OECD Science, Technology and Innovation Outlook 2016

Policy Profile

Cross-border science, technology and innovation governance arrangements

Rationale and objectives

Cross-border governance of science, technology and innovation (STI) involves the partial or total delegation of policy making from the national to the international level. It implies, among other things, international co-ordination of national policy initiatives, removal of obstacles to the movement of resources, setting of international standards and regulations, and transfer of authority to intergovernmental organisations or supranational structures. It is part of a wider dual delegation process that gives a greater say in STI matters to the international, but also to the sub-national, level of governance. There are good scientific and economic arguments for extending the scope of STI governance beyond national borders (OECD, 2012):

- International scientific co-operation often increases impact as measured by citations of publications, as pooling expertise and resources under international governance, often using more rigorous oversight, fosters scientific excellence (OECD, 2013a);
- R&D and innovation are characterised by pronounced economies of scale and scope. In areas such as the increasingly transnational "grand challenges" (demographics, environment, energy), but also in some S&T disciplines (notably aerospace, some areas of physics), fixed costs exceed levels that could be covered by any one nation alone. Opening up national research systems to outsiders (e.g. through participation in joint R&D) may increase the variety of applications and have valuable learning and demonstration benefits (Mowery, 1998).
- The generation, diffusion and application of knowledge have significant international externalities: some of the benefits and costs of national STI efforts take place outside national borders. From a global perspective, national economies are likely to under-invest in R&D and innovation, as some of its benefits will occur abroad, and national policy is thus likely to give insufficient weight to the benefits of national efforts beyond a nation's borders.
- International S&T policy can help resolve mismatches between national and functional systems when organisations, markets or networks extend beyond national borders. Its policy actions can lift barriers that inhibit flows and interactions within functional systems. Standards setting is a means commonly used to address such mismatches. It extends markets by homogenising demand and reducing uncertainty and allows for a division of labour to emerge in supply.

In terms of international STI policy goals, most countries seek efficiency and/or effectiveness gains from complementarities in orientation, planning, regulation and resource pooling. And there is an obvious global trend for increased international scientific collaboration on many global challenges despite the added complexity (OECD, 2012). Requests for more funds for cross border scientific collaborations have increased accordingly (ESF, 2011). A 2009 survey of direct international cooperation between European Research Funding Organisations and Research Performing Organisations identified strong interest in multilateral cooperation in Europe and beyond and stressed that the funding organisations were facing strong demands by their research communities to expand resources for cross-border collaborations.

However, national governments may also tend to focus on domestic challenges and can be reluctant to take a global or even a collective view. The economic and financial crisis has for instance increased the emergence of STI as a focus of industrial policy. Countries also have concerns about the appropriation of the benefits of public investments in education, research and innovation, given the increasing international competition for scarce talent and investment (see also the STI Outlook Policy Profiles on *International Mobility of the Highly Skilled, the Internationalisation of Universities and Public Research and Attracting*

International S&T Investments). As a result, narrower objectives often determine the nature and extent of national involvement in cross-border STI initiatives. Commitment to cross-border STI policy is therefore often shaped by contingency and tends to vary over time. Ultimately, the reluctance to internationalise aspects of STI governance reflects the limitations of existing arrangements to provide credible assurances about the distribution of the resulting costs and benefits.

