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Going global

Enhancing international cooperation in EU research and innovation

Report of the Science|Business Framework Programme Working Group

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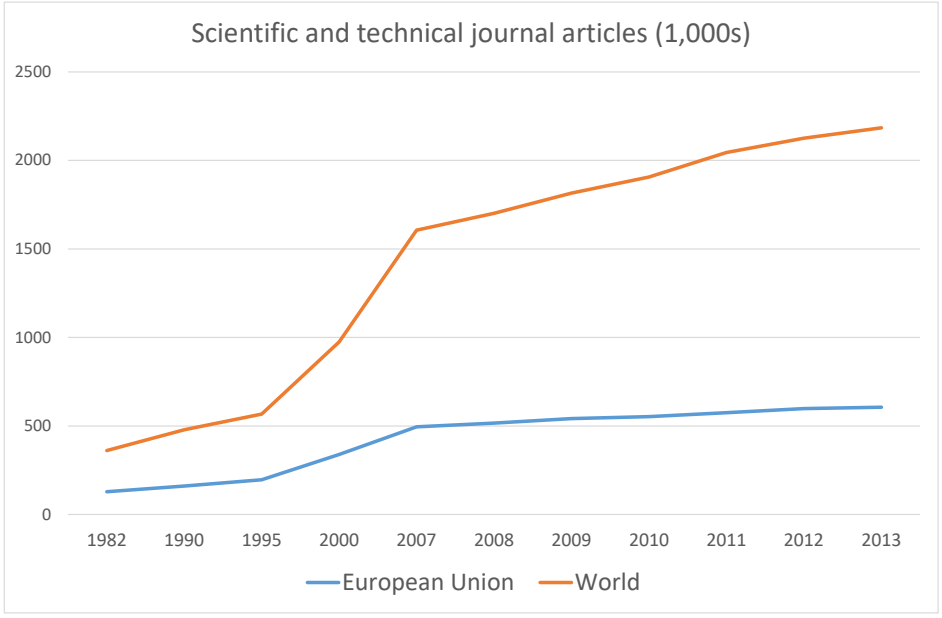
Enhancing international cooperation in EU research and innovation

Cooperating internationally in science and technology is important. Be it the urgent threat of climate change, major health scourges or achieving sustainable economic growth - all require a huge collaborative effort in science and technology to invent new solutions.

International cooperation is used in this report to mean collaboration by EU Member States (MS) and countries associated to the Framework Programme with third countries around the world. In discussions on this topic, it is worth reflecting on the fact that intra-EU cooperation is now assumed, showing just how far the EU has come. Indeed, international cooperation (IC) in research and innovation (R&I) has a long history: from the spread of Greek philosophy to the Library of Alexandria, and from the Islamic 'House of Wisdom' to the Colleges of Oxford and up to the International Space Station. This progress has been closely tied to trade routes, globalisation and development — and remains so, with the generation of new knowledge accelerating, particularly beyond Europe's boarders. Indeed, based on current trends in scientific publications and patents, Europe is slow-marching its way to lower significance; China, India, North America, the Asian Tigers and other parts of the world are sprinting ahead. So Europe needs international partners.

EU research: Losing the journal wars?



Notes: Scientific and technical journal articles refer to the number of scientific and engineering articles published in the following fields: physics, biology, chemistry, mathematics, clinical medicine, biomedical research, engineering and technology, and earth and space sciences. Source: World Bank (2017a)

Typically, international cooperation in R&I has occurred on an individual, institutional or company level, with the pursuit of knowledge, progress or profits as key drivers. But international cooperation has also been important to the European Project, on a political level, from the early days, with the European Organisation of Nuclear Research (CERN) established in 1954, followed by the COST Association in 1972 and EUREKA in 1985. Since 1983, the EU's Framework Programmes have institutionalised and accelerated global R&I cooperation in EU policy.

Why do it?

What's the point of cooperating internationally? After all, in this political climate there are plenty of loud voices calling on politicians to put their own citizens first, and ignore the rest of the world.

