monitoring of the expenditure contributing to SD with the key underpinnings of the 2030 Agenda;
  - to set up science-to-policy task forces for each SDG in order to diagnose the STI needs along the innovation chain, and consider trade-offs and possible conflicts for each goal/target;
  - to develop a framework to guide investments in STI on projects, programmes and initiatives with transformative potentials, institutionalise a "high-impact logic" that allows the prioritisation of investments, and promote the creation of "Rating systems for STI4SD investment projects";
  - to develop an ERA initiative for SDGs, promote the internationalisation and access for developing country participants in EU innovation instruments and research infrastructures by extending their remit and mandates, and establish incentives to "globalise" key on-going EU innovation and Public-Private Partnerships initiatives;
  - make the mission of the European Institute of Technology fully aligned to the SDGs.
- As **policy coherence** is crucial to minimise the cost of transition to SD, the Report recommends:
  - to engage in the conceptualisation of Policy Coherence for SD, pursue alignment of EU STI instruments and of EU external policies to the SDG framework, and promote a similar alignment of Member States' STI policies;
  - to include in the ongoing "mapping and gap analysis" of EU policies vis-à-vis the SDGs an analysis about how STI tools could help in supporting actions aimed at filling the gaps or in improving policy coherence, and complement the policy gap analysis with an implementation gap analysis;

- to evaluate the policy coherence between internal market rules (including state aid), international trade rules and STI4SD policies; evaluate how the coherence between existing tools needs to be improved, especially in the linking of the domestic and the external dimensions;
- to systematically integrate the SD perspective and the SDGs in social innovation research;
- to produce an annual report and/or database on actions taken in its STI policies.

- As **communication and information on STI4SD** is vital not only to foster investments towards SDGs, but also to change policy makers', citizens' and stakeholders' behaviours, the Report recommends to:
  - to put more effort into communicating the knowledge gained in Horizon 2020 projects in support of the SDGs;
  - establish an effective communication between the science and the policy community, in order to both inform policy makers about emerging issues and the role that STI can play to identify feasible solutions, and improve the science base in policy making;
  - to build a communication/education strategy on the possible change in production and consumption patterns, supported by a strong package on circular economy and by engaging behavioural economists;
  - to initiate annual or biennial awards on STI4SD.

- The Report also provides suggestions for **engagement of the EU with international initiatives** linked to STI4SD. Besides recommendations concerning existing initiatives, it is proposed:
  - to follow and take stock of the developments in relevant global STI related initiatives;
  - to support the effort aimed at the global monitoring process, follow up and review of SDGs;
  - to take a leading role in existing international collaboration on selected 2030 Agenda topics, building on EU recognised strengths and leadership, and to promote the establishment of new cross-thematic international initiatives that will drive change across the SDGs, where the EU is a recognised global leader.

- To ensure remaining on the right track, once the objectives on aligned policies are set, an **efficient and effective evaluation framework of STI4SD is required**. Therefore, the Report recommends to:
  - to establish a permanent observatory of changes and trends in new, emerging and potential future technologies for SDGs, and set up a grassroots surveillance framework for ongoing evaluation of STI4SD policies;
  - to expand the Horizon 2020 ethical framework to EU international STI4SD initiatives;
  - to establish non-financial Ratings Agencies in the field of STI4SD and include the Common Defence and Security Policy in the evaluation scheme of STI4SD success.

- Finally, the Report also identifies **opportunities for specific research** to support implementation and better policies for SDGs. In particular, the following areas should be considered as candidates for research topics:
  - interdependencies between SDGs, to identify both critical trade-offs between policies aimed at achieving specific SDGs and how they can be mitigated through synergy solutions and possible multipurpose actions;
  - governance for the SDGs at national level and for improving the links to other levels;
  - improvement of the availability and timeliness of data related to SDGs and new approaches to train statisticians and data scientists;
  - the function and effects of internal market rules (including State aid rules) to foster innovation for SD;
  - improvement of social innovation research to address SD in a comprehensive way, to effectively stimulate practices for the adoption of behaviours oriented to SD.

1. INTRODUCTION

The independent Expert Group on the *"Follow-up to Rio+20, notably the Sustainable Development Goals (SDGs)"* (hereby referred as Expert Group[1]) was established by the European Commission (EC) with the purpose of providing advice to the Commission on the role of science, technology and innovation (STI) for implementing the sustainability agenda agreed at the Rio+20 Summit on Sustainable Development of 2012 and in particular the SDGs, including the potential of research and innovation cooperation in this context[2].

This Report presents the conclusions of the Expert Group and its suggestions and recommendations for future actions. The aim of the Report is not to carry out an in-depth analysis of the current state of the European Commission's policy on STI policies, neither to provide recommendations on all aspects of existing programmes, but, according to the mandate received, to

"elaborate a reference framework in which research and innovation policy and related implementation measures are seen as engines of a transformative agenda built around universally applicable sustainability goals".

In particular, the Group has been asked to:

- *elaborate a framework that positions the EU research and innovation policy within the international sustainability agenda with a view to effectively link research and innovation policy to the SDGs in support of a transformative agenda and in a context of shared governance, including by maximising the synergies with other policies;*
- *provide recommendations, both in terms of policy orientations and concrete areas of engagement, for EU research and innovation to contribute to the implementation in Europe and beyond of the sustainable development agenda and the SDGs;*
- *formulate suggestions for a possible engagement in relevant Rio+20 follow up actions and international initiatives through EU research and innovation."*

The Report goes from general to particular. The second section underlines the importance of STI to take the world onto a sustainable path. Summarizing the key points included in the 2030 Sustainable Development Agenda[3] agreed by the United Nations in September 2015 (which builds in the conclusions of the Addis Ababa conference held in July 2015), it addresses the links between STI policies and other policies and takes stock of key international initiatives on STI policies for sustainable development (SD). The third section discusses the relevance of the 2030 Sustainable Development Agenda (henceforth "2030 Agenda") for the European Union (EU), both vis-à-vis its Member States and the rest of the world, and elaborates a framework for policies and actions, taking into account existing overarching strategies. It also addresses the role of investments to change current economic and social paradigms and practices to make them sustainable. In the fourth section the key recommendations for mainstreaming SD in the EU policies for STI are elaborated, based on an analysis of current EU policy priorities aligned with STI policies to the 2030 Agenda and Group Members' expertise in specific fields.

The Annex provides the Expert Group's proposals to better align the Horizon 2020 tracking system to the SDGs, as requested in the Terms of Reference.

This Report benefited from extensive comments received in two occasions from various services of the European Commission. It is also worth noting that a preliminary version of the Report, incorporating a first set of recommendations, was presented in a side event organised by the EC in the margins of the Third International Conference on Financing for Development held in Addis Ababa (Ethiopia)[4] in July 2015: the reaction from the audience was extremely positive, witnessing the interest from non-EU institutions in the approach developed by the Expert Group.

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[1] The Expert Group was chaired by Enrico Giovannini (University of Rome «Tor Vergata») and composed by Ingeborg Niestroy (rapporteur, IISD), Måns Nilsson (Stockholm Environment Institute), Françoise Roure (French High Council for Economy), Michael Spanos (Global Sustain).

[2] Horizon 2020 Work Programme 2014-2015 for 'Climate action, environment, resource efficiency and raw materials', pages 79-80.

[3] "*Transforming our world: the 2030 Agenda for Sustainable Development*" was agreed by consensus on 2 August 2015 at the informal meeting of the UN General Assembly plenary and adopted on 25-27 September 2015 at the UN Sustainable Development Summit. The full text is available at: https://sustainabledevelopment.un.org/content/documents/7891Transforming%20Our%20World.pdf.

[4] *Addis Ababa Action Agenda (AAAA),* http://www.un.org/esa/ffd/wp-content/uploads/2015/08/AAAA_Outcome.pdf

2. 2015: A CRUCIAL YEAR FOR THE WORLD

2.1 The new global 2030 Agenda and the Sustainable Development Goals

The year 2015 presents a historic and unprecedented opportunity to bring the countries and citizens of the world together to embark on new paths to improve people's lives everywhere and the state of the ecosystems. The decisions taken in the international system this year will shape the global course of action to end poverty, promote prosperity, peace and **well-being for all, while taking into account environmental and resources limits, and tackling climate change.**

Since the Rio Conference in 1992, the world has tried to reconcile environment and development, stimulating a lot of important actions both at global and at national levels. With the Millennium Declaration in 2000, the United Nations launched a development agenda built around the Millennium Development Goals (MDGs). Notwithstanding the progress made towards these objectives, economic, social and environmental conditions are still far from being satisfactory in large parts of the world. Concerns for the overall sustainability of the current and future pathways have grown considerably over the years. The Rio+20 Conference in 2012 and the outcome document "The Future We Want"[5] launched a process to develop a strong "Post-2015 Development Agenda" around the concept of sustainable development and universally applicable SDGs to be achieved by all countries in the world.

As result of this "Post-2015 process" the United Nations in September 2015 agreed on a new global Agenda to take the world on a sustainable pathway ("2030 Agenda")[6]: in it, 17 goals and 169 targets have been agreed to "guide the decisions we take over the next fifteen years", together with a Declaration and sections on Means of Implementation and Global Partnerships, and Follow-up and Review. The conclusions of the Addis Ababa Conference on "Financing for Development"[7] are an integral part of the 2030 Agenda. The indicators needed to monitor progress towards the targets will be defined at the beginning of 2016.

To be implemented, the new Agenda will require a fundamental change in the cultural and political approaches followed so far. In particular:

- The Agenda marks a shift in how the community of nation states looks upon itself and where it wants to go. The pursuit of "economic growth at all cost", i.e. the idea that the increase of aggregate income and wealth can fix all societal problems, without considering environmental consequences and addressing social inequalities, has come to an end and a much more holistic understanding of development, where social and environmental outcomes are valued just as highly, has been embraced. The new framework (including the "no one will be left behind" principle) finally makes clear that:
  - development means much more than economic growth measured in terms of GDP[8];
  - sustainability means much more than environmentally compatible;
  - inequality means much more than fair income or wealth distribution.
- The SDGs cover a wide range of topics, from social (health, poverty, education, migration, gender balance, etc.) to economic (production and consumption, jobs, energy, resilience, etc.), from environmental (climate change, water, ecosystems, etc.) to rule of law and governance (accountable institutions, policy coordination, transparency, effectiveness, reducing corruption and violence, etc.). Also human rights and gender balance are now mainstreamed in the 2030 Agenda. The 2030 Agenda and its SDGs represent a new long-term perspective on global development that needs to be reflected in a policy framework that encompasses all dimensions of SD and that needs to be strongly embedded in decision-making of governments, businesses and people. Science, technology and innovation are fundamental ingredients of such a shift, as they allow improving efficiency in both economic and environmental senses, developing new and more sustainable ways to satisfy human needs, overcoming historical divides, as well as empowering people to drive their own future.

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[5] A/RES/66/288, https://sustainabledevelopment.un.org/rio20/futurewewant

[6] *Transforming our World: The 2030 Agenda for Sustainable Development* https://sustainabledevelopment.un.org/content/documents/7891Transforming%20Our%20World.pdf

[7] *Addis Ababa Action Agenda (AAAA),* http://www.un.org/esa/ffd/wp-content/uploads/2015/08/AAAA_Outcome.pdf

[8] See work on "Beyond GDP" over the last 10 years (www.wikiprogress.org), including the Commission communication *GDP and beyond* (COM(2009) 433) http://ec.europa.eu/environment/beyond_gdp/background_en.html.

- The SDGs also mark a shift in the economic and political relationships between developing, emerging and developed countries, where the boundaries between them are becoming increasingly blurred and the priorities they pursue are increasingly more universal. This requires significantly rethinking not only our external action, including development cooperation, but also domestic ones.
- The new Agenda calls for the design of a new international cooperation policy based on the concept of "enhanced global partnership" and the use of a wide range of tools. Partnerships may be formed in many forms, ranging from alliances between countries, governments, businesses and non-governmental organisations, multilateral development institutions and civil society with the aim to creating shared value for all stakeholders. International, as well as domestic policies should embrace partnerships and collective action efforts that pool resources, share risks and aim to find solutions faster. This new approach will require more interaction with governments in developing countries for governance issues such as domestic resources mobilisation, as well as shaping effective relationships with new actors in the partnerships, also taking into account what works where and why.
- As the transition towards a sustainable path of development requires time and the mobilisation of all citizens, stakeholders, business and policy makers, these processes obviously need to be conducted in a participatory manner. There are still low hanging fruits, but many trade-offs as well. New business opportunities need to replace unsustainable ones, options for consumers need to be attractive and behaviour may be further nudged towards sustainable choices, for which innovation (including social innovation) plays a central role.

The SDGs pose new challenges to both domestic and international policies, and actions to achieve them need to be pursued in three key parallel tracks[9]:

- *domestic policies to be pursued by all countries to improve their national conditions* (human rights, governance, rule of law, education, health, income equality within nations, environmental protection, etc.);
- *domestic policies and actions that have an impact on other regions and countries* (consumption and production patterns, GHG emissions, resource use, agriculture and fisheries, transboundary environmental pollution, etc.);
- *international policies* (development cooperation, trade, migration, financial systems, etc.).

[9] See also: Weitz, N, Persson, Å. Nilsson, M. and Tenggren S. (2015): Sustainable Development Goals for Sweden: Insights on setting a national Agenda. Stockholm Environment Institute, Stockholm (http://www.sei-international.org/publications?pid=2817); Martens, J. & Obenland, W. (2015): Gut Leben Global. Neue Ansaetze der Wohlstandsmessung und SDGs in Deutschland. Global Policy Forum Europe, Bonn, p. 38 (https://www.globalpolicy.org/home/265-policy-papers-archives/52739-neuer-report-gut-leben-global.html).

Table 1: The Sustainable Development Goals

Goal 1	End poverty in all its forms everywhere
Goal 2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
Goal 3	Ensure healthy lives and promote well-being for all at all ages
Goal 4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Goal 5	Achieve gender equality and empower all women and girls
Goal 6	Ensure availability and sustainable management of water and sanitation for all
Goal 7	Ensure access to affordable, reliable, sustainable and modern energy for all
Goal 8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
Goal 9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
Goal 10	Reduce inequality within and among countries
Goal 11	Make cities and human settlements inclusive, safe, resilient and sustainable
Goal 12	Ensure sustainable consumption and production patterns
Goal 13	Take urgent action to combat climate change and its impacts
Goal 14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
Goal 15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
Goal 16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
Goal 17	Strengthen the means of implementation and revitalize the global partnership for sustainable development

2.2 The role of science, technology and innovation to achieve SDGs

Science, technology and innovation (STI, as referred to in the UN and OECD[10] contexts) have been recognised as one of the main drivers behind productivity increases and a key long-term lever for economic growth and prosperity. It is also vital for environmental sustainability.[11] In the context of the new Agenda and for achieving the SDGs STI plays an even more central role.[12] First of all, STI features strongly both in Goal 17 on Means of Implementation, as well as a cross-cutting one to achieve several sectoral Goals and Targets. Fostering innovation is part of the Sustainable Development Goal 9 related to resilient infrastructure and inclusive, sustainable industrialisation. In particular, Target 9.5[13] elevates the role of research and innovation policy well beyond STI as one of the Means of Implementation[14]. Moreover, the Addis Ababa Action Agenda (AAAA)[15], which is an integral part of the 2030 Agenda, has identified concrete policies and actions - including STI - as support for meeting the SDGs.[16] Finally, the negotiations for the Paris climate COP in December 2015 address STI issues, most notably underlining that cooperative action is key to facilitate and promote technology, and proposing a framework for enhanced action on technology development and transfer.

In particular, the AAAA recognises that "the creation, development and diffusion of new innovations and technologies and associated know-how, including the transfer of technology on mutually agreed terms, are powerful drivers of economic growth and sustainable development". It underscores that STI strategies must be "integral elements of our national sustainable development strategies to help to strengthen knowledge-sharing and collaboration" and contains an entire chapter on STI, underlining:

- the role of new innovations, technologies and associated know-how, including the transfer of technology on mutually agreed terms, as powerful drivers of economic growth and sustainable development[17];
- the need to craft policies that incentivise the creation of new technologies, that foster research and that support innovation in developing countries;
- the importance of an enabling environment at all levels, including enabling regulatory and governance frameworks, in nurturing science, innovation, the dissemination of technologies, particularly to micro, small and medium-sized enterprises, as well as industrial diversification and value added to commodities;
- a commitment to promote social innovation to support social well-being and sustainable livelihoods;
- knowledge-sharing and the promotion of cooperation and partnerships between stakeholders, including between governments, firms, academia and civil society, in sectors contributing to the achievement of the SDGs;

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[10] OECD Daejeon Ministerial Declaration on Science, Technology and Innovation policies for the Global and Digital Age, 21 October 2015 OECD DSTI/STP/MIN(2015)1 (http://www.oecd.org/science/sci-tech/sti-ministerial-2015.htm).

