



Enhancing reciprocity in international cooperation in research: issues and metrics

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Administrative Abstract	<p>This paper combines two project deliverables, D1.1 an analytical report on the reciprocity issues of bilateral cooperation, and D1.2, a scoping paper on desirable attributes of openness and reciprocity metrics from a policy perspective.</p> <p>The key outcomes of the paper are as yet undefined as this aspect awaits feedback from stakeholders following circulation of this paper.</p>
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ABSTRACT

This paper has been prepared as part of a set of inter-connected projects that aim to raise awareness amongst European-based researchers of the funding opportunities that support collaboration with colleagues in a range of non-European nations. The paper highlights key policy trade-offs between competition and cooperation in international research cooperation. This is a tension of particular relevance to support for public interest-oriented scientific research (which is inherently international in its ethos) versus support for innovation - which has a strong national competitiveness dimension and is hence less amenable to international cooperation. Consequently, recent trends to closely couple science policy and innovation policy have complicated the policy agenda as regards support for international cooperation. Within this context, the paper draws attention to the growing importance of openness and reciprocity considerations in national policy framework and research funding arrangements. Finally, it proposes a methodology for calculating the proportion of a nation's domestic research funding portfolio that is open to applications from overseas researchers (referred to as the 'Three C's method'). This comprises: *capacity*: the quantum of funding available (converted to €); *commitment*: the extent to which a funding mechanism allows for international access (measured on the scale C_1 $0 < x < 1.0$), and; *clarity*: the extent to which guidelines are easily grasped by an international researcher in a timely manner (measured on the scale C_2 $0 < x < 1.0$). Capacity ($\text{€}_{\text{AVAILABLE}}$), commitment (C_1) and clarity (C_2) are related in the following simple equation: $\text{€}_{\text{OPEN}} = \text{€}_{\text{AVAILABLE}} \times C_1 \times C_2$. This method has the potential to provide an evidence-base that would allow the relative openness of different nations' policy stances and funding arrangements to be assessed.

1. Introduction

This paper has been prepared as part of a set of inter-connected projects which aim to raise awareness amongst European-based researchers of the funding opportunities that support collaboration with colleagues in a range of non-European nations. Projects with this focus, funded by the European Commission, are now underway in Australia, Brazil, Canada, China, India, Mexico, New Zealand, Russia, South Africa, South Korea, and the USA. These projects target both research and innovation support programmes. They are known collectively as ACCESS4EU projects.²

These moves to develop a more coordinated relationship between the European Union and a range of non-EU countries may point the way towards more effective multilateral coordination over these matters in the future.

The Australian project is led by the *International Bureau of the German Federal Ministry of Education and Research* and also involves the *Forum for European-Australian Science and Technology cooperation (FEAST)*, the *Commonwealth Scientific and Industrial Research Organisation (CSIRO)* and *The British Council*.

The various national projects are cooperating over the development of a standard database architecture that aims to make it easier to understand and compare different nations' research funding arrangements. The projects are also collecting and disseminating data on:

- access opportunities for European researchers in each country;
- the distinctive research and innovation strengths and capacities of third countries;
- current levels of European participation in third country programmes;
- current third country policies on international collaboration as it may affect European participation; and
- any obstacles to the participation of European researchers in third country programmes.

In addition to aligning efforts with those in the other participating countries, the Australian project is also carrying out some exploratory work on the potential for developing measures of openness and reciprocity in access to national research funding systems. This latter objective is the focus of this paper.

2. Policy Issues

2.1 The key policy trade-offs

Policies for research are developed and implemented within a complex nexus of national and international imperatives and interests. Research is inherently global in that new knowledge is produced and improved through international coordination

² Details of this new collective initiative, which is known as ACCESS4EU, can be obtained from: <http://www.access4.eu/>.

processes, collaboration and networks of peers. These processes and networks are continuing to globalise.

At the same time, research is contributing to responses to the major policy challenges of our time, such as climate change, energy and food security, which are by their very nature global. While collective responses to these issues do not rely exclusively on research, a commitment to ‘evidence-based policy’ means that effective national responses will, more likely than not, be predicated on international research outcomes. There is a growing recognition of the need to improve the efficiency and the effectiveness of those areas of research that address collective international interests. This is especially important in regard to addressing major global challenges – areas in which there tend to be collective security concerns, broadly understood. In such cases the advantages of more effective international cooperation tend to outweigh the disadvantages because of both the collective benefits and the enormous collective costs of failure.

In order to address these challenges, barriers to researcher mobility need to be lowered. Open and/or reciprocal relationships via which researchers in one country can access research mechanisms in another country need to be built up. Impediments to stronger bilateral and multilateral research cooperation need to be identified and removed. A renewed commitment to such a cooperative regime may also require that new forms of standardised ‘agile’ contractual arrangements are developed in order to make it easier to exploit synergies between existing national research projects without long delays and/or high transaction costs. Moves in this direction should reduce unhelpful duplication of efforts in research and allow the economies of scale and scope associated with coordinated global research to be better exploited.

