

Mutual Learning Exercise (MLE) on National Strategies and Roadmaps for International Cooperation in R&I

Framework Conditions for Challenge-
driven International R&I Cooperation

Thematic Report No 3



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MLE on National Strategies and Roadmaps for International Cooperation in R&I: Thematic Report No. 3: Framework Conditions for Challenge-driven International R&I Cooperation

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Mutual Learning Exercise (MLE) on National Strategies and Roadmaps for International Cooperation in R&I

Framework Conditions for Challenge- driven International R&I Cooperation

Thematic Report No 3

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1 INTRODUCTION

1.1 Background to the Thematic Report

This Thematic Report discusses the experiences of European Member States (MS) and Associated Countries (AC) concerning **framework conditions for challenge-driven international R&I cooperation**. This is the third topic of the Mutual Learning Exercise (MLE) on National Strategies and Roadmaps for International Cooperation in Research and Innovation, supported by the Policy Support Facility of the Directorate-General for Research and Innovation¹.

The MLE aims to foster a policy exchange on the various national approaches towards international cooperation in research and innovation (R&I). Thus, the activities and deliverables of the group of MLE participants are focused on learning from each other and taking these lessons 'back home' to implement good practices and good ideas within the national context. This Thematic Report builds on the literature review, the discussions during an MLE meeting in Stockholm on 12 and 13 November 2019 and the survey to the MLE participants.

The Thematic Report complements two other Reports that have been produced in the context of this MLE. The first was published in July 2019 on the topic of internationalisation strategy and the second in October 2019 on the topic of tools for internationalisation, in particular on STI agreements.

1.2 Scope and Objectives of the Report

Scope of the Thematic Report

In this MLE, the third topic was initially demarcated to address how framework conditions for R&I international cooperation (such as reciprocity, intellectual property rights, the openness of national research programmes to entities from other countries, open science, ethics, etc.) are catered for within national strategies for R&I international cooperation. In general, addressing framework conditions relates to the whole policy cycle (planning, implementation and evaluation) and in particular to the selection of partner countries and the design of STI agreements (See Annexe I for further information on discussed MLE knowledge needs on framework conditions).

The added value of this MLE is to delve deeper into a specific topic and engage in concrete operational policy learning by the participants. With this mindset, further discussions among the MLE participants especially in Bucharest came to the following conclusions regarding the scope of Topic 3 of the mutual learning exercise:

- Framework conditions for international R&I cooperation have been extensively studied over the years, including in other MLE exercises such as those related to ethics and research integrity.
- **The changes in R&I policy** in general, however, have implications also on **how framework conditions affect international R&I cooperation**, which create new needs for learning. In particular, increasing attention is paid on the societal impact of R&I and how R&I can be channelled to address the societal challenges.
- Henceforth, to offer MLE participants the opportunity to explore and engage in mutual learning on how these recent developments affect their practices, the scope of the third Country Visit was crystallised to focus on examining the current state

¹ <https://rio.jrc.ec.europa.eu/en/policy-support-facility/mutual-learning>

of **challenge-driven international R&I cooperation and related existing framework conditions.**

When international R&I cooperation shifts towards **challenge-driven approaches**, also the role of different **framework conditions may change**. While previously the emphasis has been, for instance, on ethics, research integrity, and open access, the attention has been gradually extended and focused especially on science diplomacy in response to geopolitical risks, and the increased importance of the Sustainable Development Goals (SDG) among other drivers of change. Hence, international R&I collaboration can affect and drive changes in framework conditions and vice versa:

- Framework conditions for challenge-driven international R&I programmes may need to pay more attention to extending the scoping and partner selection, the calls, the peer-reviews and the programme evaluations to incorporate **interdisciplinarity, market access and societal impact** considerations. This may also mean extending the set of criteria beyond scientific excellence and being more flexible with reciprocity of funding, for instance.
- Another change in framework conditions may be the way how R&I cooperation becomes increasingly **connected horizontally** to other policy-fields and private funding organisations creating a need to explore synergies and complementarities across policy fields and sectors.
- Furthermore, addressing challenges may call for inducing changes in institutional structures necessary for realizing societal transformation. This may create expectations for institutions, including funding organisations, on the one hand, to consider **ethics**, for instance, even more rigorously, and on the other to initiate processes of **reflexivity** and the engagement of a wide set of stakeholders, which may be addressed via **foresight** and other participatory processes.

Objectives of the Thematic Report

The general objective of this Thematic Report is to provide an introduction to and reflections from MLE participants of the current state of challenge-driven international R&I cooperation and related existing framework conditions at the national, European and global level. The specific objectives entail:

- What is meant by challenge-driven international R&I cooperation?
- What reference frameworks and initiatives of challenge-driven approaches are in place on the national, European and global level?
- How the framework conditions are perceived to influence challenge-driven international R&I cooperation and governance, and *vice versa*?

2 CHALLENGE-DRIVEN INTERNATIONAL R&I COOPERATION

2.1 Introduction

By **challenge-driven international R&I cooperation** we refer to international cooperation processes and practices in the realm of research and innovation (R&I)² to solve shared challenges. With challenges, in turn, we refer to major societal challenges or grand challenges; of which today the most widely recognised reference framework is the Sustainable Development Goals (SDG) of the United Nations³. In line with the 2030 Agenda

² Note that we use R&I and STI (Science, Technology and Innovation) interchangeable in line with the use of the terms in the documents referenced.

³ <https://sustainabledevelopment.un.org>

for Sustainable Development (United Nations, 2015), we understand that the governance addressing global challenges calls for:

- **interdisciplinary,**
- **intersectoral,**
- **global and universal** (meaning no-one left behind) and
- **transformative** approaches.

Such transformative governance of challenges could offer an integrated and systemic approach which targets the underlying **connections and trade-offs among the SDGs:**

- Firstly, rather than treating the SDGs as individual targets, the focus may be on transformation processes that format specific outcomes as defined by the entire collection of SDGs (Schot et al., 2018).
- Secondly, while challenges may have an ambitious target, they may also be kept in purpose inclusive and heterogeneous entailing various elements to be integrated (Kuhlmann and Rip, 2018). Hence, they may differ from the highly cited missions such as those of the Manhattan Project (to develop an atom bomb) and the Apollo Project (to put a man on the moon). There, the challenge was technical (and organisational), and whether the goals were achieved or not was unambiguous (Kuhlmann and Rip, 2018).
- Thirdly, due to the complex nature of challenges, they often require global responses. This is prone to create expectations for governance changes, in particular in the realm of international R&I cooperation.

This requires critical reflection of current governance practices. For instance, Weber and Rohrer (2012) propose that policies for transformative change begin with the recognition of four areas of potential failures: directionality, policy coordination, demand-articulation and reflexivity. Indeed, the challenge-driven R&I governance may need to increasingly incorporate practices that ensure **multi-level and multi-dimensional coordination** of policies and sectors to stimulate new pathways and ensure their integration for scaling up promising solutions responding best to the challenges at the local, national, European and global level. However, challenge-driven international R&I co-operation is subject to diverse barriers, in particular (Cervantes, Hong and Koide, 2019):

- National inward-looking R&I governance frameworks that limit international co-operation;
- Fragmented bottom-up non-state initiatives (e.g. universities, NGOs, foundations) and insufficient scale of investment necessary to address the global challenges.
- Lack of trust, legal regimes and IPR protection, knowledge and capacities, especially in developing countries;
- Individual countries may be unwilling to pay the costs of action for public goods ("tragedy of the commons");

Such barriers and differences in national contexts create uncertainties that can hold back advances. It is therefore important that countries pursue international co-operation within a general framework of common norms and practices.

2.2 Challenge-driven R&I policy at the global level

The most widely recognised global frameworks on major societal challenges have been orchestrated by the United Nations. In 2015, the United Nations General Assembly formally adopted the 2030 Agenda for Sustainable Development, along with a set of 17 SDGs and

169 associated targets (United Nations, 2015). They seek to build on the Millennium Development Goals and complete what has not been achieved. The Agenda positioned Science, Technology and Innovation (STI) as key means of implementation of the SDGs, and launched the UN Technology Facilitation Mechanism (TFM) as well as guidelines for the development of national STI roadmaps (IATT, 2018).

The SDGs can also be seen to provoke a broader system change not only in terms of technology used but also in consumer practices and needs, skills and capabilities of all actors involved, infrastructures, governance, regulation, industry structure and cultural meaning of the system process of mainstreaming SDGs into current policies. From a transformative R&I policy point of view, three types of SDGs can be distinguished (See also, Figure 1) (Schot *et al.*, 2018):

1. **SDGs which cover specific or a wider range of sociotechnical systems or application areas.** For example, SDG 3 on health, SDG 4 on education, SDG 6 on clean water and sanitation, SDG 7 on affordable and clean energy, but also SDG 9 on Innovation, industry and infrastructure, SDG 11 on sustainable cities and communities, SDG 14 life below water and SDG 15 life on land are directly linked to a range of systems.
2. **SDGs which emphasize 'transversal directions' or directionality.** SDGs 1 No poverty; SDG 2 Zero hunger; SDG 5 Gender Equality; SDG 8 Decent work and economic growth; SDG 10 Reduced inequalities; SDG 12 responsible production and consumption, and SDG 13 Climate Action.
3. **SDGs which focus on structural transformation in framework conditions** necessary for realizing transformation. This includes changing governance arrangements among the state, the market, civil society and science. These are expressed in the remaining two SDGs: SDG 16 Peace, Justice and Strong Institutions and SDG 17 Partnerships for the SDGs.

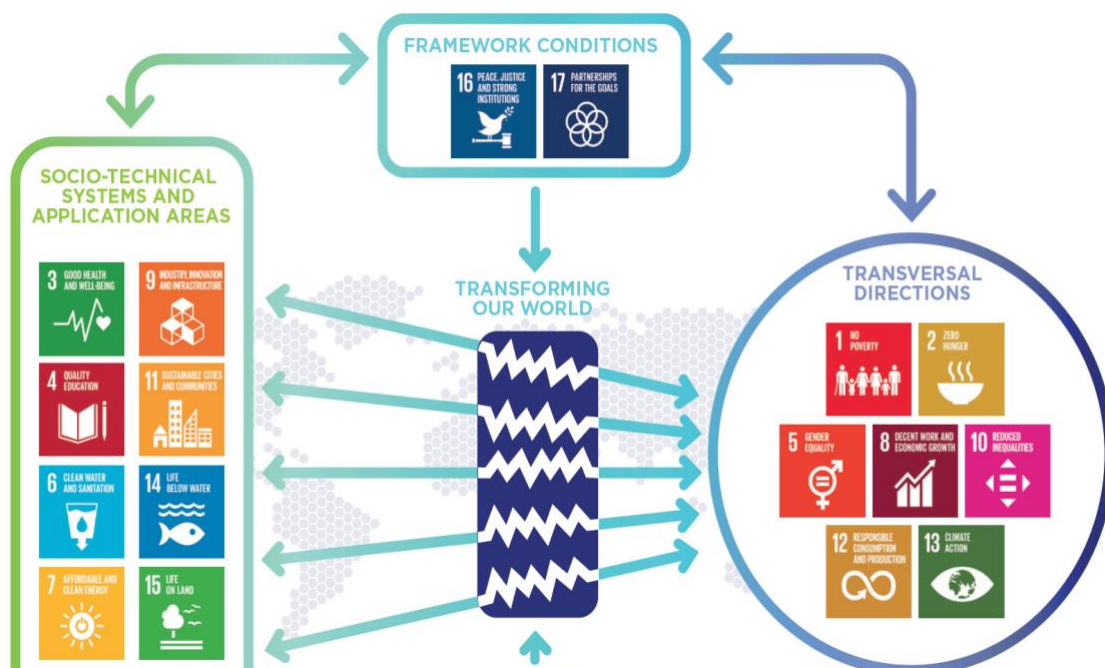


Figure 1 Three types of SDG areas and transformations (Modified from Schot *et al.*, 2018)

2.3 Challenge-driven R&I policy at the EU

The challenge-driven policy-making at the EU level is influenced by the UN Agenda 2030 and the SDGs⁴. Soon after the UN launch of the SDGs, at the EU level, the group of experts to follow-up to Rio+20 addressed SDGs in their report: "The Role of Science, Technology and Innovation (STI) to Foster the Implementation of the Sustainable

⁴ https://ec.europa.eu/environment/sustainable-development/SDGs/implementation/index_en.htm

Development Goals”, which lists the following recommendations for European R&I policy (Giovannini *et al.*, 2015):

- SDGs to be further integrated into the research framework programmes;
- Establish science-to-policy task forces under the SDGs to identify the need for STI along the entire innovation chain and to consider conflicts and possible incompatibilities between SDGs;
- R&I investments should be targeted to potentially transformative projects, programs and initiatives based on high-impact criteria for STI for sustainable development policies;
- Developing a European Research Area (ERA) initiative for SDGs;
- Promoting the participation of emerging and developing countries in EU innovation instruments, stimulating the globalization of key EU innovation projects;
- Alignment of the European Institute of Innovation and Technology (EIT) mission with the SDGs.

