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Mutual Learning Exercise

National Strategies and Roadmaps for International Cooperation in R&I

Thematic Report No 1:

Design and Development of National Strategies

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MLE on National Strategies and Roadmaps for International Cooperation in R&I: Design and Development of National Strategies for International R&I Cooperation – Thematic Report No 1

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Mutual Learning Exercise

National Strategies and Roadmaps for International Cooperation in R&I

Thematic Report No 1:

Design and Development of National Strategies

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1 INTRODUCTION

This Thematic Report discusses main policy challenges and practices about the design and development of national strategies for international research and innovation (R&I) cooperation. It includes the results from the first Working Meeting of the participants of this Mutual Learning Exercise, which was held in Paris on 3rd and 4th June 2019. Mutual learning refers to exchanging, debating and learning from practices used by peers, which are of interest to several European Union (EU) member states and countries associated to Horizon 2020. Its aim is to identify good practices, lessons learned and success factors based on robust evidence.[1]

The meeting in Paris focussed on the following themes:

- Strategic objectives of R&I internationalisation policies and theories of change
- Futures thinking – scenarios for international R&I cooperation
- Assessing progress – indicators, benchmarking and monitoring
- The challenge of embedding R&I internationalisation policies in overall national and European R&I strategies
- Governance and processes for the development of an R&I internationalisation strategy

These themes also constitute the thematic corpus of this report. It is important to note that this report is focussing on R&I internationalisation policies and not on R&I internationalisation in general (see Section 2 on this).

This report also includes the results of a survey launched directly after the Paris meeting to obtain additional information on the themes mentioned above from the viewpoint of the participating countries (or region as in the case of Flanders). 11 of the 15 countries participating in this MLE have provided feedback.[2]

Seven of the respondents are delegated by a national ministry, two by a national agency, one by an Academy of Science (quasi representing a national research ministry) and one by a regional agency. Although all deal with research, the competence portfolio of the responding institutions differs; some are more geared towards higher education and science, while only few are more oriented towards innovation and business. This composition limits the transferability of some of the findings to a certain extent, because responses are understandably embedded in the particular national context and the national governance system.

After a short introduction about the globalisation of research and innovation (R&I) to frame the following deliberations (section 2), this Thematic Report focusses on the following aspects:

- Objectives and Theories of Change for international R&I strategies (section 3)
- Selection of countries/regions and thematic priorities (section 4)
- The embedding, alignment and coordination challenge (section 5)
- Anticipating the future (section 6)
- Assessing Progress (section 7)

[1] Definition partly taken from https://rio.jrc.ec.europa.eu/en/policy-support-facility/mutual-learning; accessed on 18 July 2019.

[2] Feedback was provided by Austria, FWO from Belgium/Flanders, France, Greece, Hungary, Ireland, Moldova, Norway, Portugal, Slovenia and Turkey, for which the author is grateful.

The Thematic Report makes references to literature and to specific strategic R&I internationalisation documents of countries, which are either part of this MLE or not (e.g. Germany, Switzerland or UK). References to such strategic documents should not be interpreted as normative statements unless explicitly mentioned (e.g. as an inspiring practice).

One more note: the use of abbreviations such as R&D, RTD, S&T, STI or R&I is not by chance, but expresses the slightly different notions in the specific contexts where these abbreviations are used. The notion of R&I, which is also in the name of this MLE, for instance, has been strongly forwarded in EC documents, because both research and innovation fall under the shared competencies between the European Commission and the EU member states. However, some internationalisation strategies also include elements of vocational education and higher education (e.g. the German internationalisation strategy), where the EC competencies are less pronounced.

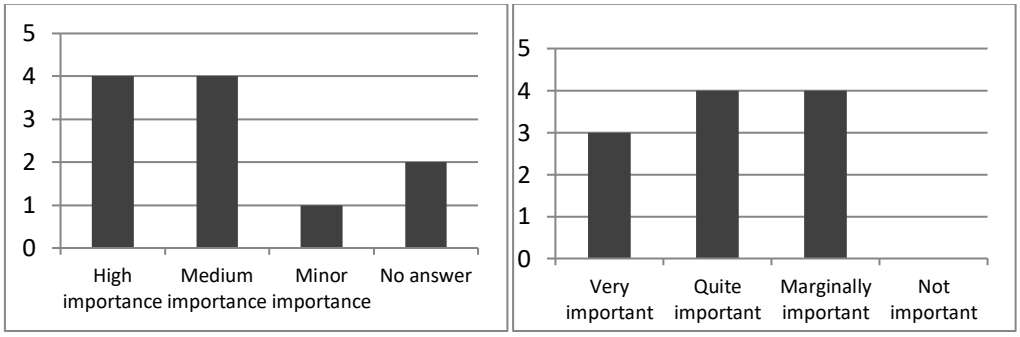
2 THE GLOBALISATION OF R&D

A growing body of literature provides evidence that the internationalisation of R&D is gaining momentum (Dachs 2017, OECD 2005; UNCTAD 2005, Hatzichronoglou 2008; OECD 2008a; OECD 2008b; OECD 2008c; Shapira et al. 2009, OECD 2010, Hall 2010). Alkemade et al. (2015) and Laurens et al. (2015) see it differently.[3] This trend is largely driven by the international division of labour of multinational enterprises (MNEs), available technologies (ICT; digitalisation and AI), the liberalisation of world trade and economic regimes, innovations in logistics and transport and the emergence of knowledge-oriented societies providing the human capital base necessary for an international exchange of goods, services, capital, knowledge and information (Schuch 2017; Schuch 2008; Deuten 2015). As a result, the human capital base is increasingly dispersed around the world. For instance, AWT (2014) forecasts that China, Russia, Brazil, India, Indonesia, Saudi Arabia and South Africa will by 2020 together have almost 40% more higher education graduates than the 34 OECD countries put together.

Consequently, there is a strong consensus among experts that this trend of international cooperation in research and innovation can be explained by its increasingly important role in developing and sustaining world-class innovation and research system and that international R&I policies will have to make best efforts to hold onto existing and attract new talent and R&D investment (AWTI, 2017).

The survey among the MLE participants confirmed this important role of R&I internationalisation. Eight of eleven respondents mentioned that the aspect of internationalisation within the overall national R&I strategy is very important or at least medium important (see Figure 1, left side). The 'no answer' response of two respondents is caused by the fact, that these countries do not have an overall national R&I strategy (Turkey and Belgium-Flanders). If asked, however, how important the internationalisation of research is within the strategic policy discourses in their countries, then the picture becomes more blurred (see Figure 1, right side).

Figure 1: Importance of R&I internationalisation within the national R&I strategy (left) and within the national strategic policy discussions (right)



Source: Survey sent to MLE participants, n=11

One of the important factors influencing R&D internationalisation is the size of the economy (defined by income and market size) (Dachs 2017). High income and high income growth attracts foreign direct investment (FDI) (Ekholm and Midelfart 2004; Blonigen 2005; Jensen 2006; Athukorala and Kohpaiboon 2010; Hall, 2010); and FDI, in turn, increasingly entails also R&D investments, which are, in most cases, an extension of existing overseas production and marketing activities (Birkinshaw and Hood 1998; Birkinshaw et al. 1998;

[3] Laurens et al. mention that data on multi-national enterprises (MNEs) patenting indicates a break in the continuous growth of R&D internationalisation and that the dominance of the national base remains very central in MNEs' R&D. Alkemade et al. claim an obvious heterogeneity in sectoral and national patterns of internationalisation with China among the least internationalised countries, while EU countries, especially UK and Netherlands, are among the most internationalised countries. They further state that Asian countries are on average less internationalised than would be expected and that internationalisation is strongly related to certain sectors (such as financial sector, oil and gas sector).

Archibugi and Lammarino 1999, De Backer et al. 2016). Moreover, firms may find it easier to cover the cost of R&D in a country with a large market where they expect larger absolute revenues than in a country with a small domestic market, even if wages are considerably lower. Hence, the importance of market size in attracting R&D investments points to the relationship between R&D and other activities of multi-national enterprises (MNE).

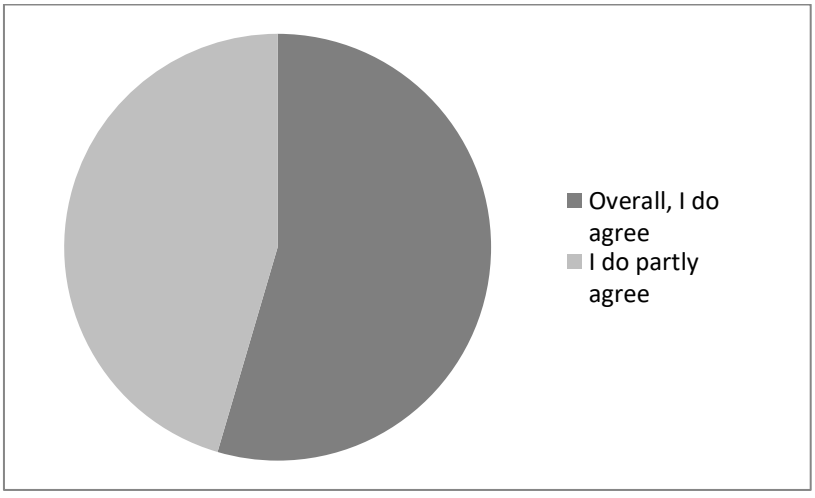
Moreover, also the market for R&I itself becomes more and more global. Companies can today develop, produce, market and sell their products and services across the world, which forces them to make judicious location choices, and often also forge partnerships for their business activities (AWTI, 2017). Herein, small open economies rely on external demand and international markets for sustainable and continued growth.

The breaking-up process of the triadic hegemony in S&T (i.e. the close to complete global distribution of S&T between the USA, Europe and Japan) remains an ongoing phenomenon since the 1990s. Although large centres of knowledge such as USA, Germany and the UK still have a strong global presence, countries such as China, Singapore, Brazil and Korea are moving up the ladder. One of the consequences is the increase in the number of international co-publications, even without active policy interventions from the side of EU countries.

By referring to R&I internationalisation in general, we need to make the important distinction between R&I internationalisation in the business sector, the public R&D sector and the issue of R&I internationalisation policies. However, while most of the literature on R&D internationalisation is focussing on MNE, a much lower number of literature is available on international comparisons of R&I internationalisation policies (CREST Working Group 2007, OECD 2008a, TAFTIE 2009, Schwaag-Serger and Wise 2010, Schwaag-Serger and Remoe 2012, OECD 2016a, SFIC 2018).

R&I internationalisation in the business sector, but also in the public R&I sector is often developing without clear R&I internationalisation policies. The Netherlands, for instance, could serve as an appropriate example, whose companies and research organisations are strongly embedded in internationalisation processes, but the Netherlands lack both a national R&I internationalisation strategy and a strong public instrumental internationalisation portfolio (AWTI, 2017). Also all 11 countries participating in this MLE that responded to the survey agreed or at least partly agreed that the business sector and the public R&I sector are internationalising their activities even without R&I internationalisation policies (see Figure 2).

Figure 2: Degree of approval/disapproval that the business sector and the public R&I sector are internationalising their activities even without R&I internationalisation policies



Source: Survey sent to MLE participants; own calculations; n=11

Only one MLE participant responded that R&I internationalisation policies do substantially support these emergent internationalisation policies, five were attributing at least some contribution, and two were reluctant in attributing a contribution of R&I internationalisation policies at all.

The main issue for R&I internationalisation policy-making in this respect is whether internationalisation policies should just simply facilitate emergent internationalisation trends or instead steer them for supporting specific policy objectives (for instance towards SDGs). In our following deliberations we are focussing on R&I internationalisation policies and not on R&I internationalisation in general.

3 OBJECTIVES AND THEORIES OF CHANGE

Many European R&I policy makers perceive international cooperation in R&I as essential (see multiple statements of Commissioner Moedas[4] or the inclusion of international cooperation as 6th dimension into the European Research Area). National policy makers share the views of the European Commission that the global competitiveness of an R&I location today largely depends on how well a country under scrutiny is integrated into international knowledge flows and value chains. Norway, for instance, claims that socio-economic development and modernisation rest on access to and the ability to apply an international body of high-quality knowledge.

Thus, international R&I cooperation should be designed as strategically as possible in order to achieve the best possible impact. The basic feature of a strategy is that it defines clear goals, which go beyond the wish to simply increase international R&D cooperation, because international cooperation is usually not considered to be an end in itself.[5] Thus, the most fundamental question refers to what should be achieved with international R&D policy cooperation (i.e. the overall objectives) and which theory of change is applied when R&D internationalisation policies are developed and implemented.

The Theory of Change (ToC) concept emerged from the field of programme theory and programme evaluation in the mid-1990s. In general, a Theory of Change lays out the sequence of outcomes that are expected to occur as the result of an intervention. In a further step, an evaluation strategy could track whether these expected outcomes have been actually produced (or not). The quality of a ToC can be approximated by plausibility (i.e. the logic of the outcomes pathway), its feasibility (i.e. can the proposed interventions realistically achieve the expected long-term outcomes and impact) and testability (which refers broadly to the indicators).

Most EU member states' policies involve in their R&I internationalisation strategies both cooperation within and outside Europe. Austria and Moldova are exceptions, because Austria has a dedicated beyond Europe focus, while the focus of Moldova is entirely focussed on the EU. In many – but not all - cases, the knowledge triangle research-innovation-education is covered. Other important general issues include cooperation with emerging and developing countries.

As basis for their R&I internationalisation policies, most states see international mobility exchange as an essential condition for research excellence. Some countries focus explicitly on innovation too (e.g. Ireland), while others are more hesitant in this direction. In addition to goals deemed to strengthening their own position, many states also consider global challenges as an important task of research cooperation (e.g. Norway) or define goals in the field of science diplomacy. With respect to the latter, e.g. the German Federal Government also focusses on some new cross-cutting measures in foreign science policy and international networking. Among other things, these measures should help to keep the channels of communication open even in times of tense political situations.

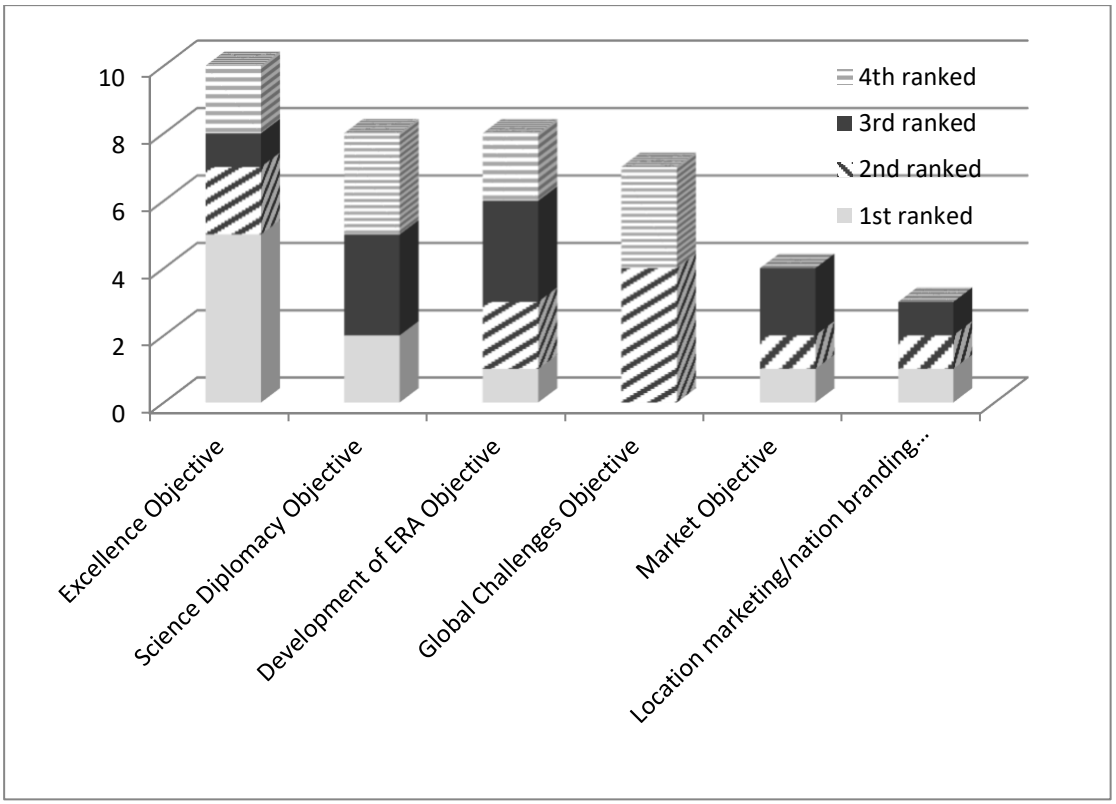
Although literature (Boekholt et al., 2009; CREST, 2007) would rather suggest that most of the R&I internationalisation strategies of EU member states focus on the principal objectives 'Excellence Objective', 'Market (or innovation) Objective', 'Global (or Grand)

[4] See for instance European Commission (2017).