[11] S-T-I are frequently referred to as a set, which means that, although they indeed are of different nature and expand on specific ecosystems, they may be considered in a continuum from a novel idea and/or knowledge, towards commercialisation.

[12] See also the recommendations of the Scientific Advisory Board of the UN Secretary General, *The Crucial Role of Science for Sustainable Development and the Post-2015 Development Agenda*, 9 July 2015, http://en.unesco.org/un-sab/sites/un-sab/files/Preliminary%20reflection%20by%20the%20UN%20SG%20SAB%20on%20the%20Crucial%20Role%20of%20Science%20for%20the%20Post-2015%20Development%20Agenda%20-%20July%202014.pdf

[13] Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending.

[14] Goals and targets that explicitly mention the role of STI include the following: (2.a), 3 (3.b), 6 (6.a), 7 (7.a), 8 (8.2), 9 (9.5, 9.b), 14 (14.4, 14.a), 17 (17.6, 17.7, 17.8).

[15] *Addis Ababa Action Agenda (AAAA),* http://www.un.org/esa/ffd/wp-content/uploads/2015/08/AAAA_Outcome.pdf

[16] See AAAA, Para 40 and 62.

[17] In AAAA, Para 67, it is recognised that "Private business activity, investment and innovation are major drivers of productivity, inclusive economic growth and job creation. We acknowledge the diversity of the private sector, ranging from micro-enterprises to cooperatives to multinationals. We call on all businesses to apply their creativity and innovation to solving sustainable development challenges."

- the important role of public finance and policies in research and technological development, as well as the use of public funding to enable critical projects to remain in the public domain, and open access to research for publicly funded projects;
- the need to step up international cooperation and collaboration in science, research, technology and innovation, including through public-private and multi-stakeholder partnerships, and on the basis of common interest and mutual benefit, focusing on the needs of developing countries and the achievement of the SDGs;
- areas for special attention, such as research and development of vaccines and medicines, preventive measures and treatments for the communicable and non-communicable diseases, food security, agricultural productive capacity in developing countries, marine technology in order to improve ocean health.

The 2030 Agenda also launches a Technology Facilitation Mechanism in order to support the policies for SDGs, based on a multi-stakeholder collaboration and composed of:

- a United Nations Interagency Task Team on Science, Technology and Innovation for the SDGs;[18]
- a collaborative Multistakeholder Forum on Science, Technology and Innovation for the SDGs;[19]
- an Online Platform for Technology Knowledge and Information Sharing (OPTKIS).[20]

It is important that the Mechanism serves all countries to step-up solution-oriented cooperation and capacity building in STI for SD. As the EU pointed out in April 2015, research and innovation must respond to the needs of society and should be based on the co-design, co-development and co-delivery of solutions, including through partnerships between relevant stakeholders from governments, private sector, civil society, research community and the relevant international partners (especially the UN bodies), which the Technological Facilitation Mechanism should bring together.[21]

Moreover, with the adoption of the 2030 Agenda there is a renewed momentum for a number of existing and new international initiatives related to science-policy interactions. Indeed many of the SDGs themselves point the way for deploying STI for SD as a tool for international cooperation and diplomacy, especially about global science, technology facilitation and innovation capacity building mechanisms (targets 17.6-17.8), as well as about data analytics and measurements (targets 17.18 and 17.19). Box 1 shows some relevant Rio+20 follow up international initiatives related to STI, which will be revisited in section 4.6.

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[18] The Task Team will promote coordination, coherence, and cooperation within the UN System on STI related matters, enhancing synergy and efficiency, in particular to enhance capacity-building initiatives; it will work with 10 representatives from the civil society, private sector, the scientific community, to prepare the meetings of the Multistakeholder Forum and to operationalize the online platform.

[19] The Forum will be convened once a year to discuss STI cooperation around thematic areas for the implementation of the SDGs, congregating all relevant stakeholders to actively contribute in their area of expertise. The Forum will result in a summary of discussions as an input to the meetings of the High Level Political Forum, in the context of the follow-up and review of the implementation of the Post-2015 Development Agenda.

[20] The Online Platform for Technology Knowledge and Information Sharing (OPTKIS) will:

• be used to establish a **comprehensive mapping** of, and serve as a gateway for, information on existing science, technology and innovation initiatives, mechanisms and programmes, within and beyond the United Nations;

• **facilitate access** to information, knowledge and experience, as well as best practices and lessons learned, on science, technology and innovation facilitation initiatives and policies. The online platform will also facilitate the dissemination of relevant open access scientific publications generated worldwide;

• be developed on the basis of **an independent technical assessment** which will take into account best practices and lessons learned from other initiatives, within and beyond the United Nations, in order to ensure that it will complement, facilitate access to and provide adequate information on existing science, technology and innovation platforms, avoiding duplications and enhancing synergies.

[21] EU statement for the discussion of Technology Facilitation Mechanism and other STI Issues on 22 April 2015, http://eu-un.europa.eu/articles/en/article_16377_en.htm.

Box 1 - Some relevant Rio+20 follow up international initiatives related to STI

While there is a large number of international initiatives related to STI, a few recently established ones that have both science and science-to-policy dimensions in the field of sustainability and green economy are presented here. Section 4.6 provides some recommendations about the EU's participation in them.

Group on Earth Observations (GEO)

Established in 2005 and renewed in 2014 for another 10 year period, the role of GEO will be significantly enhanced in the light of the data needs in the follow up of the 2030 Agenda. The role of Earth observations (EO) for follow up of the SDGs has been acknowledged repeatedly in UN documentation. The contribution of the Group on Earth Observation System of Systems to sustainable development programming, planning and implementation was acknowledged in the Rio+20 Outcome Document. The GEO is an intergovernmental organisation bringing together major actors in global Earth observation and which decisions are taken by consensus in a Plenary with representatives from 98 states and the European Commission as well as representatives from almost 90 international organisations with a remit in Earth Science. The European Commission (through the Directorate General for Research and Innovation) is one of the four co-chairs of GEO together with United States, China and South Africa.

Future Earth (FE)

The Science and Technology Alliance for Global Sustainability[22] (in short the 'Alliance') promoted the creation of Future Earth, a new initiative launched at the Rio+20 Summit, to create a global, independent platform for scientific collaboration on global change research and sustainability. Future Earth will integrate and replace currently disparate international programmes like Diversitas, the International Geosphere-Biosphere Programme (IGBP) and the International Human Dimensions Programme (IHDP). Together, these programmes involve up to 70.000 researchers. Future Earth's Executive Director is currently housed in Montreal (Canada), at the top of a geographically-distributed secretariat (in Canada, France, Japan, Sweden and US). The EC has a role in this initiative as member and present co-chair of the "Belmont Forum", one of the members of the Alliance. With Future Earth's current momentum and influence with national research funding agencies, it appears realistic that significant funding is going to be channelled to the topics that Future Earth will define.

Green Growth Knowledge Platform (GGKP) and Global Green Growth Institute (GGGI)

Green economy was one of two main themes for the Rio+20 conference on sustainable development, which was the foundation for the 2030 Agenda. In connection to the Rio+20 conference, a number of initiatives was established, aiming to promote the transition to a green economy in the context of sustainable development. In particular, GGKP is a platform for knowledge sharing, dissemination and promotion of the concept of "green growth". GGKP, which has a membership including OECD, UNEP and World Bank, has become established as an important forum for knowledge exchange and learning with its own funding base and governance structure. A significant number of International Governmental Organizations (IGOs) and research institutes have joined the network as "Knowledge partners", as GGKP defines research priorities and commissions research, predominantly seemingly of the "grey literature" type. GGKP was initiated by the GGGI, a Korea-based international organisation set up to promote the green growth agenda and South Korea's position in the multilateral arena. The GGGI itself has had organisational challenges including intense media scrutiny due to reports about economic wastefulness[23] and dispatches of funding grants where there have been conflicts of interest[24].

Sustainable Development Solutions Network (SDSN)

The SDSN is a global network initiated and spearheaded by Jeffrey Sachs of Columbia University. SDSN early was launched in August 2012 under the auspices of the UN Secretary-General Ban-Ki Moon, but it should be noted that it is not a UN programme or agency. SDSN does three main things: it establishes academic memberships and develops curriculum (including an online Master's Programme), informs and seeks to influence the development of the Rio+20 outcomes, SDGs, financing for development and COP negotiations, and develops research themes around various "solutions" topics globally. Much like FE (where SDSN is a part of its founding alliance), the SDSN has established a complex governance machinery involving a leadership council, an academic committee, an assembly, an executive committee and a secretariat (distributed in Paris, New York and New Delhi). SDSN has succeeded in establishing a very broad network of universities and institutes as members and have over the last two years done numerous national "launches". It has also been active for the preparation of the SDGs, having prepared reports on the goal framework itself as well as monitoring indicators, and it seeks to play a significant role in their implementation and in the associated processes.

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[22] It comprises the International Council for Science (ICSU), the International Social Science Council (ISSC), the Belmont Forum of funding agencies, the Sustainable Development Solutions Network (SDSN), the United Nations Educational, Scientific, and Cultural Organization (UNESCO), the United Nations Environment Programme (UNEP), the United Nations University (UNU) and the World Meteorological Organization.

[23] http://cphpost.dk/news14/politics-news14/a-first-class-scandal-for-luxury-lars.html.

[24] http://www.information.dk/487918.

The High Level Political Forum and the Global Sustainable Development Report (GSDR)

The High Level Political Forum (HLPF) on Sustainable Development, which replaced the Commission on Sustainable Development after Rio+20, is the main UN platform providing political leadership and guidance on sustainable development issues at the international level. One of its functions is to strengthen the science-policy interface on sustainable development. In this context, the GSDR is a new recurring UN publication aiming to strengthen the science-policy interface between the SDG political process and the scientific community, and to deliver the basis for deliberations in particular for the HLPF. The report, which is being prepared by UNDESA, is seen as an "assessment of assessments" and a first "prototype" attempt was published in 2014. The 2015 edition is available on the UN website[25]. Rather than seeking a comprehensive scope for all SD issues, it attempts to present new ways of interconnecting issues and linking with and between the SDGs. It also attempts to maintain an open process, where inputs and submissions are invited from civil society, the UN system and from the scientific community. Ultimately, the GSDR could be the key instrument for global-level follow up on the SDGs.[26]

2.3 The links between STI policies and other policies

Moving the world development onto a sustainable path will depend not only on scaling of existing appropriate technologies, but also radical innovations (including social ones) and changes in mindsets and behaviours. Technology alone is not sufficient for ensuring a sustainable pathway, inter alia due to rebound effects, thus innovation (including social innovation) is vital to induce these changes and make behaviour change attractive. Overall, STI is key to reduce the costs of transition, also in terms of job losses: this is why it should be directed to areas that stimulate transitional movements in the economy and the society, and be considered as a common objective of the public and the private sectors. Horizon 2020 (the 2014 – 2020 EU Framework Programme for Research and Innovation) has a strong commitment in favour of SD, as at least 60% of its overall budget is expected to contribute to sustainable development[27].

However, fostering STI alone would not be enough, as the implementation of the SDGs calls for an unprecedented collaboration in areas such as enabling governance and policy environments, developing human skills and capacities for innovation, mobilisation and effective use of public finance, stimulating trade, harnessing the positive effects of migration and implementing a continuous monitoring and review of the results achieved to ensure a full accountability of decision makers. It is part of an enabling governance environment that STI policies are fully integrated in overarching and sectoral strategies and policies. At the same time, STI itself can contribute to build an enabling environment. It can be used more to help and to empower people, for example with respect to transparency and accountability, and better access to education and public services (e.g. with specific apps), as well as regarding technologies and innovation with direct benefits for people (e.g. clean cooking stoves, biotech for smallholders), which is also a key opportunity to nudge behaviour towards a sustainable way.

For the international dimensions of the SDGs, STI can provide the grounds for a new global partnership that will eventually bring a new spirit of solidarity and cooperation. For this to happen, development cooperation can work more synergistically with research and innovation actors in building STI capacities in developing countries also in order to enable engagement in related international activities. Increasing public and private spending and investment in research and development, including through public-private partnerships, is a supportive measure for this.

In conclusion, "STI policies for sustainable development" (henceforth STI4SD) are a key transformational force to change existing, clearly unsustainable, pathways globally. As such they should become a vital ingredient of future policies in the European Union, and could become a "motto" for the global policy community's discussion on how to achieve the SDGs.

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25 https://sustainabledevelopment.un.org/globalsdreport.

26 See also recommendations by the Scientific Advisory Board of the UN Secretary General on *Strengthening the High-Level Political Forum and the UN Global Sustainable Development Report*, 9 July 2015, https://en.unesco.org/un-sab/sites/un-sab/files/Final_UNSAB-HLPF_UNGSDR_policy_brief.pdf

27 Horizon 2020 COM(2011) 808 final.

3. THE 2030 AGENDA AND ITS POSSIBLE IMPACT ON EU POLICIES

3.1 Making the EU a world champion in sustainable development: a vision for the next 10 years

In line with the overall aim of the 2030 Agenda, the EU has committed to moving towards a sustainable Europe where people are "living well within the limits of our planet".[28] This requires, among other things, transitions in the ways we use natural resources, how we generate and use energy, produce and use food, how transport modalities are organised, and how to get to competitive low carbon production processes. The European Union needs to prepare adequate responses to the pressures on its economies, environment and quality of social life caused by global megatrends[29]: population growth, migration, scarcity of and competition for natural resources that are essential to the EU's economy and currently have to be imported, climate change and other environmental problems which will put substantial pressure on Europe's various infrastructures, as well as new health threats such as pandemics. Ignoring the long-term consequences of such pressures may come with huge economic, environmental and social costs.[30] Combined with the existing and emerging domestic challenges within the EU Member States, as well as the European footprint in other parts of the world, it is clear that concerted action is needed and 'business as usual' is not an option.

For example, the migration crisis shows how Europe is connected and the world's problems are also EU's challenges. This crisis does not have an easy fix, especially as there are predictions that climate change and further environmental degradation can lead to more migration to come.[31] In this perspective, it should be seen as an opportunity for raising the awareness that migration and climate change are interconnected and that a successful outcome of the forthcoming COP21 is a "must" also to mitigate the risk of massive migrations to Europe.

It is impossible to predict how Europe will look like 10 years from now, but it is clear that steering Europe towards "a future we want" requires an extraordinary investment in knowledge production and use, thus in science, technology and innovation, as well as the capacity to successfully address the deep systemic causes of the current and future challenges. Technology alone will not 'fix' this: changes in mindsets and behaviour are also vital. And although technological progress is a key part of the solution, it can also bring new challenges and risks.

The 2030 Agenda is also a commitment towards a Europe, where analytical and scientific capacities are used to anticipate future risks and challenges, decisions are made on evidence, especially when new legislation is prepared, and rigorous and comprehensive impact assessment tools, incorporating all dimensions of sustainable development for domestic and external aspects of its policies, are widely used. It is furthermore a commitment to a Europe that is ready to share its experience and knowledge with other parts of the world, supporting other countries to move on sustainable pathways, developing and/or adapting technologies to meet their needs, taking into account economic, social and cultural specificities, and engaging all stakeholders in this process.

The concerted pursuit of these objectives **could make the EU the 'world champion' in SD**. This is not an impossible objective, as:

- the EU and its Member States have a long-standing commitment to SD, also reflected in the Treaties and the efforts for mainstreaming SD in policy and governance;
- the SDGs represent a great opportunity to reinvigorate this commitment at EU and individual Member State levels, and turn the commitments into more concrete actions. For example, there is a number of recent or forthcoming policies which set new standards for the future and address several of the systemic challenges, such as the Circular Economy package (expected end 2015[32]), the Innovation Union, the Energy Union, the Digital Single Market, and the ambitions of the EU to make the Paris Climate Conference a success.

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[28] Title of the 7th Environmental Action Programme of the EU.

[29] EEA 2015. *The European Environment – State and Outlook 2015. Assessment of Global Megatrends*.

[30] E.g. EEA 2014. *Late Lessons from Early Warnings II*.

[31] E.g. Recommendations from the Advisory Group on Climate Change and Human Mobility (March 2015) http://www.unhcr.org/5550ab359.html), quoting the IPCC's Working Group II Contribution to the Fifth Assessment Report (March 2014): IPCC 5AR, WG2, Volume 1, Chapter 12, (2014), http://www.ipcc.ch/report/ar5/wg2/. See also http://www.unhcr.org/pages/49e4a5096.html.