In addition to the recommendations to improve the SDG orientation of R&I policy, the Expert Group Report provides important information on issues related to (a) general policy orientations and the need for policy coherence, (b) communication and information on STI for sustainable development policies, (c) EU engagement with international initiatives, (d) efficient and effective evaluation frameworks of STI for sustainable development policies, (e) opportunities for specific research to implement the SDGs. In November 2016, the Commission published "Next Steps for a Sustainable European Future", its Communication on the Sustainable Development Goals that should ensure all coming EU policy measures take SDGs on board at the outset (Mayer and Schuch, 2019). The Advisory report to the European Commission by the Multi-Stakeholder Platform on the Implementation of the Sustainable Development Goals in the EU, of March 2018, highlights the urgent need to adjust the Multiannual Financial Framework (MFF) post-2020 to be more result-oriented and consider the implementation of the SDGs. In May 2019, the first draft of the post-2020 MFF was presented. In the MFF draft, **the SDGs⁵ are addressed especially in the 2nd pillar of Horizon Europe with the 5 focus clusters proposed by the EC:**

- Health;
- Culture, Creativity and Inclusive Society;
- Civil Security for Society;
- Digital, Industry and Space;
- Climate, Energy and Mobility;
- Food, Bioeconomy, Natural Resources, Agriculture and Environment.

Each cluster contributes to several SDGs; and many SDGs are supported by more than one cluster (Mayer and Schuch, 2019).

In the MFF draft text⁶ **international cooperation is situated in close relation to the SDGs:** *"The Programme should promote and integrate cooperation with third countries and international organisations and initiatives based on common interest, mutual benefit and*

⁵ Within the rationale of the MFF, research and innovation activities in Horizon Europe are subsumed under "single market, innovation and digital" with no direct reference made to the SDGs. The SDGs are not mentioned either in Pillar 1 about the ERC and the MSCA nor in Pillar 3 (Mayer and Schuch, 2019).

⁶ <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52018PC0435&from=EN>

global commitments to implement the UN SDGs. International cooperation should aim to strengthen the Union's research and innovation excellence, attractiveness and economic and industrial competitiveness, to tackle global challenges, as embodied in the UN SDGs, and to support the Union's external policies".

Mission-oriented innovation policy

Horizon Europe encompasses also the novel 'missions' approach. The starting point and reference framework for defining a mission-oriented approach are the UN's Sustainable Development Goals. The SDGs are a point of departure for rethinking Europe's efforts, instruments and approaches to promote R&I, including through a mission-oriented approach. Mission-oriented policies can be defined as systemic public policies that draw on frontier knowledge to attain specific goals. According to the definition in the draft Horizon Europe (HE) legislation (art. 2 of the FP/RfP Regulation), 'mission' means a portfolio of excellence-based and impact-driven R&I actions across disciplines and sectors, intended to:

- achieve, within a set timeframe, a measurable goal that could not be achieved through individual actions,
- have an impact on society and policy-making through science and technology, and
- be relevant for a significant part of the European population and a wide range of European citizens.

The purpose of a mission is to deliver concrete results for society and create a European public good. Horizon Europe will introduce a limited number of highly visible R&I missions. Missions will complement and build on the current "focus areas" used within Horizon 2020. They should be well-defined and self-standing programme parts, as opposed to the focus areas which are 'virtually linked calls' within the Horizon 2020 programme structure.

This mission-oriented policy approach would put into practice key recommendations of the Horizon 2020 interim evaluation⁷ and the Lamy High-Level Group reports⁸. According to the criteria in the draft Horizon Europe legislation (art. 7 of the FP/RfP Regulation), a mission shall:

- use SDGs as a source for their design and implementation, have a clear research and innovation content, **EU-added value**, and contribute to reaching Union priorities and commitments and Horizon Europe programme objectives;
- cover areas of common European relevance, be inclusive, encourage broad engagement and active participation of various types of stakeholders from public and private sectors, including citizens and end-users, and deliver R&I results that could benefit all Member States;
- be **bold and inspirational**, hence have wide, scientific, technological, societal, economic, environmental or policy relevance and impact;
- indicate a **clear direction and objectives** to be targeted, be measurable, time-bound and have a clear budget frame;
- be **selected transparently** and be centred on ambitious, excellence-based and **impact-driven** but realistic goals and research, development and innovation activities;

⁷

http://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/fp7_interim_evaluation_expert_group_report.pdf

⁸ https://ec.europa.eu/info/sites/info/files/conferences/sof/hlg_2017_report.pdf

- have the necessary **scope, scale and mobilization of the resources** and leverage of additional public and private funds required to deliver the mission outcome;
- stimulate activity **across disciplines** (including Social Sciences and Humanities) and encompassing activities from a broad range of TRLs, including lower TRLs;
- be open to multiple, **bottom-up** approaches and solutions taking into account human and societal needs and benefits and recognizing the importance of diverse contributions to achieve these missions;
- benefit from **synergies** in a transparent manner with other Union programmes as well as with national and, where relevant, regional innovation ecosystems.

European challenge-driven transformative governance initiatives

In the last couple of years, challenge-driven approaches have been taken up within the framework of EU institutions and agencies inspired, in particular, by transition research. For instance, the **European Environment Agency** (EEA) has shifted increasingly the attention to transitions during the last five years. The agency is exploring how an organisation can operate at the European scale tap into the enormous wealth of evidence about the emerging fields of 'sustainability transitions' and 'transformations'. Common to them is an acknowledgement that achieving long-term, large-scale sustainability visions and goals will depend crucially on enabling the emergence and upscaling of innovative technologies and practices at the local level. There is no question that quantitative, indicator-based assessments will continue to underpin much of the EEA's analysis of the European environment's state, trends and prospects. However, understanding innovation is likely to entail an increased focus on case studies and qualitative evidence, drawing on a broader range of disciplines (European Environment Agency, 2016).

The **Joint Research Centre** has identified a fruitful link between Smart Specialisation and the achievement of the SDGs through two main "entry points": (i) the formulation of Science, Technology and Innovation Roadmaps for development, on one side, and (ii) the inclusiveness of policy-making for innovation-driven development strategies and priorities, on the other. The added value of Smart Specialisation, particularly as a possible illustration of Science, Technology and Innovation Roadmaps for the SDGs, has been recognised by international organisations, notably under the umbrella of the United Nations (Gómez Prieto, Demblans and Palazuelos Martínez, 2019).

In connection to smart specialisation and Regional Innovation Strategies for Smart Specialisation (RIS3), **Understanding and Managing Industrial Transitions**⁹ is a Working Group launched by the JRC (Joint Research Centre) within the frame of the project RIS3 Support to Lagging Regions that aims to support regional (and where appropriate national) authorities facing major industrial transitions that draw on expertise on system innovation/transition management, foresight, industrial policy and innovation governance. The reviews focus on an industrial theme of growing global importance suggested by the relevant territorial authorities to collect evidence and examine the scope for developing adequate territorial responses that harness cross-portfolio complementarities and cross-stakeholder coordination.

The **EIT Climate-KIC** has also published its strategy¹⁰ for the years 2019–2022 focusing on systemic change. Its approach assumes strategy as a process of active learning and continual evolution towards the vision of 'a prosperous, inclusive, climate-resilient society with a circular, net-zero emissions economy by 2050'.

⁹ <https://s3platform.jrc.ec.europa.eu/industrial-transition>

¹⁰ <https://www.climate-kic.org/news/transformation-in-time/>

2.4 Challenge-driven R&I policy at the national level

One way of understanding the national-level views on SDGs is to consider their views on the objectives of Horizon Europe. Towards this end, the research conducted for the Austrian Federal Ministry of Education, Science and Research on the SDGs in the European R&I policy (Mayer and Schuch, 2019) identified a number of national communications that allowed concluding that the following **countries explicitly relate Horizon Europe objectives with the SDGs**: Belgium, Switzerland, Cyprus, Denmark, Germany, Greece, Ireland, Iceland, Italy, Latvia, Norway, and UK (and Scotland). In one way or the other, all of them see **the next framework programme as key to the implementation of the SDGs that in turn are considered as the only global rational and overarching perspective currently available on sustainable development**. Germany highlights the fact that *"stronger ties between FP9 and the R&I related aspects of the SDGs would also highlight the serious ambition to link national, European and international processes more closely than in the past."* (Mayer and Schuch, 2019, p. 31). Many countries in the same study link the SDGs with the mission-oriented approach.

Among the surveyed Member States, most prominently represented was the thematic focus of SDG 9 Industry, Innovation and Infrastructure excluding research infrastructures with the special focus of re-industrialisation, the visions of "industry 4.0" and innovation-driven science and technology development and cooperation. Next came economic growth and with lesser emphasis on "decent work" or unemployment as it would be framed in the SDG 8, followed by education SDG 4 (with a special focus on science education and higher education and research training), followed by gender equality (SDG 5) and health (and lesser the dimension of "well-being" as formulated in SDG 3, after which come clean energy (SDG 7) and climate action (SDG 13) (Mayer and Schuch, 2019).

Given the voluntary and country-led principles of follow-up and review of SDGs implementation, and early stages of countries' development of "ambitious national responses to the overall implementation" of Agenda 2030, comparable evidence base is still limited in assessing countries' gaps and policy priorities in achieving the SDGs (IATT, 2018). Outside the UN System, attempts have been made to fill this gap. For example, the Sustainable Development Solutions Network (SDSN) developed the SDGs Dashboard and Index across developing and developed countries (See, Figure 2).

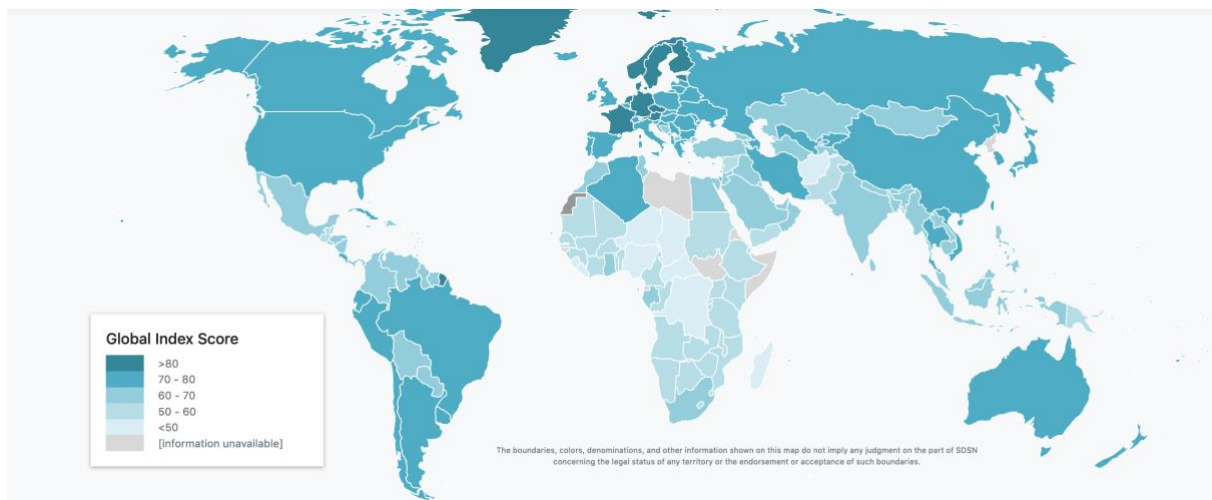


Figure 2 SDG Implementation by country according to Sustainable Development Report Dashboards 2019 (Sachs et al., 2019)

As regards the general state of implementation of SDGs in Europe, EUROSTAT monitors the SDG implementation at national level¹¹. However, there is no official mechanism to track transversal progress of R&I commitment of countries in contributing to the different SDGs. Still, one possible measure is to interpret Voluntary National Reviews (VNRs). Broadly, VNRs from **developed countries tend to elaborate more on STI's**

¹¹ <https://ec.europa.eu/eurostat/web/sdi/indicators>

contributions to achieve a broader set of the SDGs, than those from developing countries. Some developed countries like Japan and Sweden, also specify current programs, plans and recommendations on international STI contributions, through development assistance and international research partnerships. Brazil and Thailand are two examples of middle-income countries that elaborate their VNRs STI plans to contribute to a broad set of SDGs (IATT, 2018).

3 FRAMEWORK CONDITIONS FOR CHALLENGE-DRIVEN INTERNATIONAL R&I COOPERATION

3.1 Introduction

Different kinds of framework conditions influence challenge-driven international R&I Cooperation. These can be clustered at least in the following three themes.

Framework conditions for challenge-driven international R&I programmes:

- Which framework conditions are relevant for R&I cooperation in general and what changes when one focuses on challenge-driven approaches?
- How are challenges integrated in the international programming?
- Which SDGs are funded more, which less? Why? What is done from the EU vs. the national level?
- How are challenges addressed in the selection of a partner country; e.g. in view of research excellence, market access and societal impact?
- How interdisciplinarity, cross-industry connections and societal impact are taken into account in international calls?
- How are challenges addressed in monitoring and evaluation?

Framework conditions for challenge-driven domestic horizontal coordination:

- How does horizontal coordination happen today?
- What mechanisms exist for horizontal coordination of international cooperation among government entities?
- What kinds of international multi-stakeholder funding partnerships with private and third sector entities exist?

Framework conditions for challenge-driven transformative governance:

- How do governance and institutional structures influence on addressing challenges?
- How good principles (dual-use, ethics, gender, research integrity, RRI, open access, etc.) are taken into account in cooperation with third countries? What is done from the EU vs. from the national level?
- How do stakeholders (R&I community and civil society) participate in the scoping of cooperation and foresight and in agenda-setting at home and in partner countries?

To explore these themes, we requested initial reflections from MLE participants on their organisational practices. The survey was sent to all MLE project participants about the current state of challenge-driven international R&I cooperation and related existing framework conditions. A total of 15 responses was received in October/November 2019 (see, Table 1).