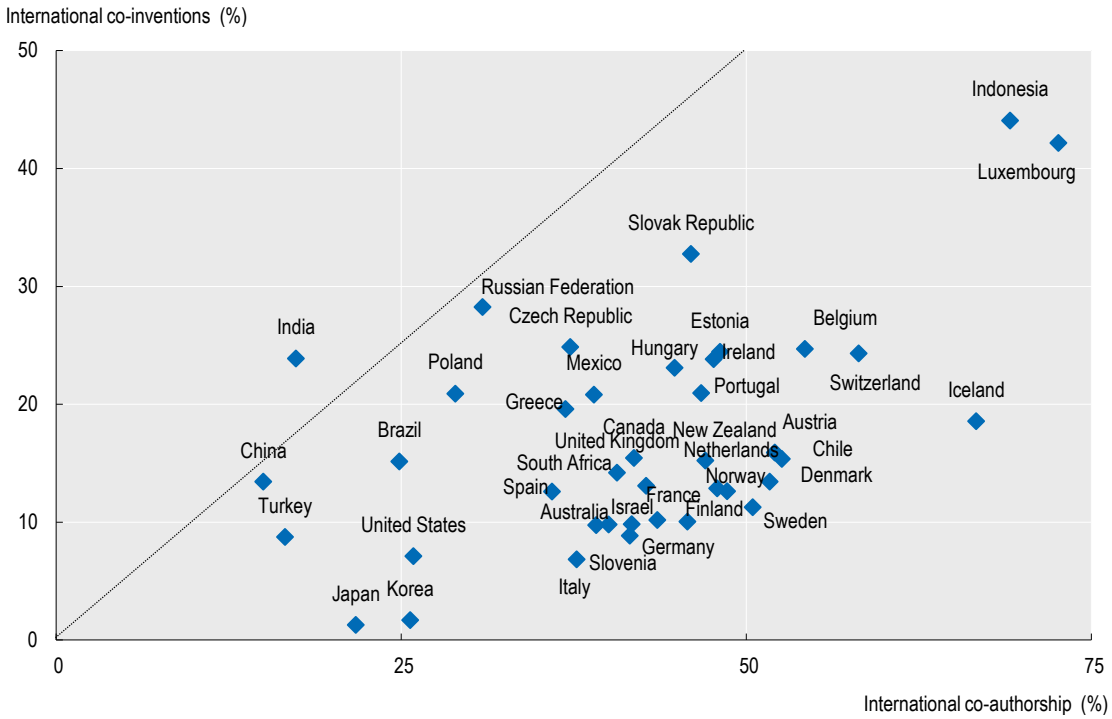
Nevertheless, the benefits in terms of sharing cost for ambitious projects and in terms of excellence usually offset the added cost due to increased administrative burdens. In times of financial stress, the major problem seems therefore to be related to making choice within the very large demand for international cooperation from the scientific community, as international engagement have to be fulfilled and leave less flexibility to adjust funding at national level.

Major aspects and instruments

Science is a global endeavour. National borders rarely circumscribe contemporary STI networks, which also include emerging economies (see Chapter 1). As globalisation has increased, technological development has become increasingly internationalised. However, evidence from patents and scientific publications suggests that international co-invention remains considerably less common than international co-authorship (Figure 1). This may reflect the relatively greater importance of proximity for technological innovation.

Figure 1. International collaboration in science and innovation, 2003-12

Co-authorship and co-invention as a percentage of scientific publications and IP5 patent families



Notes: International co-authorship of scientific publications is defined at institutional level. A scientific document is deemed to involve an international collaboration if there are institutions from different countries or economies in the list of affiliations reported by single or multiple authors. Estimates are based on whole counts from information contained in the Scopus® database. International co-inventions are measured as the share of patent applications with at least one co-inventor located in a different economy in total patents invented domestically. Data refer to IP5 patent families with members filed at the European Patent Office or the US Patent and Trademark Office, by first filing date and according to the inventor's residence using whole counts.

Source: OECD (2015), OECD Science, Technology and Industry Scoreboard 2015: Innovation for Growth and Society, OECD Publishing, Paris, based on OECD, STI Micro-data Lab: Intellectual Property Database, http://oe.cd/ipstats, June 2015; OECD and SCImago Research Group (CSIC) (2014), Compendium of Bibliometric Science Indicators 2014, http://oe.cd/scientometrics.

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Cross-border STI initiatives range from foreign policy and economic diplomacy, to access to funding for the development of national STI capabilities and access to international scientific networks.

Extensive international policy co-operation frameworks for R&D have been developed (especially in Europe which has adopted an integrative research policy), but international frameworks in other STI areas are still in their infancy. For instance, much can still be achieved by establishing technological standards for the environment and improving international coordination on cyber-security.