[32] http://ec.europa.eu/environment/circular-economy/index_en.htm.

Some strengthening and fine-tuning of existing EU policies will probably be needed, though. The European Commission's Ten Priorities (established in 2014) can to some extent be linked to the SDGs (Table 2), but they were not developed with sustainable development as main goal (they carry the signature of the economic and financial crisis within the EU) and only weakly address the environmental dimension.

Table 2: European Commission's Ten Priorities (July 2014) and the SDGs

EC Priorities	Sustainable Development Goals *																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Jobs, Growth and Investment	X	X	X	(X)		(X)	(X)	X	X	(X)	(X)						X
Digital Single Market								X	X								X
Energy Union and Climate						(X)	X	X	X		(X)	(X)	X				
Internal Market								X		X							
Economic and Monetary Union								X		(X)							
EU-US Free Trade								X									
Justice and Fundamental Rights					X					X						X	
Migration										X							
EU as a Global Actor																X	X
Democratic Change					X					X						X	

* Brackets indicate: possible positive effects on the SDGs through this Priority

The set of SDGs offers a comprehensive view on short- and long-term issues, not only for jobs and growth, but also for other social and environmental dimensions. The interconnected nature of the SDGs requires an effective policy response to be comprehensive and entail a coherent and integrated approach to sectoral policies. While the current EU 2020 Strategy, at least in principle, covers the three dimensions of sustainable development ("for smart, sustainable, inclusive growth",[33] see Table 3), it does not yet address the international perspective, such as the impacts of EU domestic policies on other parts of the world and external policies including development cooperation[34].

[33] http://ec.europa.eu/europe2020/targets/eu-targets/index_en.htm.

[34] The strategy itself includes a chapter on "Deploying our external policy instruments", which mainly addressed trade and international macroeconomic policy coordination, as well as the external aspects of our various internal policies (e.g. energy, transport, agriculture, R&D), but this was not followed-up in the priorities or flagship initiatives.

Table 3: The EU 2020 strategy (March 2010) and the SDGs

EU 2020: Priorities, Targets and Flagship initiatives	Sustainable Development Goals																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Smart growth								X									
Target 1: Employment rate					X			X		X							
Target 2: R&D / GDP ratio								X									X
Target 4: Rate of early school leaving and third level education				X													
Flagship (1): Digital agenda for Europe (Creating a digital single market)								X	X								
Flagship (2): Innovation Union (Refocussing R&I on major challenges of society)			X				X	X	X			X	X	(X)	(X)		X
Flagship (3): Youth on the move (Fostering study abroad, improving skills, etc.)				X				X									
Sustainable growth												X					
Target 3: Climate change and energy sustainability: "20 – 20- 20 targets"							X		X		(X)	(X)	X				
Flagship (4): Resource-efficient Europe (Reducing GHG emissions and the resource intensity of consumption, etc.)						(X)	X					X	X	(X)	(X)		
Flagship (5): An industrial policy for the globalisation era (Supporting entrepreneuship, improve competitiveness, etc.)									X								X
Inclusive growth										X							
Targets 1. and 4. (repeated)																	
Target 5: Fewer people in or at risk of poverty and social exclusion	X									X							
Flagship (6): Agenda for new skills and jobs (Help people acquire new skills, modernise labour markets, etc.)				X				X									
Flagship (7): European platform against poverty (Ensuring economic, social and territorial cohesion, etc.)	X									X							

Brackets indicate: possible positive effects on these SDGs through the respective priority, target or flagship.

These considerations are also valid for possible strategies to be pursued at national level. The *universality* of the SDGs, one of their key characteristics, requires a significant change in the way in which policy agendas are being built: it obliges all countries, but especially the developed ones, where the legacy of existing and well established practices is larger, to address current and future challenges from a holistic perspective. This means reinvigorating horizontal coordination of line ministries (and potentially rethinking the current division of labour among them), addressing and integrating the domestic and the international cooperation perspectives, including the impacts of domestic policies on developing countries. In a nutshell, a serious commitment to achieve the SDGs implies a strong focus on policy coherence.

In conclusion, it is quite clear that the EU has both the *imperative* and the *opportunity* to become the global forerunner of sustainable development if it gears its strategies and policies towards this overarching goal and integrates policies, tools and measures to achieve it, while minimizing the costs of transitions. As far as the Commission is concerned, the lead responsibility of the First Vice-President for SD is an opportunity to engage all relevant DGs within the Commission and to fully integrate this internationally agreed 2030 Agenda in the forthcoming revision of the EU 2020 Strategy and its monitoring mechanism, the European Semester, addressing both important domestic challenges as well as the international policy of the Union.

3.2 The role of investments to change current economic and social paradigms and practices to make them sustainable

Investments are a vital instrument to change the current economic paradigm, increase social outcomes, improve energy and resource efficiency and reduce environmental costs. Indeed, one of the key actions undertaken by the Commission over the last year is the establishment of the European Fund for Strategic Investments (EFSI). But investing for impact, making practices of the 21st century actually sustainable, require quite a strong shift away from the traditional maximisation of the rate of financial return on investment.

Orienting investments in the real economy to the SDGs, in full cooperation between private and public stakeholders, represents a major response to the challenge of sustainability. Private investments, as well as publicly supported ones (through Official Development Assistance (ODA) and Other Official Flows (OOF)), may accelerate appropriate and sustainable technology transfers and adaptation in vital infrastructures like energy and water. Investments may also be a powerful engine of transformation and strengthen governance capacities, provided that they receive due protection and are undertaken in societies that have a minimum capacity of absorption (skills and capacity in industrial and technological management).

Also the so-called "impact investments", i.e. investments made into companies, organisations, and funds with the intention to generate a measurable, beneficial social or environmental impact alongside a financial return[35], can move a country onto a more sustainable path. In particular, investments in STI4SD is a powerful tool to reinforce countries and their capacity to protect their own populations from poverty and the deterioration of their environment and health. As financeability and attractiveness of "impact investments" are important factors to make this tool effective, a priority could be assigned, especially in developing countries, to investments in sustainable energy systems and services (as they condition access to water and sanitation), to the cyber sphere, financial monitoring and review, and education.

In order to get the highest possible leverage on SDGs by identifying appropriate investments in terms of social, economic and sustainable results, investment projects need to be evaluated according to a set of indicators (such as the position of the investment project in the "technology readiness level" scale, or the project's position in the technology life cycle, from research to demonstration and diffusion)[36]. These could underpin a dedicated methodology to be proposed in the context of relevant UN technology-related initiatives, such as the Technology Executive Committee of the UNFCCC and to the Least Developed Countries' (LDCs) Technology Bank and Technology Facility Mechanism.

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[35] See http://www.thegiin.org/impact-investing/ and http://www.socialimpactinvestment.org/.

[36] The UN Interagency Working Group (IAWG) has identified the share of "technology" contribution for each of the 17 SDGs as an initial vision. See https://sustainabledevelopment.un.org/content/documents/78165%20IAWG%20Technology%20Brief%20for%20Addis%20side%20event%20July%207%20final.pdf.

3.3 Current EU policy priorities aligned with STI policies to the 2030 Agenda

As shown in section 3.1, STI policies are fundamental for achieving SD and they must be fully integrated in overarching and sectoral strategies and policies. This is particularly true for the European Union, bearing in mind that:

- the EU has agreed that, by 2020, 3% of Member States' GDP should be invested in research, development and innovation; as this is one of the five headline targets for the EU 2020 Strategy, implemented by the Flagship initiative Innovation Union (see Table 3), STI is already at the heart of the EU's strategic agenda;
- the Commission has set out overarching implementation principles in its Communication on the Post-2015 Agenda,[37] which emphasises that "Science, technology and innovation, including digitalisation, can generate profound changes in a relatively short period of time. However, these changes might not automatically address social and environmental problems. All stakeholders have to exploit the potential offered by science, technology and innovation to benefit smart, sustainable and inclusive development" (for possible actions to implement this vision see Box 3 below);
- several of the new Commission's Ten Priorities, as well as some key recent initiatives (like the Digital Single Market) heavily rely on STI to speed up the change and improve prosperity of the European Union, minimizing the transition costs;
- it is expected that at least 60% of the overall Horizon 2020 budget will be related to sustainable development, and at least 35% to climate-related expenditure.

As there are too many policies, initiatives, measures and actions potentially related to STI at EU level to allow a comprehensive assessment, this section briefly discusses those that are more closely related to the new global Agenda.[38] In particular, two axes of the 2030 Agenda alignment are considered below: a) whether the measure enables international and developing country partnership and engagement; and b) whether the measure addresses the substantive issue areas for sustainable development embodied in the 2030 Agenda.[39]

- The **Horizon 2020** orientation towards societal challenges maps very well onto the set of global transformations implied in the new Agenda, across economic, environmental and social dimensions of sustainable development (see Box 2 below). Within Horizon 2020, the European Strategy Forum on Research Infrastructures 2010 Roadmap also addresses significant areas of the 2030 Agenda, such as energy, environmental sciences, and biomedical sciences. When it comes to opening up access to international partners, there is also progress. In the previous framework, both FP7 in general and the International Cooperation (INCO) area set up under FP7, induced the scientific community in the EU to engage with the outside world. However, FP7 had very limited outcomes in terms of developing country participation (0.9%) and non-EU countries participation was dominated by major powers, such as United States, China and Russia. Horizon 2020 has placed stronger emphasis on international participation with the objective of increasing the participation of non-EU partners in the programme. The global perspective of the 2030 Agenda leads to a stronger focus on tomorrow's major international players, such as India, Indonesia, Mexico, Colombia, Ethiopia, or Nigeria. Finally, in Marie Sklodowska-Curie Actions a significant proportion of involved people is coming from outside the EU (15,000 out of a total of 65,000 between 2014 and 2020).
- Measures are taken **to facilitate the influx of third country scientists to the EU** also through EURAXESS (the international science jobs portal), 'Destination Europe' and the forthcoming Scientific Visa. However, there is not much attention to enabling access to research infrastructures for developing country scientists and moving towards the development of global research infrastructures.

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[37] *A Global Partnership for Poverty Eradication and Sustainable Development after 2015* (COM(2015) 44 final).

[38] Many of these measures are covered in the "Innovation Union" commitments made in 2010.

[39] In addition to these STI policies there are of course many sectoral policies in which STI for sustainable development could be stimulated. These, which are outside the scope here, would include major established EU institutions with very significant budgets, such as the Common Agricultural Policy and Structural Funds, but also emerging and/or smaller-budget efforts such as European standardisation system, Circular Economy Package, the Eco-innovation Action Plan, the Energy Union, and measures related to the Water Framework Directive.

- The reinforcement of the **European Research Area** (ERA)[40] also aligns well with some items of the 2030 Agenda, for instance through its focus on gender equality (Goal 5), access to and transfer of knowledge (Goal 17), and transnational cooperation. Joint programming, one of five ERA partnerships launched in 2008, focuses attention to key sustainable development focus areas, for example non-communicable disease (Goal 3) and water (Goal 6). A link between the internal and external dimensions of the ERA has gradually been strengthened.

Box 2 – Key features of the Horizon 2020 framework and of the Multiannual Financial Framework concerning SD

The Horizon 2020 Regulation states that: "Climate action and resource efficiency are mutually reinforcing objectives for achieving sustainable development. The specific objectives relating to both should be complemented through the other specific objectives of Horizon 2020. As a result it is expected that at least 60% of the overall Horizon 2020 budget is expected to be related to sustainable development. It is also expected that climate-related expenditure should exceed 35% of the budget, including mutually compatible measures improving resource efficiency." In addition, in the MFF (Multiannual Financial Framework[41]) the EU has committed to report on biodiversity expenditure across the whole EU budget, without any explicit spending target. For these reasons, climate action and sustainable development objectives need to be clearly mainstreamed throughout the Horizon 2020 work programmes and adequate budget should be devoted to actions supporting these objectives. Horizon 2020 reporting will also include expenditure contributing to biodiversity.

The method that the Commission is currently using for tracking expenditure on climate action and sustainable development is based on the Rio Markers[42], which assigns weightings of 0%/40%/100% to the topics in the thematic parts of the Work Programme[43] (so-called 'programmable actions') based on their contribution to economic, social and natural capitals.

- The Commission's commitment to promote **open access** to results of publicly funded research[44] is an example of a development which is well aligned with the 2030 Agenda, which places heavy emphasis on transfer of technology and knowledge sharing on favourable terms as a key factor for SD (under Goal 17). The Commission (and many national funding agencies) have a default setting about open access to peer-reviewed literature, as well as practical projects for building up online infrastructures for data and establishments of knowledge transfer offices. These initiatives are important for maximising the impact of each research project or programme. This "walking the talk" is very useful for pushing other countries towards similar approaches, in the effort of building a global support for knowledge and technology transfer. A forthcoming comprehensive policy approach to open knowledge and innovation, potentially including also the issue of patents, licensing and IPR, can take into account the commitments made in the 2030 Agenda, and in doing so consider in particular the "policy coherence for development" aspect – i.e. implications for third countries (see also section 4.4).
- The **European Institute of Innovation and Technology (EIT)**, and its main mechanism "Knowledge and Innovation Communities" (KiCs), also addresses key dimensions of the 2030 Agenda, with the first set of KICs covering climate change, energy and ICT, and the second set covering healthy lives, raw materials, added value manufacturing, urban mobility and sustainable food systems. However, so far the engagement with non-European research and innovation networks appears to have been very limited and to make the EIT "fit for purpose" it would be advisable to look over its international mandate and establish a mechanism for involving developing countries.
- It is worth noting the "challenge-driven approach" taken in the **European Innovation Partnerships**, through which major SDGs and large scale societal challenges (agriculture, health for the ageing population, cities, water, and raw materials) are addressed in a concerted way, with a focus on policy coordination and coherence between actions of different societal actors. This approach has shown to be useful for both delivering significant outcomes of global benefit in these areas, and contributing to EU's competitiveness and innovation capacity[45]. The operating model across demand and supply and working towards accelerating progress by

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40 *A reinforced European Research Area Partnership for Excellence and Growth* (COM(2012) 392).

41 http://ec.europa.eu/budget/mff/introduction/index_en.cfm.

42 OECD Statistics on External Development Finance Targeting Environmental Objectives Including the Rio Conventions.

43 http://ec.europa.eu/research/participants/portal/desktop/en/funding/reference_docs.html#h2020-work-programmes-2014-15-main-wp.

44 *Towards better access to scientific information: Boosting the benefits of public investments in research* (COM(2012) 401).

45 Independent Expert Group Report *"Outriders for European Competitiveness"*. See https://ec.europa.eu/research/innovation-union/pdf/outriders_for_european_competitiveness_eip.pdf.

building up the innovation system in institutional terms rhymes well with the transformational aspirations of the 2030 Agenda.

- **Challenge prizes** (also known as 'inducement' prizes) under Horizon 2020 also offer interesting opportunities for stimulating innovation for the SDGs. Prizes have the potential to stimulate new solutions and attract additional private investment in research for sustainable development.[46]
- Finally, **public-private partnerships** (PPPs) under Horizon 2020 can help deliver the SDGs, not lastly the targets under Goal 17 centred on the global partnership for sustainable development. There are two types of PPPs under Horizon 2020: contractual PPPs and Joint Technology Initiatives (JTIs). With their investment in cutting-edge research, both are contributing to the Europe 2020 strategy targets of smart, sustainable and inclusive growth. Contractual PPPs follow the Horizon 2020 rules and procedures, with industry providing key advice on research priorities. JTIs are run as Joint Undertakings: for example, the Clean Sky JTI, the Innovative Medicines Initiative and the Bio-based Industries Joint Undertaking will be important contributors to the realisation of the SDGs although they have mostly a European focus.[47]

In conclusion, the EU has developed a lot of tools to implement a serious STI4SD policy. In particular:

- the global dimension of STI has increasingly been taken into account by the EU and concrete initiatives are taken to cooperate with the outside world along multiple axes;
- open access and knowledge transfer is being systematically addressed;
- key dimensions of the 2030 Agenda are been already considered through existing programmes, from basic research to innovation-oriented initiatives.

This approach is both contributing to placing the EU in the leadership role globally when it comes to STI4SD, but also reducing the innovation gap with main competitors (by almost 50% since 2008 vis-à-vis US and Japan).[48] However, progress in terms of turning these ambitions into practice, both when it comes to international dimensions, or to open access, has been too slow. Moreover, although acknowledging the systemic character of the 2030 Agenda, some of its key elements are not yet explicitly addressed and therefore risk falling off the political radar screen. The recommendations presented in this report, as well as the proposals included in Box 3, would help the EU to further strengthen its position and increase the effectiveness of its STI policies, fully orienting them towards sustainable development.