Country	Organisation
Austria	Austrian Federal Ministry of Education, Science and Research
Denmark	Danish Agency for Science and Higher Education
Finland	Ministry of Education, Science and Culture
France	French Ministry of Higher Education, Research and Innovation
Greece	General Secretariat of Research and Technology (GSRT)
Hungary	National Research, Development and Innovation Office
Ireland	Department of Business, Enterprise and Innovation
Moldova	Academy of Sciences of Moldova/Council of Rectors in Moldova
Norway	Research Council of Norway
Norway	Norwegian Ministry of Education and Research
Portugal	Fundação para a Ciência e a Tecnologia, I.P.
Romania	Ministry of Research and Innovation
Sweden	Ministry of Education and Research
Sweden	Swedish Innovation Agency Vinnova
Turkey	The Scientific and Technological Research Council of Turkey (TÜBİTAK)

Table 1 Participant organisations providing in the MLE survey in October/November 2019.

The MLE participants were asked to respond based on their impression on the current practices in their organisation, in general, using the Likert scale: 1 Not at all, 2 Only a bit, 3 Somewhat, 4 Very and 5 Extremely. The issues were further discussed in **the MLE meeting** 'Framework Conditions for Challenge-driven International R&I Cooperation' among MLE participants in Stockholm between 12-13 November 2019. What follows are the findings of this meeting together with the survey results and the existing documentation on related initiatives.

Integration of challenge-driven approaches

Among MLE participants there are different opinions regarding how framework conditions are affected by the increased focus on challenge-driven approaches. This can be partly explained with varying degrees of how challenges are integrated in international R&I programming in MS and AC, for instance by "maturity" of funding of challenge-driven R&I or how countries are influenced by the historical transition of Europe that took place after the Soviet era (Gustafsson, 2019).

Such varying views are in line with the survey results. With regard to the MLE respondents' views, while **challenge-driven approaches seem to be commonly integrated** into the practices, the level of integration of SDGs varies, if mentioned or not either in national R&I strategies or specifically in international R&I cooperation (Figure 3).

How extensively the following are integrated in your practices?

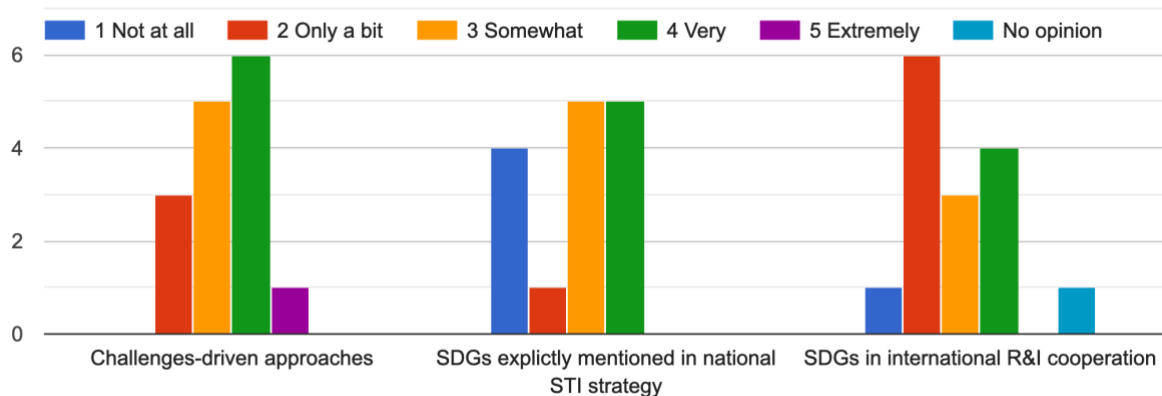


Figure 3 Integration of challenges in the practices of funding organisations

Source: Survey sent to MLE participants October/November 2019; n=15

In Finland, the Ministry of Education takes **SDGs into account in its overall steering and funding** of education and research. It is an integral part of the strategy. The Strategic Research Council (which is affiliated with the Academy of Finland (AKA) but operates independently) funds challenge-based research. AKA does not explicitly promote a challenge-based approach but elements of it can be found in the Academy's research programmes. It funds development research programme together with the Foreign Ministry; the research funded addresses several SDGs. AKA is engaged in international co-funding with Nordic partners and through ERA-Nets, JPIs and similar networks, including non-European partners. Their thematic approaches can sometimes be labelled "challenge-based".

When the strategies have been made **before 2015 (the year when SDGs were launched), they do not explicitly mention the SDGs**, for instance, Ireland's national R&I strategy 'Innovation 2020' predates the SDGs. However, Ireland's research prioritisation, which aligns the majority of competitively awarded public investment in research with 14 priority areas, was revisited in 2018 and the priority areas have been revised to reflect the SDGs¹². In the case of the Austrian Ministry of Education, Science and Research (BMBWF) the SDGs are not mentioned in the current STI Strategy as the strategy was published already in 2011. However, through its Development Research Programme as well as the new STI Strategy to be adopted in 2020, it is expected that both the SDGs and the challenge-driven approach will gain more importance. In Sweden, societal challenges and SDG are government priorities and they are foreseen to play an important role in the coming years.

The challenge-driven approach does not need to influence all activities. For instance, the Mobility Programmes of the BMBWF for international cooperation are driven as bottom-up activities. In Romania, the addressed challenges are at the national level rather than the European or international level.

Also, specific instruments for challenge-driven funding have been developed:

¹² <https://dbei.gov.ie/en/Publications/Publication-files/Research-Priority-Areas-2018-to-2023.pdf>

- Science Foundation Ireland (SFI) has in place **challenge-based funding**¹³, which is a solution-focused approach to funding research that uses prizes and other incentives to direct innovation activities at specific problems. It establishes a specific challenge (or problem) to address early in the research process and secondly, focuses strongly on the delivery of solutions in well-defined timeframes. To ensure that challenge-based funding solves real-world problems, it emphasises engagement with the beneficiaries of research such as key stakeholders, end-users and the general public. Challenge-based funding, therefore, focuses on challenges that are both visionary and inspirational but also achievable. SFI currently runs challenge prizes and challenge-related activities and expects to expand its portfolio over time to address various societal issues using STEM-led solutions.
- In Portugal, challenges approaches in Fundação para a Ciência e a Tecnologia, I.P. are customised to the target country/region. Concerning international cooperation in PhD and Post-doc grants, the contributions are **mapped (labelled) according to the SDGs**¹⁴.
- The Swedish Innovation Agency Vinnova, in turn, has responded to the Agenda 2030 with a challenge-driven **Innovation Programme**¹⁵ building on a bottom-up approach.
- In Finland, the '**Business with Impact**' Programme has been also established between the Ministry of Foreign Affairs and Business Finland. It is an applied R&D programme which refers to SDGs.

3.2 Challenge-driven international R&I programmes in thematic areas

Addressing challenges in international R&I cooperation calls for interdisciplinary and intersectoral approaches and matching interests with partner countries on thematic R&I application areas for cooperation. The transformative nature of challenge-driven innovation policy implies also that such cooperation, on the one hand, develops further the existing pathways towards more sustainable socio-technological systems and on the other takes further risks in betting on the emergence and acceleration of new alternative scientific, technological and social pathways towards the transformation of society at large.

Such application areas have been identified in SDGs, especially those which cover specific or a wider range of sociotechnical systems or application areas. For example, SDG 3 on health, SDG 4 on education, SDG 6 on clean water and sanitation, SDG 7 on affordable and clean energy, but also SDG 9 on Innovation, industry and infrastructure, SDG 11 on sustainable cities and communities, SDG 14 life below water and SDG 15 life on land are directly linked to a range of systems.

Framework conditions for the challenge-driven international programming cycle are subsequently addressed in its different phases of i) scoping and initial commitments, ii) calls, proposals and peer-review and iii) running, monitoring and evaluation as discussed in the following paragraphs in more detail.

Scoping and initial commitments

Scoping is initiated by the systematic analysis and sense-making of the context and followed by the identification of research/innovation topics and societal challenges. Programme design and initial funding commitments are made and appropriate processes for programming are initiated. According to the MLE respondents, governments often establish horizontal coordination mechanisms to address SDGs. For instance, in Austria, an inter-ministerial coordination group led by the Federal chancellery has been established

¹³ <https://www.sfi.ie/challenges/>

¹⁴ http://maisciencia.fct.pt/MaisCiencia_MelhorSociedade/BrowseODS.aspx

¹⁵ <https://www.vinnova.se/en/m/challenge-driven-innovation/>

to coordinate the contribution of Austria to the SDGs, addressing among other policy areas also research. Most of the **MLE respondents identify several SDG areas being extensively funded by their international R&I programmes**, especially those related to energy and health (Figure 4). In other areas, the views vary considerably indicating different thematic priorities.

A) How extensively the following SDG areas are funded in your international R&I programmes?

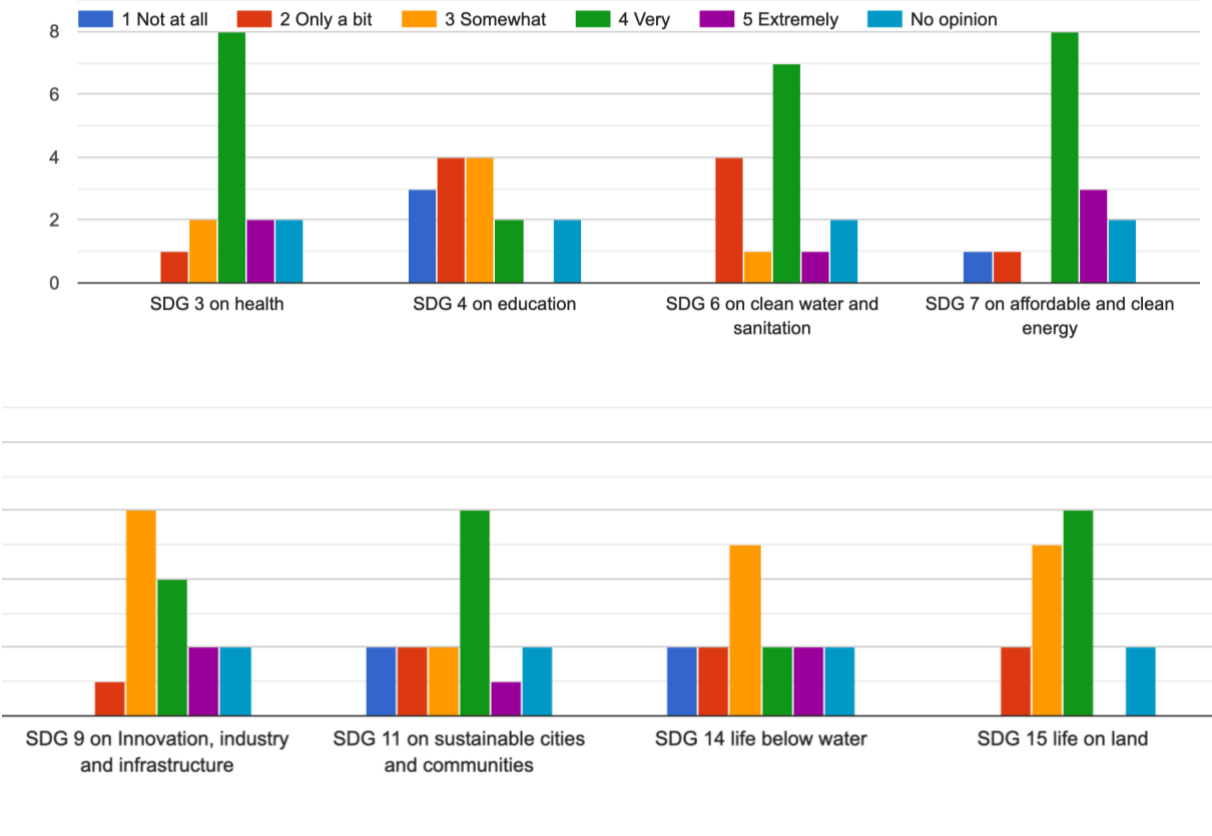


Figure 4 Funding for SDG areas in international R&I programmes

Source: Survey sent to MLE participants October/November 2019; n=15

In some countries challenges are more **integrated into some thematic areas** than others; in case of Romania in clean water, sanitation and education, and in France in the environment and climate change. In some cases, the SDGs are not specifically referred to, but the relations between programme themes and SDGs can still be established, for instance in areas like food, water, agriculture, energy, environment and ICT. Establishing such connections may be also made among the collaborating organizations who decide together with their counterparts what areas to include.

In several cases, even if there are no specific international R&I programmes in a country, international cooperation still takes place in various forms. In Finland, for instance, the Ministry of Education does not have international STI programmes. They are implemented through the Academy of Finland (its research councils) or by Business Finland (the innovation agency). Other ministries have several sectorial (international) programmes, too, in their specific fields (agro, health, climate, food, water, sanitation and so on). Interestingly, the Strategic Research Council has juxtaposed its research themes with SDGs to clarify their relations¹⁶ (Figure 5).