Cross-border governance of STI can be achieved through arm's-length policies, such as bilateral or multilateral agreements of limited duration or co-ordination of national policies, without delegation to a supranational body. This seems to be the preferred approach to cross-border governance of STI outside of Europe. Even within Europe, international STI governance frameworks – by far the most developed of their kind globally – have historically been designed as complements, rather than substitutes, to national frameworks.

However, a number of STI policy areas can benefit from delegation of decision making and deeper integration. Some of these areas are characterised not only by high fixed costs but also by high international transaction costs owing to the need for access on equal terms to highly specialised, single-purpose assets. This is typically the case for large STI infrastructures which are supported by dedicated international organisations, such as the European Organization for Nuclear Research (CERN) or the International Thermonuclear Experimental Reactor (ITER)], which require high frequency of interaction (which, in addition to international STI infrastructures also applies to coordinating the EU Horizon 2020) and present high uncertainties. A recent example of the latter is the high-risk, high-potential research funded by the European Research Council (ERC) which can maximise success by drawing from the largest possible pool of excellent scientists. Outside of Europe, the Consultative Group of International Agricultural Research (CGIAR) is an example of a long-term strategic arrangement with common R&D programming and performance functions (OECD, 2012). Another domain which has benefitted from stronger STI policy integration is that on global challenges (typically in health or environmental areas), as the sheer size of the problem as well as the need to gather data and expertise from all over the world has led to the development of numerous international scientific cooperation initiatives (e.g. the Global Research Collaboration for Infectious Disease Preparedness (GloPID-R), the Group on Earth Observations (GEO) etc.).

Several funding models can also support grant portability across borders, including the “Money follows Researcher”, which allows researchers to bring the balance of a grant to another country; the “Money follows Co-operation Line”, which allows part of a grant to be used to fund participation of a researcher from another country; and “the Lead Agency Procedure”, which enables researchers to avoid ‘double jeopardy’ in bilateral or multilateral co-operation through evaluation by a single Lead Agency (Science Europe, 2014).

Recent policy trends

There have been ambitious initiatives to promote cross-border governance of STI in several regions, including South East Asia and Latin America, e.g. the Association of Southeast Asian Nations (ASEAN) Committee on Science and Technology. However, contrary to Europe, they have a short history and limited continuity to date. The case of Europe is unique, in that its progress in cross-border governance of STI is part of wider economic integration.

The field of Research Infrastructures (RIs) is probably one of the areas which has benefitted most from increased international policy coordination in recent years. RIs play an ever growing role in scientific research and allow for many new and breakthrough research discoveries. These facilities are not only dedicated to basic scientific research but many of them have been built recently to provide direct scientific support for the resolution of major societal and environmental challenges. Concomitantly, building and operating RIs requires a growing share of public research funding, and government and research funding institutions are therefore increasingly collaborating at international level. To facilitate such coordination, various policy structures have been set up: in Europe, the European Strategy Forum on Research Infrastructures (ESFRI), launched in 2002, publishes a roadmap which plays a crucial role in determining priorities and collaborations within and beyond Europe (the latest ESFRI roadmap update was released in March 2016). At a more global level, the Carnegie Group of G8 + 5 Science Advisers established in 2010 a Group of Senior Officials (GSO) on Global Research Infrastructures to reach a common understanding on matters such as governance, funding and management of large-scale research infrastructures. The OECD Global Science Forum also plays an important role in facilitating international collaboration on RIs and has recently created an informal high-level group on RI policy which brings together the leaders of the various organisations involved in this area, to share information and identify upcoming challenges.

In Europe, the EU's European Research Area (ERA), launched in 2000, has sought to create a single space for research. In July 2012, the European Commission re-defined its priorities: to improve the effectiveness of national research systems; to achieve an optimal balance between transnational co-operation and competition; to open up the labour market for researchers; to promote gender equality; and to improve knowledge circulation (EC, 2012). European countries – EU members and partner countries such as Norway – see the ERA as the main framework for cross-border policy co-ordination in the region.