[5] This statement could be perceived as contrary to the old internationalisation strategy of Switzerland (Schweizerische Eidgenossenschaft, 2010), which, however, was replaced in 2018 by a new one. Then it was postulated as first and main priority to enhance international networking through participation in international, multi- and bi-national programmes per se (Sigl and Witjes, 2014). This includes also the participation in ERA and in the European R&I programmes. In the new Swiss internationalisation strategy (Schweizer Eidgenossenschaft, 2018), the access to international, multi- and bilateral programmes and measures is again stressed, but with clearer aims, such as that infrastructures, programmes and services abroad should become accessible to Swiss stakeholders and players (e.g. researchers, students) to help them to safeguard and increase the quality of their own services, which points to the Excellence Objective.

Challenges Objective' and 'Science Diplomacy Objective', the results of the MLE survey showed a slightly different picture (see Figure 3). The R&I internationalisation objectives, which have a more economic focus (i.e. the 'Market [or innovation] Objective', the 'Cost and Risk Sharing Objective' and the 'Location Marketing (or nation branding) Objective', are obviously less important than assumed, while for instance the 'Development of ERA Objective' is higher rated. This may be partly caused by the composition of the respondents, which include a few countries associated to Horizon 2020. The 'Cost and Risk Sharing Objective' was not listed among the four main R&I internationalisation objectives by any of the countries which responded to the survey. This, however, might also point to an unclear terminology (see next section).

Figure 3: Ranking of R&I internationalisation objectives



Source: Survey sent to MLE participants; own calculations

Based on the results of the survey we can conclude that countries participating in this MLE exercise focus mostly on the following principal objectives:

1. Excellence Objective
2. Science Diplomacy Objective
3. Development of the European Research Area Objective
4. Global (or Grand) Challenges Objective

Further important but secondary objectives are, although not as frequently stated in R&I internationalisation strategies as the ones above, include:

5. Market (or innovation) Objective
6. Location Marketing (or nation branding) Objective
7. Cost and Risk Sharing Objective

Other objectives stated by the respondents relate to international research infrastructures, the alignment of the European Research Area (ERA) and the European Higher Education Area (EHEA), the relation between cohesion policy and internationalisation, alignment with industrial strategy development goals, the promotion of collaborative international processes,6 the attraction of talent[7] or - in general terms - to remain competitive and a top-world location for research.

In the next section the principal and the secondary objectives are discussed in more detail.[8]

3.1 Principal Objectives in R&I Internationalisation

Boekholt et al (2009) differentiate the objectives by a narrow and a broader STI cooperation paradigm. In the narrow STI cooperation paradigm, the drivers for international research collaboration policies aim to improve the quality, scope and critical mass in science and research by linking national resources and knowledge with resources and knowledge in other countries. Here, the drivers originate from within the science community and are translated in science and research policy instruments.

Thus, the Excellence Objective would be the most 'pure' narrow STI cooperation objective. In the broad STI cooperation paradigm, on the other hand, also other non-science policy objectives interact with the 'intrinsic' science-oriented objectives and STI cooperation becomes a means to reach other policy ends. According to Boekholt et al. (2009) these other policy ends relate to (i) improving national competitiveness, (ii) supporting less developed countries by developing STI capabilities, (iii) tackling global societal challenges, and (iv) creating good and stable diplomatic relationships.

The Excellence Objective is often understood as an objective to enhance R&I quality, R&I relevance and R&I capacity, especially – but not only - in countries which are not among the leading R&I countries. In that sense, excellence is perceived as something which should be achieved rather than preserved. It is a recurrent challenge and work in progress.

What is fundamental for the Excellence Objective is the argument of attracting and/or gaining access to the global knowledge production and latest available knowledge globally. Thus, the Excellence Objective is sometimes complemented by other objectives, such as the 'resource optimisation objective'[9] (e.g. to attract the best talent worldwide [incl. solvent students] or to secure a high juste retour from the European Framework Programmes for R&I) or the 'attraction quest', which means to increase the international attraction of the national R&I system, e.g. by internationalisation of the national system. Examples for the latter are the Japanese Top Global University Project and the 'Go global Japan Project'. Similar interventions in Korea[10] are, for instance, the World-Class University 2008-2013 Initiative, the Brain Korea 21 Plus (2013-2019) and the Global Research Network and Global Hub Centres. This so called 'attraction quest' overlaps with the Location Marketing Objective which aims to promote the advantage of the national R&I system and its institutions in order to attract solvent students, bright researchers and – of course –

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[6]See for instance the example mentioned by Portugal: https://www.fct.pt/apoios/CoLAB/index.phtml.en; accessed on 9 July 2019.

[7] See for instance the example mentioned by Portugal: https://www.study-research.pt/; accessed on 9 July 2019.

[8] Please note, that also other distinctions can be made, e.g. between "core" objectives such as Excellence or Science Diplomacy on the one hand, and on the other hand "thematic" objectives such as Global or Grand Challenges which pre-suppose at least one and usually a combination of two or more "core" objectives. Climate related challenges, for example, cannot be successfully addressed without high quality research and suitable innovation measures.

[9] This objective is mentioned as such in the Austrian RTI internationalisation strategy 'Beyond Europe'.

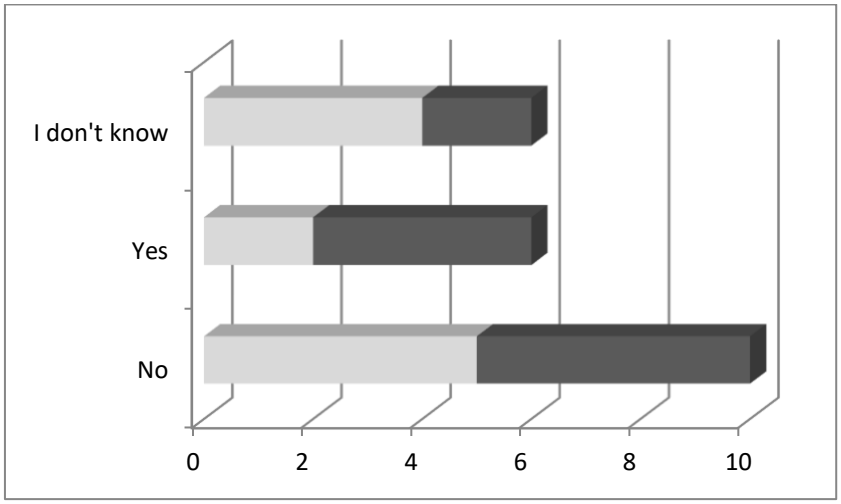
[10] Since the late 1990s, the South Korean government has been promoting the development of its own university and research system with personal and well-known support from abroad. With the beginning of the 21st century, numerous university agreements and scholarships ensured a lively student exchange. In order to position itself among the world leaders in research, the state relies on international cooperation and strengthens the cooperation of universities with research institutes and industry.

foreign direct investment in R&D. The 'attraction quest' is also a component of the Market Objective.

The **Science Diplomacy[11] (SD) Objective** is usually applied to facilitate external policy.[12] Although frequently mentioned, this objective remains often rather vague. It subsumes issues such as building scientific bridges in times of conflict, providing collaborative resource management for our planet, working on common standards for market access and trade, or simply taking care of – mostly historical and geographical – cultural, political or socio-economic ties between countries. It is sometimes linked to development cooperation.

Advanced development cooperation in the field of STI is increasingly focussing on setting-up STI partnerships (including capacity-development), institutions and infrastructures (including the establishing of funding agencies, RTI councils or support in drafting laws). This should help partner countries to develop into knowledge societies and at the same time contribute to the development of a lasting relationship which is expected to be mutually beneficial in the longer term (AWTI, 2017).[13] According to the survey sent to the countries participating in this MLE, this is to some extent the case in France, Moldova, Portugal and Turkey. France does this advanced structural development cooperation on the basis of joint roadmaps, with formulated objectives and indicators. In Moldova the Academy of Sciences and the National Agency for Intellectual Property are active in this respect. Six countries, however, are not engaged in such exercises with their international partner countries.

Figure 4: Formal science diplomacy (SD) training and formal exchange process between the ministries engaged in R&I and the foreign ministry to consult regularly (not just ad-hoc) on SD issues



Source: Survey sent to MLE participants; n=11

Note: The light grey bars depict the existence of formal SD training (yes/know/don't know). The dark grey bars refer to formal exchange processes between the ministry of foreign affairs and the ministry responsible for R&I.

[11] See Royal Society and AAS (2010).

[12] The Dutch Advisory Council for Science, Technology and Innovation, however, seems to perceive this differently. For them SD can be equalised with R&I internationalisation policy (see the definition used by AWTI, 2017).

[13] The United Kingdom has two funds focusing (mainly) on encouraging this relationship: 1) the Newton Fund (2014-2021; £735 million) which supports science and innovation partnerships in order to foster economic growth and social development in partner countries, promoting the United Kingdom and creating opportunities for business; 2) the Global Challenge Research Fund (2015-2019; £1.5 billion) has the mission of finding British solutions to social challenges in developing countries. In Germany, the BMBF has drawn up an Africa Strategy (2014-2018; €300 million) in which the central focus is on common research and educational cooperation. This has for example led to the formation of the African-German Network of Excellence of Science. The European Commission links development cooperation to STI within the European Development Fund for 'Knowledge for Development' with a budget of €35m (all information taken from AWTI, 2017).

Despite the importance of Science Diplomacy (SD) as primary objective of R&I internationalisation among many countries participating in the MLE, the indicators depicted in Figure 4, however, clearly show that SD exercised by the ministries for foreign affairs and the ministries responsible for international R&I cooperation policies are only loosely connected. The first indicator (the light grey bar in Figure 4) refers to formal SD training of diplomats. Only diplomats in Austria and France are formally trained in SD. Interestingly, four respondents did not know, which suggests action spaces rather distant to each other. As regards formal exchange processes on SD issues between the ministries of foreign affairs and the ministries responsible for R&I (the dark grey bar in Figure 4), only four countries have such a mechanism in place, but the majority has not.

The development of the **European Research Area Objective** is a special case, because it refers to the internal fabric of R&I within the European Union. Some of the more recent R&I internationalisation strategies, which do not deliberately refer to the non-EU context only (such as the Austrian R&I internationalisation strategy), include also **the joint development of the European Research Area** sometimes as a separate objective or at least as a framework condition.

This objective has a strong power of attraction for several non-EU member states which are associated to the European Framework Programmes (FPs) for –R&I and/or which aspire to become an EU member state in the future. In this sense, the EU exercises an extended science diplomacy influence (i.e. 'soft power') resulting in a take-over of rules by non-EU member countries while they associate to or participate in European programmes and/or projects.

In technical terms, the Lisbon Treaty defines the European Research Area (ERA) as a unified research area open to the world and based on the Internal Market. It should enable free circulation of researchers, scientific knowledge and technology. The initial political concept of the ERA was launched by the publication of the *'Communication Towards a European Research Area'* in 2000 (European Commission, 2000). The main objectives of this initiative were to boost Europe's competitiveness, to improve the coordination of research activities on national and European level, to develop human resources, and to increase the attractiveness of European research to the best researchers from all over the world.[14]

In February 2014 the Competitiveness Council called to develop an ERA Roadmap by deciding on concrete measures.[15] Responding to this request, member states developed a document through the European Research Area and Innovation Committee (ERAC) and the ERA Related Groups, in close cooperation with the European Commission and stakeholder organisations. On 29 May 2015, the Competitiveness Council adopted the ERA Roadmap 2015-20.[16] The most recent and fourth ERA Progress Report was published in February 2019. It assesses the progress made on ERA implementation in 2016-2018. After 2016, progress has been measured at country level using the ERA monitoring mechanism for the second time. A set of 24 core indicators and eight headline indicators jointly defined by

[14] Taken from era.gv.at, accessed on 9 July 2019.

[15] The ERA implementation focuses on six priorities:

1. More effective national research systems
2. Optimal transnational cooperation and competition, including 'jointly addressing grand challenges' and 'research infrastructures'
3. An open labour market for researchers
4. Gender equality and gender mainstreaming in research
5. Optimal circulation, access to and transfer of scientific knowledge, including 'knowledge circulation' and 'open access'
6. International cooperation.

[16] Taken from https://era.gv.at/directory/230; accessed on 9 July 2019.

member states, research stakeholders and the Commission form the basis of the analysis. This 2018 ERA Progress Report shows that progress on ERA implementation continues, albeit at a slower pace than before (European Commission, 2019).

The **Global (or Grand) Challenges Objective** is increasingly taken-up in the internationalisation policies of EU member states. Some countries use slightly different and overlapping wordings, for instance Ireland refers to shared societal problems.

As regards the Global Challenges Objective, most countries (e.g. Germany, France, Norway, etc.) and also the EU focus on trans-border issues such as infectious diseases, climate change and the environment, which are in line with the thematic FP trajectory. But they also include issues such as poverty reduction, human rights and conflict resolution, and improvement of health in partner countries resulting from a 'science for development' trajectory, which was previously strongly influenced by the Millennium Development Goals (2000-2015). The Sustainable Development Goals (SDG) agenda 2030 is continuing this approach, but at the same time it urges developed countries to do also domestically more and better and not just through development assistance and cooperation. Thus, the FP trajectory and the science for development trajectory are converging under the SDG agenda.

Six out of ten of the countries which participate in this MLE responded that the orientation towards global or grand challenges is rather also a shared priority of their partner countries, while four responded that this is only true for a few partner countries.

3.2 Secondary Objectives in R&I Internationalisation

The **Market Objective** in general focusses on supporting economic and industrial competitiveness including the creation of business opportunities (outward and inward). The R&I internationalisation strategy of the European Union can serve as an example for this, but also Ireland, Norway, Germany or Austria can be mentioned among others. For France an upstream academia-industry partnership approach is a strategic element for its international cooperation.

A special challenge is to bring the different spheres of 'academic knowledge production' and 'business driven innovation practices' together and to develop R&I internationalisation approaches that combine these spheres. Two of the eleven respondents from the countries participating in this MLE mentioned that "innovation" and "science" cooperation are 'worlds apart' in their internationalisation practices and four more countries confirmed that this is at least partly the case. It is also interesting to note, that only six of the responding countries explicitly target the internationalisation of their domestic MNEs with specific R&I instruments or programmes. Of these, only France assigns high importance to this. France is also the only responding country which assigns high importance to the internationalisation of domestic SMEs with specific R&I instruments or programmes. Seven other responding MLE countries also explicitly target SMEs with specific R&I instruments or programmes, but assign only limited importance to it.

In this regard, it should also be mentioned that the notion of innovation is disruptive to the trajectory of international S&T policy strategies. Most of the specific instruments employed to foster international R&D cooperation were and still are focussing on the areas of basic research and international mobility of researchers and students. Economic relevant approaches, although mentioned also in a number of 'older' internationalisation strategies, were until recently primarily focussing on attracting FDI or on facilitating both inward and outward technology transfer, but not so much on supporting the expansion of domestic businesses through innovations abroad. Today, innovation is a strong driver of economic growth and change, also for mutual benefit, but it is in its substance also disruptive and

creates winners and losers, while traditional S&T internationalisation policy-making is built on the notion of immediate mutual benefit.[17]

Eight of the ten MLE countries which responded to the survey confirmed that they at least partially agree with the statement that the notion of innovation in international S&T policy-making is disruptive to traditional research internationalisation policy-making. One respondent confirmed this statement overall and another one rejected it.

Furthermore, six out of nine countries actively support inward and outward technology transfer beyond Europe through their research internationalisation policies. Two countries actively support only inward technology transfer and one country only outward technology-transfer with specific support measures. Seven out of ten countries mentioned that they also actively support innovations or the development of innovation capabilities of their domestic companies abroad; one country at least to a certain extent via its national Chamber of Commerce.

The Location Marketing (or nation branding) Objective is partially found as a separate R&I internationalisation objective. It refers to specific locational advantages (such as unique R&I infrastructure; top-rated universities or PhD courses) in the field of R&I of a certain country or region. Thus, one can read under the section 'Location Marketing' in the German R&I internationalisation strategy that 'Long-term marketing should sharpen the image of Germany as a scientifically-technologically efficient location abroad and make access to the research location visible. On this basis foreign target groups should be shown the added value of cooperation in and with Germany in the further development of their ideas.' (BMBF, 2016; p. 98).