¹⁶ <https://www.aka.fi/en/strategic-research-funding/blogeja/2019/kestavampaa-tulevaisuutta-strategisen-tutkimuksen-keinoin/> The goals of the 2030 Agenda are listed in order from the goal with the most links to the strategic research themes (on the left) to the one with the least links (on the right). Key to abbreviations: EQUA: Equality in Society, PIHI: A Climate-Neutral and Resource-Scarce Finland, TECH: Disruptive

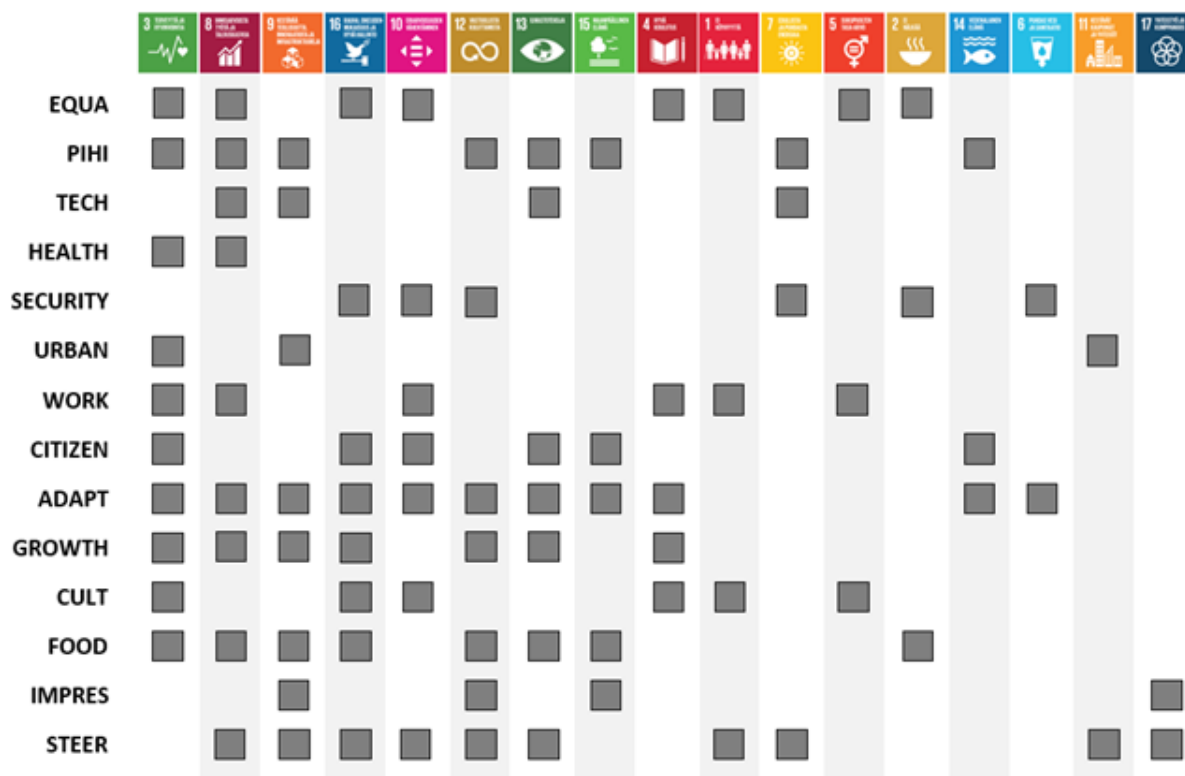


Figure 5 SDGs and the research themes of the Strategic Research Council of Academy of Finland

According to MLE participants, the countries should continue their work on addressing and strengthening R&I concerning SDGs, and the EU should continue to create incentives for making this happen. The EU is perceived to be very important both for R&I cooperation in general and for challenge-driven international R&I. This includes support for research and innovation in response to the implementation of the broad SDG agenda. Not only does the EU influence national priorities, but also representatives of business and research communities are increasingly becoming convinced to implement the SDGs (Gustafsson, 2019).

Some themes such as health and climate are highly funded at both national and European levels. Still, MLE participants judge some SDGs to be more in focus at the EU level than in the individual countries. A "holistic" approach to SDGs is also given higher priority by the EU than by national authorities. The inclusiveness characteristic of the SDGs may presuppose an international approach that is easier to accomplish at EU level than at national level (Gustafsson, 2019).

Challenge-driven approaches are also entering in the third-party selection. At the European level the Framework Conditions for accession to Horizon Europe are expected to be imposed in Article 12 (d) (to be adopted) stipulating that the association of third countries and territories is possible, if they fulfil all of the following criteria: i) a good capacity in STI, ii) commitment to a rules-based open market economy, including fair and equitable dealing with IPR, backed by democratic institutions and iii) active promotion of policies to improve the economic and social wellbeing of citizens (Schuch, 2019).

Technologies and Changing Institutions, HEALTH: Health, Welfare and Lifestyles, SECURITY: Security in a Networked World, URBAN: Urbanising Society, WORK: Skilled Employees – Successful Labour Market, CITIZEN: Changing Society and Active Citizenship, ADAPT: Adaptation and Resilience for Sustainable Growth, GROWTH: Keys to Sustainable Growth, CULT: Culture in an Increasingly Technologically Driven Society, FOOD: Towards a Sustainable, Healthy and Climate-Neutral Food System, IMPRES: Innovative Materials and Services to Promote Resource Wisdom and Sustainable Development, STEER: The Changing Role of Public Authority and the Potential for Steering Society.

Challenge-driven approaches imply attention to be paid to close to market activities and impact in society. While the clear majority considers the market access relevant in third-country partner selection, innovation-related principles, especially the public procurement of innovative solutions and standardisation, are not considered relevant. Market access is also difficult to evaluate as a whole since it depends on the type of cooperation (expected TRL levels of projects) and the thematic area. **Still, without doubt, the survey confirms the MLE participants prioritise still the most the research excellence and reciprocity in funding,** especially with developed countries (with developing countries other factors like science diplomacy and societal concerns may play a larger role). Most of the MLE respondents consider also **funding only civil R&I** extremely important (Figure 6).

B) Your explicit priorities in third-country partner selection. How relevant are the following?

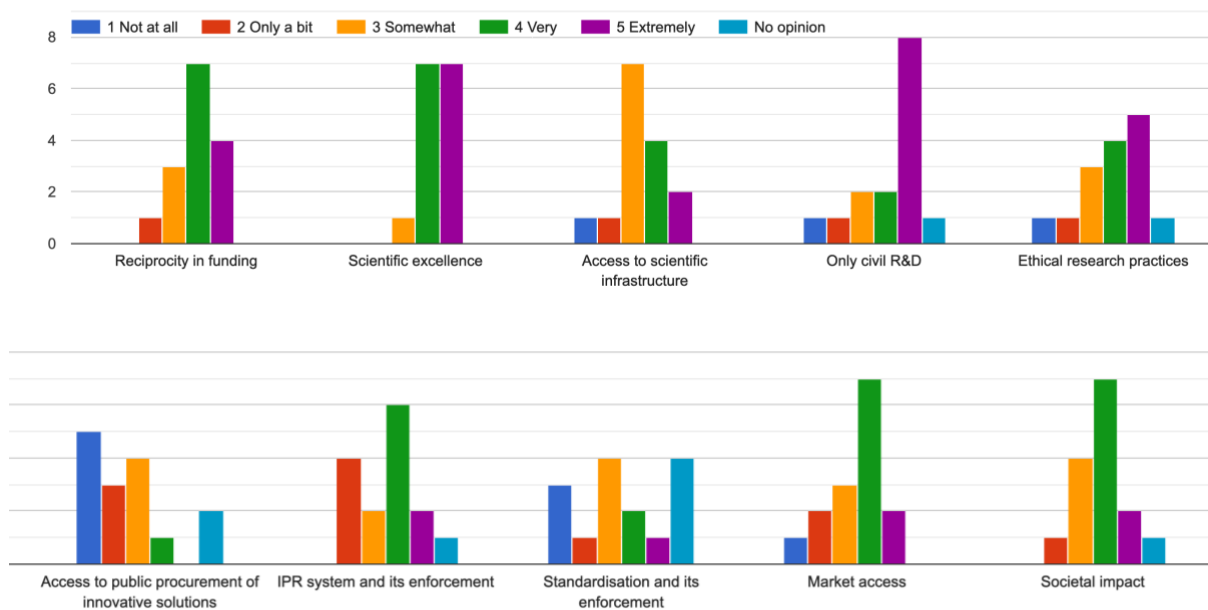


Figure 6 Priorities in third-country partner selection

Source: Survey sent to MLE participants October/November 2019; n=15

More elaborate market-driven considerations may be addressed in more detail in close-to-market funding organisations, for instance in **Finland** mainly by Business Finland. In Finland, different funding entities have the common principles of ethical research practices but approaches to market and innovation vary between the Academy of Finland, Business Finland and different ministries.

In **Portugal**, for instance, the international cooperation strategy in S&T can be broadly divided in two major trends, which frequently overlap: cooperation with countries with a more advanced STI ecosystem, from whom Portugal can learn and develop own national ecosystems; and science diplomacy, where S&T is used to strengthen relations with other countries, not always primarily concerned with S&T excellence or immediate returns.

In **Sweden**, a challenge-based approach is highly integrated into programmes. FORMAS, for instance, is perceived to have an advanced challenge-oriented programmatic approach. It was further mentioned that the Research Council in Sweden prepares a call on the Agenda 2030. Until today, however, there is still no alignment with the international strategy in terms of selection of countries with whom an agreement is concluded, instead, it seems that Sweden is operating rather on an ad-hoc basis (Schuch, 2019).

In **France**, a Steering Group on SDGs was created in April 2018. Several initiatives have been launched by France with a view on SDGs, e.g. the One Planet Summit¹⁷ and the 'Make Our Planet Great Again' initiative¹⁸. SDGs have been also integrated in the National Research Agency of France¹⁹. Also, a new Law²⁰ on Research and Innovation is expected to come into effect in 2020 that will change the funding approaches. At the international level, France and Germany together launched the German-French-initiative in the field of climate change and environment research.

Calls, proposals and peer-review

Calls for proposals are prepared and disseminated to receive project proposals, which are peer-reviewed and finally selected for funding within a programme. While **the clear majority of MLE respondents consider interdisciplinary, cross-industry connections and societal impact criteria in international calls, proposals and peer-reviews relevant**, these are often agreed case by case with international partners (Figure 7).

C) Your international calls, proposals and peer-reviews. How relevant are the following?

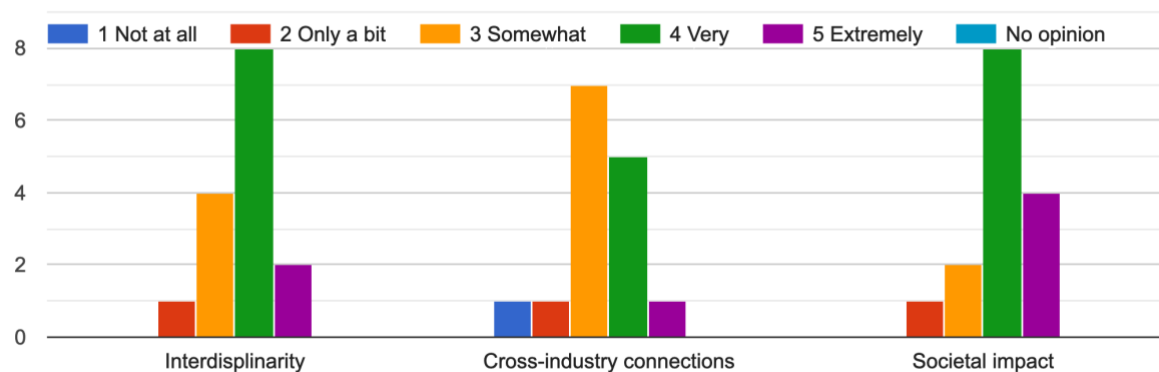


Figure 7 Interdisciplinarity, cross-industry connections and societal impact in international calls, proposals and peer-reviews

Source: Survey sent to MLE participants October/November 2019; n=15

Specific calls may be also developed to address industry connections and societal impact. For instance, in Finland, while cross-industry connections are less important for the Academy of Finland, they are addressed more in the Strategic Research Council. Furthermore, the national Flagship programme (involving Academy funding and private funding) may also have such calls in the future with non-European countries.

Addressing sustainable development and other societal impacts of R&I projects may require further attention to be paid on **interdisciplinary science and cross-industry connections**. However, this creates new challenges to make sure they are recognized on a level playing field with the R&I focused on one discipline and sector. **Current structures**

¹⁷ <https://www.oneplanetsummit.fr/en/coalition-make-difference-5>

¹⁸ <https://www.campusfrance.org/fr/make-our-planet-great-again-0>

¹⁹ <https://anr.fr/fr/actualites-de-lanr/details/news/publication-du-plan-daction-2020-de-lagence-nationale-de-la-recherche/#>

²⁰ <https://www.enseignementsup-recherche.gouv.fr/pid39124/loi-de-programmation-pluriannuelle-de-la-recherche.html>

in some programs may not be well designed to consider such criteria and are problematic in terms of interconnections and access to suitable reviewers.

Interdisciplinarity, cross-industry connections, and social impact should be accomplished by monitoring and evaluating progress, by supporting for public-private partnerships and by recruiting peers with experience of integration of different fields of research to judge the quality of applications that involve interdisciplinary research (Gustafsson, 2019). 'Innovation diplomacy' could be also a way to increase market access and thereby accomplish a win-win situation in terms of impact (Gustafsson, 2019).

There is a need for a change in culture. In practice, this means that actors such as policy-makers, civil society organizations, consumer/client organizations etc. should be invited to **participate in the scoping of programmes**. An incentive structure is needed for making this happen to overcome different potentially conflicting goals and to result in mutual understanding of benefits.

It is worthwhile to start some experiments to find out how interdisciplinary calls can be set up to create incentives for broad participation and achievement of good results. A list of peers, from Europe and beyond, with the relevant experience and knowledge needed for evaluation of interdisciplinarity could also be established. Furthermore, attempts should be made to organize platforms for dialogue between science and political communities especially at the EU level (Gustafsson, 2019).

Running, monitoring and evaluation of international programmes

Running a programme is a subject of effective administration and execution of projects. Monitoring refers to on-going control and evaluation refers to the assessment of a programme's or a projects performance. The evaluation of international programmes refers typically to the assessment of appropriateness, effectiveness and efficiency in execution of the entire programme and its parts.