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[46] For instance, as a result of the 2012 "Innovative Vaccine Technology" pilot prize that was awarded €2 million from the EC, the Bill and Melinda Gates Foundation in March 2015 announced a commitment to invest €46 million to accelerate the development of this innovative vaccine technology.

[47] In December 2013, the European Commission launched eight contractual PPPs of strategic importance for European industry, namely Factories of the Future, Energy-efficient Buildings (EeB), European Green Vehicles Initiative, Sustainable Process Industry, Photonics, Robotics, High Performance Computing and Advanced 5G networks for the Future Internet (http://europa.eu/rapid/press-release_IP-13-1261_en.htm). In contrast to the Joint Technology Initiatives (JTIs) being set up under Horizon 2020 (see IP/13/668), the contractual PPPs do not organise their own calls but funding is awarded by the Commission through open calls under the Horizon 2020 Work Programme. The first Horizon 2020 Work Programme for 2014-15, budgeted around €1.45 billion for the eight contractual Public-Private Partnerships, while around €6.2 billion are budgeted for the whole H2020.

[48] State of the Innovation Union. see http://ec.europa.eu/research/innovation-union/pdf/state-of-the-union/2013/state_of_the_innovation_union_report_2013.pdf#view=fit&pagemode=none.

Box 3 – Possible actions in the field of STI4SD (Commission communication COM (2015) 44 final, 5 February 2015)

Actions for all

- Increase bilateral, regional and multilateral cooperation on science, technology and innovation, and solutions-oriented research.
- Raise awareness of how to use Intellectual Property Rights to stimulate growth for government, business and researchers.
- Strengthen capacities in science, technology, innovation, research and digitisation in developing countries and promote worldwide and cross-sector mobility and open access to publications from publicly-funded research.
- Improve access to education and training in developing countries to support the development the skills needed for innovation, job creation and growth.
- At UN level, facilitate access to information on existing technology and promote coherence and coordination between technology-related mechanisms including any new technology mechanisms.

Additional EU actions

- Promote open access to publications, and on a pilot basis data, resulting from research funded under Horizon 2020.
- Facilitate knowledge sharing and build research capacity including in developing countries.
- Support innovation and technology development in collaboration with low- and middle income countries, in areas such as health and poverty-related diseases, sustainable agriculture and food security, and through community-level innovation.
- Support innovation and technology transfer capacities through higher education programmes.
- Work in a constructive and open manner with all other partners on the proposals to support science, technology, innovation, and capacity building for LDCs.
- Continue to contribute to relevant global initiatives like the Global Earth Observation System of Systems, the Intergovernmental Panel on Climate Change and the Global Alliance for Chronic Diseases, and further support relevant EU collaborations with non-EU partners, such as the European and Developing Countries Clinical Trials Partnership.
- Support training on the use of intellectual property rights for government, business and researchers, and technical assistance to government for relevant legislative projects.

4. RECOMMENDATIONS TO MAINSTREAMING SUSTAINABLE DEVELOPMENT IN THE EU POLICY FOR SCIENCE, TECHNOLOGY, RESEARCH AND INNOVATION

In this section recommendations are provided to foster the STI4SD approach, based on the framework proposed above. Of course, they only cover those STI policies more urgent and directly linked to the SDGs discussions. For example, we do not discuss how to improve the functioning of the Single Market, an aspect that can be extremely important to have a Union more oriented to innovation, and a subject on which the Commission is very much engaged.

The following recommendations are clustered in eight groups, starting with "main avenues" (i.e. cross-cutting issues) that emerged, followed by recommendations concerning general STI policy orientations, specific options towards the achievement of SDGs, the use of STI to improve policy coherence, communication on STI4SD, options for engaging with relevant international initiatives on STI4SD, how to evaluate the success of STI4SD policies, as well as short-term research needs.

4.1 Main avenues and key recommendations for STI4SD

From the analysis carried out by the Expert Group, the following key messages emerge as main 'avenues' to strengthen STI4SD:

1) Switch the focus:

- **Re-orient mindsets and behaviours towards SD.** To tap the full potential of STI as tool to move EU and other countries onto a sustainable path, changes in mindsets and behaviour of politicians and policy makers, business leaders, investors, consumers and civil society are needed. As mindsets and behaviour are strongly culturally determined, governance approaches for integrating STI with the SDGs implementation need to be differentiated. This would be in sync with the observed global megatrend towards differentiated governance frameworks[49]. STI can itself foster this by investing in areas that stimulate transitional movements in the economy and the society. Social innovation is as important ingredient of this process: co-creation, co-design, co-deliberation of knowledge will contribute to finding and supporting innovative solutions. The orientation of STI towards SD has to become a common objective of public and private sectors, to mobilise all investments in this direction and deeply engage in this effort policy makers, private investors and consumers.
- **Reframe the EU's STI challenges.** The SDGs address in many policy fields deep systemic changes ('transitions'). Therefore, thinking differently also concerns how problems and solution are framed, and this consequently influences how STI projects are prioritised. One example is switching from funding biodiversity research to investing in creating new models for nature-based solutions (NBS) and to scale up innovative pilots projects in cities to cover larger areas. Other examples include refocusing from environmental damage to health benefit (e.g. through cleaner air); from increasing food production to food quality and decreasing the food production footprint; from more roads to better mobility; and from taxing 'goods' (like labour) to taxing 'bads' like pollution and resource use.
- **Refocus from technology transfer to building innovation capacity**. Technology transfer is essential but not enough, as it may create new dependencies in receiving countries. Development of innovation capacity should become one of the highest priorities, a prerequisite to making societies and economies sustainable in the long run. The Commission recognises that "cooperation on technology transfer should go beyond pure technological development and include longer-term investments that are adapted to local contexts, engage with communities and users and ensure that the needs of people and the environment are taken into account ('human-and eco-centred design')".[50] Still, a more concrete focus on innovation capacity building would be recommendable. Education and other forms of investment in human capital are a key accelerator and multiplier of STI4SD, as well as programmes aimed at stimulating social innovation benefitting from the opportunities offered by new technologies.

2) Strengthen partnerships:

- **Develop tailor-made partnerships on STI for SDGs.** STI is vital to reduce the costs (also in terms of job losses) of transition towards environmentally sustainable societies and economies.

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[49] See Global Megatrend 11, *The European Environment - State and Outlook 2015*, http://www.eea.europa.eu/soer-2015/global/governance.

[50] Commission Communication *A Global Partnership for Poverty Eradication and Sustainable Development after 2015* (COM(2015) 44 final), p.11.

This cost-saving aspect is essential for the discussion on the Means of Implementation for the SDGs. The Commission supports this: "Governments should foster the facilitation of technology diffusion, sharing and transfer through an enabling environment and incentives at domestic level that are geared towards sustainability and provide adequate protection of intellectual property rights according to the WTO rules".[51] Recognising that there are some contentious policy issues related to technology transfer, some barriers that emerged in the past, also recognised by the OECD Forum on "Aligning Transition Policies", need to be addressed. For example: while many technologies are available in principle without license fees, so far they have not been implemented for SD purposes in developing countries, and most technology transfer takes place in a North-North trade; the traditional Intellectual Property Rights – IPR – system; the absence of knowledge about availability of technology without license fees; the accessibility to knowledge on available relevant technologies for SDGs; capacity for a sustainable implementation and related social innovation as well) that need to be overcome if one wants to make progress in this field. Moreover, it would be important to avoid rebound effects and adapt technologies to local contexts. This is why technology needs assessments are required as a first step. Partnerships between governments, research and innovation organisations, businesses and civil society organisations will be needed to create the conditions for breakthroughs. Such partnerships would need to be tailor-made to the needs of respective business sectors (see e.g. the 'Green Deals' in the Netherlands[52]) and to the STI context in each country.

3) Walk the talk:

- **Address systemic causes of implementation gaps.** It is important to investigate *policy gaps* between the SDGs and agreed EU policies and legislation, and refocus STI to underpin the additional policies which will be needed. However, analysing the *implementation gaps* regarding existing policies and legislation is equally important. The EU and its Member States have in the fields covered by SD a stronger track record on adopting strategies and a legal acquis than on practicing what is agreed. Acting on the SDGs also implies addressing questions like: "What are the underlying causes of implementation gaps, to which extent are they horizontal (i.e. observed in many EU countries), and what STI will be needed to mitigate or adapt to these causes?" Typical causes may include shortcomings in knowledge and awareness in administrations at all levels, shortcomings in administrative capacities, under-investment and delayed investments in long-term solutions, weak enforcement mechanisms, and inflexibility of implementation programmes to adapt to changing circumstances.
- **Ensure domestic integration of the SDGs in/with STI.** On the one hand, the SDGs should be fully integrated in the (implementation of the) Horizon 2020 Framework Programme for Research and Innovation (2014 - 2020) and in other EU policies related to sustainable development. One key example is the Commission's upcoming proposal on the transition to the circular economy, which should dramatically increase re-use and recycling in Europe and boost intelligent product design and the market for recycled materials. This will help building a new generation of innovative and energy efficient European businesses in a global world with increasingly scarce raw materials, and will create sustainable jobs in Europe. Other examples include the EU climate change agenda and the development and use of nature-based solutions to sustainability challenges.
- **Improve policy coherence.** As stated in the guidelines issued in the context of the "Better Regulation package", "policy preparation should be supported by both retrospective performance evaluations and forward looking impact assessments. Both look at how a problem is, or should be, addressed (and its underlying causes) to achieve the desired objectives taking account of costs and benefits. Both are based on an integrated approach that addresses impacts across the environmental, social and economic pillars of sustainable development and so contribute to the mainstreaming of sustainability in policy making at the Union level".[53] Therefore, all EU Member States should be encouraged to integrate the STI4SD perspective in their national strategies and monitoring processes, as well as ensuring policy coherence by integrating the SDGs in their (regulatory or comprehensive) impact assessments. At EU level, policy coherence could be improved by integrating the monitoring of the SDGs in the existing processes, like the "European Semester" of the EU 2020 Strategy, the Commission's Investment Plan based on the European Fund for Strategic Investments (EFSI), the implementation of the 2014-2020 EU Structural and Innovation Funds (ESIF) and the Policy coherence for development (PCD, see section 4.4). An operational framework for prioritisation has to be

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[51] Commission Communication *A Global Partnership for Poverty Eradication and Sustainable Development after 2015* (COM(2015) 44 final), p.11.

[52] https://www.government.nl/topics/energy-policy/contents/green-deal.

[53] *Better Regulation Guidelines* (SWD (2015) 111 final), p.8.

developed in these strategies and programmes taking aspects of urgency and irreversibility into account.

- **Build up opportunities to fully benefit from the "data revolution".**[54] It is quite evident that economic and social innovations will be based on the use of an unprecedented amount and availability of data suitable for different purposes. In this context, data should be considered an "asset" whose development for pervasive use should be the objective of public policies, also protecting people from the misuse of personal data. Some areas of the world are investing huge public and especially private resources in this field (e.g. big data, data mining, software and applications dedicated to predictive modelling) and in case Horizon 2020 would miss this opportunity the EU would be lagging behind them hence weakening its role as frontrunner of SDGs implementation. Moreover, different rules coexisting within the Union in terms of data exploitation and exchange represent huge obstacles from fully exploiting existing data.[55]
- **Set up monitoring, evaluation and assessments of STI4SD.** To ensure mainstreaming of sustainability in the EU's policies, a framework is needed which guides monitoring, evaluation and assessment of the contributions of STI to the achievement of the SDGs, at EU and Member States level, as well as for reporting to the international level. Within the Commission, all impact assessments (IA) must evaluate, in a balanced way, environmental, social and economic impacts. This also applies to the Sustainability Impact Assessment (SIA) and ex post evaluations. The 2015 "Better Regulation package" features impact assessment and promotes enhanced procedures to "ensure that keeping the EU competitive and the EU's development sustainable remains a priority in all we do".[56] Moreover, it states that "Applying the principles of better regulation will ensure that measures are evidence-based, well designed and deliver tangible and sustainable benefits for citizens, business and society as a whole. This applies both to new and the large body of existing EU legislation. This legislation is essential for sustainable development, for the single market that drives our economy and for unlocking the investments needed to support jobs and growth".[57]

Box 4 –Short-term actions that the EU could consider

- Assess how STI policies can help better realise current EU policy objectives mapped against the SDGs and on this basis adopt a Communication on how STI4SD will support the implementation of EU strategies for sustainable development up to 2030 as part of the EU's overall socio-economic policy agenda.
- Develop a framework for Policy Coherence for Sustainable Development and align EU STI instruments and external policies to the SDGs framework, as well as of Member States' STI policies.
- Develop a framework for guiding STI investments to projects, programmes and initiatives with transformative sustainable potential, and establish a permanent observatory of changes and trends in new, emerging and potential future technologies for the SDGs.
- Integrate in the future Horizon 2020 work programmes the SDGs framework and language, increase the share of Horizon 2020 funds for SDGs-oriented projects and align the Horizon 2020 monitoring of the expenditure for SD to the 2030 Agenda.
- In cooperation with behavioural economists, build a communication/education strategy on changes in production and consumption that supports the circular economy package.
- Take a leading role in relevant international collaborations related to SDGs for which the EU has a recognised leadership and promote the establishment of new cross-thematic international STI cooperation initiatives that will drive change across the SDGs.
- Carry out foresight and research to identify critical trade-offs between policies aimed at achieving specific SDGs and understand how they can be mitigated through synergy solutions and possible multipurpose actions; strengthen governance for the SDGs; improve the availability and timeliness of data related to SDGs and develop new integrated indicators for measuring progress; evaluate how single market rules can be improved to foster innovation for SD.

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[54] See the Report "*A World that Counts: Mobilising the Data Revolution for Sustainable Development*", www.undatarevolution.org.

[55] See the recent Communication on the Digital Single Market (COM(2015) 192 final).

[56] *Better regulation for better results - An EU agenda* (COM(2015) 215 final), p.6.

[57] COM(2015) 215 final, p.3.

4.2 General policy orientations

As already pointed out, STI policies are fundamental to take economies and societies onto a sustainable path. Given the expected high costs of transition, policies need to be carefully designed, using available scientific evidence. The use of evidence for policy making is often taken for granted, but the practice is often far from this principle. To increase accountability of European institutions vis-à-vis stakeholders and citizens, we consider a must for the European Commission to practice such a principle, improving existing tools, also with the help of new available technologies (for example, expending the coverage of the newly developed Knowledge Centres) . Moreover, the EC should push other countries, especially developing countries, to adopt a similar approach. Therefore, we recommend:

a) **to undertake a stock-taking and analysis of current Commission strategies**, taking into full consideration the domestic and international components of the SDGs (see categories introduced in section 2.1), with respect to the environmental, social and economic dimensions and their interlinkages, to see how STI policies could help in addressing these issues;

b) **to adopt a Communication on STI4SD**, to describe the future framework for this kind of policy, sending a strong message to the rest of the world on the EU commitments and on the critical role it sees for scientific knowledge in supporting policy making, both in the EU itself and in other economies. Such a Communication would also be an opportunity to transform the "possible actions" included in the February Communication (COM (2015) 44 final) into a concrete action plan (see Box 3);

c) in the context of the new 2030 Agenda, especially with respect to the HLPF, to **continue emphasising the need to strengthen the role of STI policies and actions** in all countries of the world as part of the Means of Implementation and Global Partnership for Development. This should include the promotion of both appropriate regulatory frameworks and the creation of enabling environments for STI around the world;

d) in order to facilitate appropriate transfer and adaptation of technology as well as investment in STI capacity building, **the EU should apply for itself and advocate for specific levers and investment in STI4SD accelerators already selected by the AAAA**:

   - as the Technology Bank is designed to support LDCs, which are the countries emitting the lowest levels of GHG per capita, a specific narrative should be set by the EU in order to promote the use of the LDCs Technology Bank also for Climate and Energy investments. Without a specific action to raise awareness on the strong links between technology, materials, industry, climate change, energy supply and poverty, this new tool otherwise risks to have a limited impact on relevant goals, such as SDG 13 related to climate change;

   - the Multi-stakeholder Forum on Science Technology and Innovation for the SDGs under the newly created Technology Facilitation Mechanism and the OPTKIS platform are opportunities that should not be missed by the Commission to play a leadership role. At the same time, any EU involvement must be tempered according to principles of effectiveness and efficiency, as UN processes can be huge drains on resources unless the outcomes and mandates are very clear;

e) to advocate in global fora the importance of international agreements to **move beyond the issue of technology and technology transfer towards a broader emphasis on innovation systems**. In this context, discussions about STI should be more explicitly oriented towards inducing private sector involvement, as well as leveraging and steering private investments into STI domains of relevance for the 2030 Agenda.[58] The international agreements and conventions with technology provisions[59] could be implemented with a SDGs perspective, with the support of specialised agencies. Specific policy instruments like prizes could promote the commitment of the industry to obtaining concrete results in the SDGs. Disseminating better evidence on the coordination of the Technology instruments available in a "systems innovation" could reduce time to SDGs as well.

f) **to promote international efforts for capacity building and education for innovation and entrepreneurship**, including secondary, tertiary and vocational skills of EU citizens as well as of partners in third countries (especially LDCs) in areas such as engineering and

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[58] Often it is the appropriate combination of instruments which brings the best results in this field. Public authorities in the Member States and the European Commission could make an evaluation of good practices in this area to be disseminated.