Among the countries participating in this MLE, the Location Marketing (or nation branding) Objective is highly rated by Moldova and Portugal. Also the FWO from Belgium/Flanders assigns some importance to it for the region of Flanders. For all other MLE participants who responded to the survey this objective is of minor importance. Interestingly, eight of the eleven respondents also partner together with other EU member states in international research promotion beyond Europe. For this, mostly EU tools are used such as 'Destination Europe',[18] PRIMA[19] or ERA-NET Rus PLUS,[20] which emphasises the subsidiarity value of these activities/instruments. In a few cases also bi- or multilateral cooperation without EU support can be identified (e.g. the Norwegian embassy is sometimes partnering-up in particular with Nordic counterparts for joint promotional activities).

The **Cost and Risk Reduction Objective** primarily refers to efforts for which critical mass is needed and which hardly can be tackled by one single country alone due to the overwhelming financial and/or risk burden (e.g. development and operation of large research infrastructures). Examples are ITER or CERN. In Austria, this objective for instance is subsumed under the resource optimisation objective.

Sometimes the objectives mentioned above are complemented by one or the other more specific objectives which point to a country's specific problem, capacity or agenda. A good example is the new German internationalisation strategy, which puts a special emphasis on supporting vocational education and fighting labour shortage (in Germany but also at the location of German companies abroad). Another example is Switzerland, which prioritises in its international strategy for education, research and innovation the recognition of diploma to facilitate 'brain gain' (Sigl and Witjes, 2014). Among the countries participating in this MLE Hungary, for instance, indicated as further objective a better

[17] Therefore, brain drain, for instance, is often disguised as brain circulation.

[18] https://ec.europa.eu/research/index.cfm?pg=events&eventcode=DD143BEF-ED42-3BC5-EF52F5DB5950E2A1; accessed on 11 July 2019.

[19] http://prima-med.org/; accessed on 11 July 2019.

[20] https://www.eranet-rus.eu/; accessed on 11 July 2019.

harmonisation with strategic industrial development goals and Slovenia, as another example, stated the alignment between ERA and EHEA and a better connection of internationalisation policies with the cohesion funds as further objectives.

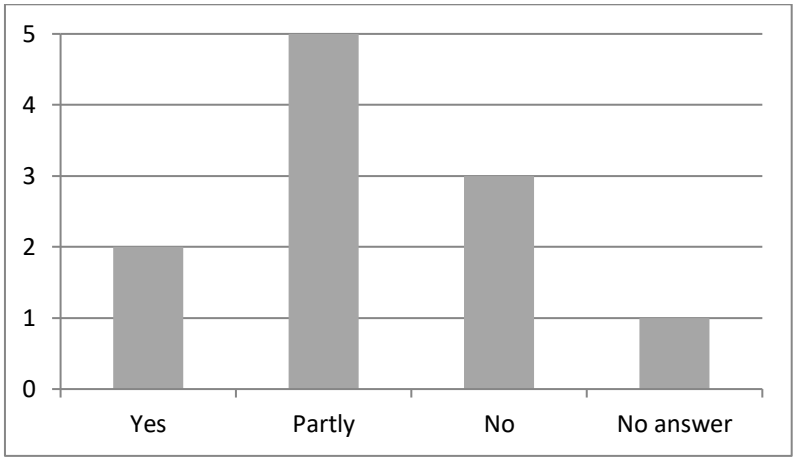
3.3 Theory of Change in R&I Internationalisation

The more specific R&I internationalisation strategies usually also list a series of policy interventions to the identified objectives. The Austrian 'Beyond Europe' strategy is a good example for this, without, however, making a clear logical connection or pathway between the overall objectives and the policy interventions (which are mostly either programmes, or instruments or other measures or initiatives) explicit. Such a logical deduction of an intervention pathway could be qualified as an explicit Theory of Change. In fact, a Theory of Change (ToC) should ask about what will have changed or what changes will have occurred due to policy interventions. Thus, the ToC approach focusses much on the tangible outcomes/results of an intervention or a portfolio of interventions, and not just on the overall objectives.

Although Theories of change are hardly formulated in R&I internationalisation strategies, if at all, it can be assumed that many R&I internationalisation strategies have had some kind of implicit Theories of Change (by the different stakeholders involved) when they were formulated. However, the formulated lack in writing could also be a reason, why several R&I internationalisation strategies seem to propose broad objectives, while the available resources (not at least in financial terms) for fuelling the internationalisation strategy are often (very) low and often dispersed across a stately number of policy interventions.

The lack of an explicit Theory of Change might also aggravate coordination among the different stakeholders involved in the development and implementation of an R&I internationalisation strategy, because stakeholders might have different Theories of Change in mind, which per se would not be bad as long as they are known (and thus debatable and in a synergetic way 'harmonisable') and do not contradict each other. This issue will be further elaborated in the chapter on coordination.

Figure 5: Availability of a Theory of Change for R&I Internationalisation Strategy



Source: Survey sent to MLE participants; n=11

In general one can assume that R&I internationalisation strategies which explicitly would include a plausible, feasible and testable Theory of Change, are considered as being more credible and action-oriented by their target groups than vaguely formulated strategies, even if they promise a lot but do not make pathways to achievement traceable.

Figure 5 confirms that the ToC-approach for R&I internationalisation strategies is still rather the exception than the rule, although many countries include partly some elements of it. Only Turkey and Slovenia responded to have a logical pathway from inputs into research internationalisation to attributable outcomes to make the link between policy interventions and objectives traceable.

4 SELECTION OF COUNTRIES/REGIONS AND THEMATIC PRIORITIES

4.1 Selection of Partner Countries

As regards the selection of partner countries, an approach which is strictly based on quantitative scientometric indicators cannot be found and there is evidence of well-grounded scepticism among experts for cut and dried indicator-based selection approaches. It is also argued that R&D related criteria for the selection of partner countries are biased to the detriment of emerging countries, for which can be assumed that the area of 'dark knowledge and innovation', i.e. those innovative activities that are not or cannot be covered by existing quantitative data, is particularly high. Thus, Sigl and Witjes (2014) argue in favour of exploring these 'dark' areas of research and the potential for cooperation with additional studies, consultations and subsequently fact finding missions.

In most cases the selection of partner countries is a combination of top-down and bottom-up priorities: top-down in the sense of a selection based on broad political criteria (originating from foreign policy rationales and R&D rationales), and bottom-up in the sense of focussing on the institutional and personal knowledge networks of the research community. Moreover, there are only a few systematic indicators for the identification of scientific and technological future spaces available.

In general, criteria for the selection of partner countries are not published in the R&I internationalisation strategies. An exception to this is the European Commission, which published criteria in its strategic communication 'Enhancing and focussing EU international cooperation in research and innovation: a strategic approach' (COM (2012) 497), which was adopted on 14 September 2012. These criteria can be summarized in four building blocks:

(i) Criteria related to R&I capacities of the presumable partner country;

(ii) Risks and chances for accessing markets and impacts on the competitiveness of the EU;

(iii) Contributions of the EU to international commitments (e.g. Millennium Development Goals and SDGs, Rio+ 20; G-20); and

(iv) Legal and administrative frameworks of the international partners including previous experiences.

In line with many other countries, it is argued that the selection of partner countries should be based more on evidence-based decision-making processes. However, it has to be noted that the European Commission also points out that the choice of partner countries requires above all qualitative assessment.

Sigl and Witjes (2014) have elaborated a complex set of criteria for the selection of international partner countries. They differentiate between quantitative and qualitative criteria. The quantitative criteria focus only on R&D related elements, such as co-publications, impact factors, position in scientific ranking; co-patenting; mobility patterns; good (financial) governance; GDP, Gross Domestic Expenditure on Research and Development (GERD)and Higher Education Expenditure on Research and Development (HERD); percentage of researchers and students in total population. The qualitative criteria are formulated as questions which refer basically to the most important R&I internationalisation objectives including the Excellence Objective, the Market Objective, the Grand Challenges Objective and the Science Diplomacy Objective.

Box 1: The Austrian approach to identify potential partner countries

The Austrian approach to identify potential partner countries

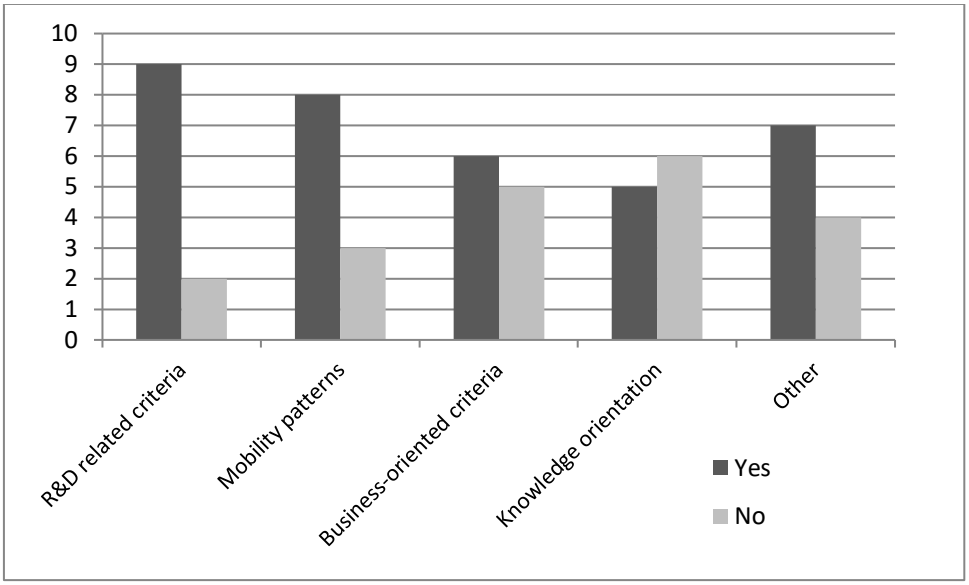
During the preparation of the Austrian RTI Internationalisation Strategy 'Beyond Europe' the following evidence-gathering steps led to the identification of partner countries:

1) **Scientometric and econometric analysis** (bibliometrics; co-patenting; mobility patterns; R&I input indicators of potential partner countries, foreign trade relations) of up to 15 potential non-EU partner countries
2) **Screening and document analysis** of existing programmes, instruments and initiatives to support R&I Internationalisation (domestic ones, uni-lateral, bi-lateral and multi-lateral ones including the European level [in particular ERA-NETs and Joint Programming Inititatives])
3) **Surveying the R&I internationalisation priorities** (current and desired situation) of the main domestic target groups (especially research and higher education organisations but also stakeholders such as the Chamber of Commerce or the Austrian Business Agency [whose aim is to attract inward investment] and all major research and higher education funding agencies)
4) **Expert assessment** about the future potential and trends of RTI cooperation with certain countries and about the readiness of potential countries to partner with Austria in the field of RTI by taking into account the previous evidence gathering. The handful of experts came from the ministries dealing with science, research and innovation and foreign affairs and included a few academic experts.

Eight of eleven countries participating in this MLE responded that their selection of partner countries for international research policy cooperation is sufficiently grounded. Further three respondents think that this is at least partly the case.

Figure 6 shows that the majority of the MLE participants who responded to the questionnaire are using different criteria classes for the selection of partner countries. Most prominently used are R&D related criteria such as co-publications, impact factors or positions in scientific rankings. These criteria strongly relate to the excellence objective of R&I internationalisation strategies. Also mobility patterns are widely used. Business-oriented criteria (such as GDP growth, market size) and criteria related to knowledge orientation (such as % of students and researchers in total population) are also often used, but at lower overall levels. The category 'other' includes different dimensions such as the belonging of a potential international partner country to a specific region or a specific socio-economic status. This is, for instance, the case of Slovenia, for which the belonging of partner countries to the so-called West Balkan region or the grouping of BRICS is of importance. The FWO (Belgium/Flanders) mentioned political stability but also qualitative criteria, such as experiences of other European funding agencies or the demand for cooperation articulated by the research communities. Cooperation experience and already existing collaborative activities are mentioned by a few more countries (Austria, Greece, Hungary, and Ireland). For Greece this is even further broken down by referring to the importance of the Greek diaspora in this respect.

Figure 6: Indicator classes used for the selection of partner countries



Source: Survey sent to MLE participants; own calculations; n=11 (multiple answers)

Five of the responding MLE participants think that more or better indicators would not make a significant difference in selecting partner countries. The other six responding countries believe that it would partly make a difference.

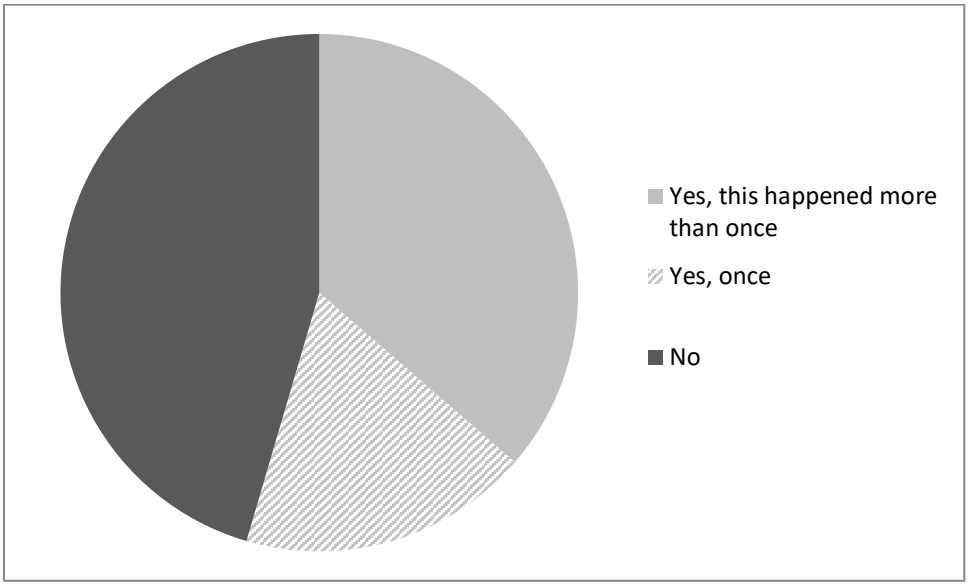
The fourth aspect mentioned above during the establishment of the Austrian R&I internationalisation strategy – namely if there is readiness at all of potential countries to partner with Austria in the field of RTI - should not be underestimated, because in the quest for the selection of the partner countries to cooperate with, also the following questions need to be raised and answered:

What makes us attractive for R&I cooperation?

What can we offer to the presumable partner countries (also in practical terms)?

Figure 7 shows, that the majority of the MLE countries responding to this survey have already – at least once –had the experience that a potential partner country addressed by them refrained from entering into formal research policy cooperation. Interestingly, one cannot identify a clear pattern among the countries which experienced this. Refusal was experienced by both strong and weak R&D performing countries.

Figure 7: Did you already experience that a potential partner country addressed by you refrained from entering into formal research policy cooperation with you



Source: Survey sent to MLE participants; own calculations; n=11

Nine of the eleven MLE countries responding to the survey have at least partly a formulated concept why potential international partner countries should cooperate with them. France, for instance, has a research marketing strategy in place on the national level. FWO (Belgium/Flanders) is highlighting scientific indicators of how well Flemish research is performing in a world context, which world class research facilities, infrastructures, renowned universities and research centres are operating in Flanders and which funding schemes are available providing optimal conditions for all career stages. Also Greece and Hungary provide information on excellent research infrastructures. In Austria, the Austrian Offices of Science and Technology in China and the USA partly serve the function to manage the expectations in partner countries; and an official brochure about 'Research in Austria'[21] - as a kind of promotion folder for businesses to come to Austria - is available.

If made explicit, R&I internationalisation strategies refer repeatedly more or less to the same countries. This is also confirmed by the Strategic Forum for International Cooperation (SFIC) survey on Tools and Policies in International S&T Cooperation (2018), which revealed that most MS/AC have ongoing cooperation relations in science, technology and innovation with China, India, and the USA. Leaving intra-European R&I cooperation aside, Switzerland, for instance, explicitly names Brazil, China, India, Russia, South Africa, Japan and South Korea. The Research Council of Norway references 10 countries of high scientific importance with which cooperation is seen as vital. Among the non-EU countries mentioned by the Norwegian Research Council are Brazil, India, Japan, China, Canada, Russia, Chile, Argentina and South Africa (RCN, 2010). In addition, the Norwegian Ministry of Education and Research published a higher education and research strategy focussing on BRICS plus Japan with a duration from 2016 to 2020 (Norwegian Ministry of Education and Research, 2015). In Austria the top-priority partner countries outside the EU include USA, China, India and Russia. The second group includes South Korea, Brazil, Japan, South Africa (incl. Southern Africa), Israel, Canada, Turkey, Singapore/Malaysia, and Australia. In addition, South East Europe, although more and more integrated into ERA, remains a priority region for Austria.