Until now few approaches to measuring the impact of research and innovation on SDGs have been developed. Monitoring and evaluation of R&I concerning the SDGs could provide a good basis for developing science-society-policy interfaces through participatory approaches in the evaluation of socio-economic, environmental and policy impact of R&I. Indeed, **many MLE participants consider societal impact very much integrated into their monitoring and evaluation practices, others note that they do not evaluate at all** their international R&I programmes or that they do not refer explicitly to SDGs (Figure 8).

D) How far the following are integrated in the monitoring and evaluation of your international R&I programmes?

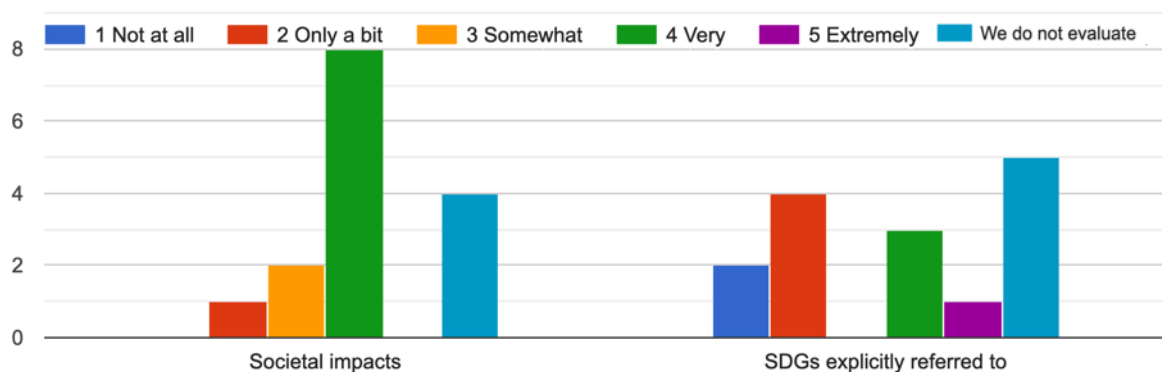


Figure 8 Societal impacts and SDGs in the monitoring and evaluation of international R&I programmes

Source: Survey sent to MLE participants October/November 2019; n=15

Among the participants in the MLE meeting, there was broad agreement that “monitoring and evaluation of challenge-driven international R&I” is important. There is a lack of reliable indicators and statistics, including those of Eurostat. A Mutual Learning Exercise (MLE) could be initiated to suggest and agree upon performance indicators of relevance in the field of international R&I (Gustafsson, 2019).

The evaluation needs to be considered from early on in the design of instruments. Programmes should define ex-ante impact pathways. Evaluation could use indicators in line with the SDGs and share the results for further learning. Also, new performance indicators for researchers are needed. Developing guidelines for systematic monitoring of SDG activities would help follow up progress and the comparison of results over time. One way of advancing is SDG labelling of the funded projects. To improve the quality of evaluation processes attention should be paid also how the evaluators are selected and how their work is also evaluated.

3.3 Challenge-driven horizontal coordination

Challenge-driven R&I priorities are horizontally connected to the needs of other sectoral policies and sectoral policies that can contribute to financing R&I and absorbing its results. The major societal challenges, especially the SDGs, are global and universal which means that in international R&I cooperation the parties would consider not only the impacts to the home country but also to the partner country and the world as a whole. This holistic approach refers to a collective responsibility to make sure that no-one is left behind. In practical terms, this implies enhanced coordination between different policy fields and rationales to look for shared multi-level and sector agendas, for instance across development aid, trade, environment and R&I.

Such transversal agendas could be further integrated into the transformative pathways that provide directionality in societal change. Transversal directions are also emphasized by several SDGs encompassing in particular: SDG 1 No poverty; SDG 2 Zero hunger; SDG 5 Gender Equality; SDG 8 Decent work and economic growth; SDG 10 Reduced inequalities; SDG 12 responsible production and consumption, and SDG 13 Climate Action.

Cross-sectoral coordination

Effective co-operation and co-ordination between national research funding institutions – including development research funders – help achieve coherence and impact in challenge-driven international R&I cooperation, for instance, in connection with countries and communities receiving Official Development Assistance (ODA). Such coordination could result, for instance in:

- More effective inclusion of the business community and building of creative coalitions and partnerships for funding and implementation across borders and institutional boundaries;
- Innovation in financing to harness digital solutions for health, education, and the environment, including through the use of open-source software platforms, effective business models and crowdfunding;
- Increasing public investments in research and innovation that can deliver global public goods, including the use of mission-oriented research and innovation policies, and better monitoring and co-ordination of such investments;
- Develop robust internationally harmonised indicators for the financing of global public goods.

Most of the MLE respondents considered their **current domestic horizontal coordination for international R&I cooperation to be extensive**, especially with the ministries of foreign affairs, industry and economy, environment and health. In contrast to this, cooperation with defence was considered less extensive (Figure 9).

A) To ensure the domestic horizontal coordination for international cooperation how extensively your organisation collaborates with the other government entities?

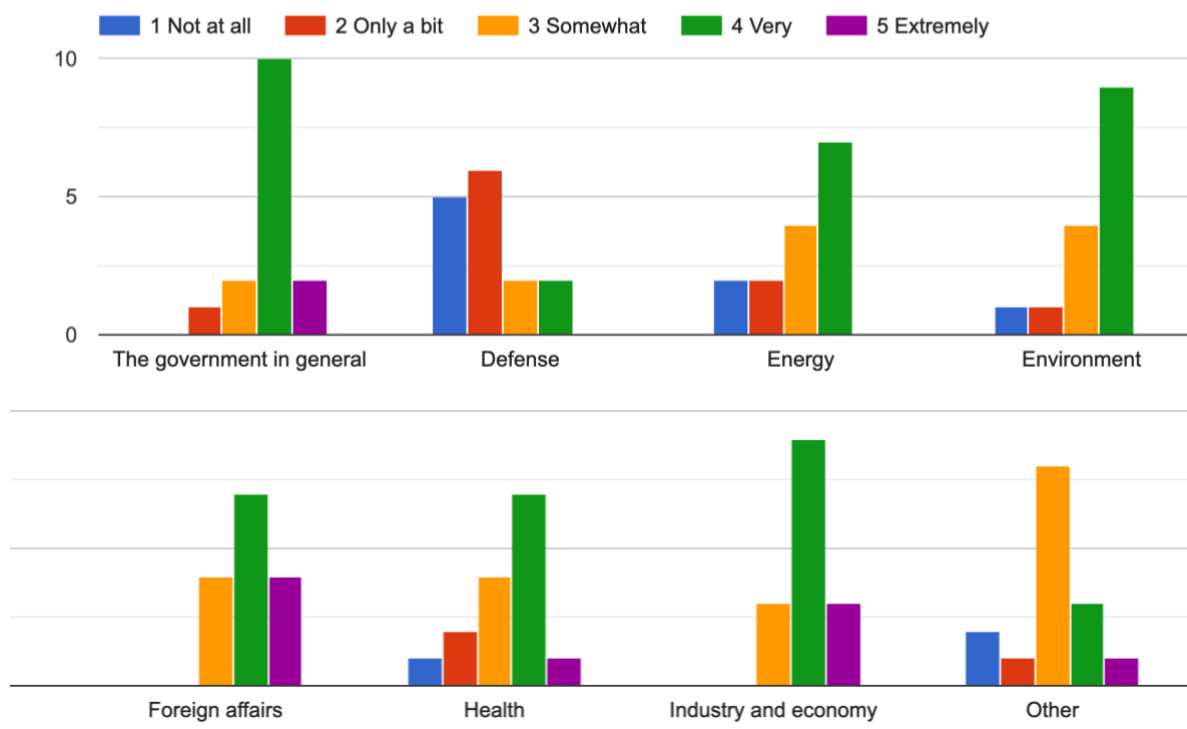


Figure 9 Domestic horizontal coordination

Source: Survey sent to MLE participants October/November 2019; n=15

In most of the MLE respondent countries, **horizontal coordination across the government** exists in the field of international cooperation. For instance, in France, the Ministry for Foreign Affairs is always included as a general rule and in Finland, the Ministry of Foreign Affairs invites other ministries and stakeholders to 'round table discussions' on priority countries. Also, higher education and R&I dialogues are open to other actors (ministries, agencies, NGOs, industry associations ...). In Sweden, the Ministry of Foreign Affairs is contacted especially for diplomatic reasons concerning particular countries. In Austria, the Ministry of Foreign Affairs is responsible for coordination in the context of Bilateral S&T Agreements, Science Counsellors and Science Diplomacy. The overall STI Policy and Strategy is prepared in coordination across the government, and there is a working group for coordination between the ministries responsible for basic and applied research and innovation. The Ministry of Finance is responsible for Impact Analysis. Ireland also takes a whole of Government approach to the development and implementation of its R&I policy.²¹

Challenge driven research and innovation policy reinforces the need to promote horizontal policy coordination. The MLE meeting discussions showed that the MLE countries can be group in three types concerning their conditions (Boekholt, 2019):

- In the first type of countries horizontal coordination, both **inter-ministerial and/or inter-agency** is well embedded in the mainstream policy making governance structure. There are regular policy decision making meetings involving relevant ministries, in some cases coordinated by the office of the prime minister.
- In the second type of countries the horizontal policymaking occurs in a more ad-hoc manner with regular meetings, mostly centred around information sharing or **joint actions towards a particular third country** (for example joint science, innovation and trade missions to China) or a particular activity (for example around the theme of Atlantic ocean matters in Portugal). The relevant horizontal

²¹ See, Chapter 7 of 'Innovation 2020': <https://dbej.gov.ie/en/Publications/Publication-files/Innovation-2020.pdf>

coordination may take place also at the level of programmes, for instance in Moldova, all R&D programmes are consulted with relevant ministries and the SDGs are mentioned in the National Program for R&I, which was adopted in September 2019. In Sweden, extensive coordination takes place through joint calls, especially on environment, health and industry and economy.

- In the third type of countries horizontal policy coordination, in general, is difficult as **ministries are protective of their (limited) resources**. Besides, frequent political changes (often associated with changing mandates and priorities) effect the general outlook towards international cooperation. Thus, a sustainable platform for horizontal cooperation is much more difficult to build up. In Norway, a vertical approach has been deliberately chosen, in which each sectoral ministry is responsible for research within its sector (policy development and implementation as well as funding), including international cooperation within their sector.

In the first two types of countries, the coordination of international collaboration is well organised concerning European matters, but much less so concerning international cooperation with third countries. For third-country collaboration, it is often more difficult to raise the interest of other sectoral ministries, specifically when these ministries are expected to use their budgets for research and innovation purposes. Collaboration with Foreign Affairs ministries and between the Ministries of Education and Science and Industry & Economic Affairs are more common.

The Swedish INTSAM initiative is a good example of the collaboration of five agencies coordinating international research funding for particular geographical areas and countries, also outside Europe (Boekholt, 2019). INTSAM is the intra-agency coordination for international cooperation in Sweden. INTSAM started with a small additional budget to make agencies working together. The agencies could decide themselves on how to organise INTSAM. The intra-agency working groups operating under the umbrella of INTSAM are mostly target country-focused. Two are multilateral (Belmont WG and Africa WG). Multilateral cooperation is often done via EU activities (e.g. by using JPIs). There is also EUSAM, similar to INTSAM but with a focus on cooperation towards the EU.

In the MLE meeting, participants considered demonstrating the benefits to other (sectoral) ministries and creating personal networks between the staff of these ministries and agencies useful for promoting horizontal cooperation, though the incentives and resources to mobilise this type of broad support are not always available. Collaboration is very much a people's business and existing examples demonstrate that it is very rewarding for policymakers involved when it works well (Boekholt, 2019).

Information sharing was also considered essential for horizontal cooperation. Sharing information at the ministry/agency level of activities in a specific country is a necessary first step. Some countries are making efforts to collect data at the level of researchers and research projects (who collaborates with whom in country xyz). It is challenging to do this systematically if these data are not collected at the institutional level (Boekholt, 2019).

The reluctance to allocate sectoral R&I budgets was considered a challenge. One country had the experience that when there are ample budgets available, the inter-ministerial or inter-agency discussions run the risk of being only about allocating funding, rather than on the strategic considerations for international collaboration. So the lesson here is to start building the relationships by focussing on the strategic aspects of international cooperation (Boekholt, 2019). One can first start with establishing multi-stakeholder partnerships and then develop them towards joint funding (but not start with the issue of funding because this would put too much stress and expectation on the cooperation) (Schuch, 2019).

The good examples of horizontal policy collaborations among the MLE participants concerned dedicated actions towards a specific country or geographical area. The SDG approach would, however, ask for a more thematic joint approach tackling a particular challenge, where geography is not the first concern. There were not many examples in the MLE countries where this has been developed in a sustainable manner (Boekholt, 2019).

The MLE meeting participants considered as the most difficult horizontal collaboration to establish multilateral agreements. The Commission could play a role in this matter to bring together multiple countries in SDG-inspired multilateral collaborations. It was suggested that the Joint Programming Initiatives (JPIs) could also be used for this purpose. There are some good experiences where these have opened up to third countries along their life cycle. Member States could orchestrate this in Horizon Europe by using community financed CSAs (Boekholt, 2019).

Multi-stakeholder partnerships

Addressing challenges calls for more **effective governance models to secure flexibility and to exploit innovation**, including addressing the complex relationships between partners in a multitude of bilateral and multilateral networks. Governments, international organizations, NGOs and private philanthropic funders, as well as the private sector, may engage in international, collective efforts to deploy R&I resources for addressing challenges, for instance for the provision of global public goods. Challenges are occasions (and incentives) for developing new constellations of innovation actors to emerge and become active.