[59] A list of at least 18 international agreements, conventions and protocols has been mapped out by the UN IAWG on a Technology Facilitation Mechanism: An Overview of the UN Technology Initiatives, 23 July 2015. https://sustainabledevelopment.un.org/content/documents/2091Mapping%20UN%20Technology%20Facilitation%20Initiatives%20Aug%2023%202015%20clean.pdf

environmental technology, higher education in science, ICT, and skills in entrepreneurship and technology-driven business development, across the innovation system from laboratories to markets. Education is a key accelerator and a multiplier of the impact of STI. It is also a source for paving the ground for behaviour changes, through which also the demand for different choices can be stimulated. In light of the multiplier effect of education, the cooperation with DG Education and Culture should be enhanced and a new programme for higher education collaboration (also to build a generation of data scientists) might be set up (possibly with online platforms);

g) **to strengthen the use of aid flows for STI purposes in the context of the EU development cooperation**. In light of the EU and its Member States' position as the largest contributor of ODA globally, it might be considered to dedicate a modest but visible floor percentage of the EU countries' ODA to STI4SD, to be progressively increased according to the results of "Technology Needs Assessments" and implemented during 2016-2030. The ODA statistical framework should be adapted so it is fit for monitoring this policy;

h) **to consider capacity building and early inclusion of social innovation** as part of the initial investment projects evaluations by Multilateral Development Banks and International Financial Institutions. This would mitigate the risk of *stranded investments* in STI infrastructures due to a lack of technical capacities in operation and maintenance, and possibly a lack of economic sustainability, and would improve the long lasting lack of investors and strengthen users' trust. The use of the European Institute of Technology with a reviewed mandate would increase the EU readiness to better international cooperation between knowledge and innovation communities, within and off the EU boundaries, and leverage the European means in this field at low marginal costs;

i) in cooperation with UNCTAD (who estimated a 2.5 trillion dollars annual funding shortfall in developing countries for investments in SDGs-related sectors[60]), **the EU should support the promotion of private impact investments for SDGs** by lowering barriers to investment, in particular securing property, focusing on skills and capacity and providing guaranties to invest in innovative areas with higher risk;

j) **to promote a global IPR initiative** to ensure that the global intellectual property regime is consistent with the aims and action mechanisms of the 2030 Agenda. This regime needs to overcome the barriers for sharing IP, and needs to strike the right balance between open access and IP protection. Special attention should be given to enabling open access to publications, data, etc. for developing countries;

k) **to use in a synergic way tools such as Horizon 2020, LIFE, the EU structural and innovation funds (ESIF) to make EU cities as STI breeding grounds for experiments**, pilots, niche development and their scaling up with respect to fostering behavioural change. With their direct link to citizens, they are particularly suitable for transdisciplinary approaches and STI's transformational role therein (for example, to implement social engineering and nudge towards SD);

l) **to develop a strategy to make businesses and people fully benefit from the "data revolution"**, making Europe a champion in the digital world, also overcoming existing barriers for data exchange and use within the EU. Data are fundamental not only to monitor progress towards SD, but also to build in practice a more sustainable development (smart cities, more efficient use of energy, new online services for people, etc.). Moreover, the EU should foster the investment in human capital at all levels (not only at school) to both create appropriate skills to support these processes (for example, investing on the training of "data scientists") and to allow people to be informed consumers and citizens. Strengthen the public availability of data and tools that are developed through projects funded by the EU. Finally, the EU should help non-EU countries to implement the policies aimed at implementing the "data revolution";

m) the EC may examine the **feasibility of a global research area for the achievement of the SDGs based on the model of ERA** (suggested abbreviation: GRA4SDGs - Global Research Area for SDGs). Cooperation opportunities might also arise between ERA and GRA4SDGs, as ERA is currently working[61] on issues and breakthrough areas that could provide sustainable input to the GRA4SDGs. For this purpose the EC may capitalise on existing initiatives such as the Belmont Forum.

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60 http://unctad.org/en/PublicationsLibrary/wir2014_en.pdf.

61 http://ec.europa.eu/research/era/index_en.htm.

4.3 Improve the orientation of the EU STI tools towards achievement of SDGs

This section provides specific recommendations concerning the improvement of existing tools (including Horizon 2020) to reinforce their orientation to contribute to the achievement of SDGs:

a) **integrate in the future Horizon 2020 work programmes the SDGs framework and language.** Although the current structure of Horizon 2020 cannot be changed in the short run, Horizon 2020 calls should explicitly require to incorporate in the submission of proposals the proposed research project's intended contribution to the achievement of SDGs. In order to enhance, in quality and in quantity, the alignment of proposals to the SDGs in Horizon 2020, an adaptation of the guidelines describing ethical compliance and Horizon 2020 related mandatory procedures could be made to better assess proposals and carry out evaluations from this new perspective;

b) **increase the share of Horizon 2020 funds allocated to SDGs oriented projects**, including those aimed at supporting open-ended science and technology research to discover the future technologies and innovations that will drive the next generation of implementation towards SDGs achievement. The objective is also to make sure that the Horizon 2020 commitment to support sustainable development and climate related expenditure with at least 60% and 35% respectively of its budget is achieved or exceeded. To better monitor and track the use of Horizon 2020 funds for this purpose, an Annex to this Report provides proposals to introduce additional criteria for the application of existing markers taking into consideration the 17 SDGs and their 169 targets against the three types of capital (i.e. economic, social and natural) that the EC currently uses;

c) as an input to future work programmes of Horizon 2020 and beyond, **set up science-to-policy task forces for each SDG in order to diagnose the STI needs along the innovation chain**, and consider trade-offs and possible conflicts for each goal/target. The "Environmental Knowledge Community model" could be expanded and aligned with the 2030 Agenda. Alignment of the objectives in the Horizon 2020 calls with the SDGs can ensure that Europe produces world-class science, removes barriers to innovation and makes it easier for the public and private sectors to address environmental and societal challenges while supporting Europe's economic growth;

d) as Horizon 2020 represents a great opportunity to engage the private sector in contributing to projects related to SDGs, **pay a particular attention to publicise it vis-à-vis existing networks of European businesses**, with a special attention to the most innovative ones. Focus should be given in providing the research community with an overview of ongoing activities in EU existing PPPs, in order to maximise the opportunities for networking in the preparation of proposals for the Horizon 2020 2016 calls;

e) the same approach should be adopted **to extensively publicise the possibility to have institutions and businesses based in non-EU countries (especially developing countries) participating in Horizon 2020 projects**. This is a key feature of the European STI policy and should be used much more to advertise the international openness of the EU approach to research and innovation;

f) as there is a growing tendency to use targets and indicators to guide policies and monitor progress towards targets, well beyond what SDGs foresee, **some of the Horizon 2020 projects should look into the way in which new technologies can support the production of indicators**, both in the EU and especially in developing countries. New technologies allow making a leapfrog in this field using new data sources and innovative methodologies, but a lot of research is needed to produce high-quality data.

Beyond Horizon 2020, we also recommend that the EU considers to:

g) **develop a framework to guide investments in STI on projects, programmes and initiatives with transformative potentials**, taking into account criteria such as urgency, severity and irreversibility of the problem ("if no action is taken"); institutionalise a "high-impact logic", allowing the prioritisation of investments from the banking and investment sectors, multilateral banks as well as the European Investment Bank. This would shift resources to incentivise investors and businesses to enhance interconnections and synergies between different SDGs (multipurpose actions);

h) **promote the creation of "Rating systems for STI4SD investment projects"** (financial and non-financial), to be tested and performed in EU policies, in order to strengthen transparency, allow solid monitoring, increase accountability and review process, and provide useful contributions to the reporting process at the UN level;

i) **develop an ERA initiative for SDGs,** given the key importance of cross-country learning and experience sharing in how the 2030 Agenda is implemented, followed up and reviewed across EU member states and beyond;

j) **promote access to European research infrastructures for developing country scientists** and move forward on an international dialogue, in the context of the 2030 Agenda mechanisms under the United Nations, towards the development of global research infrastructures;

k) **establish incentives to "globalise" key on-going EU innovation and PPP initiatives** (such as KiCs and JTIs) both in terms of their scope in relation to the 2030 Agenda and in terms of opening them for selected external participation in mechanisms.

l) **review the European Institute of Innovation and Technology (EIT) mission in order to make it fully committed to the SDGs**. An ex-ante evaluation methodology could be set and tested on EIT, as a powerful lever for the transformation of this major European institution from an EU-centric mission and management towards a tool for promoting STI4SD through international cooperation. A flagship project for EIT could be to design and implement the future 'European Technology Cloud Project' as the European contribution to the UN Technology Cloud Project foreseen in the future Technology Facilitation Mechanism. The EIT, with its KICs, would become a major support to the "open innovation, open science and open to the world" principles recently presented by Commissioner Moedas. In this perspective, EIT would engage in international cooperation in STI capacity building as well as in SDGs-oriented management of technology.

4.4 Possible STI-related policies for strengthening policy coherence for SD

Policy coherence in general involves the coordination and joint programming to fully realise potential synergies and as far as possible mitigate trade-offs at the nexus between different policy domains. In this respect it has been a key priority for the Commission and many of its Member States, and a particular one in the context of governance for SD. The coherence agenda has also gained global interest and is explicitly targeted within Goal 17 of the 2030 Agenda.

Policy Coherence for Development (PCD) is a particular aspect of the broader coherence agenda. It is enshrined in the Treaty (Art. 208 TFEU) and involves that all parts of the government take account of objectives in all policies that are likely to affect developing countries.[62] The coherence agenda is relevant to STI not least because understanding synergies and trade-offs between different policy areas require science-based methods and assessment tools. The new Impact Assessment guidelines include tools for assessing potential impacts of future EU initiatives on developing countries,[63] and an external evaluation of PCD is scheduled for 2015.[64]

With the shift from the MDGs to the universal SDGs, i.e. the 2030 Agenda being implemented both domestically and in development cooperation, the OECD and others are advocating a shift from PCD to PCSD (Policy Coherence for *Sustainable* Development).[65] This aims at a shift from considering the impacts of domestic policies on developing countries to considering those together with international policies, taking into account interactions between them, as well as interactions between the three dimensions of SD within each domain. Such a comprehensive coherence approach involves both horizontal coherence (between sector policies) and vertical coherence (from global through national levels of policy making), including - in the context of the EU – coherence from policy objectives through instruments to action on the ground in Member States.

Such full coherence is not easy to achieve and requires active pursuit: therefore, as policy coherence is a key mechanism for STI to contribute to SD, we recommend for the EU:

a) to collaborate actively with the OECD secretariat and other relevant international organisations and knowledge partners in further advancing the nascent concept of PCSD as it still requires clarification, conceptual simplification and elaboration, as well as measurement and evaluation methods;

b) to promote and monitor the alignment of EU and Member States' STI policies to the SDG framework. Areas where STI4SD policies should be better considered include the following:

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62 "EU remains fully committed to ensuring PCD as a key contribution to the collective global effort for sustainable development in the post-2015 context". See *Policy Coherence for Development 2015 EU Report* (SWD(2015 159 final) from 3 August 2015; https://ec.europa.eu/europeaid/sites/devco/files/policy-coherence-for-development-2015-eu-report_en.pdf.

63 http://ec.europa.eu/smart-regulation/guidelines/docs/br_toolbox_en.pdf.

64 *Policy Coherence for Development 2015 EU Report* (SWD(2015) 159).
https://ec.europa.eu/europeaid/sites/devco/files/policy-coherence-for-development-2015-eu-report_en.pdf.

65 See http://www.oecd.org/pcd/TOOLKIT%20FRAMEWORK%20FOR%20PCSD.pdf.

review of the EU 2020 Strategy, the European Semester, the work of the Competitiveness Council (in charge of horizontal policies aimed at stimulate growth and competitiveness), the new cycle of Structural Funds, the Smart Specialisation Strategy (centers of excellence identified by the EC), the European Fund for Strategic Investments (EFSI);

c) to pursue alignment of EU STI instruments, rather than establishing new ones, with the 2030 Agenda (including the Innovation Union, the orientation of Knowledge and Innovation Communities (KICs), eco-innovation action plans, activities of the Joint Research Centres (JRC), European Research Area Networks, etc.). The introduction, over the years, of several new instruments, mechanisms and platforms has increased bureaucracy and fragmentation and may be an obstacle to policy coherence and the involvement of private sector and third countries. Deploying the SDGs as an organizing framework is an opportunity for improved coherence;

d) to pursue alignment of EU external policies with STI and SDGs and develop an intervention logic, supporting arguments, and options for models, as well as possible effects. The agenda should engage developing countries', especially LDCs', participation in various EU innovation mechanisms (for example, LDCs participation in Marie Curie Fellowships, providing access for LDCs to EU research infrastructures, such ESFRI, cooperate in the building of global research infrastructures);

e) in the course of the ongoing "mapping and gap analysis" of EU policies vis-à-vis the SDGs, to include an analysis how STI tools could help in supporting actions aimed at filling the gaps, in getting more knowledge and a better understanding of interlinkages between goals and targets, and in improving policy coherence; the ongoing *policy* gap analysis should be complemented by an *implementation* gap analysis;

f) to take stock of the policy coherence between internal market rules (including state aid), international trade rules and STI4SD policies, to better understand potential barriers and drivers for the needed increase of efforts within STI. A coherence assessment needs to be carried out to highlight the potential trade-offs among the different elements at EU and Member States levels, and to make proposals how they can be improved;

g) to evaluate how the coherence is addressed in existing tools with a view to enhance them, especially in the linking of the domestic and the external dimensions. In this perspective, the EU's general impact assessment framework could be enhanced to include the domestic policies' impacts on other regions and countries. Also the relationship between the general IA framework and the SIA for free trade agreements needs to be reconsidered and aligned in light of the SDGs, as well as the underlying methodologies, particularly assumptions in economic assessments (e.g. discount rates for future costs and benefits). The revised framework should also:

   - include risk assessment approaches that address critical uncertainties and indirect effects of the adoption of new technologies;
   - evaluate potential technical, financial and industrial risks, in particular when developing countries (and especially Least Developed Countries – LDCs - and fragile territories) are involved. Indications of specific efforts in capabilities may be an added value for dissemination and impact of well understood, adequately adapted and used STI opportunities;

h) **to integrate systematically the SD perspective and the SDGs in social innovation** (SI) research[66], as important lever for changing people's mindsets towards innovation for sustainable development, and strengthen social innovation research in the "Innovation Union" Flagship (which so far focusses on technology development and excellence research);

i) **to produce an annual report and/or database on actions taken in its STI policies** to improve EU policy coherence for SD.

4.5 Communication and information about STI4SD and to change behaviour towards SD

Communication and information on STI4SD should be targeted at multiple stakeholders (government, businesses, civil society and citizens), effectively linking STI goals, strategies and activities with the needs of sustainable economies and societies. The SDGs provide a great

[66] For example, in the program of this year's European Social Innovation Week (http://www.esiw.nl/programma/) there are just two out of 30 themes that explicitly address the three SD dimensions and very little attention is paid to education for SD, environmental awareness and tools to foster behaviour change.

opportunity, as they can represent a common language to structure the narrative across a variety of communication tools. In this perspective, **the Commission needs to develop its strategy on how to communicate the role of STI4SD**. Communication should focus on relevant issues, i.e. issues that are concrete and of significant importance not only to the Commission but especially to the targeted audience. In order to be credible and to develop a convincing communication on STI4SD, it is vital for the Commission to adopt the SDGs framework when discussing economic, environmental and social challenges, and when proposing specific policies and publishing their possible impacts (whether positive or negative). "Leading by example" is the best communication policy for any institution and it is absolutely key for the Commission.