First, it is argued, international cooperation improves the quality of R&I (its 'excellence') — benefiting all parties through sharing access to world class research institutions, funding mechanisms, R&I networks, data, knowledge, expertise, value chains and markets. This improvement of scientific excellence through IC is reflected in the higher quality of international co-publications and in European Commission statistics on the higher applicant success rates of consortia containing third countries.

Second, it generates critical mass in an era where research, research infrastructures and innovation are increasingly costly. It aligns national R&I policy agendas to tackle common challenges which alone would be unsolvable. Furthermore, cooperation supports the EU's external and development policies (science diplomacy) whilst increasing the attractiveness of Europe itself (European Commission, 2017a).

Main benefits of international R&I cooperation

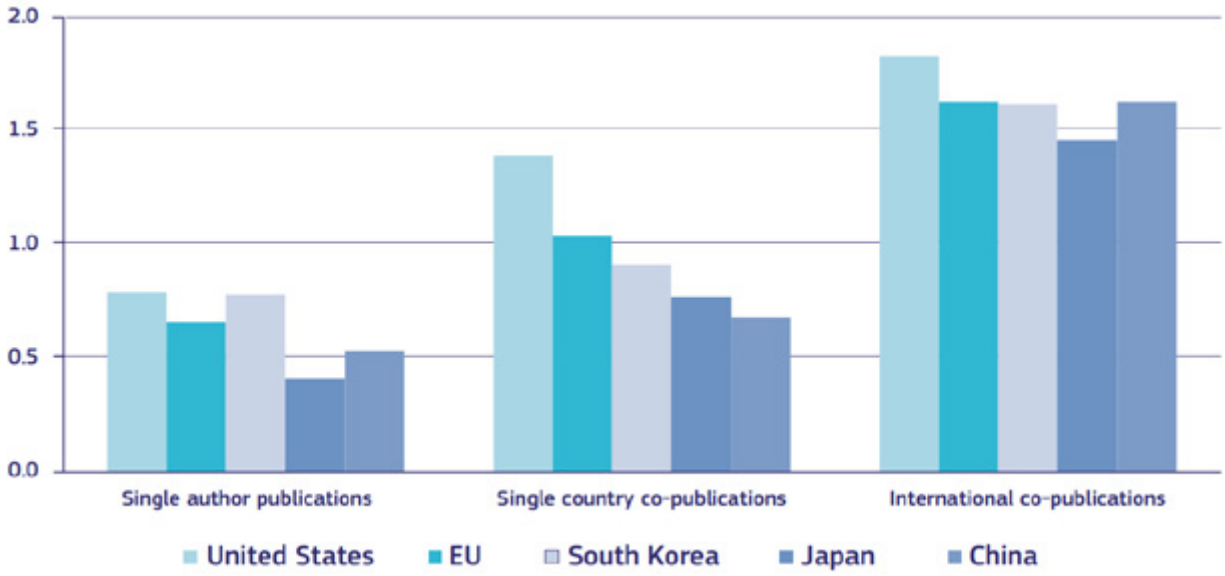
- **Higher quality**
  Aggregate research quality is commonly measured by the number of citations that publications get – and research conducted internationally receives a greater number of citations. For business, internationalisation raises R&D intensity through exposure to new ideas and competition (Department for Business Innovation and Skills (UK), 2011). This has many underlying reasons; but in principle, opening up competitive calls for funding to global markets increases the pool of project ideas to choose from, raising the standards of those that get funded.

- **Access to world-class knowledge and talent**
  International cooperation opens the door to new ideas, intellectual property, data and, of course, people.

- **Access to R&I infrastructure**
  It avoids duplication of expensive synchrotrons, supercomputers and other 'Big Science' facilities.

- **Pooling of resources**
  It builds critical mass in areas where this is required, particularly in tackling the grand societal challenges. For example, the EU has contributed greatly to research on climate change: the Intergovernmental Panel on Climate Change has cited over a thousand publications from EU-funded projects (European Commission, 2016a; Stocker, T., et al., 2014).