Public-private partnerships, when transformative, are an example of such dynamics – when many different actors are involved, new opportunities emerge from diverse perspectives on what the problem is and what constitutes its resolution (Kuhlmann and Rip, 2018). A very visible example is **the Bill and Melinda Gates Foundation**, pro-active in public health in developing countries, creating **a consortium with governments** (the traditional candidates like Canada, Sweden and Switzerland, but also Brazil and India) **and big firms, to orchestrate** the work (Kuhlmann and Rip, 2018). The government role could be to offer legitimation. Governments could also assure that there is a regular reflection on the nature of challenges and the role of various actors (and assure a link with democratic decision-making) (Kuhlmann and Rip, 2018).

Most of the MLE respondents found **multi-stakeholder funding partnerships with private and third sector entities relevant, but** not that many consider that their country is experienced in developing them. Such differences may derive from the shared perception of how **difficult** it is to develop such partnerships (Figure 10).

B) Your multi-stakeholder funding partnerships with private and third sector entities.

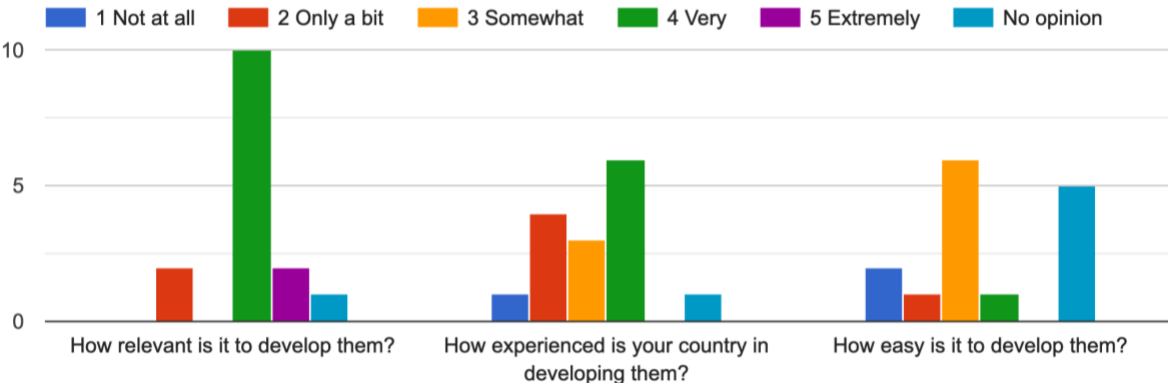


Figure 10 Multi-stakeholder funding partnerships

Source: Survey sent to MLE participants October/November 2019; n=15

In several countries, multi-stakeholder funding partnerships are relevant and common practice. The Swedish funding organizations are collaborating with foundations to generate larger impact in their collaborations with third countries. Sweden has large foundations that can be easily taken on board if the foundations consider this as beneficial to their own goals (Boekholt, 2019). Often the government follows their approach to

cooperate. Some opposition from the scientific community has emerged though against too much societally directed funding neglecting scientific development.

Multi-stakeholder funding can be found also in the development research programme jointly funded by the Ministry for Foreign Affairs and the Academy of Finland. In Finland, several foundations have formed a postdoc pool that can be mobilised for international collaboration. But in general, this has not yet been tried or implemented by the majority of the MLE countries (Boekholt, 2019). In Austria, multi-stakeholder funding partnerships are especially relevant for the applied technology and innovation-related programmes that are implemented by the Austrian Federal Ministry of Transport, Innovation and Technology (BMVIT) and the Austrian Federal Ministry for Digital and Economic Affairs (BMDW).

Some approaches of other countries **towards multi-stakeholder funding partnerships vary** considerably and **mapping different practices** could provide new learning opportunities. In Romania, multi-stakeholder funding partnerships are of interest but there is still no unanimous opinion on their development. In Hungary, the involvement of third parties, including the industry, depends on the field and the partner country. Within the Research Council of Norway, multi-stakeholder partnerships take place mainly at the project level. In Moldova, there is a big gap between R&D institutions and other sectors; the government does not support financially the commercialisation of scientific results.

The MLE participants also noted that it would be good to have partnerships with companies for SDGs in the EU (like in the USA). One way to do this can be the Projects of Common European Interest²² in the new industry policy (focused on strategic value chains). Also, the Global Forum on SDGs was referenced, which is based on enterprises focusing on thematic value chains (Schuch, 2019).

Bureaucratic hurdles still exist that may impede the materialisation of multi-stakeholder funding partnerships. There may be a need for **further development of institutional structures** at the national level as these kinds of partnerships may become more prominent and common practice. The same may be true also at the European level. Such partnerships could play also a role in the Mission approach in Horizon Europe, for instance.

3.4 Challenge-driven transformative governance and foresight processes

Addressing challenges in international R&I cooperation calls for **structural transformation of framework conditions** necessary for realizing societal transformation. Challenges are transformative in the sense that they are part of overall societal development rather than just arguments for setting priorities in ongoing research and innovation systems (in policies, in practices) (Kuhlmann and Rip, 2018). The need for transformative and structural changes in society creates expectations for institutions, including funding organisations, to consider integrated reflexivity, deep learning and considerations of underlying assumptions on **transformative processes that may be addressed via foresight and other participatory processes** that engage multiple stakeholders to joint agenda setting. This turns to further focus on the institutions that are addressed also in specific SDGs considering structural transformation in framework conditions. It includes, in particular changing governance arrangements among the state, the market, civil society and science. For instance, the UN Global Compact²³ engages also businesses and civil society by offering participants an extensive to take action to achieve the SDGs. The institutional framework conditions are expressed in the two SDGs: SDG 16 Peace, Justice and Strong Institutions and SDG 17 Partnerships for the SDGs.

Within the realm of funding organisations such structural and institutional considerations relate to how the organisations address framework conditions related to ethics, research integrity, responsible research and Innovation (RRI), gender issues or dual-use (avoiding military use of civil research). Such R&I efforts engage wider society to reinforce social

²² https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1517560605813&uri=OJ:JOC_2018_039_R_0003

²³ <https://www.unglobalcompact.org/sdgs/about>

cohesion and the trust in society. For instance, for the successful implementation of a mission-oriented policy, it has been suggested to let citizens take part in the mission, even let them co-design and select the topics (Mayer and Schuch, 2019). RRI, an approach that anticipates and assesses potential implications and societal expectations about R&I, aims to foster the design of inclusive and sustainable R&I. This implies that societal actors (researchers, citizens, policymakers, business, third sector organisations, etc.) **work together during the whole R&I process** to better align both the process and its outcomes with the values, needs and expectations of society.

The consideration of different principles in addressing shared challenges extends to international, supranational, and global resource domains that are **'common-pool resources'**, just like cyberspace, public education and public health services and to a certain degree scientific knowledge and public research data and outputs, digital tools and technologies. Global common-pool resources are typically non-rival and non-excludable in consumption, and they are severely undersupplied and underfunded. R&I policies have an important role to play in increasing the supply of such resources, including a better understanding of possible trade-offs between the provision of them (Røttingen, 2019). For instance, governments may establish platforms for free and open FAIR²⁴ data sharing with transparent metadata that are available to all stakeholders and can also be used as the basis for creating flexible indicator frameworks.

Digital public goods (DPGs), such as **public research data and copyright-free or open-licensed software**, offer a way to enable progress on many of the challenges ranging from education to biodiversity and gender. However they do not necessarily have to be created by the public sector and financed by tax revenues (i.e. the traditional market failure argument) but rather they may also be provided by the private sector and the private-not-for-profit sectors (Wilkinson *et al.*, 2016). When asked about the relevance of different principles in the implementation of R&I partnerships with international partner countries, the MLE respondents unanimously considered **research excellence extremely or very relevant; also, ethical treatment and research integrity were considered very relevant** (Figure 11).

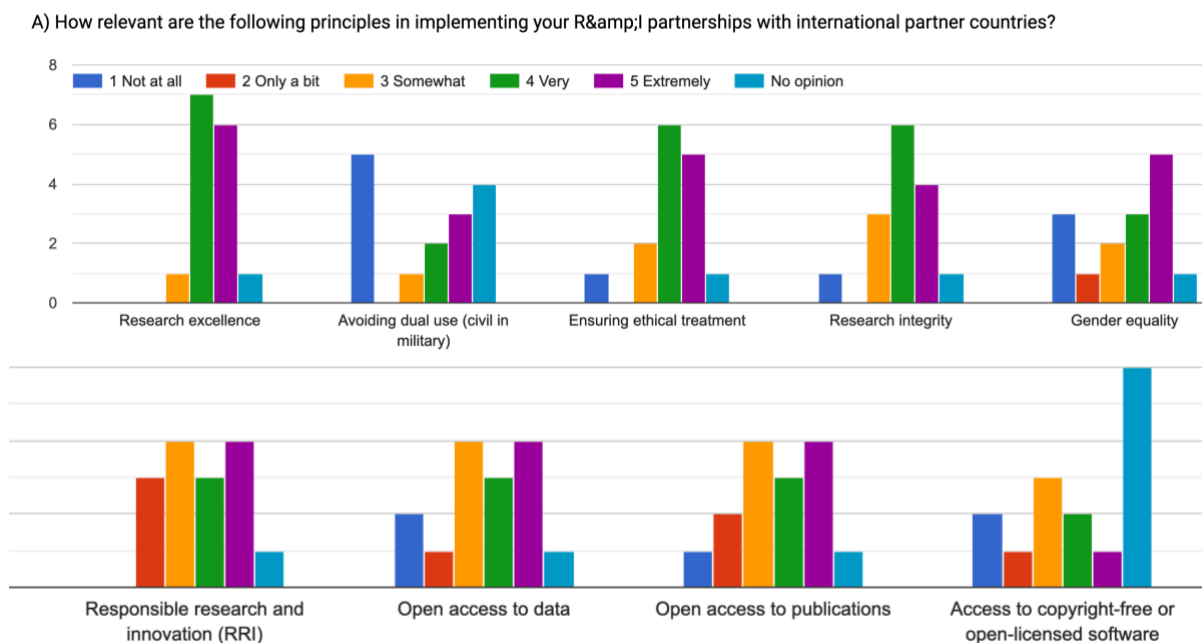


Figure 11 Principles in implementing international R&I partnerships

Source: Survey sent to MLE participants October/November 2019; n=15

²⁴ Especially FAIR data that refers to data which meet standards of findability, accessibility, interoperability, and reusability.

In Sweden, the national priority areas are given priority also in international collaboration. In Finland, the common principles of ethical and responsible research are widely shared. They are also taken into account in new MoUs with different countries, which, however, is not always easy. The following paragraph is added to all new MoUs of the Ministry of Education and Culture of Finland:

"Both participants accept that this MoU is based on mutual respect for core higher education and research values, including equitable access, public accountability, academic freedom, institutional autonomy and social responsibility, as articulated in the 1997 UNESCO Recommendation concerning the Status of Higher-Education Teaching Personnel and subsequent instruments."

Among different principles, many MLE respondents had no opinion defined on avoiding dual-use or access to copyright-free or open-licensed software. The consideration of many of the principles in practice depends on the role and responsibilities of the funding organisation. For instance, In Austria, the BMBWF largely implements bottom-up mobility activities where innovation-oriented aspects are less prominent. Austria does not want to intervene either in the national domain of other countries. The good principles are thus sometimes bent – depending on the partner country (science diplomacy means also to be flexible). In Hungary, some of these issues depend on the cooperating scientists (e.g. IPR) and are not detailed in the calls.

The participants of the MLE meeting think that 'good principles' are quite often referred to in S&T agreements between the Member States and partner countries. Usually, however, these principles are just listed without further reflection. As regards the actual use of good principles (and their enforcement) sometimes a reference to the respective applicable national law or regulations of each signatory country is made. References to international standards are seldom. Moreover, not all principles are accepted by the partner countries. The use of 'good principles' in S&T agreements is considered to be less advanced and especially less enforced than for instance within the European Framework Programme for RTD (Schuch, 2019).

In case of non-acceptance, there was widespread agreement, that pressure on the partner country is not helpful. To overcome the problem of non-acceptance of a certain 'good principle' by a partner country, soft influence by promoting the good principle under scrutiny through examples and through showing the added value of this principle is regarded as the preferred (and only feasible) solution. Sometimes the partners also have different meanings about some 'good principles'. In such cases, it is advantageous to enter into dialogue with the partner to clarify the perspectives and meanings. This has demonstrably been proven successful in some cases (Schuch, 2019).

As a future orientation, it was considered to be helpful that principles should not be neglected but rather developed together so that European standards are stepwise also reflected in Member States' driven international cooperation initiatives. Some participants argued that the processes of dissemination and acceptance of 'good principles' across the different partner countries and regions should be supported by the European Commission. As channels of support, specific activities of the ISF (International Support Facility of the DG R&I) were suggested (e.g. to prepare a practical 'guidebook'). The lack of support instruments (such as the former INCO-NETs) was again mentioned in this context (Schuch, 2019).

The standards of 'good principles' seem to be at highest at EU level and the EU is also considered to be a global driver in this respect. Other international countries are approaching the European Commission to learn from her experience and to orient themselves towards European standards (e.g. in terms of IPR, data protection, research integrity). The association to the Framework Programme is considered to be the 'hardest' trigger for adoption of the standards of good principles. Participants mentioned that the widespread adoption of 'good principles' standards across several research communities was supported by the European Commission also through several soft measures, especially in the SWAFS programme but also through MLE exercises implemented under the H2020-Policy Support Facility. Such supporting coordination actions, however, are missing at the international outreach level. Another argument brought up, was that the NCPs within the

EU but also outside of the EU should be better trained and informed about 'good principles'. Especially outside of the EU, NCPs often have only a little knowledge and understanding about the importance of 'good principles' in joint research undertakings financed by the European Commission (Schuch, 2019).