Therefore, **before engaging into communication and information on the role of STI to change current paths towards SD, a stakeholder mapping and engagement process should be carried out** to identify the priorities where to concentrate the effort in the first phase.[67] Effective communication considers issues of high significance responding to interests, concerns and expectations of stakeholders. To this end, a two-dimensional matrix built around an assessment, for each SDG, of the *'impact of Commission's policies on economic, environmental and social phenomena'* and the *'influence on stakeholder assessments and decisions',* could be a way to visualise the strengths and weaknesses of the communication strategy.

In line with the above, the following proposals could be considered:

a) although sustainable technologies and lifestyles exist, their public acceptance is often a key bottleneck for mainstreaming them.[68] Therefore, **more effort needs to be put into disseminating/communicating the knowledge gained in Horizon 2020 projects**, particularly among consumers, whose everyday decisions have a major impact on sustainability. A wide spectrum of activities could be initiated to achieve this goal, including:

   - organise pan-European information campaigns targeting consumers;
   - design calls for proposals aimed at communicating to the wider public the impact of the most relevant past EU-funded projects and at establishing large scale "living labs" to foster behavioural changes towards sustainable development. As part of such projects, citizens all around Europe would get involved in raising awareness about the project results regarding sustainable development;
   - establish a strong cooperation with key media in this field, as well as key stakeholders in spreading out the policy and achieve viral impact results. To this purpose, it could be helpful to create an interactive, frequently updated knowledge sharing platform for all interested stakeholders (including a searchable database with good practice examples);
   - organise communication events in Brussels and in Member States to raise awareness about STI4SD, as well as roadshows and one-to-one or group meetings with business and investors interested in co-funding STI4SD projects;

b) as sustainable development is a concept which needs a large number of stakeholders to be involved, build a strong communication/education strategy on the possible change in production and consumption patterns, supported by a strong package on circular economy. Moreover, although sustainable production patterns are addressed by Horizon 2020 (even though there is always room for improvement as proposed above), consumption patterns and the awareness of society in general regarding environmental problems is hardly addressed, as pointed out by the results of the stakeholder consultation on Horizon 2020 "Climate action, environment, resource efficiency and raw materials" WP.[69] It is therefore recommendable to put more attention on this aspect in the future calls of Horizon 2020;

c) initiate annual or biennial awards on STI4SD run in all Member States (see for example the European CSR Award Scheme[70]);

d) as consumption and life-styles need to be re-oriented in the direction of sufficiency, and nudging and inducing behaviour change requires both technological and social innovation, taking into account differences in context, culture and tradition, engage behavioural

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[67] Institutions, agencies, academia, incubators, labs, hubs, consortia, fora, business clubs, responsible and impact investors, universities, associations, consultants advising on SD/Horizon 2020 funding, NGOs, media, governmental bodies, consumers, citizen groups, etc.

[68] http://ec.europa.eu/programmes/horizon2020/en/news/results-stakeholder-consultation-horizon-2020-societal-challenge-5-climate-action-environment.

[69] http://ec.europa.eu/programmes/horizon2020/en/news/results-stakeholder-consultation-horizon-2020-societal-challenge-5-climate-action-environment.

[70] http://www.europeancsrawards.eu/.

economists to benefit from recent research on how to develop an effective communication policy for STI4SD;[71]

e) an effective communication between the science and the policy community should be established, in order to both inform policy makers about emerging issues and the role that STI can play to identify feasible solutions, and improve the science base in policy making: formalising this kind of communication (e.g. by establishing dedicated scientific advisory bodies on a mid- to long-term basis and build on good practice, including lessons learned, in Member States and at EU level) would be crucial.

4.6 Suggestions for engagement with international initiatives linked to STI4SD

Over the years, a lot of initiatives have been launched to implement international commitments in the area of STI. Since the Rio+20 conference on sustainable development special attention has been devoted to STI policies towards SD. As it is almost impossible to provide a full census of this type of initiatives, in this section some recommendations on how to prioritise the Commission's engagement in international groups and fora are presented.

Overall, it is recommended that the EU engages leading European scientists in the various processes rather than filtering through various global initiatives that are being discussed below, as the EU scientific community is significantly stronger and with greater legitimacy overall on its own. Therefore, it is well placed to intervene directly and through DG Research and Innovation, and not only through channels which can be biased in various ways and have their own agenda and interests. This effort has to be carefully designed to avoid being perceived as a bureaucratic process. DG Research and Innovation is well positioned and with strong legitimacy to act as a clearing house for science engagement with the 2030 Agenda implementation process.

Second, the EU should carefully **follow and take stock of the developments in relevant global STI related initiatives**. Choice and prioritisation of engagement need to be made systematically based on: a) whether initiatives add value to what impact EU STI is having or may have on its own mandate; b) the governance and accountability mechanisms of these initiatives; and c) the alignment of their formal and informal political agendas with the EU priorities. A task force should be established to continuously follow these developments.

Third, **the EU should support the effort aimed at the global monitoring process of SDGs**. The adoption of the 2030 Agenda has set in motion the development of a monitoring and accountability framework to measure progress over the coming years, but methods and data are still not in place in most countries of the world. Through EU research on opportunities offered by the "Data revolution", it can play a leading role contributing to establishing a new global practice. In particular:

a) the Commission should support the newly established "Global Partnership on Sustainable Development Data" (GPSDD). The Partnership has been recommended by the UN Secretary-General and its aims are to: promote new data principles and norms and strengthen those that already exist; incentivise data generation to fill key data gaps that increase understanding and improve decision-making; expand data access to increase the timeliness, interoperability, use and value of data that already exist; support capacity building and peer learning of users and producers with a view to measure, monitor, evaluate progress and deliver the SDGs. These objectives are very important to improve the availability and the timeliness of indicators to monitor progress towards SDGs, especially given the need to engage data producers who are outside the boundaries of official statistics. The GPSDD is getting traction and support by several institutions, and the EC should join and support it;

b) the Commission should also continue to sustain the work of PARIS21 (Partnership in Statistics for Development in the 21st Century), whose mandate is "to encourage a better use of statistics in developing countries, by providing support and strengthening their National Statistical Systems", who is also member of the GPSDD;

c) there is a huge potential and a need for Earth Observation (EO) data in the monitor and review of SDGs, but as the practice of EO needs a stronger profiling at the UN level,[72] the Commission should push in this direction. In November 2015 the GEO Ministerial Meeting will adopt a new

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[71] See, for example, the UK experience ("Influencing behavior through public policy") and the JRC work ("Nudging lifestyles").

[72] Examples where EO could come in could include both predictions and ex post monitoring of land use change, forests, risks of extreme weather events, or agricultural production.

10-year implementation plan with strong linkages with the 2030 Agenda: this could justify a further engagement from the EU, both in the steering of the initiative and in terms of financial contributions.

d) As co-chair of the Belmont Forum, the EU has good reasons to follow Future Earth closely and potentially assist in strengthening its governance accountability systems drawing on experience of DG Research and Innovation, bearing in mind that:

- the cross-ownership and membership, both horizontally and vertically between Future Earth (FE), Science and Technology Alliance for Global Sustainability and Belmont Forum, can be challenging for achieving effective organisation of STI action, and for establishing meaningful accountability relationships;
- the appointment of the various governing bodies of FE, such as the Governing Council,[73] the Science Committee and the Engagement Committee has not been entirely transparent in terms of who has made the selection and on what grounds;[74]
- the decision making, fund management, organisational arrangements, funding allocation procedures and quality assurance systems are still unclear.

As far as the other initiatives mentioned in Box 1, we recommend the following:

e) as the future of the Science and Technology Alliance for Global Sustainability is somewhat unclear, and there seems to be limited momentum and commitment from some of its members, it is better to be cautious in embarking in new actions;

f) notwithstanding the fact that GGKP is more a dialogue and exchange platform than a significant international initiative in research and innovation, it is worthwhile for the EC to establish a live and direct exchange between its green economy research and this global platform. The EU is committed to a green growth strategy and therefore has a strategic interest in being informed and part of the GGKP for policy learning. Therefore, we recommend to participate as knowledge partner in GGKP and use Horizon 2020 to set in place a project on green growth with the aim to become part of the GGKP;

g) as there are good reasons to ensure a certain level of alignment of the GSDR assessment frame with the EU STI policy, DG Research and Innovation would be well placed to invest some resources to help frame the development of the GSDR as well as mobilise EU scientists and scientific knowledge base to supply data to the report, including from FP7 projects and GEOSS. It could also consider providing financial or in-kind expert support for the GSDR, on the condition that there is also an active steering role, as well as active steering and control of governance. Moreover, to feed the GSDR, DG RTD could also introduce the need for engaging with it into selected relevant Horizon 2020 calls for proposals, establishing a direct link between the most competitive EU science consortia and the UNDESA team coordinating the report preparation. Moreover, EU should push for the Report to focus specifically on the SDGs and not try to cover everything. It should also look at drivers and barriers for achieving them, insofar as these are not already formulated as SDGs in themselves (which is sometimes the case);

h) as the SDSN has been acting so far as a global policy think tank, rather than a driver of real action on STI, and its decision-making process is not entirely clear, there is no immediate need for the Commission to engage directly, although following its evolution will be of interest. Information sharing can occur in the context of the Science and Technology Alliance for Global Sustainability, in which both the Belmont Forum and the SDSN are involved. The same applies to GGGI.

Finally, the EU should take a leading role in a few existing international collaboration on selected 2030 Agenda topics, building on EU recognised strengths and leadership (such as sustainable energy, water and sanitation, health and diseases, agriculture and food security and cities) and **promote the establishment of new cross-thematic international initiatives** that will drive change across the SDGs, where the EU is a recognised global leader, such as the circular economy, resource efficiency and (potentially) bio-economy strategies. For the time being, we recommend to pay special attention to:

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[73] "Future Earth is led by a Governing Council and supported by two advisory bodies: Science Committee and an Engagement Committee. These bodies are appointed by and report to the members of the Science and Technology Alliance for Global Sustainability, which acts as the Governing Council. The Governing Council, and its subsidiary bodies, involve as appropriate, representatives from a range of stakeholder communities (academia, funders, governments, international organisations and science assessments, development groups, business and industry, civil society and the media)". See http://www.futureearth.org/structure-and-governance.

[74] Organisation and engagement processes have raised questions during FE start up, not least considering that research in global sustainable development is a complex and highly politicized arena.

- on the policy side, the Scientific Advisory Board to the UN, the Global Sustainable Development Report, and the High Level Political Forum;
- on the science side, Future Earth, Intergovernmental Panel on Climate Change, and the Global Earth Observations. The governance, potential impact and scientific approaches deployed in some of these mechanisms need to become clearer in the near future, thus further reconsideration of this list might be needed before lending them additional financial or political support.

4.7 How to evaluate the success of STI4SD policies

To ensure remaining on the right track, once the objectives on aligned policies are set, an efficient and effective evaluation framework is required. The framework should be elaborated considering indicators on both STI4SD earmarking or expenditures, as well as on non-financial/budgetary aspects. An evaluation scheme should be inclusively designed rather than top down, building on good practices that demonstrate how the evaluation process might benefit from the adjunction of the civil society to the "experts", especially in order to select the indicators needed to evaluate progress made towards agreed goals.

Given the SDGs' general frame and timescale, there is a unique opportunity to elaborate in 2016-2017 a truly ex-ante evaluation methodology that would make each stakeholder fully aware of the rules before taking any action. The process of elaborating, discussing and adopting the evaluation methodology of STI4SD policies should be, according to President Junker's priorities, democratic, transparent, fact-oriented, easily translated, relying on the integrity of data, fully accountable and open to improvements. Therefore, an evaluation scheme should not be limited or understood as a reporting scheme for accountability and transparency. Public policy evaluations are neither audits nor inspections and control of a monitoring system of expenses. They are made to close the public policies feedback loop by issuing recommendations for success based on a multi-factor analysis, including qualitative aspects and management evaluation. Therefore, the evaluation process of STI4SD policies may deliver constructive outcomes under two conditions: a) elaborating on the hypothesis that a mechanism for conflict management between contradictory policies is set and efficiently implemented in due time within the EU institutions, and within the EC missions themselves as well; b) promoting the rise of a set of non-financial indicators coherent with stakeholders' expectations (if and when expressed)[75].

As regards STI4SD policies evaluation, three main options might be considered:

- option 1: classical earmarking with a set of financial indicators for the entire duration of the programme (2015-2030);
- option 2: classical earmarking with a review on mid-term, for incremental improvements only, made by experts in budgetary matters;
- option 3: considering the evaluation methodology as an ongoing systemic assessment, dedicated to raising awareness and strengthening readiness for impact, including the mandatory earmarking of expenses, but not limited to it.

Option 3 is the only methodology open to co-construction with civil society. Considering the quickly evolving STI solutions in goods, process and services for SDGs, it would be wise to adopt a systemic approach along the third option, fact-based on a robust and long lasting dedicated observatory. This option implies an adaptation of the nature and quality of governance for STI4SD policies, instead of a classic, hierarchical governance. The implications of this choice are the acceptance of a double circle of expertise including lay but concerned people, and adapting indicators to citizens' requirements. For this purpose, **the establishment of a permanent observatory of changes and trends in new, emerging and enabling technologies for SDGs is recommended** to help translating the STI implications for SDGs to decision-makers and the widest possible audience, with a specific focus on technology, as science and innovation already benefit from international evaluation schemes.[76]

In addition, recognising that the current structure of Horizon 2020 cannot be changed, we recommend to:

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[75] These indicators could be adapted to the four sets of SDGs chosen by the IAWG, i.e. "Global Commons", "Sectoral", "Cross-Cutting" and" Overarching".

[76] Such as the OECD STI Outlook, which could be enhanced by a special chapter on STI4SDG policies, results and impacts, beyond the traditional "Patent and Publication" indicators.

a) **expand the Horizon 2020 ethical framework to EU international STI4SD initiatives**. While, according to the Regulation for participation in Horizon 2020[77], the Commission systematically carries out ethics reviews for proposals raising ethical issues in order to verify the respect of ethical principles and legislation. In the case of research carried out outside the Union, this review is meant to verify that the same research would have been allowed within the EU. In addition to that, alignment of the Horizon 2020 tracking system as regards STI4SD should provide that also research proposed to support, strengthen and accelerate the positive impact on SDGs is subject to ethical reviews when EU initiatives are undertaken under the Horizon 2020 STI partnerships with non EU countries, in particular non-OECD emerging and LDC countries. Finally, we recommend to expand the mandate of the European Group of Ethics (EGE)[78] to cover STI4SD policies implementation and include the EGE in the new mechanism for independent scientific advice to the Commission, to be adopted in Autumn 2015;

b) **set up a grassroot surveillance framework for ongoing, systemic evaluation of STI4SD policies**, implementing a reporting system based on agreed indicators and establishing a network of external watchdogs/whistle blowers for STI, to avoid missing important opportunities for Horizon 2020 and other existing tools;

c) **promote the establishment of non-financial Ratings Agencies in the field of STI4SD**, similarly to what has been done in the Carbon Disclosure Project.[79] Some Agencies within the EU (known as Environmental, Social and Governance – ESG – Agencies)[80] have already implemented or proposed non-financial data and ratings, but this practice could be expanded, also using Corporate Social Responsibility (CSR) as entry point. The 2011 Commission Communication on CSR[81] led to some initiatives that could be reinforced in the context of the 2030 Agenda, especially as the world of businesses largely contributed to its preparation and is working already on the adjustment of business reporting to make companies more accountable vis-à-vis the SDGs. Existing frameworks represent a good starting point for further development.[82] In this context, it is also recommended to undertake a review of European standards agencies[83] as relevant stakeholders in the STI4SD European policies;

d) **include the Common Defence and Security Policy in the evaluation scheme of STI4SD success**, establishing a link with the Consultation Forum for Energy in the Defence and Security Sector, which provides a platform for energy experts to discuss and advise energy policies in defence.[84]

4.8 Priority research needs

The analyses carried out during the preparation of this Report also highlighted some opportunities for carrying out research projects useful to improve the current policies or to investigate opportunities to be subsequently used to design better policies. In particular, we recommend to launch calls for research project in the following areas:

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77 Regulation (EU) n° 1290/2013 of 11 December 2013 laying down the rules for participation and dissemination in "*Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)*" and repealing Regulation (EC) No 1906/2006, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013R1290&from=EN.

78 http://ec.europa.eu/archives/bepa/european-group-ethics/welcome/mandate-2011-2016/index_en.htm

79 The Carbon Disclosure Project network and reports by sector:

https://www.cdp.net/en-US/Results/Pages/reports.aspx.