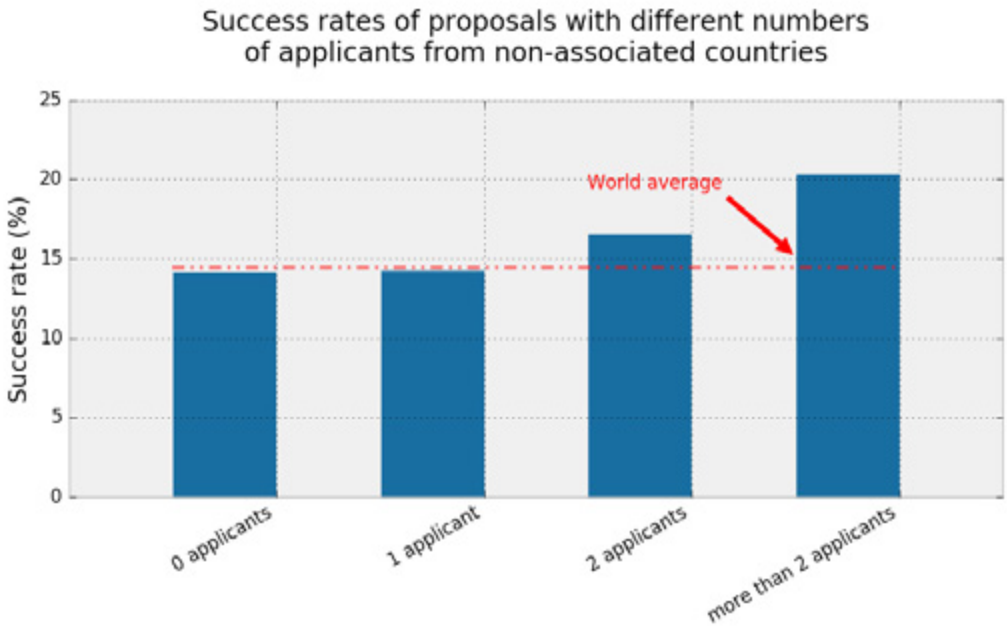
It pays to have an international partner: Citation rates



Average Relative Citations (ARC) of publications by type of co-operation, 2010
NB: An ARC value above 1 means that a given entity is cited more frequently than the world average, while a value below 1 means the opposite.

Source: European Commission, (2016a)
Data: Science-Metrix (Canada), based on Scopus database

It pays to have an international partner: Grant success



Notes: Data for collaborative projects of Horizon 2020. Success rate is the ratio of mainlisted over eligible proposals. Not included: Calls that are coordinated or joint with third countries. Actual numbers: For 0 applicants, there were 3,651 successful proposals out of 25,699 overall. For 1 applicant: 222 out of 1,559 overall. For 2 applicants: 87/522. For more than 2 applicants: 153/748.

Source: DG RTD – International Cooperation
Data: CORDA (JRC, EIT & art.185 not included), extraction date 19.04.2017

- **Creation of new networks**
  It increases the flows of knowledge and creates partnerships, increasing innovative capacity (Zeng, et al., 2010) and research quality (Abbasi, et al., 2011).

- **Science diplomacy**
  Cooperation in R&I is often less political than other fields and so provides a tangible area of cooperation upon which other areas of the EU's external policy can build. It also generates a better understanding of other cultures and needs, allowing for more informed external policies. (Sher, 2014). Furthermore, it helps the EU achieve its international responsibilities such as the Sustainable Development Goals.

- **Raising the EU's profile**
  It enhances the EU's image as an attractive place to work and live through open policies, exchanges of researchers and the provision of opportunities to third country nationals.

- **Access to markets and supply chains**
  It provides a foothold in markets which otherwise might not be accessible, facilitating trade, public procurement and venture capital. This in turn brings opportunities and innovations to more people, whilst ensuring the fair handling of intellectual property. As such, internationalisation boosts the productivity of investments in R&D by enabling companies to gain more knowledge from international markets, to participate in new value chains and to reap greater benefits from growing markets outside the EU.

- **Evidence-based decision making**
  It permits sharing and developing complementary policy approaches based on the best available evidence to address shared challenges. For example, MS and associated countries can seek peer-review of their domestic R&I policies through the Policy Support Facility (Joint Research Centre, 2016).