Larger countries with a strong economic basis seem, in general, less restrictive than smaller countries with fewer capacities (also in administrative terms). Germany, for instance, has an extensive generic education, science and technology internationalisation

[21] https://investinaustria.at/en/downloads/brochures.php; accessed on 11 July 2019.

strategy, in which partner countries are not specified, but Germany has also specific STI strategies for China and Africa.

In general, the country prioritisation includes top R&I performers and a few emerging economies (usually the ones with a large domestic market), which nobody wants to miss cooperating with, primarily driven by the Market Objective. Such orientation towards the more or less same countries can potentially lead to two effects on the side of these presumable partner countries:

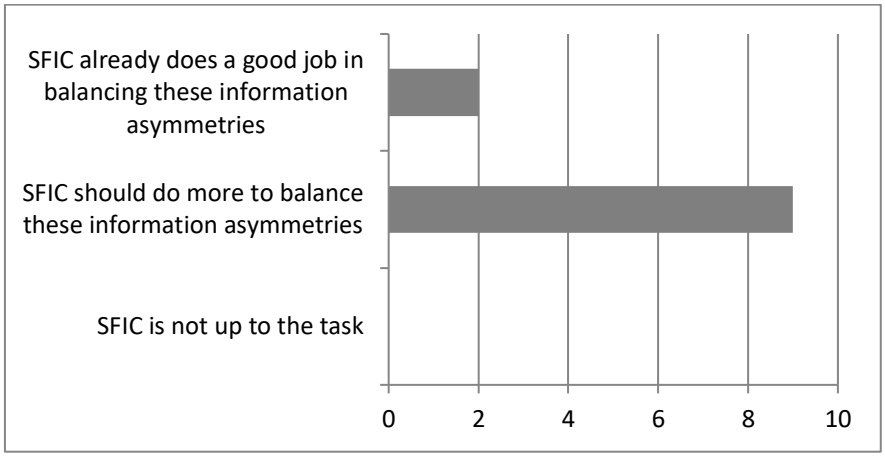
- First, a selection also from the side of these potentially attractive non-European countries vis-à-vis the EU member states, which are knocking at their doors, simply caused by opportunity rationales (like on the side of the EU member states) or by limiting the number of agreements in order to remain capable of handling them and not to overburden administrative capacities. If so, it seems likely that countries such as USA, Japan, China, Korea, Brazil or India will rather give priority to the most promising EU member states in terms of market size or R&I excellence (like the EU member states do vice versa).

- Second, a cooperation pattern in which many (EU member states) establish bilateral cooperation with one attractive partner country (e.g. China), will lead to information asymmetries, because the one preferred international partner country has the information superiority about cooperation with its European member states, but no single EU member state has sufficient information about the activities of the other EU member states with the same partner country, unless some information exchange mechanisms among the EU member states are introduced (which was - inter alia – a major reason to establish SFIC for instance).

Figure 8 clearly shows that SFIC is already active in balancing these information asymmetries, but by far most respondents to this survey answered that more should be done.

The focus on such repeatedly referred priority partner countries mentioned above is often complemented by neighbourhood related aspects (e.g. Norwegian focus on Arctic and Antarctica region and Scandinavian neighbours; Austrian and Slovenian focus on South East Europe) or grounded in a former colonial history (ERAWATCH, 2013). Cooperation influenced by historical aspects may have different underlying reasons: development cooperation, diplomacy, security, access to research sites and/or dealing with global challenges. They are often based on path dependencies (ERAWATCH, 2013). Historical relations and policy rationales for R&I cooperation are also often intertwined. *'Examples of this are the cooperation of Spain and Portugal with South-American countries, which provides benefits for both scientific and competitiveness purposes while a shared language and cultural aspects may serve as catalysts for cooperation. Similar patterns are to be observed for France and the UK'* (ERAWATCH, 2013, p. 22).

Figure 8: Performance of SFIC in balancing information asymmetries of EU MS about certain international partner countries (e.g. BRICS)



Source: Survey sent to MLE participants; own calculations; n=11

It is interesting to mention, that the internationalisation strategy of the Norwegian Research Council emphasises, that cooperation should also encompass emerging economies (which need to become part of the solution to preclude their becoming part of the problem) and to developing countries, *'who will suffer the most if we fail'* [… to find solutions for the Global challenges] (RCN, 2010). Thus, the Norwegian internationalisation strategy also pushes towards Open Access publishing for advancing the global knowledge pool and facilitating access to knowledge all over the world. Nevertheless, like most MLE countries participating in the survey, also Norway did not (yet) implement a strict Open Access policy for scientific papers funded under international research programmes or instruments. Only France, the FWO (Belgium/Flanders) and Turkey implement a strict Open Access policy for scientific papers funded under international research programmes or instruments.

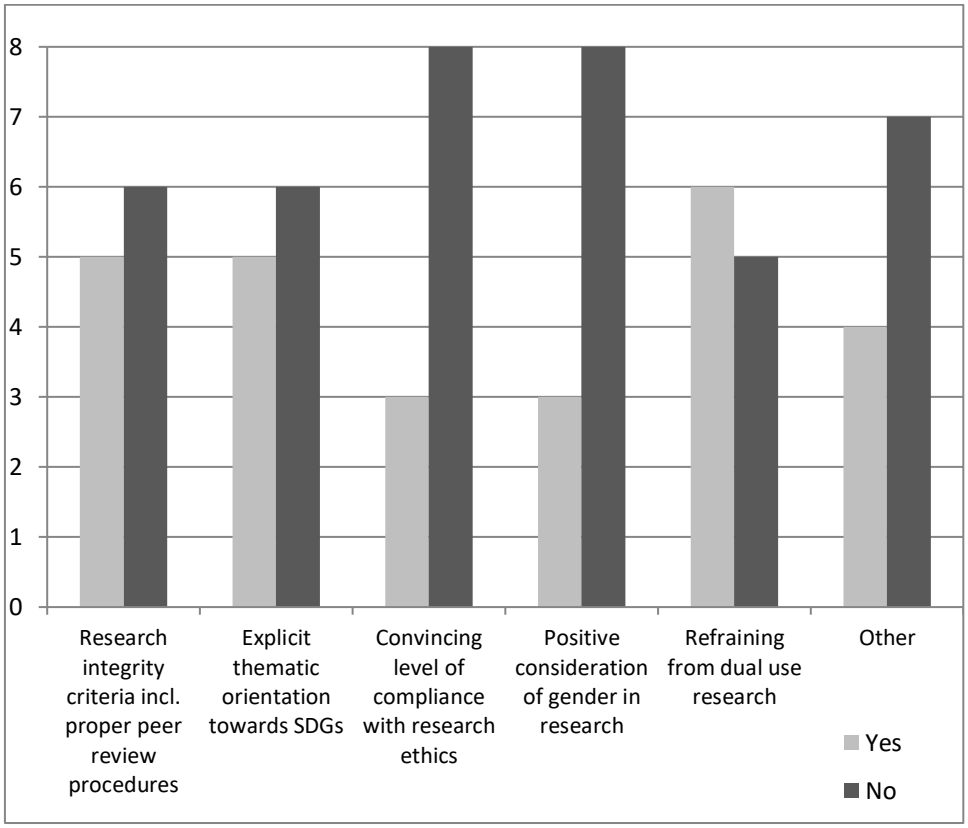
The identification of and focus on partner countries, however, remains always important in that sense, that for bi- and multi-lateral cooperation somebody to negotiate with is needed. Such contacts are usually identified at national level (ministries or national funding agencies), but very seldom at sub-state level (Brazil, however, is a notable exception). In terms of thematic priorities, also agreements with specialised agencies, such as the National Institutes of Health (NIH) of the USA, do exist, but more often agreements with ministries or funding agencies, which offer a broader thematic portfolio, are concluded. Sometimes, however, this broader thematic portfolio is jointly narrowed down to fewer (but usually still broadly defined) themes.

As pointed out in the European Commission's R&I internationalisation approach, also other aspects could play a role in the selection of specific cooperation countries and partners. They include normative aspects (such as dual use or research integrity), procedural aspects (such as rules of participation) or aspects related to competition frameworks (such as IPR enforcement).

As regards this consideration of normative principles in selecting or developing further cooperation with international partner countries, the empirical results based on the survey sent to the MLE participants show a rather mixed pattern (see Figure 9). No country, which responded to the survey, considers all of the listed normative principles scrutinised in the survey. Two countries even totally refrain from using normative principles at all for selecting or further developing cooperation with international partner countries. Interestingly, the respondent, who considered most of the scrutinised principles is not a country, but FWO from Flanders (Belgium). Only the category *'Refraining from dual use research'* is taken into account by the majority of responding countries for selecting respectively further developing international research cooperation with international partner countries. All other categories are not applied by the majority of respondents for this purpose (see Figure 9). The category 'other' includes a few scattered issues referring to IPR, data protection and other normative issues such as potential health risks deriving

from project implementation, violations of the principle of equal treatment in project implementation or violations of labour and social standards.

Figure 9: Normative principles influencing the selection and/or development of cooperation with international partner countries



Source: Survey sent to MLE participants; own calculations; n=11

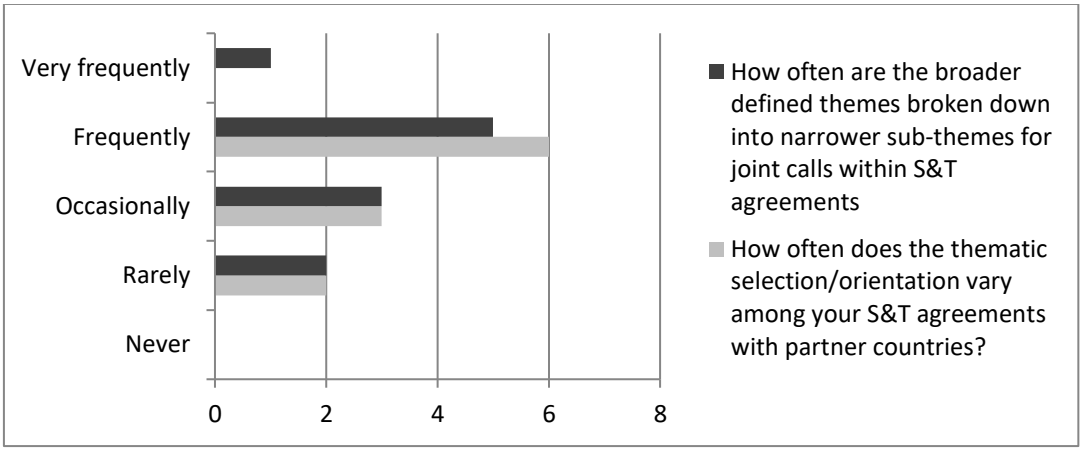
4.2 Thematic Priorities

The former fierce quest about which thematic priorities should be selected seems to have lost momentum because of the widespread thematic orientation of most of the EU member states on the global challenges as defined at European level on the one hand, and on the other hand, because many programmes and instruments supporting R&I internationalisation are bottom-up designed without any or –at least - without strong limiting thematic specifications.

ERAWATCH concluded already in 2013, that it is difficult to connect the geographical focus to a thematic priority (ERAWATCH, 2013). In addition to thematic openness and/or the orientation towards global challenges, national thematic strengths remain of course a core criterion for thematic selection, although these are sometimes combined with a thematic Grand Challenges orientation. An example is Austria, which has technological strengths in transport technologies, which are, for instance, included in the bilateral R&I cooperation with China, partially under the 'Smart City' agenda.

The SFIC survey on Tools and Policies in International S&T Cooperation (2018) revealed, that many MS/AC focus their cooperation with third countries in general on the broad areas of engineering and technology and natural sciences. ERAWATCH (2013) summarised that thematic priorities are in R&I internationalisation strategies either framed as 'challenges' or as 'technological growth areas' that often imply certain sectors and markets. These broad thematic areas include environmental technologies (incl. energy), health (incl. medicine), biotechnology, ICT and nanotechnology. The thematic selection/orientation varies among the S&T agreements with partner countries as indicated by the survey respondents (light grey bar in Figure 10). Moreover, it is also common practice that the broader defined themes are broken down into narrower sub-themes for joint calls within S&T agreements (dark grey bar in Figure 10).

Figure 10: Thematic variations between partner countries and calls within S&T agreements



Source: Survey sent to MLE participants; own calculations; n=11 for both dimensions

Also the European Commission is specific by identifying themes for bilateral cooperation for each country. In the case of New Zealand, for example, the Commission chooses to cooperate in the fields of health and food security, while the cooperation with Ukraine is focussed on ICT, new materials, transport and biotechnology (AWTI, 2017).[22]

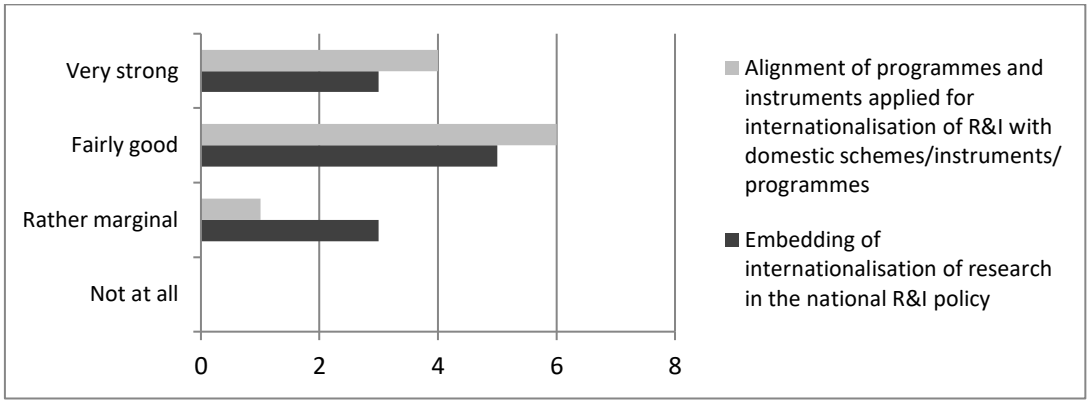
[22] See also EC (2014) and EC (2016).

5 THE EMBEDDING AND ALIGNMENT CHALLENGE

The 'embedding challenge' concerns basically two issues: first, to embed the R&I internationalisation strategy into the overall strategic R&I framework of the country (or region), but also – in the case of EU member states or countries associated to the framework programme for R&I – in the overall strategic R&I orientation of the EU, and to make use of the available domestic and European structures, programmes and instruments.

Figure 11 clearly shows that the level of embedding of internationalisation of research in the national R&I policy differs significantly among the countries participating in this MLE which responded to the survey. In general, there is still room for further gains. Only Ireland, Slovenia and Turkey reported a very strong embedding. The situation is slightly better as regards the alignment of programmes and instruments applied for internationalisation of research with domestic schemes, instruments and programmes. Ireland, Norway, Portugal and Turkey reported a very strong alignment in the respect.

Figure 11: The embedding and alignment of international cooperation in the national R&I policy and domestic schemes, instruments and programmes



Source: Survey sent to MLE participants; own calculations; n=11 for both dimensions

If we have a look at the alignment of national research internationalisation policies with the European R&I strategy, we can identify a slightly higher level compared to the embedding of national research internationalisation policies in the national R&I strategy (see Figure 12). This could indicate that the EU sets a strong(er) internationalisation policy agenda or rationale than this is done at national level in some of the countries which responded to this survey. Data confirm that this seems to be the case especially for countries which do not have an own R&I internationalisation strategy in place. It also might hint to a sophisticated application of the subsidiarity principle, where synergies are identified, and division of labour is well-thought-out.