80 A list of ESG Rating Agencies worldwide was released by Novethics:

http://www.novethic.fr/fileadmin/user_upload/tx_ausynovethicetudes/pdf_complets/2013_overview_ESG_rating_agencies.pdf.

81 *A renewed EU strategy 2011-14 for Corporate Social Responsibility* (COM(2011) 681 final). http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1445784141886&uri=CELEX:52011DC0681

82 For example, the Eco-Management and Audit Scheme (EMAS), the UN Global Compact's Guiding Principles on Business and Human Rights implementing the UN 'Protect, Respect and Remedy' Framework, the proposals of the Global Reporting Initiative (GRI) for integrated reporting, the OECD Guidelines for Multinational Enterprises, the International Organisation for Standardisation's ISO 26000, the International Labour Organisation's Tripartite Declaration of principles concerning multinational enterprises and social policy.

83 For example, the European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CENELEC).

84 Its aim is the provision of specific guidance for the military authorities on existing EU legislation and programs governing energy efficiency and renewables, and of proposals for improving the protection of critical energy infrastructures.

a) **interdependencies between SDGs**, with the aim to identify both critical trade-offs between policies aimed at achieving specific SDGs and how they can be mitigated through synergy solutions and possible multipurpose actions, including a nexus approach. Insights in both areas will impact the criteria for prioritisation. In this context, the researchers should be encouraged to develop analytical models and other tools to evaluate these aspects, also for ex-ante and ex-post impact assessment, especially taking into account long-term perspectives;

b) **governance for the SDGs** at national level, including comparative research in order to enable taking-up of innovations and good practices. The research could look into, *inter alia*, horizontal and vertical coordination mechanisms, meaningful and practicable participation of civil society, translation of the long-term perspective in short-term decision-making processes, in order to achieve better design and manage strategies and policies for implementing the SDGs; it would be desirable to carry this out in a transdisciplinary fashion, i.e. also include practitioners, and consortia should design and establish partnership arrangements between participants from EU Member States and developing countries;

c) **improvement of the availability and timeliness of data related to SDGs**. New ways of data gathering, replicable methodologies for measurements and programmatic evaluations of SDG funding streams necessary to develop a new class of analytical tools (including world and regional models) should be addressed;

d) **new approaches to train statisticians and data scientists**, in order to build a strong community of experts in this field, able to underpin the necessary transformation of public and private institutions in knowledge-based organisations able to harness the new sources of information;

e) **the function and effects of internal market rules (including State aid rules) to foster innovation for sustainable development**, in order to stimulate the development of new business opportunities in emerging sectors respecting the EU Treaty;

f) **identify practices to effectively stimulate social innovation** and maximise its impact on the adoption of behaviours oriented to sustainable development, conduct a stocktaking and meta-analysis of how SD is covered in ongoing social innovation research and develop guidelines for SD "tracking" in future calls in order to improve that SD is addressed in a more comprehensive way.

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ANNEX: HOW TO BETTER ALIGN THE HORIZON 2020 'TRACKING' SYSTEM WITH THE MONITORING AND ACCOUNTABILITY FRAMEWORK FOR THE SDGS

Background

The Horizon 2020 Regulation states that: "Climate action and resource efficiency are mutually reinforcing objectives for achieving sustainable development. The specific objectives relating to both should be complemented through the other specific objectives of Horizon 2020. As a result it is expected that at least 60% of the overall Horizon 2020 budget should be related to sustainable development. It is also expected that climate-related expenditure should exceed 35% of the budget, including mutually compatible measures improving resource efficiency." In addition, in the MFF (Multiannual Financial Framework[85]) the EU has committed to report on biodiversity expenditure across the whole EU budget, without any explicit spending target.

The method that the European Commission is currently using for tracking expenditure on climate action and sustainable development is based on the Rio Markers[86]. This tracking methodology consists of applying weightings of 0%, 40% and 100% respectively to the topics in the thematic parts of the Work Programme (so-called 'programmable actions'). Once the calls are evaluated and projects are selected for funding, the weighting chosen for the topic in question is applied to the EC contribution for the project(s) selected under that topic. In the case of bottom-up calls, the weightings are allocated to projects once they have been selected for funding.

For ascertaining contribution to sustainable development objectives, the action's contribution to the three dimensions of SD (economic, social and natural capital) is assessed. An action aiming to contribute to all three dimensions will be allocated the 100% weighting. An action aiming to contribute to two of the three is allocated the 40% weighting. Resource efficiency is considered to contribute to both economic and natural capitals. Actions with both climate action and resource efficiency as primary or secondary objective are allocated the 100% weighting. Extensive guidance documentation is available to define more clearly the categories of economic, social and natural capital to ensure coherence of approach across the Commission services.

Issues to be considered for aligning the tracking system

When considering a tracking system for monitoring Horizon 2020 against the SDGs the following issues have to be taken into consideration:

1) Ex ante vs. ex post evaluation

The purpose of this task is not on aligning the evaluation system towards the SDGs, but only about aligning the current Horizon 2020 tracking system, which is preformed after the projects' selection but prior to the project termination and evaluation (and is therefore considered as ex ante). The Horizon 2020 target of meeting the 60% budget on SD and 35% on climate related expenditure needs to be achieved within 7 years (2014-2020); i.e. if the level of contribution to SD is too low in the first years of the programme, the WP programming can - and may need to be - amended. Hence the tracking has potential impact on the design of future calls.

From a long term, forward looking perspective the current system could be improved linking the assessment of the project's impact on SDGs to the evaluation process (both ex-ante in proposal evaluation and ex-post in evaluation of the projects or the whole programme). This would require both a change in the way in which the current programme is designed, as well as an improvement in the current information system.

2. Types of capital to be considered

The current definition of SD within the Horizon 2020 programme is in line with the overall framework of SDGs, and the Horizon 2020 work programmes broadly take into account the challenges that SDGs are addressing. The alignment should therefore consider the contribution of

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[85] http://ec.europa.eu/budget/mff/introduction/index_en.cfm.

[86] OECD Statistics on External Development Finance Targeting Environmental Objectives Including the Rio Conventions.

each of the different SDGs (and their respective targets) to the three types of capital already employed in the definition of SD used by the EC (i.e *economic*, *social* and *natural*). However, it is worth noting that there are stakeholder groups (researchers, sustainability practitioners and policy leaders) who have introduced more types of capital (inter alia applied by the World Bank):

- four types of capital[87]: *natural, social, produced* and *human* capital;
- five types of capital[88]: *natural, social, manufactured, financial* and *human* capital;
- six types of capital[89]: *natural, social, manufactured, financial, human and intellectual*. This approach is being incorporated in upcoming business/corporate reporting schemes as it addresses both tangible and intangible value of business[90].

The EC may consider introducing a more detailed and modern approach which may lead to greater complexity. However, for the time being, the system using three types of capital in use is adequate and should not be changed.

3) Practicality vs. complexity

When suggesting an improved alignment of the current tracking system for monitoring the Horizon 2020 contribution to SD against the SDGs issues of practicality and simplicity. The proposed alignment bears in mind the Commission's intention to keep the tracking system simple enough to be practicable, easy to use and in line with the current tracking system for SD and climate action. The existing system has been in place for two years. The actual allocation of the Rio markers/weightings to topics or projects is generally done by the project officers.

The system has to remain simple enough to be usable by people non familiar with SD and under time pressure, as some calls can result in over one thousand projects for funding per call. One function of the tracking system is also, to better inform EC staff on what SD is, especially in the context of the SDGs.

4) Introducing additional criteria when applying the Rio Markers

The declaration of the UN 2030 Agenda states that[91] "*The **interlinkages and integrated nature** of the Sustainable Development Goals are of crucial importance in ensuring that the purpose of the new Agenda is realised. If we realise our ambitions across the full extent of the Agenda, the lives of all will be profoundly improved and our world will be transformed for the better.*"

Under this notion, the introduction of additional criteria when applying the Rio Markers to the tracking system that will capture issues such as universality, scalability, internationalisation, transformation and governance, is strongly advised.

5) Communicating the tracking system

As the concept and science of SD is a reflexive learning process, also **the proposed aligned tracking system should allow for further development**, which might then require a back-casting in order to make the entire seven years of the Horizon 2020 comparable – although this would represent a major task in terms of resources.

Aligning the current Horizon 2020/SD tracking system with the SDGs: A proposal

By their origin and conceptualisation, SDGs address economic, social and natural capital in the notion that the European Commission has used so far in its assessment of the Horizon 2020 work programmes' contribution to SD. The proposed tracking system has been designed to assist in understanding how the SDGs and their targets align with the three types of capital already used. It may be used as a reference point to give guidance on how the SDGs serve economic, social and natural capital, in line with the Commission's definitions about these terms.

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87 https://www.gfdrr.org/economic-modeling-income-different-types-capital-and-natural-disasters.

88 https://www.forumforthefuture.org/project/five-capitals/overview.

89 http://integratedreporting.org/wp-content/uploads/2013/03/IR-Background-Paper-Capitals.pdf.

90 http://www.pwc.com/gx/en/audit-services/publications/assets/pwc-ir-practical-guide.pdf.

91 https://sustainabledevelopment.un.org/post2015/transformingourworld.

To do that, maintaining the existing 0-40-100% scale, an "upgrading system" is proposed to take into account the circumstance that projects may have impacts than cannot easily be associated to this simple scale. A two-step approach is recommended:

FIRST STEP: BASIC MARKER

An action is considered to have SD as an objective if it contributes to **one goal**, but if such a contribution concerns:

- only one type of capital, then the action is considered as having a limited SD objective and is marked 0%;
- two of the three capitals, the action is considered as having a significant but not predominant SD objective and is marked 40%
- all three types of capital, the action is considered as having a large impact and SD as predominant objective and is marked 100%.

SECOND STEP: UPGRADING THE BASIC MARKER TO TAKE INTO ACCOUNT IMPACT AND COMPLEXITY

The "upgrading system" would use the following additional criteria:

1. If a project is 0% or 40% marked and addresses **more than one goal** then it should be upgraded to 40% or 100% respectively.

2. If a project is initially 0% or 40% marked (i.e. after the first step - evaluation against the three types of capital), but addresses elements such as the universality of SDGs, the transformative potential, the interlinkages/integration/trade-offs elements that reduce the cost of transition, governance and overarching issues (described below under a) – c)), then the project is upgraded depending on whether the project addresses:

2.1) two of the three above elements, then this project should be upgraded from 0% to 40% or from 40% to 100% (from 40%) respectively;[92]

2.2) all three above elements will be upgraded to 100% (this applies for both those that were in the beginning in category 0% and 40%).

The proposed system is summarised in the following table.

		1 capital	2 capitals	3 capitals
FIRST STEP (Basic marker)	**Basic criterion: number of capitals addressed**			
	Only one goal	0%	40%	100%
SECOND STEP (Marker upgrade)	**Criterion 1: more than one goal**			
		0%-> 40%	40% -> 100%	No change
	Criterion 2: universality/scalability, transformative potential/ governance, means of implementation			
	two additional elements	0%-> 40%	40% -> 100%	No change
	three additional elements	0%-> 100%	40% -> 100%	No change

a): In order to address **universality/scalability** issues the action could involve results and outcomes relevant for multiple actors in society - across academia, civil society, governments and business in an activating

[92] By introducing this refinement, the tracking system should also address the problem of granularity, i.e mitigate that specialised projects would be allocated a low Rio Marker (weighting).

manner. The results and outcomes should also be either universally applicable or scalable across the European Union and / or globally as opposed to only for a specific geography. They would be designed in the spirit of "no one will be left behind"(regarding people and/or geography), which might also include rather specific projects, which would be of high use for people in many countries.

b): In order to address **transformative potential** issues the action could address systemic drivers or barriers to societal change including trade-offs. The action may also contribute to bringing forward solutions and or levers of change for different SDGs in an explicitly integrated way.

c): In order to address **governance and means of implementation** issues the action could involve means of the implementation of the SDGs such as finance, technology, capacity building and systemic issues of governance ("enabling environment" such as policy coherence for SD, cooperation and coordination of institutions in government and beyond, multi-stakeholder partnerships, monitoring and accountability)

Mapping the SDGs and their Targets against the Three Types of Capital

As a guidance to the users of the Rio Markers, an indicative mapping of the three types of capital that the existing tracking system employs against the SDGs and their targets is presented below. The proposed mapping needs to be further refined through a careful interaction between experts in the Commission working on this subject, eventually with the support of a conceptual framework describing the interactions among different forms of capital, to avoid duplications in the mapping.[93]

Goal / Target	Economic Capital	Social Capital	Natural Capital
Goal 1. End poverty in all its forms everywhere	**X**	**X**	
1.1 by 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day	X	X	
1.2 by 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	X	X	
1.3 implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable		X	
1.4 by 2030 ensure that all men and women, particularly the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership, and control over land and other forms of property, inheritance, natural resources, appropriate new technology, and financial services including microfinance	X	X	
1.5 by 2030 build the resilience of the poor and those in vulnerable situations, and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters	X	X	
1.a. ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation to provide adequate and predictable means for developing countries, in particular LDCs, to implement programmes and policies to end poverty in all its dimensions	X	X	
1.b create sound policy frameworks, at national, regional and		X	

[93] As in the sustainable development framework "everything depends on everything", the table is built on the "prevalence" criterion, highlighting the capital mostly addressed by the goal/target, without considering second round effects. For example, the economic capital is considered significant only when the target is more directly related to economic activities (of people, sectors, businesses), or when budget issues are involved.

international levels, based on pro-poor and gender-sensitive development strategies to support accelerated investments in poverty eradication actions			
Goal 2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	**X**	**X**	**X**
2.1 by 2030 end hunger and ensure access by all people, in particular the poor and people in vulnerable situations including infants, to safe, nutritious and sufficient food all year round		X	
2.2 by 2030 end all forms of malnutrition, including achieving by 2025 the internationally agreed targets on stunting and wasting in children under five years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women, and older persons		X	
2.3 by 2030 double the agricultural productivity and the incomes of small-scale food producers, particularly women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets, and opportunities for value addition and non-farm employment	X	X	
2.4 by 2030 ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters, and that progressively improve land and soil quality	X	X	X
2.5 by 2020 maintain genetic diversity of seeds, cultivated plants, farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at national, regional and international levels, and ensure access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge as internationally agreed		X	X
2.a increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development, and plant and livestock gene banks to enhance agricultural productive capacity in developing countries, in particular in least developed countries	X	X	
2.b. correct and prevent trade restrictions and distortions in world agricultural markets including by the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round	X		
2.c. adopt measures to ensure the proper functioning of food commodity markets and their derivatives, and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility	X		
Goal 3. Ensure healthy lives and promote well-being for all at all ages		**X**	
3.1 by 2030 reduce the global maternal mortality ratio to less than 70 per 100,000 live births		X	
3.2 by 2030 end preventable deaths of newborns and under-five children		X	

3.3 by 2030 end the epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases and combat hepatitis, water-borne diseases, and other communicable diseases		X	
3.4 by 2030 reduce by one-third pre-mature mortality from non-communicable diseases (NCDs) through prevention and treatment, and promote mental health and wellbeing		X	
3.5 strengthen prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol		X	
3.6 by 2020 halve global deaths and injuries from road traffic accidents		X	
3.7 by 2030 ensure universal access to sexual and reproductive health care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes		X	
3.8 achieve universal health coverage (UHC), including financial risk protection, access to quality essential health care services, and access to safe, effective, quality, and affordable essential medicines and vaccines for all	X	X	
3.9 by 2030 substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water, and soil pollution and contamination		X	X
3.a strengthen implementation of the Framework Convention on Tobacco Control in all countries as appropriate		X	
3.b support research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration which affirms the right of developing countries to use to the full the provisions in the TRIPS agreement regarding flexibilities to protect public health and, in particular, provide access to medicines for all	X	X	
3.c increase substantially health financing and the recruitment, development and training and retention of the health workforce in developing countries, especially in LDCs and SIDS	X	X	
3.d strengthen the capacity of all countries, particularly developing countries, for early warning, risk reduction, and management of national and global health risks		X	
Goal 4. Ensure inclusive and equitable quality education and promote life-long learning opportunities for all	**X**	**X**	
4.1 by 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes		X	
4.2 by 2030 ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education		X	
4.3 by 2030 ensure equal access for all women and men to affordable quality technical, vocational and tertiary education, including university		X	
4.4 by 2030, increase by x% the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship	X	X	