How does it work?

The EU designed Horizon 2020 to be as open as possible to participation from across the globe – and a somewhat elaborate system has evolved to manage it. This includes several types of Horizon 2020 calls for grant proposals, some of which aim at specific parts of the world – such as the Partnership for R&I in the Mediterranean Area (PRIMA) to improve food and water security. An advisory body of the European Council, called the Strategic Forum for International Science and Technology Cooperation (SFIC), provides a forum for these priorities to be discussed among the Member-States.

There are several forms of cooperation. Coordinated Calls are agreed through joint steering committees with international partner countries. The EU and a third country agree upon the content, funding, evaluation procedures, timing and other procedures, but both issue legally separate calls which run in parallel: for example, the EU-Japan Coordinated Call on Net Futures (European Commission, 2014). By contrast, Joint Calls are jointly managed with a third country, rather than separate calls run in parallel. Another form of cooperation can involve Third Party Entities from industrialised countries (so, without funding) which are unable to sign a grant agreement. Participants from those countries must be contracted to a regular participant who must obtain the intellectual property rights from the third party as if results were generated by the full participant itself.

There are several categories of countries involved. 'Associated countries', like Norway and Israel, can participate and receive funds from all parts of the programme, including single-beneficiary grants, just like an EU Member-State. Each Associated Country contributes to Horizon 2020 an amount based on its gross domestic product – though, for some countries like Tunisia, the contributions are partly reimbursed by EU external funds. Developing countries are automatically eligible to receive funding for participation in collaborative projects of Horizon 2020. Industrialised countries are eligible to participate but do not automatically get funding; as a result, several of these countries have established 'co-funding mechanisms.'

The Commission issues a bi-annual report on the implementation of the International cooperation strategy, that includes a set of country-specific roadmaps for R&I cooperation. Furthermore, the Commission has formal science and technology agreements with several third countries that are guided, reviewed and reported by joint steering committees (SWD(2014) 276).

Despite these efforts, however, Horizon 2020's open-door policy has had fewer targeted efforts. In contrast to its predecessor, Framework Programme 7, Horizon 2020 dropped a dedicated international cooperation 'theme' from the budget. The funding eligibility rules changed for Brazil, Russia, India, China and Mexico – five significant partners under the old programme. So the results suffered. According to the Commission, "only 11 per cent of Horizon 2020 grant agreements include one or more partners from outside the EU Member States (MS) and the Horizon 2020 Associated Countries (AC), compared to 18.5 per cent under FP7" (European Commission, 2016b).

To correct this, the Horizon 2020 work programme for 2018-2020 is to contain a list of flagship initiatives of large scale and scope on topics dedicated to international cooperation in areas of mutual benefit. The Commission intends this to spur more activities targeted to third countries, for instance making international cooperation required or encouraged in specific areas.

But cooperation goes beyond Framework. The EU also participates in many multi-lateral R&I initiatives such as the Intergovernmental Panel on Climate Change (IPCC) and the Global Earth Observation System of Systems (GEOSS) that will link satellite systems world-wide. It also works with the OECD and other organisations to improve cooperation on framework conditions – the rules and context determining publicly funded R&I.

Recommendations

For the Commission, international cooperation is a tenet of research policy. It wants to be at the centre of a web of global science and technology. Whilst this may be beneficial for the EU, the question remains how efficient such devolved, regional cooperation is.

Looking forward to the next Framework Programme in 2021, the overarching challenge is how to make international cooperation work better. Should there be better targeted instruments? How can we balance the requirement for excellence with the need for greater cooperation?

- **Be more flexible**

To better tailor instruments to third countries, the Commission should allow more bottom-up collaboration - with third-country applicants approaching the EU for open funding calls, not restricted by topic area or a pre-defined R&I Framework (as in Joint Programming). The calls should be more flexible, fitting local contexts.