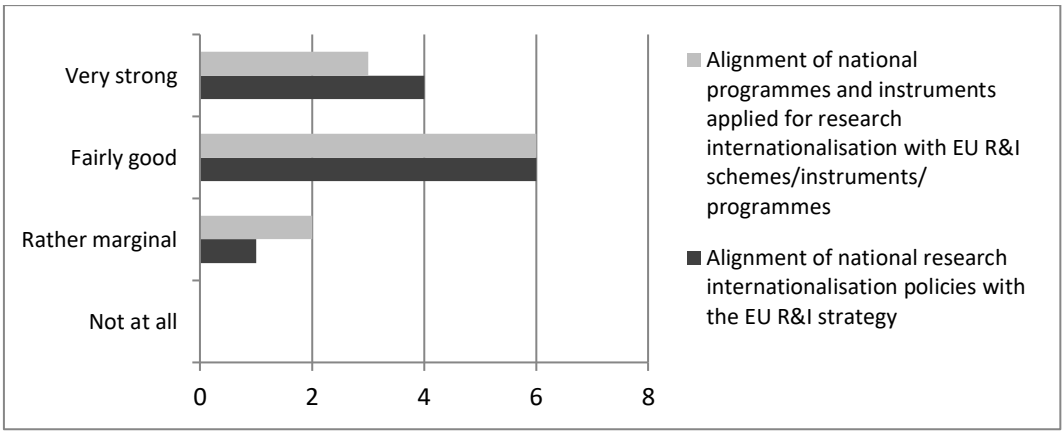
At the level of alignment of national programmes and instruments used for research internationalisation with European R&I schemes, instruments and programmes, the situation, however, is slightly different. At this instrumental level, alignment is better developed at the national level than between the national and the European schemes (see Figure 12).

The countries participating in the MLE which responded to the survey indicated a long list of EU policies and instruments for research internationalisation which they miss or – if already existing – which should be expanded. Among the perceived shortcomings are the following:

- More joint initiatives with MS/AC promoting the EU as a site for R&I abroad (such as the *'Tour of China'* and *'Tour of Brazil'* initiatives, or *'Destination Europe'* in the US)

- Specific low-key Instruments that give the possibility to enter into multilateral activities such as international ERA-NETs, INCO-NETs and BILAT activities (which have been cancelled in Horizon 2020)
- More explicit measures for international R&I cooperation in the European Framework Programmes for R&I
- Re-introduction of the previous INCO-Net tool
- More targeted activities for R&I internationalisation, e.g. through open calls or in flagship initiatives
- Stronger involvement of EU member states into the development of the EC's multiannual roadmaps with partner countries / regions
- For Horizon Europe information is still missing about the tools/instruments to increase international cooperation
- Ensure good framework conditions for third country participation
- New and novel instruments for supporting the 'widening' agenda
- Mechanisms to increase the participation levels of EU neighbourhood countries in COST
- More outreach of the European Open Science Cloud towards associated countries
- Alignment with EHEA
- Synergies with cohesion policy
- More joint policies together with other EU member states
- Stronger science-diplomacy activities also at the European level

Figure 12: Alignment in the field of international cooperation between national and the European R&I policy and between domestic schemes, instruments and programmes and European ones



Source: Survey sent to MLE participants; own calculations; n=11 for both dimensions

On the other hand, there are already many European measures which are used by the member states or countries associated to Horizon 2020 and which are propelling their own research internationalisation efforts. Frequently mentioned in this respect was of course the European Framework Programme for R&I as such, but also Joint Programming Initiatives and international ERA-NETs targeting specific countries/regions. Furthermore, the respondents to the survey also make use of:

- Art. 185 initiatives such as the 'Research and Innovation in the Mediterranean Area' (PRIMA)[23] and the 'European & Developing Countries Clinical Trials Partnership' (EDCTP)[24]
- INCO-Net[25] and BILAT activities (which, however, have already been cancelled in Horizon 2020)
- European Networks of Research and Innovation Hubs (ENRICH Centres)[26]
- COST[27]
- European Research Council activities[28]
- European Strategy Forum on Research Infrastructures in Europe (ESFRI)[29]
- COM + MS/AC International Political Dialogues such as UE-Africa; UE-India; UE-CELAC; GSO Euro-Mediterranean;
- ERA Roadmap[30]
- Participation in policy advice formulating bodies such as European Research Area and Innovation Committee (ERAC),[31] and use of the Horizon 2020 Policy Support Facility[32]
- ERASMUS+ (in particular European universities)[33]
- Strategic documents and initiatives such as the Strategy 2020 of the European Union[34], the Galway Statement (2013),[35] the Belém Statement (2017),[36] the 2012 strategy for international research cooperation (European Commission, 2012).

The 'embedding challenge' is also intensified by a sometimes observable 'policy distance' between those who develop a strategy and those responsible for designing and implementing the instruments. This is a classical client-agency challenge. The strategic objectives and requirements need to have the power to influence and shape the necessary programmes and instruments, but sometimes the available programmatic and instrumental toolbox remains unchanged.

If, however, structures, programmes, instruments or framework conditions are not conducive towards supporting R&I internationalisation, it is the task of an R&I internationalisation strategy (and its 'owners') to influence and shape them to become more beneficial for international R&I cooperation and/or to provide additional structures,

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[23] http://prima-med.org/; accessed on 12 July 2019.

[24] http://www.edctp.org/; accessed on 12 July 2019.

[25] Information about some INCO-NETs can be found in European Commission (2008). https://ec.europa.eu/research/iscp/pdf/publications/978-92-79-08080-7_en.pdf, accessed on 12 July 2019.

[26] http://enrichcentres.eu/; accessed on 12 July 2019.

[27] https://www.cost.eu/; accessed on 12 July 2019.

[28] https://erc.europa.eu/; accessed on 12 July 2019.

[29] https://www.esfri.eu/; accessed on 12 July 2019.

[30] https://era.gv.at/object/document/1845; accessed on 12 July 2019.

[31] https://www.consilium.europa.eu/en/council-eu/preparatory-bodies/european-research-area-innovation-committee/; accessed on 12 July 2019.

[32] https://rio.jrc.ec.europa.eu/?country=at; accessed on 12 July 2019.

[33] https://ec.europa.eu/programmes/erasmus-plus/node_en; accessed on 12 July 2019.

[34] https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester/framework/europe-2020-strategy_en; accessed on 12 July 2019.

[35] https://ec.europa.eu/research/iscp/.../galway_statement_atlantic_ocean_cooperation.pdf; accessed on 12 July 2019.

[36] https://ec.europa.eu/research/iscp/pdf/belem_statement_2017_en.pdf; accessed on 12 July 2019.

programmes and instruments (e.g. targeted R&I internationalisation programmes) where the national ones fall short.

Box 2: The Norwegian approach of embedding international R&I cooperation

The Norwegian approach of embedding international R&I cooperation

The 'Strategy for International Cooperation 2010-2020' of the Research Council of Norway clearly states in this respect, that *'… special measures to promote international research cooperation will undoubtedly be needed. But the real foundation for success in international research lies in the ability of the Research Council's ordinary funding instruments to sustain an attractive, well-functioning research and innovation system with sound, knowledge-based companies, skilled researchers and first-class infrastructure'* (RCN, 2010, p. 7). Embedding in a practical sense, thus means, to make use also of existing programmes and instruments, possibly by adapting them.

In Norway all of the programmes and activities operated under the RCN, for instance, must include clearly defined objectives and plans relating to internationalisation. The level of ambition is adapted to the objectives of the relevant activity. Thus, the interventions to support international R&I cooperation can be different. Research proposals for instance, that feature convincing aspects of international cooperation, can be given priority over other proposals, assuming that all else is equal. Alternatively, internationalisation activities may also be strengthened by means of supplementary allocations for internationalisation measures in projects that have already been selected on the basis of scientific merit. Moreover, Ph.D. candidates and post-doctoral candidates, who receive funding from the RCN are encouraged (and financially supported) to stay at an institution abroad. But although international research cooperation is integrated into the discipline-based and thematic activities of the RCN as a general rule, also additional targeted R&I internationalisation programmes are developed, which provide extra momentum needed to encourage research cooperation in the introductory phases.[37]

A very strategic aspect of embedding is, however, the relation of the R&I internationalisation Theory of Change with the overall national R&I strategy.

The boxes below provide a summary on how the embedding challenge has been discussed by the participants of this MLE exercise who gathered in the Paris workshop. The discussions on value creation through embedding were focussing on:

- Improving research excellence including research infrastructures
- Supporting international market development and innovation exploitation (outward/inward)
- Tackling global challenges.

[37] For this whole paragraph information from (RCN, 2010) was taken.

Box 3: Embedding research excellence including research infrastructures

Embedding challenge 1:

Improving research excellence including research infrastructure

The first question discussed was if and how an R&I internationalisation strategy can create added value for the national R&I strategy in the area of research excellence. It was argued that it is of outmost importance that internationalisation is part of national R&I strategies focussed on research excellence, and that this can be done in many different ways. Access to high quality research infrastructures (RI) was perceived as a precondition for excellence in most areas of research. In addition to providing high quality data, RI were also considered to create incentives and possibilities for international collaboration, co-publications and thereby also for international attention.

An argument put forward by several participants was that excellence should be embedded in a national R&I system based on competition. This is because competition leads to additional funding for the best researchers or research teams. It was also considered most likely that possibilities for a country to keep and recruit talented researchers would be strengthened in this way. The role of government should be to provide the right framework conditions for excellent research. It was stressed that by using their written or unwritten strategies, countries could be enhancing a culture that is *'outward looking',* open and based on benchmarking. During the discussion it became obvious that European member states and associated countries usually aim to do this, but also that they organise different ways to accomplish this goal. An example is that some governments provide core funding for excellent research directly to universities and research communities whereas others do this indirectly through funding agencies. Combinations of these approaches are also common.

Many of those who contributed to this discussion touched upon the concept of 'excellence'. The key idea was that it cannot be defined by others than the research communities themselves. It was emphasized that no strings should be attached to core funding and that researchers have to be allowed to formulate research questions without thinking of the immediate impact. This 'blue sky' research, which is sometimes called 'fundamental' or 'basic' is, however, in the long run also expected to fundamentally lift the level of knowledge and lead to enlightenment and societal impact. It was made clear that not every university can or should aspire to be excellent as this presupposes a certain size and quality in terms of personnel, equipment and budget.

It was commonly agreed that excellence is the key to building knowledge independently of political ambitions or demands from interest groups of different kinds. ERC and independent national funding agencies were considered to be of crucial importance for the development of research excellence. It was mentioned that many universities nowadays have strategies which make them successful in ERC competitions, and that many of those who work within research communities regularly keep an eye on who and what groups receive ERC grants as these may bring international talent to their country. Another indication of the influence of EU funding on the internationalisation of national research communities was that excellent researchers often check if they can join already ongoing research initiatives such as Joint Programming Initiatives (JPIs) and ERA-NETs before they initiate new projects.

It was concluded that the fact that there are financial resources for research excellence at the EU level results in cooperation across borders that would not otherwise have occurred. This might not hinder influence from member states and countries associated to the Framework Programmes to use their voice to influence the EU. Thus, important organisational arrangements exist in Europe that balance top-down and bottom-up development of strategies for excellence, but voices were raised to emphasize that these could still be further elaborated.

Excellence was by its very nature considered to be global. Therefore, bilateral and multilateral approaches to internationalisation were not considered to threaten, but on the contrary, to

strengthen the national and European ambitions to improve excellence. It was also argued that it is important that the ambition to become excellent with the help of internationalisation is 'exported' to countries outside Europe in order to engage them to build capacity for turning their countries into knowledge societies. An example of how multilateral and bilateral agreements can be enhanced by national initiatives was provided by a participant from a country where public funded research programmes are open to international researchers who enrich the research community and more generally bring value and embed international expertise in the country.

It was pointed out that national strategies for research infrastructures, which are usually called Roadmaps, often are influenced by EU goals and ambitions. This is an area where member states and countries associated to the EU Framework Programmes for R&I adjust their strategies to the EU internationalisation approach. The reason is that high quality research infrastructure is becoming more and more important for research excellence but also more expensive, and that therefore cost sharing becomes necessary. A positive effect of establishing research infrastructures at the EU level is that European researchers get relatively equal access to these and thereby opportunities for excellent research and internationalisation are facilitated with potential impact on education, innovation and business. Building consortia in the research infrastructure sphere was considered important also as a trigger of collaboration with countries outside Europe.

Summarised and compiled by Gunnel Gustafsson (Chair of the MLE)

Box 4: Embedding international market development and innovation exploitation

Embedding challenge 2:

Supporting international market development and innovation exploitation (outward/inward)

How can the R&I internationalisation strategy create added value for the national R&I strategy in the area of international market development and innovation exploitation (and what is better done at EU level)?

On the one hand, close to market aspects of R&I internationalisation are related to country representation activities in third countries. Depending on the country, this may bring opportunities to present in a systemic way the country offerings which help identifying areas for collaboration engaging both business and research. Also more linear approaches exist in R&I strategies in which market development is seen rather as an activity of selling innovation resulted from research, thus possibly missing the opportunities to make connections with science communities.

On the other hand, close to market aspects bring in also opportunities to exploit innovations from third countries in the domestic markets. For instance, Denmark has a network of scoping good practices to develop its policies; they also support businesses to implement technology scouting to develop their business activities.

How to connect the national R&I strategy in the area of market development/innovation exploitation with bilateral or multilateral internationalisation approaches?

Bilateral internationalisation offers opportunities to focus on mutually interesting areas and develop cooperation engaging business and research stakeholders. Sometimes this is done through the cross-ministerial representation and leading to new initiatives engaging both the research and business stakeholders in both countries. In case of Ireland, the country has attracted MNCs through fiscal incentives. These companies today stand for the majority of the

BERD, thus having a positive impact on the local R&I system. For Ireland, it has actually been more challenging to internationalise their SMEs and through this way to develop also their R&I activities.

Multilateral internationalisation can be particularly valuable when benefits can be created by pooling of resources or increasing bargaining power. The EU as a one block may be better off in influencing the development of framework conditions in third countries, for instance, IPR, standardisation and other regulation and the enforcement of such norms to facilitate fair market access.

How should the EU strategy consider national R&I internationalisation priorities in the area of market development/innovation exploitation? How to make sure that MS/AC adjust their own international R&I strategies with the EU internationalisation approach in the area of market development/innovation exploitation?

The EU negotiations with third countries often consider the reciprocity between the parties. It is not, however, the third countries only who find it difficult to cope with European programme requirements. The same happens when European countries consider participation in the programmes of third countries. Thus, simplification of the requirements on both sides might ease the cooperation.

The EU strategic positioning in the negotiations with third countries related to international market development and innovation exploitation may be prone to accommodate especially the interests of the large member states to enhance their market access and increase market shares. Indeed, such competitive matters between member states may play role and leave smaller member states with less means to defend their interests.

The EU strategies may provide structures and support to facilitate the coordination between member states in this area. For instance, within the framework of ERANETs the member states have been able to pool their R&I internationalisation. The EU can also help the coordination between member states to encourage joint development of programmes for internationalisation. For instance, the on-going initiative, INNOWWIDE[38] – Viability assessment of collaborative and INNOvative business solutions in WorldWIDE markets – is a Horizon 2020 project that aims to fund at least 120 European innovative SMEs and start-ups to conduct Viability Assessment Projects (VAPs) in markets outside of Europe.

The INNOWWIDE pilot call intends to bring European highly innovative SMEs to the forefront of international markets by supporting Viability Assessment Projects (VAPs) in cooperation with local stakeholders. It will, then, create the conditions to increase the uptake of European innovative solutions in markets outside of Europe, targeting markets of developing countries, large emerging economies (Brazil, Russia, India, China, Mexico) and developed countries.

The EU strategy may also coordinate the matching of similar thematic interests across regions that may lead to joint international R&I networks. For instance, the thematic platform in smart specialisation facilitates such networking of which principles and practices could be extended to third countries.

Summarised and compiled by Totti Könnölä (Independent expert)

[38] www.innowwide.eu

Box 5: Tackling global challenges

Embedding challenge 3:

Tackling global challenges

It is obvious that global challenges are by definition topics that require international collaboration as the issues are too big for one country or even Europe as a whole to tackle. The UN's Sustainable Development Goals (SDGs) indeed give some structure for joint strategies and EU actions. However, they are still so broad that national prioritisations have to be made based on national competences as well as interests.

While more and more countries are including societal challenges and SDGs in their national and international STI strategies, there are still quite a number of countries that do not include them (for instance, because there is no thematic prioritisation in research funding), or only include some of the SDGs. The SDGs that are now addressed by Horizon Europe often partly overlap with national strategies (mostly accidental) or form an additional set of thematic areas not present at national level. Thus, while the global challenges seem an obvious starting point to add value to national (internationalisation) STI strategies and foster alignment, the prioritisation of topics within the broad spectrum of SDGs would be a first necessary step still to be taken. It was suggested that the European Commission should play a leading role in identifying the most urgent challenges that have EU-wide impacts and can bring together 27+ EU countries.