The 'nationalisation' of data and results deriving from public-funded research projects in China or the difficult situation related to the massive burning of the Amazonian rain forest in Brazil were mentioned as difficult cases how to handle international partner countries which break 'good principles'. The EU should have a common approach and a common way to deal with such infringements, which requires better communication between the European Commission and the Member State (Schuch, 2019).

Stakeholder engagement in international R&I cooperation

Addressing challenges may benefit from new spaces for articulation of views of diverse actors and for innovative ways of addressing political and organizational complexities and uncertainties (Kuhlmann et al. 2018). Governments (and their alliances) can adopt the role of a coordinating change-agent for open-ended transformative environments requiring experimental and creative actions.

In the MLE meeting interesting national examples were shared how a broad set of stakeholders can be involved to set the direction for international collaboration in research. Workshops and round tables are organised regularly to discuss the stakeholders' interest in certain partner countries. In countries that do this systematically, the challenge is to involve actors beyond the 'usual suspects', i.e. the organisations that are already active with third-country collaborations (Boekholt, 2019).

When MLE respondents were asked about the relevance of direct engagement of stakeholders in scoping international R&I cooperation, most of them considered **the academic R&I community in their home country as well as in the partner country extremely or very relevant** (Figure 12).

B) For the scoping of international R&I cooperation how relevant is the direct engagement of...?

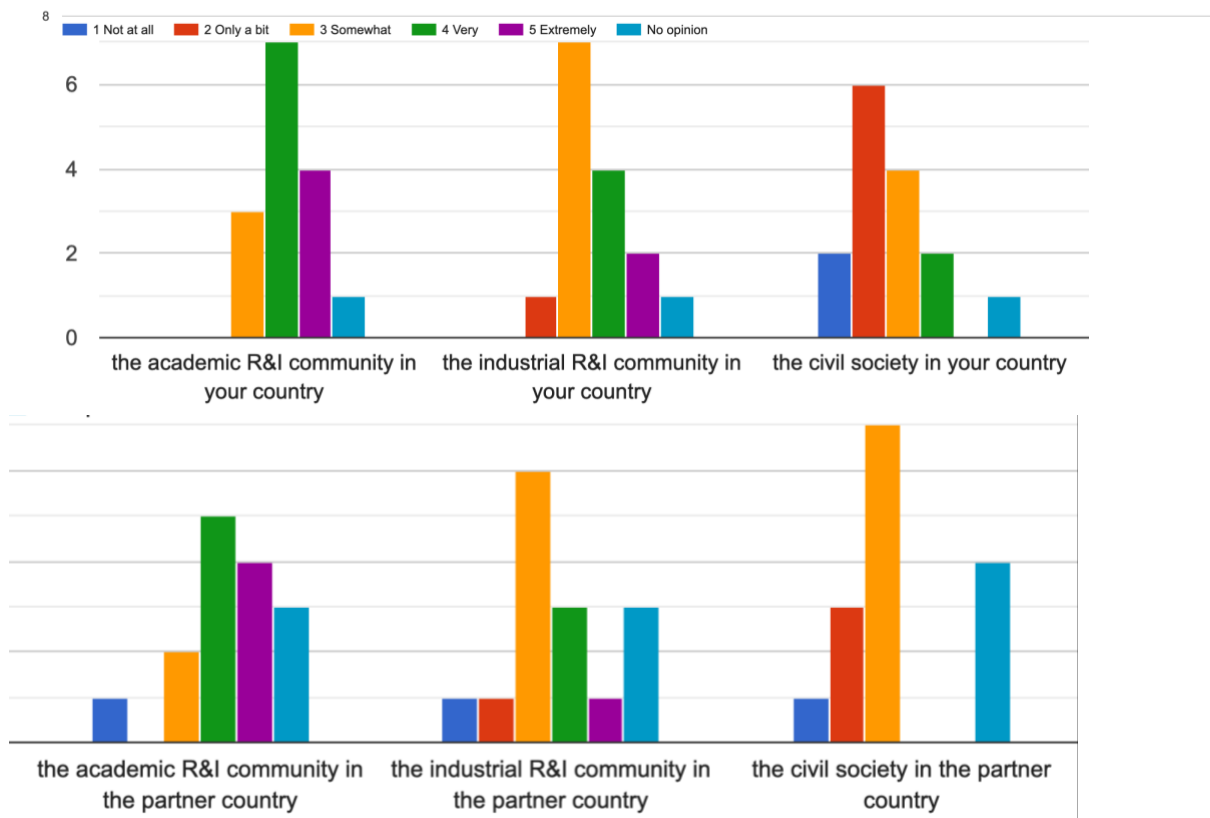


Figure 12 Stakeholder engagement in scoping international R&I cooperation

Engaging the industrial R&I community is considered more relevant in the home country of respondents than in partner countries. When asked about extending the engagement also to civil society, the responses vary more indicating that this is a less relevant and/or less addressed area. In France, consultation with stakeholders is done regularly approximately every six months and structured along with geographical approaches (with a few thematic areas – such as enhancing international attractiveness).

It is also worth noting that some respondents had no opinion on the engagement of stakeholders in the partner country. **Stakeholder engagement in the partner country is often considered to be the responsibility of the partner country.** In Austria, the ministry works regularly with stakeholders and representative organisations and associations as well as with open consultations. However, these activities rarely include civil society actors. It is expected that via their partner country organisations (ministries, funding agencies), the contacts to stakeholders in the academic, industrial and civil society sphere takes place in the partner country. In Finland, the academic community (etc.) of a partner country will be represented by their funder(s). Also in Hungary, it is not considered as a task of the ministry to communicate with the stakeholders of the partner country. Joint agenda setting in international cooperation is not frequent, but it is increasing. The example of Vinnova to establish joint partnership platforms (e.g. with China), which also secure large stakeholder involvement, was perceived by the MLE participants as an inspiring example for an international innovation initiative with an international partner country (Schuch, 2019). In case of the Air Centre²⁵ coordinated in turn by Portugal, 30 workshops took place in many different third countries along the Atlantic to let the stakeholders define the Research Agenda during a 2-year's long process of scientific diplomacy.

Strategic dialogues occur at several levels between the EU with global partners (e.g. African Union, LAC). These, however, should (1) be better communicated and prepared between the European Commission and the Member States, (2) better coordinated and (3) better used. The current situation negatively influences the mobilisation and implementation. Also, the tools to achieve better coordination, establishment (and subsequent implementation) of **joint agendas with certain international partner countries were perceived by most participants as not well developed.** Most participants agreed that efficient platforms for this are lacking respectively that no supportive instruments (such as the former INCO-NETs) are in place (Schuch, 2019). SFIC could provide a framework to improve the situation and develop an MLE type of activities with third countries. SFIC could be more empowered as the only remaining body at cross Member States level to deal with international R&I cooperation (there are no programme committees anymore, no INCO NCPs or specific instruments). SFIC could be more and better involved in consultations by the European Commission (Schuch, 2019).

Foresight for international R&I cooperation

The need for transformative and structural changes in society creates expectations for learning and considerations of underlying assumptions on transformative processes that may be addressed via foresight and other participatory processes. Over the years, organizations have undertaken various efforts to conduct foresight and scenario exercises at global, regional and country levels, to inform R&I strategies as well as broader economic, social and environmental policies.

Within **the UN framework** foresight has been deployed in particular by UNCTAD's Commission on Science and Technology for Development (CSTD), UNDP's Innovation

²⁵ <https://aircentre.org/timeline/#>

Facilities and UNESCO's Futures Literacy Laboratories (FLL) which is part of the Management of Social Transformations (MOST) Programme²⁶ (IATT, 2018).

Outside the UN System, the **European Commission and OECD** have advanced foresight practices across different sectors and themes. The EU's Directorate-General for Research and Innovation has been ensuring effective cross-directorate collaboration on the foresight work, producing many collaborative studies, while the Joint Research Centre complements its internal research capabilities by tapping into a wider network of foresight professionals across all sectors and providing methodological support through its EU Policy Lab. The definition of Missions in Horizon Europe is also currently supported by foresight exercises. The OECD follows a similar route by engaging in community building around foresight activities. In 2014, the OECD launched the Government Foresight Community with over 60 experienced foresight practitioners from 23 governments to facilitate knowledge exchange (IATT, 2018). Also in Russia, foresight is extensively used.

The International Institute for Applied Systems Analysis (IIASA), the Sustainable Development Solutions Network (SDSN), and the Stockholm Resilience Centre (SRC) have also launched '**The World in 2050**' (IIASA, 2019), a global research initiative bringing together a network of leading policymakers, analysts, modelling and analytical teams, and organisations from around the world to collaborate in developing pathways towards **sustainable futures and policy frameworks needed for implementing the SDGs**, and more importantly, for achieving the needed transformational change.

The Future Earth (FutureEarth, 2019) initiative is another international example of how stakeholder processes and negotiations could be organised to have an impact on policymaking. Driven by research and innovation actors from around the world, latest research findings are transferred to the government, business and community decisions and policies. As part of the initiative, **the German Committee Future Earth²⁷ acts as an independent research advisory board to national research funders** as well as a national platform for global sustainability researchers. It provides support for interdisciplinary and integrated research. Furthermore, the German Committee identifies relevant research topics within a national as well as international context. In this regard, the German Committee encourages the collaboration between natural and social sciences, the humanities and engineering to advance research activities that help shape pathways for a global sustainable society, to find a systematic approach for problems and to generate societal relevant knowledge.

Among different MLE respondents, **the views vary considerably on the implementation of participatory foresight processes** on challenge-driven societal transformation (Figure 13). It appears also that many have not formed their opinion yet; especially if their organisation would implement foresight projects that would engage also partner countries.

²⁶ <http://www.unesco.org/new/en/social-and-human-sciences/themes/most-programme/>

²⁷ <http://www.dkn-future-earth.org/en/>

C) How relevant is it to implement participatory foresight processes on challenges-driven societal transformation...?

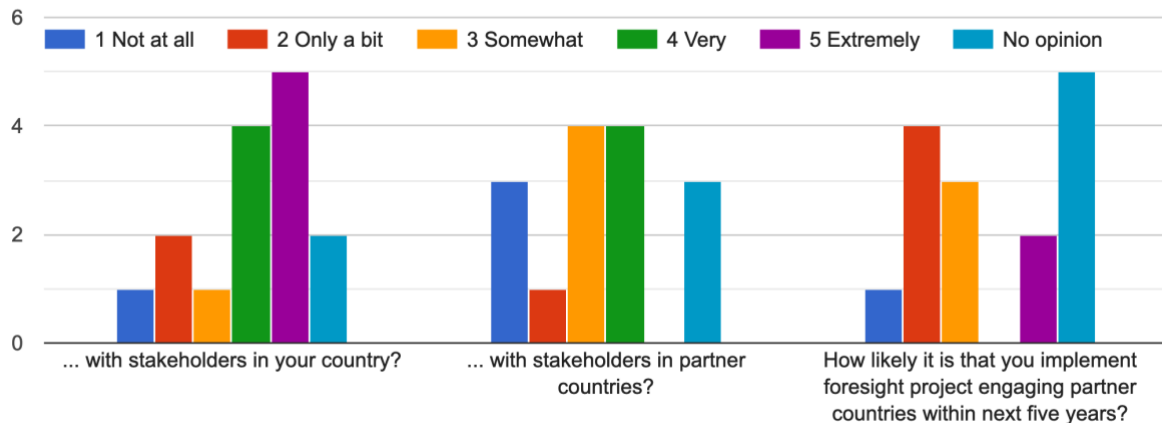


Figure 13 Foresight processes on challenge-driven societal transformation

Source: Survey sent to MLE participants October/November 2019; n=15

In Finland, all education and science councillors are working with foresight actions in partner countries. For instance, Business Finland has two persons in Asia working explicitly on foresight. Business Finland has a systematic foresight approach in place and also processes for stakeholder engagement are in place depending on the thematic area. All knowledge via foresight on global challenges is regarded as important for the civil society, research communities and industry. In Sweden, it has been recognised that foresight studies should be included in the priorities, but this hasn't been done so far. The varying views may also relate to **different levels of familiarity on foresight processes**. In Austria, the ministry is not considered very strong in participatory foresight processes so far, though they are adapting to the processes of engaging relevant stakeholders in strategy developments. In Hungary, foresight specifically for the sake of international cooperation is not happening for the time being.

The MLE participants discussed to establish SFIC Working Groups to implement specific jointly coordinated activities. In this regard also the issue of the absence of **joint foresight activities among the Member States** was mentioned. Foresight is done elsewhere by now (e.g. Horizon Europe Partnerships and mission boards). The question was raised if SFIC could maybe employ more also the existing European Interest Groups which survived as offspring of some previous international ERA-NETS and INCO-NETS (e.g. with Japan and Korea), but it was also agreed that for most regions such support platforms are simply not available (Schuch, 2019).

Foresight can support multilateral cooperation by building strategic intelligence. Deliberating foresight projects can result in good discussions on joint agendas. SFIC could provide a forum for sharing foresight outputs of EU/MS, for instance. Also, joint EU/MS foresight activities could be developed. Existing national foresight processes/platforms could be applied more to develop international foresights on R&I cooperation, for instance, to address mission-oriented international cooperation.

4 CONCLUSIONS

This Thematic Report has provided a brief introduction and reflections from MLE participants on the current state of challenge-driven international R&I cooperation and related existing framework conditions at the national, European and global level.