Bottom-up cooperation could also be advanced, not through potentially expensive and burdensome project calls, but through the exchange of researchers. Long-term scholarships, lasting more than the one-year standard today, encourage the exchange of people and ideas, fostering links between countries (Trippl, 2013). Whilst this will result in some brain drain, it will be offset against resultant knowledge exchange and network building. Such a bottom-up exchange has been extremely popular within the EU, through the Marie Skłodowska-Curie actions, and between the US and the EU (CIES, 2017). The resultant, long-lasting relationships could help third countries move towards the excellence required for EU grant funding. They also embed international partners in European R&I networks.

There are also many existing, bottom-up initiatives with which the Commission already collaborates, but with which more synergies remain possible. The COST Association has been expanding its international scientific networking activities, as a low-cost way to bring together researchers across borders. And EUREKA's GlobalStars instrument allows member-states of EUREKA to form partnerships in third countries to create an open call, with topics and funding agreed between them. Participants then apply through their respective and amended national R&I procedures (EUREKA, 2016).

- **Recognise local practices**

Whilst excellence should not be compromised, EU programme administrators should recognise that there are many forms of research and innovation, and excellence in it. In developing countries, there can be profound expertise in land management, fisheries, mining and other fields; examples

What does it do? Some examples…

Infectious and rare diseases. The European Commission has set up the Global Research Collaboration for Infectious Disease Preparedness (GloPID-R) to coordinate research on major outbreaks of infectious disease with pandemic potential. It quickly mobilised research on the Ebola and Zika outbreaks (Matthiessen, et al., 2016). Another health example is the International Rare Diseases Research Consortium (IRDiRC). Through it, funding bodies from 40 countries are sponsoring research projects to deliver 200 new therapies for rare diseases, and the means to diagnose most rare diseases by 2020. Rare diseases are a clear example of how it can be necessary to join forces internationally to tackle a problem that unfortunately does not reach a critical mass in a single, national research system.

Physics in the Middle East. International collaboration in large scientific facilities is nothing new; astronomy and particle physics have long depended on large-scale international infrastructure, such as the Very Large Telescope or CERN. A new infrastructure project, SESAME for Synchrotron-light for Experimental Science and Applications in the Middle East, is a "third-generation" synchrotron light source, and has drawn $90 million of investment from the member countries, UNESCO, CERN and others. As the first major international research centre for the Middle East, SESAME includes countries better known for their conflicts than cooperation, such as Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, the Palestinian Authority and Turkey. The site will welcome researchers from across the member countries and beyond. It acts as a beacon for international collaboration in science.

Water and food in the Mediterranean. Addressing water scarcity and its consequences is PRIMA, the Partnership for Research and Innovation in the Mediterranean Area. This project pools resources to address unsustainable agriculture, overexploitation of natural resources, poor nutrition, reduced biodiversity, and a decline in food culture. PRIMA has been awarded €220 million from the EU for a 10-year project, with an equivalent amount being made up by the member countries.

Earthquake monitoring. The EU is particularly vulnerable to the effects of earthquakes. The EU REAKT project has developed a system which monitors sudden increases in traffic on the European Mediterranean Seismological Centre and allows the origin of the earthquake activity to be identified within just two minutes. This is combined with data from online public behaviour to map out the affected areas and where action may need to be urgently taken.

abound of Western farming technologies – for instance, imported to India or Bali during the Green Revolution – boosting crop yields but harming biodiversity and ignoring local skills and cultures. There is also room for broadening the definition of innovation to include more social and cultural innovations.

This is not to say the EU should fund bad science; far from it. But those drafting calls, and evaluating applications, should be more sensitive to the wide range of research practice around the world. Without that, some of the most interesting, high-impact ideas will wither in the first round of Framework evaluations.

- **Simplify**

The Commission has striven to simplify its funding system in Horizon 2020. In the international area, it still has a ways to go. To a typical researcher or project coordinator, the various classes of countries, conditions and eligibilities are hard to keep track of. For potential partners from industrialised countries, it should be possible to standardise the system better, to allow participation through self-funding under rules that take into account intellectual property, jurisdiction and ethics.

Also, the administrative burden for third countries could be reduced through, for example, covering the costs of reporting and accounting, or simplifying these with flat rates. Additionally, greater efforts in arranging Science & Technology agreements, which reduce barriers to access, could be made.