In order to foster more convergence, a necessary next step is to systematically share information on national competences and existing STI collaborations that EU countries have with partners in third countries. A dedicated data sharing platform is needed for this. None of the existing STI policy platforms was seen to cover this in a satisfactory manner.

The general view amongst the participants was that, when national (internationalisation) STI strategies are developed, little attention is given to what other countries or international organisations are already doing. Adjustment to the EU internationalisation approach is not built in.

Increasingly, countries organise extensive stakeholder consultations to inform their national strategies. These are mostly internally focused and hardly any international stakeholders take part. It was suggested that by involving industry in these stakeholder consultations it is more likely to increase an international perspective.

Carrots for stronger alignment are access to EU funding or an urgent need to collaborate in crises (e.g. the Ebola virus outbreak).

A stronger adherence to SDGs in European countries in the future will likely lead to more attention to whether the partner countries outside Europe have some level of respect to these SDGs. This asks for higher (ethical) standards in cooperation agreements and joint research projects and thus a more selective approach to partnering. There was no clear agreement on how and by whom these standards should be set and there was some concern whether the EU 27+ would have a common approach to applying these standards.

A lesson that all countries can take on board is to have a clearer involvement of the partner countries when developing STI collaboration strategies. Dialogues should be used to ask the partner countries what specific topics in the spectrum of SDGs they would like to prioritise. That means that the EU countries should have some flexibility in their own set of SDGs that they aim to focus on. The chances of success will be higher if both sides have a strong interest in the STI collaboration topics.

Summarised and compiled by Patries Boekholt (Independent expert)

ERAWATCH (2013) concluded that the absence of a stand-alone STI internationalisation strategy does not necessarily imply the absence of activities or active STI cooperation at other than central policy levels. The study, however, also observed that in countries that do have a strategy, coordination and alignment are stronger.

Germany, France or Austria are examples of countries, where the R&I internationalisation strategies were developed as follow-ups after the national R&I strategies, while in other countries international R&I cooperation was already considered as dedicated part (usually in the form of a chapter or section) in the national R&I internationalisation strategy. In fact, also the above-mentioned countries have included aspects of R&I internationalisation already in their national R&I strategies, but more as general strategic concerns and/or as an important framework condition.

There is no general recipe.

Probably the ideal approach would be to co-develop an overall R&I internationalisation concept (or 'Leitbild') strategically together with the overall national R&I strategy and then to follow-up with a dedicated R&I internationalisation strategy (incl. a roadmap) which builds on the overall national R&I strategy and which further refines it.

Within the overall strategy development process co-development facilitates to consider the integration and the mainstreaming of international R&I cooperation and to remove barriers from the very beginning. It provides also the right timing to make influential opinion-makers and gate-keepers aware about the importance of the R&I internationalisation agenda and – in the best case – to make them allies. Since many overall national R&I strategies, however, lack operational implementation details and specific roadmaps, it seems to be beneficial to follow-up with a targeted R&I internationalisation strategy which shows a clear Theory of Change aligned to the overall national R&I strategy, objectives and intervention areas, instruments, time plan, a budget forecast and a section on monitoring and evaluation.

6 THE COORDINATION CHALLENGE

The 'embedding challenge' refers also to the coordination among stakeholders and target groups, not at least to make use of their capacities and to make them feel responsible and committed to develop and implement the R&I internationalisation strategy. Especially in countries with federal systems and/or traditions (e.g. Switzerland, Germany, Italy), coordination is an important component of R&I internationalisation strategies. The overall aim of coordination is that stakeholders should cooperate more consistently internationally and develop and implement joint initiatives (e.g. the so-called synergy projects in France). As a result, the creation of an internationalisation strategy today often involves extensive and timely involvement of stakeholders - whether through input papers and dialogue formats (such as in Austria) or online surveys, working groups and interviews (such as in France).

The final beneficiaries of an R&I internationalisation strategy are the researchers from academia and industry, higher education institutions, research organisations and companies. It is, however, a challenge to directly reach out to them. Thus, R&I internationalisation strategies usually use intermediaries, the actual target groups, to bridge to the final beneficiaries. Thus, target groups are often funding agencies, business related associations or specific bodies, such as international offices of universities.

The term 'stakeholder' is an often used, but rather vague expression. Often target groups, beneficiaries and the governance (or steering) level are subsumed under this terminology. In any case, the identification of stakeholders depends on the strategic objectives of the R&I internationalisation strategy. In countries where responsibilities for intrinsic STI related objectives are divided across a range of ministries dealing, for instance, with higher education and science on one hand, and research, technology and innovation on the other, a stronger need for strategic harmonisation and guidance becomes evident. In such cases, it seems, that a dedicated R&I internationalisation strategy, which involves governmental key-players and their downstream agencies/bodies (both during the phase of development and implementation), is truly beneficial for the division of labour and for creating a more synergetic approach. Or in other words vice-versa: coordination is presumably more limited if no national (or regional) strategy exists. ERAWATCH (2013) provided some evidence for this.

Since the R&I internationalisation objectives, however, usually include also non-S&T-intrinsic matters (e.g. economic objectives, development cooperation, and science diplomacy), coordination for developing and implementing the R&I internationalisation strategy concerns in the very first circle basically a cross-governmental approach. In some countries, international activities have to be by law closely coordinated with the ministry of foreign affairs.

The default situation is that the ministries responsible for science, research, innovation and economy have elements of R&I internationalisation in their portfolio and they are the main drivers of steering and coordination. Very often the foreign ministry is called in. Increasingly, also the ministries responsible for environment, food and agriculture, health, energy, climate, (sustainable) development and defence are dealing - at least at some interfaces - with related R&I internationalisation policies (ERAWATCH, 2013). Thus, it is important to carefully screen the competence distribution. It is also helpful to divide the governmental players mentioned above into graded layers of inclusion in the development and implementation of an R&I internationalisation strategy. The most important involved ministries usually constitute **the first layer of stakeholders**. In a few countries, however, which have strong delegated agencies, the coordination effort is exercised by the agency.

The second cycle of stakeholders is usually constituted by R&I funding agencies, research councils, academies of science and representatives of universities and research organisations (e.g. rectors' conference), specialised agencies (such as international oriented business agencies, development cooperation agency, or space agency), ministries which have only marginal relations to R&I internationalisation and – in some countries –

social partners**.** In countries with stronger federal governance systems, also (some) regions are included in this second circle (e.g. Italy, Germany). In a few cases, also large private research funding foundations are considered to be stakeholders like, for instance, the Welcome Trust in UK.

A special challenge is to take the beneficiaries, for which the R&I internationalisation strategy is actually developed, on board (i.e. researchers from academia and business, higher education institutions, research organisations and companies). Very often this is just done via representation bodies (e.g. rectors' conference) mentioned above in the second coordination cycle. Sometimes the international offices of higher education institutions or bottom-up constituted groups (e.g. science for development associations) are directly approached **in a third cycle**.

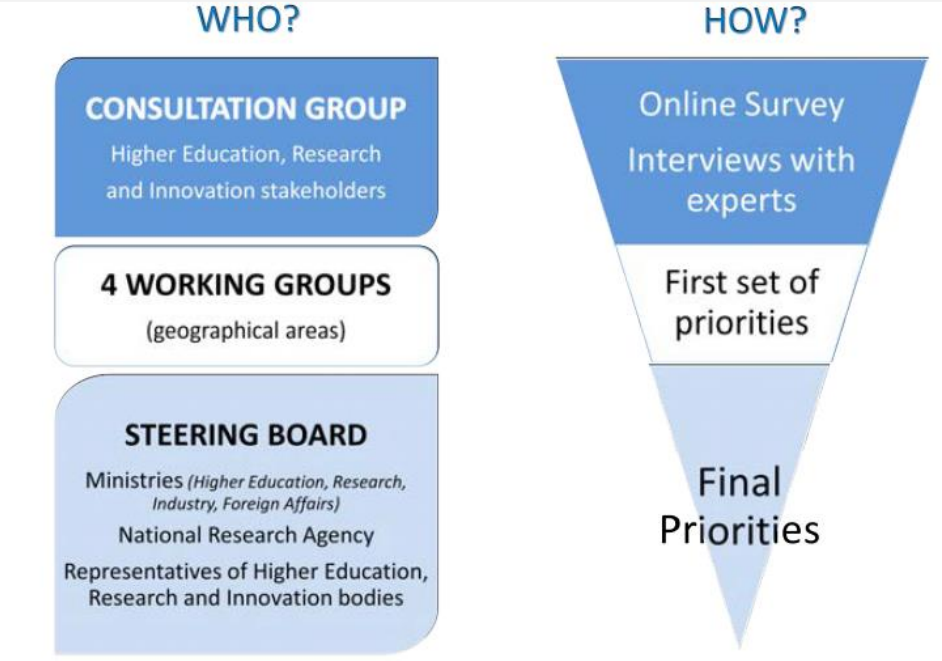
In some countries, the universities and public research organisations are also required to contribute to the implementation of R&I internationalisation objectives by including elements of their contribution to the implementation of the overall R&I internationalisation strategy in their performance contracts or strategic development plans (e.g. in Austria). The public universities and research organisations (PROs) in France and Moldova are formally obliged to contribute to the implementation of the research internationalisation strategy. In France, PROs and universities are also included in all Joint Scientific and Technology Cooperation Committee (JSTCC) meetings with third countries. They are also consulted on a regular and structured basis regarding the negotiation and monitoring of the EU framework programmes. In Moldova, this inclusion of universities in contributing to the implementation of the R&I internationalisation strategy is done through national action plans and it is a requirement for programmes evaluation. All the other countries participating in this MLE, who responded to the survey, do not have a mechanism of formally obliging universities or PROs to contribute to the implementation of the research internationalisation strategy.

It is unclear, however, how a written R&I internationalisation strategy is effectively important for the actual beneficiaries. To reach out to them (and to create some kind of ownership) mostly means to provide them with incentives (e.g. through funding mechanisms or advantages for career promotion). Since this is usually done via existing or newly designed programmes and instruments, those who are in charge of these programmes and instruments, are considered to have probably the most powerful position to reach out to the final beneficiaries and to drive forward a strategic R&I internationalisation agenda.

The Development of the French International Strategy for Research, Innovation and Higher Education (2017-2030) (SIRIES)[39]

Coordination of SIRIES is carried out by the French Ministry of Education, Higher Education and Research, specifically the Division for European and International Affairs for Higher Education, Research and Innovation (MEIRIES). Further involved are the Ministry of Foreign Affairs and International Development, which coordinates the network of science attachés in French embassies throughout the world, and the Ministry of Economic and Financial Affairs to enhance the focus on innovation.

Figure 13: Stakeholders and procedures for the elaboration of SIRIES



Source: Ministry of Education, Higher Education and Research; taken from ITB (2017)

Higher Education, Research and Innovation stakeholders were invited to take part in the elaboration of the strategy and are consulted throughout all stages of the process (see Figure 13):

- The Plenary assembly (Consultation group) for a larger consultation of Higher Education, Research and Innovation stakeholders. Its purpose was to provide recommendations for SIRIES.
- Four Working groups on the main geographical areas: Africa/Middle East; North and South America; Europe/Russia; Asia/Oceania. Its purpose was to elaborate a SWOT analysis in Higher Education, Research and Innovation for each geographical area (country and regional analysis) and to suggest priorities for the SIRIES.
- The Steering board consisting of representatives from Ministries (Education, Higher Education and Research; Foreign Affairs and International Development; Economic and Financial Affairs), the National Research Agency, Universities, Engineering Schools and

[39] The following paragraphs are taken from Chapel (2017).

Research bodies. Its purpose is to monitor the output of working groups and to validate the deliverables.

The elaboration of SIRIES was carried out in four steps:

Step 1: state-of-art: For embedding of SIRIES the relevant French strategic documents on Higher Education (StraNES) and on Research (SNR), the context of the European Research Area (ERA) and the European Higher Education Area (EHEA), and global issues such as the SDGs and the COP[40] negotiations were taken into account. Furthermore, the existing international activities and strategies of French stakeholders were considered. The consultation was based on online stakeholder surveys and interviews with experts. Furthermore, an impact assessment of French bilateral and multilateral cooperation schemes was integrated.

Step 2: Identification of priorities: Geographical working groups defined selection criteria to identify a first set of priorities, focussing on strategic areas for France. SWOT analyses encompassing the knowledge triangle was used for this. The steering board chose the final priorities among the ones identified by the working groups.

Step 3: Establishment of a roadmap: Based on the selected final priorities, the Ministry of Education, Higher Education and Research establishes a roadmap, which is meant to offer a strategic guidance to French stakeholders for their own international strategy and insights to better fit their international cooperation schemes to the SIRIES priorities.

Step 4: Follow-up: The international strategy will be updated at regular intervals, as the landscape in Higher Education, Research and Innovation is evolving. A set of indicators should accompany this process.

It should be noted, that this procedure, which is taken from Chapel (2017) has in the meanwhile been modified.

As regards coordination approaches, it is important to distinguish between the development and the implementation phases of an R&I internationalisation strategy. Usually, the stakeholder involvement is more intense during the development phase. Expectation management becomes a critical issue, because some stakeholders approach the development process with rather opportunistic wish lists. Strategy development, however, also means to focus on important elements and to leave less important ones or those which are self-propelling and running by themselves aside. This can meet resistance.

Good practices in stakeholder coordination and inclusion during the development phase of an R&I internationalisation strategy vary. Usually the first and the second cycle of stakeholders mentioned above are included in the development process.

In general, one can conclude, that it is common to coordinate and engage stakeholders in different ways to develop an R&I internationalisation strategy. The coordination character, however, changes once a strategy is under the process of implementation and the flatlands of day-to-day policy implementation strike back. Coordination becomes then less extensive but more intensive at the operational implementation level (e.g. cooperation with R&I funding agencies and core partner ministries).

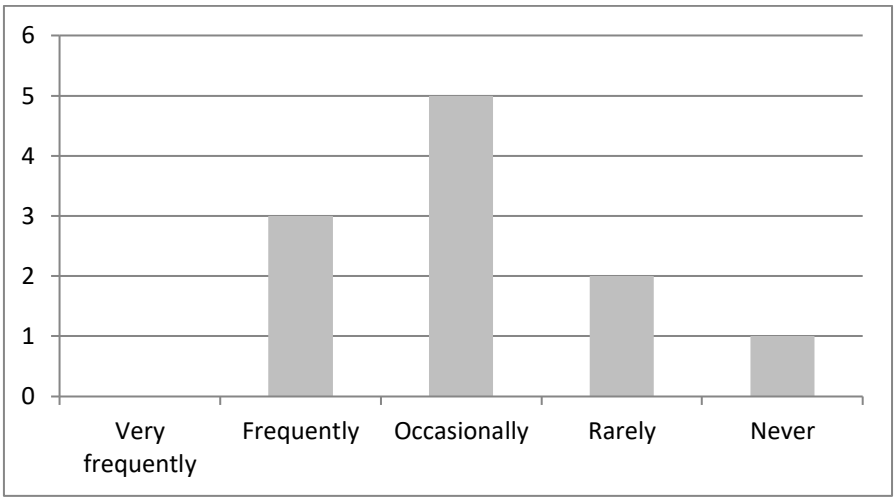
While cross-government coordination is sometimes ad-hoc established for the sake of developing an R&I internationalisation strategy, it is necessary to continue the implementation process with a formalised body (which can have different names such as task force, working group, steering board etc.) and to implement a routine of information exchange and coordinated steering, although usually with divided competences. Meetings

[40] United Nations Framework Convention on Climate Change, Conference of the Parties (COP)

at regular intervals (e.g. once in six months) are standard, but sometimes new developments are arising in between these jour-fixes, which call for more frequent exchange. For keeping the process alive, it is necessary that one ministry (usually the ministry dealing with science and research) has the authority to coordinate and steer the cross-governmental process. Sometimes other stakeholders, such as R&I councils or important R&I funding agencies, are also invited to the meetings. In a few countries (UK, for example), the scientific monitoring of the internationalisation strategy is partially institutionalised in the form of think tanks. In Germany the government reports every two years to the parliament about the state-of-art and implementation of the R&I internationalisation strategy.

Only one of the eleven countries, which responded to the survey, has no formalised process or format in place to involve final beneficiaries of R&I policies (e.g. researchers or companies) in exchanging views or opinions on certain aspects of international R&I cooperation (see Figure 14). Two more countries rarely use of the formats at hand, and five countries occasionally use them. Three countries, however, make frequent use of them. These are France, Greece and the FWO from Flanders/Belgium.