With challenge-driven international R&I cooperation we referred to international cooperation processes and practices in the realm of R&I to solve shared challenges;

specifically, major societal challenges or grand challenges of which today the most widely recognised reference framework is the Sustainable Development Goals (SDG) of the United Nations. The SDGs provide also a common framework for challenge-driven policy agenda at the EU level. In the MFF post-2020 draft text, international cooperation is situated in close relation to the SDGs, which are also the starting point defining a mission-oriented approach in Horizon Europe. While there is no official mechanism to track the progress of R&I commitment of countries for contributing to SDGs, Voluntary National Reviews from developed countries tend to elaborate more on R&I contributions than those from developing countries.

Challenges (in particular SDGs) seem to have become an integral part of European policy, including international R&I coordination. As part of the preparation of this Thematic Report, a survey was sent to all MLE project participants concerning the current state of challenge-driven international R&I cooperation and related existing framework conditions. A total of 15 responses was received in October/November 2019. According to the respondents, the level of integration of SDGs varies, while challenge-driven approaches seem to be commonly integrated into the practices. Based on the findings of this report and, in particular, the shared reflections among the MLE participants towards the end of the Stockholm meeting, the following conclusions can be derived.

Challenge-driven international R&I programmes

According to MLE participants, the countries should continue their work on addressing and strengthening challenge-driven international R&I cooperation and that the EU should continue to create incentives for making this happen. With regards to challenge-driven international R&I programmes in thematic areas, most of the MLE respondents identify several SDG areas being extensively funded by their international R&I programmes, especially those related to energy and health. Challenge-driven approaches may turn also more attention to the application of research, to close to market aspects and societal impact. Framework conditions for the challenge-driven international programming cycle were also addressed:

- For the third-country partner selection, there seems to be unanimous emphasis among the MLE respondents on scientific excellence, which is considered extremely or very important. Reciprocity in funding is also relevant, especially with developed countries, while this does not play such a role in cooperation with developing countries. Most of the MLE respondents consider also funding only for civil R&I extremely important.
- While the clear majority of MLE respondents consider interdisciplinary, cross-industry connections and societal impact criteria in international calls, proposals and peer-reviews relevant, these are often agreed case by case with international partners. Coordination in piloting new approaches is important for mutual learning.
- Until now, few approaches to measure the impact of research and innovation on SDGs have been developed. Monitoring and evaluation of R&I concerning the SDGs could provide a good basis for developing science-society-policy interfaces through participatory approaches in the evaluation of socio-economic, environmental and policy impacts of R&I. Indeed, many MLE respondents consider societal impact very much integrated into their monitoring and evaluation practices, while others note that they do not evaluate at all their international R&I programmes or do not refer explicitly to SDGs. Beyond developing new indicators for the monitoring and evaluation of funding instruments also cultural change and dialogue are crucial.

Challenge-driven horizontal coordination

Effective co-operation and co-ordination between national research funding institutions help achieve coherence and impact in challenge-driven international R&I cooperation. Most of the MLE respondents considered their current domestic horizontal coordination for international R&I cooperation to be extensive, especially with the ministries of foreign affairs, industry and economy, environment and health. In contrast to this, the cooperation

with defence was considered less extensive. Mapping good practices across Europe could provide important learning opportunities for the Member States.

Most of the MLE respondents found multi-stakeholder funding partnerships with private and third sector entities relevant, but not that many considered that their country is experienced in developing them. Such differences may derive from the shared perception of how difficult it is to develop such partnerships. Many companies and private foundations are advanced in challenges driven approaches and collaborating with them can provide not only further resources but also opportunities for mutual learning.

Challenge-driven transformative governance and foresight processes

Structural and institutional considerations for societal transformation relate to how funding organisations address the framework conditions and engage in future-oriented learning with stakeholders at home and in partner countries. When asked how relevant different principles are in the implementation of R&I partnerships with international partner countries, the MLE respondents agreed on research excellence, ethical treatment and research integrity to be very relevant. The EU is considered to be a global driver in establishing standards of 'good principles'. For instance, countries around the world are approaching the European Commission to learn from her experience and to orient themselves towards European standards.

When MLE respondents were asked about the relevance of direct engagement of stakeholders in scoping international R&I cooperation, most of them considered the academic R&I community in the home country as well as in the partner country extremely or very relevant. Engaging industrial R&I community is considered more relevant in the home country of respondents than in partner countries. It is also worth noting that some respondents had no opinion on the engagement of the stakeholders in the partner country. This may be because stakeholder engagement in the partner country is often considered to be the responsibility of the partner. Joint agenda setting in international cooperation is not frequent, but it is increasing. Strategic dialogues occur at several levels between the EU with global partners. To coordinate the international cooperation efforts SFIC could in general play a more active role.

The need for transformative and structural changes in society creates expectations for learning and considerations of underlying assumptions on transformative processes that may be addressed via foresight and other participatory processes. Among different MLE respondents, the views vary considerably on the implementation of participatory foresight processes on challenge-driven societal transformation. It appears also that many have not formed their opinion yet; especially if their organisation would implement foresight projects that would engage also partner countries. Varying views may also relate to different levels of familiarity with foresight processes. In this regard also the issue of the absence of joint foresight activities among the Member States was mentioned. SFIC could provide a forum for sharing foresight outputs of EU/MS, for instance.

Final remarks

When international R&I cooperation shifts towards challenge-driven approaches, the role of different framework conditions also changes. While previously the emphasis has been, for instance, on ethics, research integrity, and open access, attention has been gradually extended and focused especially on science diplomacy in response to geopolitical risks, and the increased importance of the SDG goals among other drivers of change. Hence, international R&I collaboration can affect and drive changes in framework conditions and *vice versa*.

Framework conditions for challenge-driven international R&I programmes need to pay more attention how to extend the scoping of programmes and partner selection, the calls, the peer-reviews and the programme evaluations to incorporate interdisciplinarity, market access and societal impact considerations. This may also mean extending the set of criteria beyond scientific excellence and being more flexible with reciprocity of funding, for instance. Framework conditions change also as R&I cooperation becomes increasingly connected horizontally to other policy-fields and as private funding organisations create a

need to explore synergies and complementarities across policy fields and sectors. Furthermore, addressing challenges may call for inducing changes in institutional structures necessary for realizing societal transformation. This may create expectations for institutions, including funding organisations, on the one hand, to consider ethics or research integrity principles even more rigorously, and on the other to initiate processes of reflexivity and the engagement of a wide set of stakeholders, which may be addressed via foresight and other participatory processes.

To conclude, it appears that there is a widely shared interest in developing challenge-driven policies at the level of international R&I cooperation. The most commonly used reference framework available is the UN Sustainable Development Goals, which may provide a common 'language' on objectives. In practice, addressing the challenge-driven policies take many forms among countries and organisations conditioned by their specific national frameworks. For the way forward, one key aspect is how countries can coordinate their efforts across sectoral boundaries and national frontiers to jointly overcome barriers and to scale up initiatives towards transformational R&I policies.

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ANNEXE I: BACKGROUND NOTE ON THE MLE DISCUSSIONS ON FRAMEWORK CONDITIONS

In this MLE, the preliminary third topic was initially demarcated to address how framework conditions for R&I international cooperation. In the kick-off meeting of this MLE exercise, MLE participants discussed among other things how to deal with the changing international environment, e.g. changes in China, Africa and Russia. The European Commission, for instance, has launched a joint roadmap for future cooperation in research and innovation with China including framework conditions for cooperation, containing: access to research and innovation programmes; open access to scientific publications and research data; standardisation; research ethics and integrity; policies to support SME's innovation; and intellectual property protection and enforcement in stimulating innovation²⁸. Also, Science Europe and other entities organise processes for countries to address China. How to deal with geopolitical changes links back to the framework conditions, for instance, the differences in addressing academic freedom, research integrity and how to take these into account in-country strategies.

Furthermore, MLE participants reflected if and when the framework conditions can be deal-breakers of international R&I cooperation? Could the violation of research integrity issues such as gender or open access, for instance, be a cause for breaking a deal? Are there double standards in practice, e.g. when a country is considered an important partner, and how does this affect bearing with the short-comings in framework conditions? Besides, how about the measures for preventing a deal-break, e.g. how to manage the communication with the partner country?

In view of further scoping of the interests of MLE participants, a first survey was sent to the MLE participants during summer 2019. Among other questions, they were asked about which topics should be further discussed within the forthcoming **'framework conditions workshop'**. Figure 14 shows that the majority of respondents were interested in **'explicit thematic SDG orientation'** of international R&I cooperation and **'research integrity'** (including proper peer review procedures), followed by a slight majority of countries that wanted to address also **'intellectual rights enforcement'**, **'open data'** and **'open access publication'**. **'Research ethics'**, **'dual-use'** and especially **'gender in research'** were not among the most demanded topics to be discussed in the workshop about framework conditions.

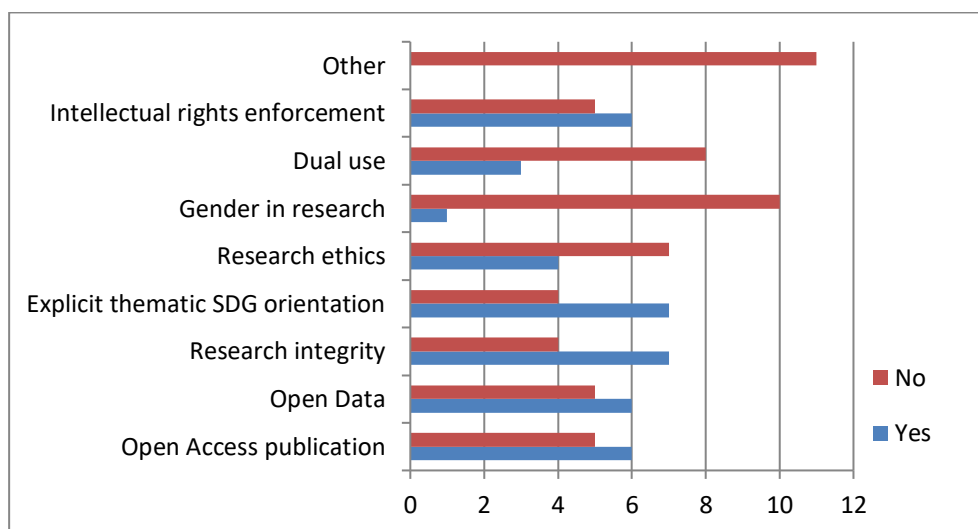


Figure 14 Topics for further discussion in the 'framework conditions workshop' under this MLE on national strategies and roadmaps for international cooperation in R&I

Source: Survey sent to MLE participants in summer 2019; n=11

²⁸ <https://ec.europa.eu/research/jscp/index.cfm?pg=china>

In the same survey, the feedback was asked on how MLE participants perceived in their national contexts the principles influencing the selection and/or development of cooperation with international partner countries. The responses indicate that the application of principles varies with great extent among the MLE participant organisations (Figure 15).

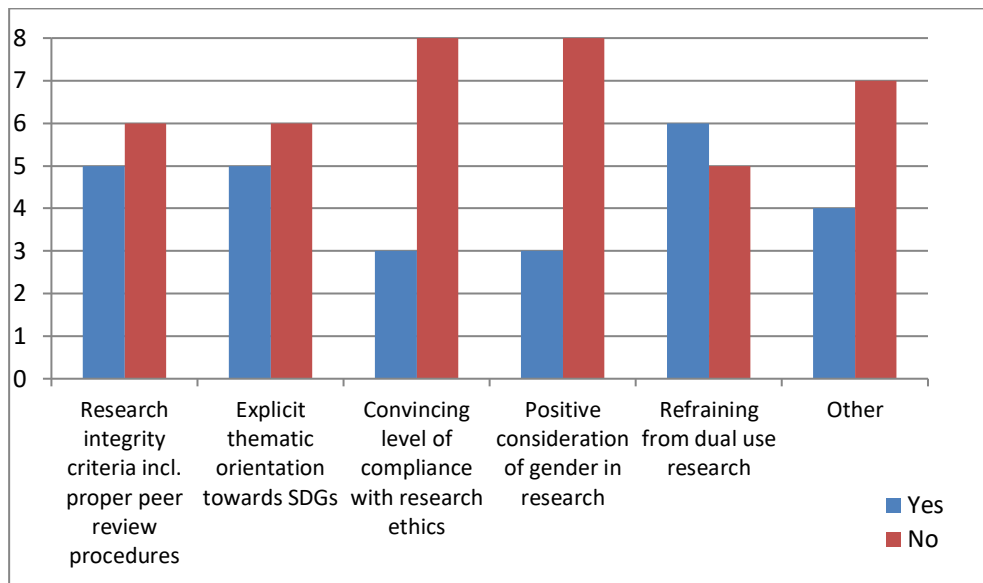


Figure 15 Principles influencing the selection and/or development of cooperation with international partner countries

Source: Survey sent to MLE participants in summer 2019; n=11

While the survey provided useful background information on diverse perspectives but no clear common ground for focusing the work. Further discussions among MLE participants on framework conditions can be summarised into the following three areas of interests:

- **Public R&I funding:** awareness and networking including country contact points; constrains in designing STI agreements; rules, reciprocity and mutual opening of funding programmes; implementation of programmes, for instance, the visa requirements and institutional constraints of mobility schemes; etc.).
- **Innovation cooperation:** The IPR system and its enforcement; standardization; institutional constrains of researchers to move internationally; access to public procurement of innovative solutions.
- **Common principles:** open access; ethics, for instance, AI and genetics in countries like China, US and Canada; research integrity, responsible research and innovation (RRI); dual-use (the military use of civil R&I); gender and culture.

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The report takes stock on a workshop organised under the Mutual Learning Exercise (MLE) devoted to national strategies and frameworks for international cooperation in R&I. The focus of this report is on framework conditions for challenge-driven international R&I cooperation.

Studies and reports