Dealing with Brexit

Britain's referendum decision jeopardises a well-established and deepening cooperation with its EU partners. The danger of a loss of status and influence in global R&I for both parties can be avoided.

For decades, Europe's approach to shared governance in R&I has enabled it to tackle challenges that transcend national borders and sovereignty. The success of the EU programme, Horizon 2020, has attracted a growing number of associated countries — such as Iceland, Israel and Turkey. They enjoy equal rules of participation as EU MS, with an agreed funding contribution based on the respective weights of both partners' GDP. Such associations benefit all parties through shared access to world class research institutions, funding mechanisms, and R&I networks.

In the upcoming UK-EU negotiations, such a status for the UK is an obvious win-win, mitigating any transitional disruption. Researchers would be able to move to wherever they are needed, allowing the UK and the EU to cooperate in creating a competitive bloc which can attract global capital to devise global solutions — protecting and enhancing jobs, growth and our standard of living.

- **Be more strategic**

International cooperation is a means to an end, not an end in itself. The EU could well afford to think more strategically about when and how it cooperates. For instance, it could require reciprocity in all future S&T agreements with other countries. Or, to ensure reciprocal funding with industrialised nations, it could create a pot of matching funds, out of which EU grantees accepted into approved third-country programmes would get paid. The funding for IC should also try not to discriminate too heavily in favour of specific countries. This risks jeopardising wider science diplomacy goals, and the added value of generating international competition. Cooperation is – or should be – a two-way street.

- **Tweak intellectual property (IP) rules**

There is a well-established set of guidelines for managing intellectual property in Horizon 2020 projects, allowing flexibility case-by-case. However, in order to advance the open science agenda, the Commission should be available to help negotiate IP rules before activities start. They could then ensure open science is upheld wherever possible, as well as balancing negotiations between partners in different positions of power and in areas of strategic importance.

- **Spread open science**

If the EU is aiming for leadership in knowledge generation and use, then it should leverage international cooperation to advance open science. In order to achieve this, the EU could foster the exchange of good practise in open science internationally – for instance, through dialog between the Commission and third-country ministries. This exchange could be aided by the creation of a repository, or toolkit, which includes best practices of open science in international cooperation.

- **Coordinate better with member-state institutions**

The EU should consider making better use of the knowledge of the R&I context of third countries held by universities, industry, funding agencies and national diplomatic services. For example, better networking between the institutions and these organisations could be encouraged and a database for member-state R&I actions in international cooperation could be developed with and for members of SFIC. This would reduce duplicative or fragmented efforts amongst these institutions, and widen access to expertise of the Commission and the EU's diplomatic service. This would also inform the Commission of the barriers to international cooperation in different countries.

Conclusions

International cooperation in research is not merely about improving European science and technology. It is a tool for diplomacy, trade and peace. It lends a helping hand to developing countries and provides concrete areas of cooperation with other countries. It should not sit isolated as an add-on to the EU's internal R&I programmes. It is the very raison d'être of Europe and, like all values, should be borderless.

But the Commission's track record in international cooperation is a puzzling mix of highs and lows. Its ambition, in its Horizon 2020 targets, is high; and one should not forget that, at least by policy, Horizon 2020 can claim to be the most open R&I programme in the world. But in practice, there have been many problems: Difficulties with funding, IP agreements, evaluations, local politics and geopolitics.

In advancing international cooperation in R&I, the EU must listen closely to third countries and act to lower barriers to cooperation. It must get more flexible in how it deals with, invites and evaluates third-country researchers. It must coordinate better between its research and diplomatic departments, both in Brussels and in the EU missions. It must coordinate its R&I programmes with other international policy areas, from health to trade.

The march of globalisation has been, and will be, led by science and technology. So Europe is right to keep itself at the vanguard of international cooperation in this field. But with other global actors moving up the ranks, it may be hard for our European culture of R&I, and the values they carry, to shape the future rules of cooperation and globalisation. Therefore, now is the time for Europe to use its leading position to shape these rules and spread our values – making European science and technology truly open to the world.

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