Figure 14: Use of formalised processes or formats to involve final beneficiaries of R&I policies in exchanging views or opinions on certain aspects of international R&I cooperation



Source: Survey sent to MLE participants; own calculations; n=11

While almost all countries involve researchers, academic institutions and research centres, most also involve companies and funding agencies. Students or student associations are explicitly addressed in France and Norway. Greece is the only respondent which also invites civil society organisations and which mentioned explicitly also the inclusion of other ministries (although it can be assumed that the latter is regarded as implicit by some countries).

In order to maintain occasional contact, Austria, for instance, organises at least once a year a so-called internationalisation round-table. These meetings usually feature programmes, instruments and initiatives targeting a certain international partner country or region. This so called 'Beyond Europe internationalisation roundtable'[41] is organised by the Austrian Research Promotion Agency (FFG) on behalf of the working group 'Internationalisation and RTI Foreign Policy' (AG 7a) of the RTI Task Force of the Federal Government and based on the recommendations of the 'Beyond Europe' Strategy. The objective is to stimulate exchange of information on activities and experiences with the international partner country under scrutiny, to identify common concerns and, as far as possible, also to discuss starting points or initiatives for coordinated activities.

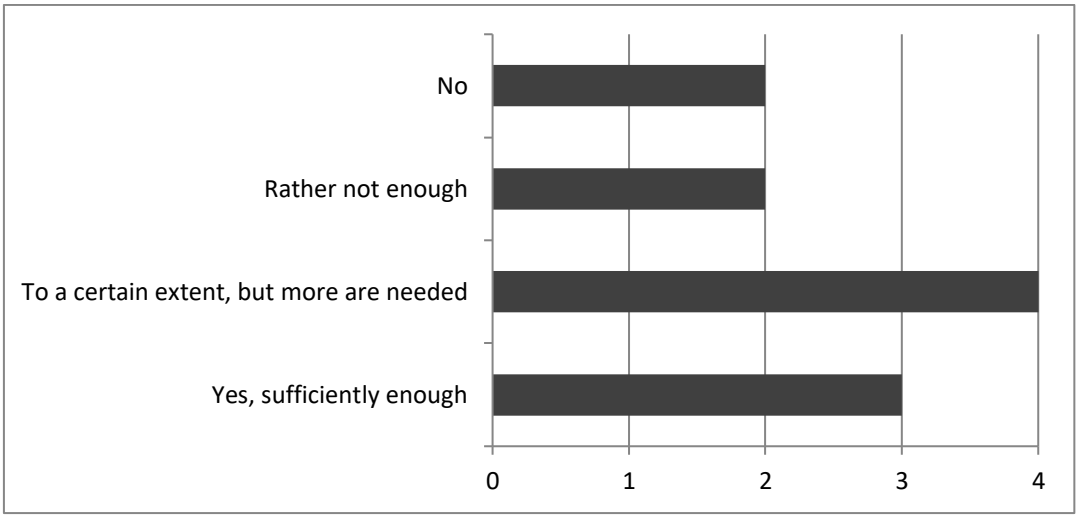
[41] https://www.ffg.at/europa/veranstaltungen/bert9_2019-03-27

Other formats to stay in regular contact with the final beneficiaries during the implementation of the R&I internationalisation strategy include newsletters and social media (often delegated to the managers of internationalisation programmes).

To stay in contact with stakeholders and to exchange information about international R&I cooperation activities, Austria has also established the 'Beyond Europe Platform'.[42] This national online information platform is available for ministries, agencies, research organisations and interest groups. To unfold its impact the mentioned stakeholders are expected to frequently feed the platform with new information about their R&I cooperation activities.

Another dimension of coordination refers to the coordination with external partners or initiatives. Taking part in common international initiatives *'is complex, and leaves less latitude for national steering. But it makes international knowledge production available to participants on a scale that would otherwise be unobtainable'* (RCN, 2010, p. 5). Especially smaller countries are more often confronted with capacity shortages to intensively play a part in international initiatives.

Figure 15: Availability of enough resources to coordinate strategic activities with external partners and initiatives in the field of R&I internationalisation



Source: Survey sent to MLE participants; own calculations; n=11

The lack of resources is confirmed by the feedback from the MLE participants to the survey (see Figure 15). Only three countries replied that they have sufficiently enough human resources and/or travel budgets available to coordinate their strategic activities with external partners or initiatives in the field of research internationalisation. These three countries are also frequently recognised as active players in the field (France, Norway and FWO from Flanders/Belgium). Four countries replied that resources are to some extent available, but more is needed. Two countries have rather not enough resources and two more definitely too little resources. This can be considered as a very severe structural problem. In order to become active and also to become perceived as an acting country in the field of international R&I cooperation, sufficient resources have to be made available by the competent authorities, both for the international R&I measures but also for R&I policy coordination.

[42] https://beyond-europe.era.gv.at/login

If no more resources can be levied in-house, then this problem can be tackled in general by the following approaches:

1) Application of the subsidiarity principle by delegating more central coordination tasks to the European Commission (where such initiatives refer to all MS)

2) Making use of available multi-level capacities and expertise in other ministries, agencies, research organisations, councils etc. (the 'leading houses'-approach in Switzerland, whereby a different university is appointed to coordinate the cooperation with a specific country, or the SWISSNEX-Network[43] can be considered as an inspiring practices).

As regards SWISSNEX, Technopolis (2016) has observed that this network is successful in terms of linking science and promoting investment, whereas in other countries the different networks responsible for the internationalisation of science and the internationalisation of investments are generally working still separately and not synergistically.

[43] Swissnex is a public-private partnership between government, research institutes and the business community: https://www.swissnex.org

7 ANTICIPATING THE FUTURE

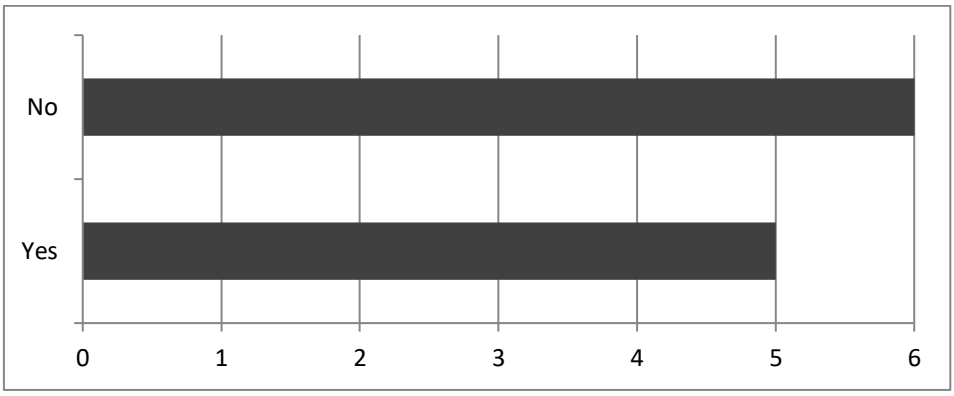
It is important to learn from past experiences, but a strategy must also remain open and dynamic in order to respond to new challenges of perceived future trends and important developments.

The time horizon of national R&I strategies as well as R&I internationalisation strategies is often around 10 years. Given the diversity and speed of developments which could be experienced in the last 10 years, this duration might seem quite long, because change processes can gain considerable momentum. Accelerated and targeted technical developments, global exchange of information or the ever-faster growing knowledge base are not just changing modern societies technologically. They also propel socio-technically interlinked iterative dynamics that shape everyday life as well as social structures, institutions and their actors. In view of artificial intelligence (AI), autonomous robotics, nano- and quantum technology, gene-editing or synthetic biology (Zweck, 2018), global challenges in the field of climate change, the preservation of biodiversity, dwindling natural resources, demographic and migration challenges, challenged systems of world trade and global economy, civic and religious crises, political and increasingly also military uncertainties, this dynamic will hardly be reduced.

Moreover, there are also new forms of R&I organisation that result in largely decentralised research landscapes, which are global and open to research-driven organisations and individuals (Leitner, 2018). They act to a large degree autonomously and are quite often not known to the government. The increasingly geographical, disciplinary and institutional cross-border self-administration of research through open research platforms is becoming a regular practice. At the same time also a growing share of 'dark science and knowledge', and an increasing loss of influence of public policy on the operations of multinational enterprises (MNEs) can be witnessed (irrespectively if one considers this as 'good' or 'bad').

Therefore, it is important that any strategy also anticipates latent or upcoming challenges in order to respond to them with adequate alternative interventions. The increasing complexity and insecurity in the international arena, which is probably less predictable than the national arena, has to be reflected, especially in an R&I internationalisation strategy, whose intention is more than the administration of old-established and sometimes toothless agreements.

Figure 16: Organisation of 'future anticipation/foresight' in the field of international research policy-making



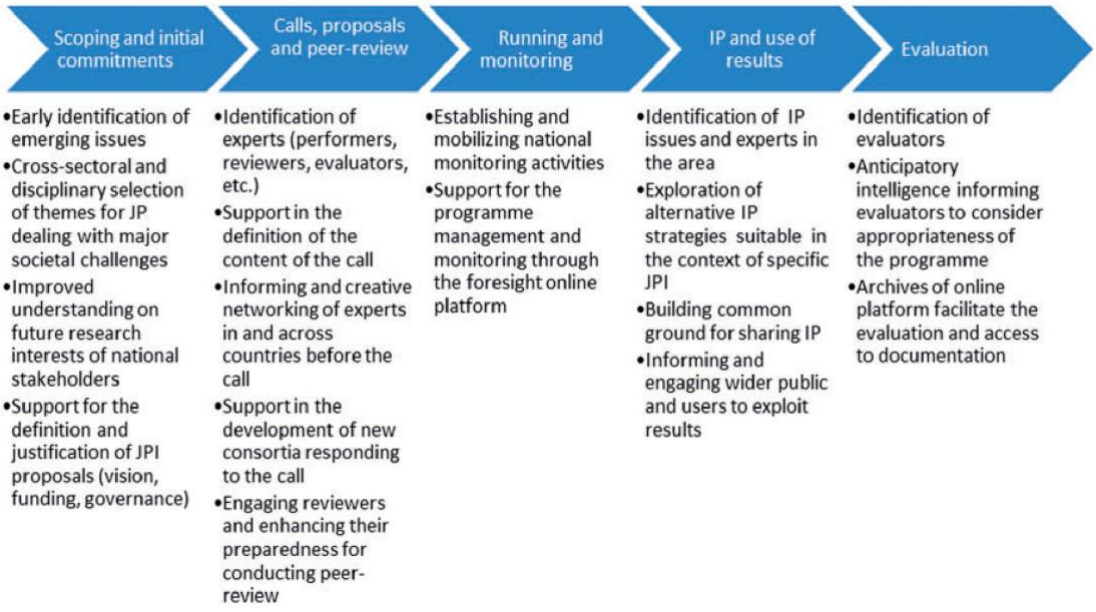
Source: Survey sent to MLE participants; own calculations; n=11

Foresight, including roadmapping and other methodologies to look into the future, can contribute to strategic planning. Some countries use these approaches to develop national R&I strategies and also to prepare for international cooperation. In Germany, for instance, the Federal Ministry of Education and Research (BMBF) operates foresight exercises to provide a basis for decision-making for the current research and innovation policy. Also for the preparation of Horizon Europe (2021 to 2027) a foresight process was used for the first time (BOHEMIA project; see Weber et al., 2018).

As can be seen from Figure 16, around half of the countries participating in this MLE, which responded to the survey, have already organised 'future anticipation' in the field of international research policy-making.

Achieving the benefits of foresight activities in support of international R&I cooperation is related to the appropriate positioning of foresight design and management in the overall programming processes. Könnölä and Haegeman (2012) consider the role of foresight as an integrator of international R&I programming functions, which structures the engagement of stakeholders from different countries, sectors and disciplines and facilitates and speeds up the implementation (see Figure 17).

Figure 17: Foresight as an integrator of different functions of international R&I programming.



Source: Könnölä and Haegeman (2012)

Among different foresight methods, roadmapping serves in particular the mid-term strategy design in order to coordinate activities towards future goals. The term roadmap is also used today in a broader sense to plan joint actions or share resources effectively (see, for instance, SFIC). Although foresight or roadmapping processes are yet hardly used for anticipation and planning in the framework of R&I internationalisation strategies, Stahl-Rolf and Noetzel (2018) argue, that international cooperation in R&I could benefit from them, not at least to use international cooperation-related foresight and roadmapping directly to identify important partner countries and topics and to pursue long-term goals together. One example mentioned by Stahl-Rolf and Noetzel (2018) is the recent roadmap development process for the German-Russian education, research and innovation cooperation, which involved university associations, vocational training institutions as well as research organisations, funding agencies and intermediary organisations from both countries.

Box 7: Examples of future anticipation in international R&I policy-making

Examples of future anticipation in international R&I policy-making

A few other examples have been realised in a number of international-oriented ERA-NET-and INCO-NET projects funded under FP7 by the European Commission: in the ERA-NET projects with Russia (Spiesberger et al., 2011) and India (Blasey and Degelsegger 2012), as well as in the INCO-NET projects between the EU and Southeast Asia (in the first phase of the SEA-EU-NET project, Degelsegger et al., 2011), and between the EU and Latin America / Caribbean. Individual foresight elements, such as scenario workshops, were also used in evaluations such as those of the international programme portfolio of the Austrian Science Fund (Degelsegger et al., 2017).

The main purpose of these foresight exercises was firstly to identify cooperation formats and cooperation geographies for international cooperation between the extra-European target regions or international partner countries, on the one hand, and the European Union and a variable geometry of EU MS and countries associated to FP7, on the other hand, and, secondly, to define steps for implementing the jointly identified cooperation objectives. These were then summarised in an action plan and a roadmap for the timing of actions. In the ERA-NET projects mentioned above, also promising research themes for bi-regional R&I cooperation were identified and applied in a number of subsequent calls for proposals.

Roadmapping or other foresight exercises, are however, seldom, if at all, applied at national level for the purpose of preparing the knowledge base for the development of R&I internationalisation strategies, although such exercises could contribute to a better understanding of future challenges and emerging trends. This is a pity, because it is typical for such exercises, that decision-makers are not just passively receiving results, but their active engagement is usually one of the operational requirements of such processes. In that sense, foresight can be also understood as a participatory practice for coordination. A special feature of foresight in international R&I policy is that the participating actors from policy and research funding co-determine future framework conditions of cooperation to a greater extent than in other foresight applications (such as in the private sector context) (Spiesberger and Degelsegger-Márquez, 2018). Depending on the design and resources of the foresight process, also scientists may be involved.

While several methods may be employed for foresight processes, most often a participatory design is used consisting of expert panels, workshops and joint scenario development processes to identify those variables (often referred to as 'drivers') which influence future cooperation frameworks. Sometimes online interactions (for example through Delphi-Surveys) are combined with offline interactions in workshops (e.g. focus groups) to enable the identification of drivers, their validation and the estimation of measured values ('forecasts') at the envisaged time horizon. The development and elaboration of detailed future scenarios as well as the appropriate selection of normative scenarios are typically carried out in offline workshops, often followed by desk research-based formulation of the scenarios by the process owners (Spiesberger and Degelsegger-Márquez, 2018).

Foresight for international science policy, however, requires a minimum of resources (typically a few tens to a few hundreds of thousands of euros for human resources, workshop budgets and travel expenses). A characteristic of foresight processes is also essential here: they must always be adapted to the respective context and do not function as a recipe, but rather as an interactive process. In that sense, meaningful forward-looking exercises for the purpose of informing developers of R&I internationalisation strategies can also be realised with limited budget resources (up to €30,000).

During the MLE Workshop in Paris, a short exercise on horizon scanning was implemented, which focussed on three levels of perspective:

- Geopolitics and STI-policy related framework changes
- The global biosphere challenge to secure a planet worth living
- The global social needs challenge to sustain or improve quality of life.

The summary of this exercise is provided in the boxes below.

Box 8: Horizon scanning: geopolitics and STI-policy-related framework changes

Horizon scanning:

Geopolitics and STI-policy-related framework changes

A starting point for the discussion was the current existence of rather huge geopolitical challenges and quite a lot of uncertainty emerging from countries outside Europe, as well as from actions inside Europe such as terrorist attacks and anti-democratic movements. The circumstances that give rise to such challenges were considered to be complex and the geopolitical horizon therefore potentially changing fast in entirely unexpected ways. It was concluded that even if we have to be prepared for surprises as 'we cannot foresee the unexpected', there is much to be learned from analysing trends regarding e.g. demography, economic developments, political alliances and partnerships. It was also emphasized that it should be kept in mind that considerable geopolitical challenges have existed previously, and that there are lessons to be learned from history, even though not all historical cases are relevant for the contemporary situation.