4.5 by 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples, and children in vulnerable situations		X	
4.6 by 2030 ensure that all youth and at least x% of adults, both men and women, achieve literacy and numeracy		X	
4.7 by 2030 ensure all learners acquire knowledge and skills needed to promote sustainable development, including among others through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, and appreciation of cultural diversity and of culture's contribution to sustainable development	X	X	X
4.a build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all		X	
4.b by 2020 expand by x% globally the number of scholarships for developing countries in particular LDCs, SIDS and African countries to enroll in higher education, including vocational training, ICT, technical, engineering and scientific programmes in developed countries and other developing countries	X	X	
4.c by 2030 increase by x% the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially LDCs and SIDS		X	
Goal 5. Achieve gender equality and empower all women and girls		**X**	
5.1 end all forms of discrimination against all women and girls everywhere		X	
5.2 eliminate all forms of violence against all women and girls in public and private spheres, including trafficking and sexual and other types of exploitation		X	
5.3 eliminate all harmful practices, such as child, early and forced marriage and female genital mutilations		X	
5.4 recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies, and the promotion of shared responsibility within the household and the family as nationally appropriate	X	X	
5.5 ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic, and public life		X	
5.6 ensure universal access to sexual and reproductive health and reproductive rights as agreed in accordance with the Programme of Action of the ICPD and the Beijing Platform for Action and the outcome documents of their review conferences		X	
5.a undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance, and natural resources in accordance with national laws	X	X	
5.b enhance the use of enabling technologies, in particular ICT, to promote women's empowerment		X	
5.c adopt and strengthen sound policies and enforceable		X	

legislation for the promotion of gender equality and the empowerment of all women and girls at all levels			
Goal 6. Ensure availability and sustainable management of water and sanitation for all		**X**	**X**
6.1 by 2030, achieve universal and equitable access to safe and affordable drinking water for all		X	X
6.2 by 2030, achieve access to adequate and equitable sanitation and hygiene for all, and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations		X	X
6.3 by 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and increasing recycling and safe reuse by x% globally	X	X	X
6.4 by 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity, and substantially reduce the number of people suffering from water scarcity	X	X	X
6.5 by 2030 implement integrated water resources management at all levels, including through transboundary cooperation as appropriate			X
6.6 by 2020 protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes			X
6.a by 2030, expand international cooperation and capacity-building support to developing countries in water and sanitation related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies	X	X	X
6.b support and strengthen the participation of local communities for improving water and sanitation management		X	
Goal 7. Ensure access to affordable, reliable, sustainable, and modern energy for all (incl. business)	**X**	**X**	**X**
7.1 by 2030 ensure universal access to affordable, reliable, and modern energy services		X	X
7.2 increase substantially the share of renewable energy in the global energy mix by 2030	X		X
7.3 double the global rate of improvement in energy efficiency by 2030	X		X
7.a by 2030 enhance international cooperation to facilitate access to clean energy research and technologies, including renewable energy, energy efficiency, and advanced and cleaner fossil fuel technologies, and promote investment in energy infrastructure and clean energy technologies	X		X
7.b by 2030 expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, particularly LDCs and SIDS	X	X	X
Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	**X**	**X**	

8.1 sustain per capita economic growth in accordance with national circumstances, and in particular at least 7% per annum GDP growth in the least-developed countries	X		
8.2 achieve higher levels of productivity of economies through diversification, technological upgrading and innovation, including through a focus on high value added and labour-intensive sectors	X		
8.3 promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage formalization and growth of micro-, small- and medium-sized enterprises including through access to financial services	X		
8.4 improve progressively through 2030 global resource efficiency in consumption and production, and endeavour to decouple economic growth from environmental degradation in accordance with the 10-year framework of programmes on sustainable consumption and production with developed countries taking the lead	X		X
8.5 by 2030 achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value	X	X	
8.6 by 2020 substantially reduce the proportion of youth not in employment, education or training	X	X	
8.7 take immediate and effective measures to secure the prohibition and elimination of the worst forms of child labour, eradicate forced labour, and by 2025 end child labour in all its forms including recruitment and use of child soldiers		X	
8.8 protect labour rights and promote safe and secure working environments of all workers, including migrant workers, particularly women migrants, and those in precarious employment		X	
8.9 by 2030 devise and implement policies to promote sustainable tourism which creates jobs, promotes local culture and products	X	X	
8.10 strengthen the capacity of domestic financial institutions to encourage and to expand access to banking, insurance and financial services for all	X	X	
8.a increase Aid for Trade support for developing countries, particularly LDCs, including through the Enhanced Integrated Framework for LDCs	X	X	
8.b by 2020 develop and operationalize a global strategy for youth employment and implement the ILO Global Jobs Pact	X	X	
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	**X**	**X**	
9.1 develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all	X	X	X
9.2 promote inclusive and sustainable industrialization, and by 2030 raise significantly industry's share of employment and GDP in line with national circumstances, and double its share in LDCs	X	X	X

9.3 increase the access of small-scale industrial and other enterprises, particularly in developing countries, to financial services including affordable credit and their integration into value chains and markets	X	X	
9.4 by 2030 upgrade infrastructure and retrofit industries to make them sustainable, with increased resource use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, all countries taking action in accordance with their respective capabilities	X	X	X
9.5 enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, particularly developing countries, including by 2030 encouraging innovation and increasing the number of R&D workers per one million people by x% and public and private R&D spending	X		
9.a facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, LDCs, LLDCs and SIDS	X	X	X
9.b support domestic technology development, research and innovation in developing countries including by ensuring a conducive policy environment for inter alia industrial diversification and value addition to commodities	X		
9.c significantly increase access to ICT and strive to provide universal and affordable access to internet in LDCs by 2020		X	
Goal 10. Reduce inequality within and among countries	**X**	**X**	
10.1 by 2030 progressively achieve and sustain income growth of the bottom 40% of the population at a rate higher than the national average	X	X	
10.2 by 2030 empower and promote the social, economic and political inclusion of all irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status	X	X	
10.3 ensure equal opportunity and reduce inequalities of outcome, including through eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and actions in this regard		X	
10.4 adopt policies especially fiscal, wage, and social protection policies and progressively achieve greater equality		X	
10.5 improve regulation and monitoring of global financial markets and institutions and strengthen implementation of such regulations		X	
10.6 ensure enhanced representation and voice of developing countries in decision making in global international economic and financial institutions in order to deliver more effective, credible, accountable and legitimate institutions		X	
10.7 facilitate orderly, safe, regular and responsible migration and mobility of people, including through implementation of planned and well-managed migration policies		X	
10.a implement the principle of special and differential treatment for developing countries, in particular least developed countries, in accordance with WTO agreements		X	
10.b encourage ODA and financial flows, including foreign direct investment, to states where the need is greatest, in particular	X	X	

LDCs, African countries, SIDS, and LLDCs, in accordance with their national plans and programmes			
10.c by 2030, reduce to less than 3% the transaction costs of migrant remittances and eliminate remittance corridors with costs higher than 5%	X	X	
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable	**X**	**X**	**X**
11.1 by 2030, ensure access for all to adequate, safe and affordable housing and basic services, and upgrade slums		X	
11.2 by 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons		X	X
11.3 by 2030 enhance inclusive and sustainable urbanization and capacities for participatory, integrated and sustainable human settlement planning and management in all countries		X	X
11.4 strengthen efforts to protect and safeguard the world's cultural and natural heritage		X	X
11.5 by 2030 significantly reduce the number of deaths and the number of affected people and decrease by y% the economic losses relative to GDP caused by disasters, including water-related disasters, with the focus on protecting the poor and people in vulnerable situations	X	X	X
11.6 by 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality, municipal and other waste management	X	X	X
11.7 by 2030, provide universal access to safe, inclusive and accessible, green and public spaces, particularly for women and children, older persons and persons with disabilities		X	X
11.a support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning	X	X	X
11.b by 2020, increase by x% the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, develop and implement in line with the forthcoming Hyogo Framework holistic disaster risk management at all levels	X	X	X
11.c support least developed countries, including through financial and technical assistance, for sustainable and resilient buildings utilizing local materials	X	X	X
Goal 12. Ensure sustainable consumption and production patterns	**X**	**X**	**X**
12.1 implement the 10-Year Framework of Programmes on sustainable consumption and production (10YFP), all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries	X	X	X
12.2 by 2030 achieve sustainable management and efficient use of natural resources	X		X

12.3 by 2030 halve per capita global food waste at the retail and consumer level, and reduce food losses along production and supply chains including post-harvest losses	X		X
12.4 by 2020 achieve environmentally sound management of chemicals and all wastes throughout their life cycle in accordance with agreed international frameworks and significantly reduce their release to air, water and soil to minimize their adverse impacts on human health and the environment		X	X
12.5 by 2030, substantially reduce waste generation through prevention, reduction, recycling, and reuse	X		X
12.6 encourage companies, especially large and trans-national companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle	X		X
12.7 promote public procurement practices that are sustainable in accordance with national policies and priorities	X		X
12.8 by 2030 ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature		X	X
12.a support developing countries to strengthen their scientific and technological capacities to move towards more sustainable patterns of consumption and production	X	X	X
12.b develop and implement tools to monitor sustainable development impacts for sustainable tourism which creates jobs, promotes local culture and products	X	X	X
12.c rationalize inefficient fossil fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities	X		X
Goal 13. Take urgent action to combat climate change and its impacts	**X**	**X**	**X**
13.1 strengthen resilience and adaptive capacity to climate related hazards and natural disasters in all countries			X
13.2 integrate climate change measures into national policies, strategies, and planning			X
13.3 improve education, awareness raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning		X	X
13.a implement the commitment undertaken by developed country Parties to the UNFCCC to a goal of mobilizing jointly USD100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible	X	X	X
13.b Promote mechanisms for raising capacities for effective climate change related planning and management, in LDCs, including focusing on women, youth, local and marginalized communities		X	X

Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development	**X**		**X**
14.1 by 2025, prevent and significantly reduce marine pollution of all kinds, particularly from land-based activities, including marine debris and nutrient pollution			X
14.2 by 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration, to achieve healthy and productive oceans			X
14.3 minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels			X
14.4 by 2020, effectively regulate harvesting, and end overfishing, illegal, unreported and unregulated (IUU) fishing and destructive fishing practices and implement science-based management plans, to restore fish stocks in the shortest time feasible at least to levels that can produce maximum sustainable yield as determined by their biological characteristics	X		X
14.5 by 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on best available scientific information			X
14.6 by 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, and eliminate subsidies that contribute to IUU fishing, and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the WTO fisheries subsidies negotiation	X		X
14.7 by 2030 increase the economic benefits to SIDS and LDCs from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism	X		X
14.a increase scientific knowledge, develop research capacities and transfer marine technology taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular SIDS and LDCs		X	X
14.b provide access of small-scale artisanal fishers to marine resources and markets	X	X	
14.c ensure the full implementation of international law, as reflected in UNCLOS for states parties to it, including, where applicable, existing regional and international regimes for the conservation and sustainable use of oceans and their resources by their parties			X
Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	**X**		**X**
15.1 by 2020 ensure conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements			X
15.2 by 2020, promote the implementation of sustainable	X		X

management of all types of forests, halt deforestation, restore degraded forests, and increase afforestation and reforestation by x% globally			
15.3 by 2020, combat desertification, and restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land-degradation neutral world	X		X
15.4 by 2030 ensure the conservation of mountain ecosystems, including their biodiversity, to enhance their capacity to provide benefits which are essential for sustainable development	X		X
15.5 take urgent and significant action to reduce degradation of natural habitat, halt the loss of biodiversity, and by 2020 protect and prevent the extinction of threatened species			X
15.6 ensure fair and equitable sharing of the benefits arising from the utilization of genetic resources, and promote appropriate access to genetic resources	X	X	
15.7 take urgent action to end poaching and trafficking of protected species of flora and fauna, and address both demand and supply of illegal wildlife products	X	X	X
15.8 by 2020 introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems, and control or eradicate the priority species	X		X
15.9 by 2020, integrate ecosystems and biodiversity values into national and local planning, development processes and poverty reduction strategies, and accounts	X	X	X
15.a mobilize and significantly increase from all sources financial resources to conserve and sustainably use biodiversity and ecosystems	X		X
15.b mobilize significantly resources from all sources and at all levels to finance sustainable forest management, and provide adequate incentives to developing countries to advance sustainable forest management, including for conservation and reforestation	X		X
15.c enhance global support to efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities	X	X	X
Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	**X**	**X**	
16.1 significantly reduce all forms of violence and related death rates everywhere	X	X	
16.2 end abuse, exploitation, trafficking and all forms of violence and torture against children		X	
16.3 promote the rule of law at the national and international levels, and ensure equal access to justice for all		X	
16.4 by 2030 significantly reduce illicit financial and arms flows, strengthen recovery and return of stolen assets, and combat all forms of organized crime	X	X	

16.5 substantially reduce corruption and bribery in all its forms	X	X	
16.6 develop effective, accountable and transparent institutions at all levels	X	X	
16.7 ensure responsive, inclusive, participatory and representative decision-making at all levels		X	
16.8 broaden and strengthen the participation of developing countries in the institutions of global governance		X	
16.9 by 2030 provide legal identity for all including birth registration		X	
16.10 ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements		X	
16.a strengthen relevant national institutions, including through international cooperation, for building capacities at all levels, in particular in developing countries, for preventing violence and combating terrorism and crime	X	X	
16.b promote and enforce non-discriminatory laws and policies for sustainable development	X	X	X
Goal 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development	**X**	**X**	**X**
Finance			
17.1 strengthen domestic resource mobilization, including through international support to developing countries to improve domestic capacity for tax and other revenue collection	X		
17.2 developed countries to implement fully their ODA commitments, including to provide 0.7% of GNI in ODA to developing countries of which 0.15-0.20% to least-developed countries	X		
17.3 mobilize additional financial resources for developing countries from multiple sources	X		
17.4 assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries (HIPC) to reduce debt distress	X		
17.5 adopt and implement investment promotion regimes for LDCs	X		
Technology			
17.6 enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation, and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, particularly at UN level, and through a global technology facilitation mechanism when agreed	X	X	X
17.7 promote development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and	X	X	X

preferential terms, as mutually agreed			
17.8 fully operationalize the Technology Bank and STI (Science, Technology and Innovation) capacity building mechanism for LDCs by 2017, and enhance the use of enabling technologies in particular ICT	X	X	X
Capacity building			
17.9 enhance international support for implementing effective and targeted capacity building in developing countries to support national plans to implement all sustainable development goals, including through North-South, South-South, and triangular cooperation	X	X	X
Trade			
17.10 promote a universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the WTO including through the conclusion of negotiations within its Doha Development Agenda	X	X	
17.11 increase significantly the exports of developing countries, in particular with a view to doubling the LDC share of global exports by 2020	X		
17.12 realize timely implementation of duty-free, quota-free market access on a lasting basis for all least developed countries consistent with WTO decisions, including through ensuring that preferential rules of origin applicable to imports from LDCs are transparent and simple, and contribute to facilitating market access	X		
Systemic issues			
Policy and institutional coherence			
17.13 enhance global macroeconomic stability including through policy coordination and policy coherence	X		
17.14 enhance policy coherence for sustainable development	X	X	X
17.15 respect each country's policy space and leadership to establish and implement policies for poverty eradication and sustainable development			
Multi-stakeholder partnerships			
17.16 enhance the global partnership for sustainable development complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technologies and financial resources to support the achievement of sustainable development goals in all countries, particularly developing countries		X	
17.17 encourage and promote effective public, public-private, and civil society partnerships, building on the experience and resourcing strategies of partnerships		X	
Data, monitoring and accountability			
17.18 by 2020, enhance capacity building support to developing countries, including for LDCs and SIDS, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity,	X	X	X

migratory status, disability, geographic location and other characteristics relevant in national contexts			
17.19 by 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement GDP, and support statistical capacity building in developing countries	X	X	X

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This report presents the conclusions of the independent Expert Group on the "Follow-up to Rio+20, notably the Sustainable Development Goals (SDGs)" that was established by the European Commission (EC) to provide advice on the role of science, technology and innovation (STI) for implementing the new global sustainable development agenda (2030 Agenda). The Group gives recommendations, both in terms of general policy orientations and concrete areas of engagement, for EU STI policy to contribute to the implementation of the 2030 Agenda in Europe and beyond, as well as for possible engagement in international initiatives concerning STI. It recommends the EU to capitalise on its Horizon 2020 research and innovation programme, which is seeking to invest more than 60% of its budget for sustainable development and is fully open to international participation.

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