EU STI policy receives substantial financial support through Horizon 2020, the successor to the long-standing Framework Programme (FP), which aims to strengthen the competitiveness of European industry through STI funding dispensed via the Structural Funds (SF), which supports regional development and intra-European cohesion. Together these account for as much as 20% of public research funding in the EU (Barré et al., 2013). Until 2013, the primary funding instrument for research and technological development was FP7, which financed collaborative research projects and frontier research (ERC) and technology (Joint Programming, Technology Platforms, European Institute of Innovation and Technology). Funding for Horizon2020 amounts to EUR 80 billion over 2014-20, an increase of over 20% with respect to its predecessor (EC, 2013). Moreover, compared to FP7, Horizon2020 is characterised by a move towards "near-to-market R&D", and a greater focus on social challenges that require increased collaboration beyond Europe. Horizon2020 is going through a mid-term review this year, and the identification of key areas where international collaboration should be strengthened is among the priorities of this review. The recently concluded (2007-13) and current (2014-20) programming periods of the SF have also placed more emphasis on STI.

In response to the EC/OECD STI policy survey 2016, many national authorities reaffirmed their commitment to cross-border governance of STI, although limited resources and lack of interoperability between funding institutions and difference in human resources policy can constitute difficult hurdles to overcome.. Mutual policy learning and the transfer of good practices appears to be an important motivation for engaging in international STI forums. This is seen as important not only by countries with emerging STI governance arrangements, but also by countries such as the United Kingdom and New Zealand. New Zealand for instance has initiated a Small Advanced Economies (SAE) working group alongside Denmark, Israel, Finland, Singapore, Switzerland and Ireland to identify the similar challenges these countries face in the global economy, and to find common solutions. Global "grand challenges" such as climate change and threats to health and resource sufficiency are strong motivators for international co-operation. Other countries see unexploited scale economies as the major challenge. In Europe, the European Research Area is perceived as a major initiative to develop cross-border governance of STI policies, with EU initiatives that seek to achieve greater coherence, such as the co-ordination of national research policies (ERA-NETs and ERA-NET+), joint programming and joint technology initiatives (public-private partnerships).

Countries' mechanisms for promoting cross-border governance differ. Latvia has launched a regional cooperation mechanism among Baltic countries (the Baltic Bonus programme) which aims at increasing the success rate of Baltic projects in Horizon 2020. This mechanism is one of the several initiatives in Baltic countries developed to establish political co-ordination frameworks for joint collaboration. Slovenia has a lead agency scheme which promotes bilateral agreements with national funding organisations and for mobilising and financing joint R&D projects. In France, the newly established Research Alliances have among their objectives the coordination of international collaborations and are the French representatives to EU joint programming initiatives. South Africa is participating in regional and bilateral STI strategies and agreements and is heavily involved into the Square Kilometre Array project (SKA), using its involvement into international research infrastructures to foster its scientific excellence. Australia, Finland and Korea seek to ensure greater consistency in international collaboration through a partnership between policy makers in STI, trade and foreign affairs. In Korea for instance, the Korean innovation Centre (KIC) has set up 5 innovation hubs overseas to strengthen international collaboration. The United Kingdom has developed a new mechanism for developing collaborations with emerging economies: the Newton Fund, which requires equal co-funding between partners.

In Europe, some regional authorities also engage in cross-border innovation initiatives to capture the extent of functional systems, sometimes using EU Territorial Co-operation funding. Among the better-established and better-resourced initiatives are the Oresund cross-border area (Denmark and Sweden) and the Top Technology Region/Eindhoven-Leuven-Aachen Triangle (TTR-ELAT) (the Netherlands, Belgium and Germany). Other examples include the Bothnian Arc, extending across the borders of Finland and Sweden and the Helsinki-Tallinn cross-border area (Finland and Estonia) (OECD, 2013b). On the whole, though, such initiatives often lack a long-term orientation.

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