It was discussed to what extent and how geopolitical considerations drive internationalisation of STI-policy. China was mentioned as an important factor in this respect, and it was reported from many countries that cooperation with China is important. All large powers, e.g. the US, India, Russia, Japan, Brazil etc., were perceived to be important as STI-policy drivers, and science diplomacy was considered to be an important element in this respect. It was mentioned that China knows much more about what is happening in the EU and about European countries than we know about China. One conclusion regarding China and other countries outside Europe was that there is a need for more comprehensive and profound analysis of both the present situation and the ongoing developments.

There was a demand for a broader approach to what geopolitical considerations drive changes of STI-policies and internationalisation of higher education. Digitalisation, migration as well as climate and environmental changes were mentioned as examples. A general view was that geopolitical drivers of change are emerging from both human behaviour and nature. It was emphasized that there is a need to combine the international relations perspective with knowledge on the interplay between nature and human activities in order to understand the contemporary situation. An important suggestion was that the EU as well as EU member states and associated countries should develop strategic intelligence so that their understanding of geopolitical drivers of change could be improved and the problems these give rise to could be counteracted and maybe turned into opportunities.

Several examples of obstacles and hindrances for managing challenges jointly were given. Erosion of the democratic value base was considered to be a serious obstacle to joint action. Other political hindrances mentioned were changes in government at different times in different countries and difficulties for politicians and researchers to trust each other, be open and have a fair dialogue. In addition, a range of examples were provided on difficulties to implement STI policies.

There were a lot of suggestions on how to overcome the obstacles that were identified. Some of these were practical, such as the creation of spaces where researchers and politicians could exchange ideas and opinions freely. It was commonly considered very important to strengthen the links between policy and implementation with the ambition to simultaneously improve the understanding of the local conditions among national and international policy-makers and make local and national actors better understand geopolitical constrains. It was argued that a series of relevant measures must be undertaken in order for this to be accomplished.

During the discussion there was relatively broad agreement on the following important points and suggestions. The geopolitical challenges are now of a magnitude that no single country can tackle them on its own. Global overarching goals such as the SDGs are of great importance, but STI policy cooperation is needed in order to better understand both what is going on and how geopolitical problems, at least partly, can be counteracted with the help of knowledge regarding conditions for implementation of e.g. SDGs. As a complement to the long term STI investments, a need to establish networks of people with strategic intelligence was foreseen. The members of these networks should help to avoid unwanted geopolitical developments and also be prepared to act if a geopolitical crisis of some kind should occur.

Summarised and compiled by Gunnel Gustafsson (Chair of the MLE)

Box 9: Horizon scanning: the global biosphere challenge to secure a planet worth living

Horizon scanning:

The global biosphere challenge to secure a planet worth living

How does the global biosphere challenge drive STI internationalisation strategies until 2030?

The global biosphere challenge to secure a planet worth living encompasses issues such as climate and energy; environmental protection, resources and eco-systems; health. Global change in biosphere is driven largely by population growth of people and the use of animals as pets or for food industry; and by how the well-being of these populations are obtained and perceived. ***The biodiversity of ecosystems is particularly high in many less developed countries of which sustainable management requires global cooperation***. Hence, this challenge calls for international R&I strategies to be part of the solution, which in turn creates opportunities and demand for R&I and the internationalisation of such activities.

What dangers and obstacles might occur and need to be tackled?

The perception of the urgency for action to curb environmental impacts affects the pace and intensity of any efforts. In general, the lack of perceived urgency slows radically down sufficient behavioural and technological changes in society. In China, for instance, environmental issues took a different pace only after serious health problems became evident in main cities. Is it necessary to live a similar 'catastrophe' in Europe and other countries, to create a sufficient momentum for a global action? The perception of the urgency for action is also related to the credibility of science and how false information like 'fake news' affect public and ultimately also political decision-making. The new challenges may emerge also from the solutions developed to reduce pressure on biosphere. For instance, while the health and environmental risks of the disposal of batteries for electric vehicles is a currently actively debated topic, tomorrow may emerge different topics that should be somehow anticipated by the scientific community.

How should international R&I cooperation be shaped and designed to make positive contributions?

The climate mitigation and adaption efforts are the case in point, as there are major efforts both for achieving global agreements as well as developing active grassroots initiatives in search for win-win-win solutions that offer profitable but also environmentally and socially sound alternatives. Thus, ***the biosphere challenge relates to a complex alignment task among countries, sectors, stakeholders and also disciplines***. For the international R&I community this is also a major opportunity to demonstrate its capacity to have impact.

The alignment and coordination and even pooling of resources and efforts for this challenge may benefit through further linkages different other areas of similar needs. For instance, in the area of artificial intelligence (AI) the coordination among European and third countries may also lead to smart solutions to curb global change, while addressing the highly competitive environment dominated by GAFA[44] and other MNCs.

The issue of the credibility of science in addressing and solving the biosphere challenge requires also coordinated efforts, through the development of evidence base, communication, education and the engagement of stakeholders. This provides further rationales for developing citizen science and open science. For the multiple implications immanent in science governance for biosphere challenge, learning from best practices in this area may benefit the sound development of international R&I strategies. For instance, Sustainable Development Goals have been noted as an increasingly important common framework for committing countries and stakeholders to action and searching for common ground for cooperation. Still, it is worth asking how the goals are articulated and if they are operational enough or if a more detailed framing is needed to enhance and share understanding.

To tackle the global biosphere challenge, Europe with is knowledge base may serve as a 'lab' for piloting solutions, which can later on provide the basis for creating global impact through collaboration with third countries. Such collaboration may also begin directly with third countries to create together new solutions for different markets and local conditions. Furthermore, Europe may also learn from third countries, for instance from the cultures and sustainable living practices in Africa. Further ***research on social aspects to better understand the social change and the diffusion of innovations***, but also to develop smart policies, should also be brought up in the internationalisation of R&I strategies.

Summarised and compiled by Totti Könnölä (Independent expert)

Box 10: Horizon scanning: the global social needs challenge to sustain or improve quality of life

Horizon scanning:

The global social needs challenge to sustain or improve quality of life

The third topic of the World Café on Horizon scanning discussed how the challenges of global social needs to sustain or improve quality of life drive STI internationalisation strategies. ***Examples of urgent social issues discussed were urbanisation, migration, terrorism, increasing poverty and a widening divide in society caused by automation and digitalisation.*** By definition, they encompass issues that cannot be tackled by one country alone and rely on transnational cooperation in policy. There was overall agreement that prerequisites are more public awareness-building on the social issues as well as a change of behaviour in society and policy communities to avoid that solutions are sought on a national basis only. In addition, it was suggested that ***more 'humanistic' technologies are needed***

[44] GAFA stands for Google, Apple, Facebook and Amazon

with a stronger focus on prioritising human wellbeing and not solely industrial competitiveness.

Global social needs and challenges are already part of the discourse in the STI community demonstrating awareness that science has a role to play to tackle these challenges. In order to increase the impact of national actions, alignment of national strategies is an obvious route to follow. Nevertheless, ***the influence of these social needs on the STI internationalisation strategies in the MLE countries is minimal.*** These strategies are mostly developed from a deep-seated national perspective. The social challenges could even increase a divide between the European countries as the effects of these challenges are quite different in countries with different development levels, risking more tensions between EU countries rather than a propensity to align national strategies. One solution that takes this into consideration is to ***create different associations of countries facing similar issues and start with STI cooperation initiatives regionally.***

A greater awareness of the social needs in STI policy is likely to trigger a stronger focus on ethical issues in STI collaboration. Partner countries will be scrutinised for their own considerations with social challenges. Thus, the geographical direction of STI partnerships might change orientation as a result.

An important obstacle that hampers the impact of scientific efforts addressing social needs is the lack of policy integration within member states and at European level. A better use of research results in the social domain requires a closer integration between STI policies and other policy domains such as social, urbanisation and national security policies. ***For science to contribute with solutions a better dialogue with these other policy domains needs to be fostered.***

An additional obstacle is the generally underfunded position of Social Sciences and Humanities (SSH) in many countries***. SSH should play a larger role in tackling the global social needs.*** SSH needs to be better integrated with other science and technology disciplines in STI collaboration activities. It was suggested that, as ***many countries are locked in with a silo approach to their funding mechanisms for SSH***, the European Commission could take a lead role in giving a more prominent and integrated role to SSH in Horizon Europe and STI collaboration. Another suggestion was that countries could join up national pools of (social) data on the road to finding joint European solutions with the help of Big Data. The EU could launch focussed programmes for that purpose.

A way to increase the impact of STI efforts is ***to involve more companies in programmes for new forms of innovation,*** as is done in some national programmes supporting social innovation and frugal innovation (e.g. in collaboration with developing countries). This allows social needs to be tackled while at the same time creating new business and jobs.

In the future a conceivable tendency should be reversed, that less and less people understand what science produces and how science contributes to tackling social needs. This comes back to the societal awareness of the upcoming challenges and the role science can play to address these challenges***. A closer link between education, research and culture is needed to avoid a societal divide and to keep future generations interested in supporting the role of science in society***.

Summarised and compiled by Patries Boekholt (Independent expert)

8 ASSESSING PROGRESS

As for any other strategy it is important to check the progress of implementation of R&I internationalisation and to identify and assess the results and impacts which can be attributed to it. Of primary interest is to understand how and to what extent the internationalisation activities derived from the internationalisation strategy contributed to the objectives stipulated by the strategy.

Modifying the phase model of Edler and Flanagan (2009), one can differentiate three interconnected phases of assessment and evaluation: Firstly, an evaluation to describe and assess the status quo of the internationalisation of the R&I system. This is usually done ex-ante, i.e. before an R&I internationalisation strategy is developed and adopted, respectively ex-post, i.e. at the end of the stipulated duration of the strategy. This ex-post assessment can be taken as the starting point for the next edition of the R&I internationalisation strategy. Secondly, the embedding of the R&I internationalisation strategy should be continuously monitored when new national and European initiatives, programmes and instruments are developed. Thirdly, the most important initiatives, programmes and instruments should be evaluated to verify if they work in the way in which they were designed. Such evaluation of single programmes and instruments, or of portfolios of programmes and instruments, are done to verify their relevance, effects (outputs and results) and – if possible – impacts.

Any evaluation is confronted with the so-called attribution challenge, i.e. the logical and de facto connection between inputs (i.e. certain interventions), outputs, results (or outcomes) and impacts. While outputs can be relatively easily attributed to certain activities triggered (and usually also funded) by certain interventions, outcomes (i.e. the direct effects on the intended target groups) and especially impacts (i.e. the longer-term effects on the final beneficiary groups or systems not directly targeted by an intervention) are more difficult to grasp and to assess.

Another problem is the adequacy (i.e. relevance, reliability and validity) of the used indicators. Indicators should be capable to capture and measure the basic properties and objectives of the R&I internationalisation strategy and its underlying Theory of Change. There are no one-size-fits-all indicators. Different indicators are needed for different considerations. It is strongly advised to combine quantitative with qualitative assessments. Unfortunately, the Frascati and the Oslo Manual of the OECD, which is also used by Eurostat and many national statistical offices around the globe, provide limited scope for R&I internationalisation. Thus, specific indicators need to be constructed, which should dispose over metrics, which are universal, precise, unambiguous and relevant.

The lack of widely acknowledged benchmarks in the field of R&I internationalisation makes it difficult to set targets. To give an example: Should a country in which 15% of all professors employed in universities are coming from abroad invest in attracting even more or not? There is no universal answer and there are definitely no optimum benchmarks available, because the context factors are varying. Thus, comparisons with other countries should be cautiously made. Relative benchmarks (e.g. by using control points over a couple of years or by comparing only with comparable countries) are thus recommended.

Probably more difficult than the identification of adequate indicators for certain questions is the issue of data availability. Often R&I internationalisation data are uneven and have limited comparability. Thus, a good monitoring system, based e.g. on the availability of well-maintained current research information systems (CRIS) is advantageous. For comparative bibliometric-based analysis however, a certain dependency from commercial data providers (e.g. SCOPUS or Web of Science) can be ascertained. Due to the increasing use of persistent digital identifiers such as ORCID, more and better studies and

international comparisons can be implemented in the future. Also aggregated information systems, such as KNOWMAK,[45] will provide soon an alternative to some commercial offers.

Since often monitoring data as well as secondary data on R&I internationalisation (which however could be regularly recorded by the national statistics offices within the R&D surveys) are not sufficient or available, surveys are still needed. They are costly and often only one-off projects, although for assessing the progress of R&I internationalisation they should be repeatedly implemented for monitoring purposes. Thus, several studies already recommended launching pilot surveys on European level or at least by a couple of European countries on variable geometry (Vullings et al. 2012). This would not only increase comparability between countries but also contribute to a standardisation of indicators.

In the following paragraphs some examples of R&I internationalisation indicators are shown which are repeatedly mentioned in studies. In general, there is no shortage of indicators (but of data). Extensive lists of indicators have been compiled by Brandenburg and Federkeil (2007) for measuring internationality and internationalisation of higher education institutions and by Schuch (2011) for measuring the internationalisation of science and research. Such R&I internationalisation indicators can be grouped in different categories depending on the respective purpose. As follows, a distinction is made between R&I internationalisation indicators at the level of:

- Embedding of an R&I internationalisation strategy;
- Systems level;
- Organisations;
- Individual researchers.

Box 11: R&I internationalisation indicators

R&I internationalisation indicators

Indicators related to embedding of the R&I internationalisation strategy

Examples:

- How many of the national programmes/instruments/tools have an R&I internationalisation component (or are fit and open for it in general) (mainstreaming)?
- How much budget is allocated for R&I internationalisation in these programmes/instruments/tools?
- What is the scope and size of targeted (uni-, bi- and multi-lateral) R&I internationalisation measures?
- Number of participation, volume and share in European or international R&I schemes (JPIs, int. ERA-NETs, international research infrastructures etc.)

Indicators at system's level

Examples:

- Financial indicators (R&D budget inflow/outflow; share of high-tech exports)
- International representation related indicators (R&D offices abroad; staff in international R&I organisations; participation in regulatory or standards setting)

[45] KNOWMAK, a project funded by the European Commission under Horizon 2020, provides European wide comparisons on a number of scientometric indicators, including number of international scientific publications, number of transnational patent applications or number of EU-FP participations, by countries or even at the regional level. https://www.knowmak.eu/dashboard

- Scientometrics (publications and co-publications differentiated by themes, countries, regions; EPO and USTPO patents)
- Mobility patterns (share of foreign academic staff at public research organisations and universities; share of international students/graduates)
- Project related indicators (e.g. juste retour from FPs)

Indicators at the level of organisations

Examples:

- Financial indicators (e.g. export quota of the R&I organisation; international licensing income)
- Scientometrics (co-publications & impacts; patents)
- International rankings
- PR and altmetrics related indicators (google and social media metrics)
- Personnel related indicators (international appointments; share of foreign personnel)
- Mobility indicators (guest professors; international students/graduates)
- Offshoring and int. joint ventures
- Project related indicators (participations, coordinations, raised international third party funding)

Indicators at individual level

Examples:

- Publication related indicators (quantity and quality)
- Patent related indicators
- Scientific and non-scientific speeches (conference participation)
- Participation in international bodies (e.g. advisory groups of the EC; editorial boards …)
- Mobility related indicators (e.g. international research stays; international appointments)
- Degrees obtained abroad
- Number of supervised international students including cotutelle de thése
- Project related indicators (e.g. participation in FPs; coordination of FP projects; international funding raised)

For assessing the status quo of R&I internationalisation of a certain country or region, the embedding indicators and the indicators at the system's level are the most relevant ones. However, even though such indicators might give a good overview in terms of activities, most of them can hardly be used to measure the impact in terms of e.g. lasting networks, thorough dissemination of knowledge, in/sufficient innovation, or environmental and social challenges (Fikkers and Horvat, 2014; Gnamus 2009).

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This Thematic Report discusses main policy challenges and practices about the design and development of national strategies for international research and innovation (R&I) cooperation; including objectives and theories of change for international R&I strategies, selection of countries/regions and thematic priorities, the embedding and alignment challenge, the coordination challenge in developing and implementing R&I internationalisation strategies, the task of anticipating the future, and suggestions on how to assess progress in R&I internationalisation policy cooperation. The report includes the results from the first Working Meeting of the Mutual Learning Exercise on 'National strategies and roadmaps for international coopration in R&I', which was held in Paris on 3rd and 4th June 2019.