Nations of course compete and cooperate at the same time in a wide range of policy areas, via differing sets of alliances, bilateral and multilateral arrangements. That this competition-cooperation tension is evident in research (both in relation to national security concerns and also to less sensitive scientific and technological work) should come as no surprise.

However, the recent trend to couple research policy with innovation policy adds another dimension to this tension between cooperation and competition. Innovation is largely a competitive national issue. Setting national security issues aside, science (in contrast) tends to have an inherent collective international emphasis. Consequently, recent trends to closely link science policy to innovation have complicated the case for enhanced international cooperation.

Taking a broader view of the outcomes of public investment in research and innovation helps to clarify the importance of international cooperation. Publicly-funded science addresses global concerns through collective actions and generates preparedness – early warning of risks and threats that help to define innovation objectives (see Matthews, 2006 and 2009). As research policy has been more and more entwined with innovation objectives, an over-emphasis on innovation through mechanisms such as commercialisation has tended to divert attention away from the collective public interest outcomes that arise from research. As both research itself and these collective action issues continue to globalise, enhanced international cooperation will be essential to ensure that national governments are connected and prepared.

It will also be necessary to develop policy architectures that seek to achieve an effective balance between national competition and international cooperation in the innovation domain itself. There are many areas in which the technology development aspect of innovation benefits significantly from international cooperation (for example sharing the cost of expensive large-scale demonstrator projects, pooling competitively ‘redundant’ segments of corporate patent portfolios to achieve collective competitive advantage etc). This means that although there is a general structural limitation to international cooperation in the innovation domain due to the national competition dimension, there is still significant scope for beneficial international cooperation provided that the ‘value proposition’ is clearly and pragmatically defined.

2.2 Reciprocity and science diplomacy

In the new internationalised research regime that is emerging, reciprocity and openness in research funding are likely to become key concerns in diplomacy – just as they have traditionally been in trade. Barriers put up to limit international engagement in research (whether deliberate or unintentional) will start to attract the same sort of negative attention as have long existed in trade negotiations and disputes. In the emerging era, major research funders (e.g. the European Research Council and the US National Institutes of Health) are open to receiving proposals from citizens of other nations resident in other nations. The stipulation is usually that the research grant can only be taken up via a host institution in the donor nation or national block (in the European Union’s case). Furthermore, these major research funders are also developing reciprocal access relationships that do not require researcher re-location (e.g. the reciprocal funding access arrangement between the US National Institutes of Health and the health domain of the European Union’s 7th Framework Programme). Of course, such (major) benefits will not be open to nations that choose to exclude themselves from the emerging international research system. A failure to articulate and develop a capability to act as a fully ‘inter-operable’ partner in collective global multilateral research activities and bilateral arrangements will limit the efficiency and effectiveness of the ‘national’ research effort in smaller economies.

2.3 International research cooperation and national policy formulation

The inter-connections between research policy and other policy domains highlight the importance of developing effective mechanisms within government for partnering with the research community (nationally and internationally).

As argued earlier, if policies are to be ‘evidence-based’ then it is increasingly likely that this evidence will either be derived from, or strongly influenced by, findings from research (and rarely research results exclusively from a particular nation). Consequently, nations that pursue highly nation-centric approaches face a ‘double whammy’. They risk becoming isolated from the mainstream because they cannot demonstrate ‘good global citizenship’ in collective responses to global challenges. Secondly, they will have sub-optimal access to the results and insights arising from the collective international research effort. In most cases, this sub-optimal access will be manifested in only becoming aware of significant research findings when work is published (and accessible to all). Given the key role of governments in handling the uncertainties and risks that markets cannot cope with very effectively, the early warning of significant findings gained from the pre-publication phase and facilitated by engagement in major international projects is a key benefit in most policy

domains. In short, modern governance cannot function effectively without access to internationally engaged research capability.³

2.4 The importance of reciprocity mechanisms in supporting international cooperation

It is also important for policy-makers to be aware that building an effective stance on international engagement in research does not necessarily require a large quantum of funding to cross national borders. The essence of effective international cooperation is *reciprocity* – arrangements via which bilateral or multilateral partners deliver reciprocal resources (e.g. host staff and students by bearing their costs *in the host nation*, pay for research instrument and laboratory costs *in the host nation* etc.). This approach also helps to avoid unproductive debates between institutions and nations of different sizes about ‘matching’ funds, when they clearly have differing capabilities to contribute to international efforts.

It is possible to construct vibrant and productive international cooperation by making it easier for such reciprocal relationships to be established and maintained. Finance Ministries need not be asked to sanction overseas payments. This is why FEAST has proposed inter-governmental liaison to develop a ‘*Standard International Research and Innovation Cooperation Agreement*’ (SIRICA) template. The SIRICA would be a generic legal template designed to significantly reduce the transaction costs and lead times (and risks) involved in establishing new reciprocity-based bilateral and multilateral cooperation agreements.

3. Metrics

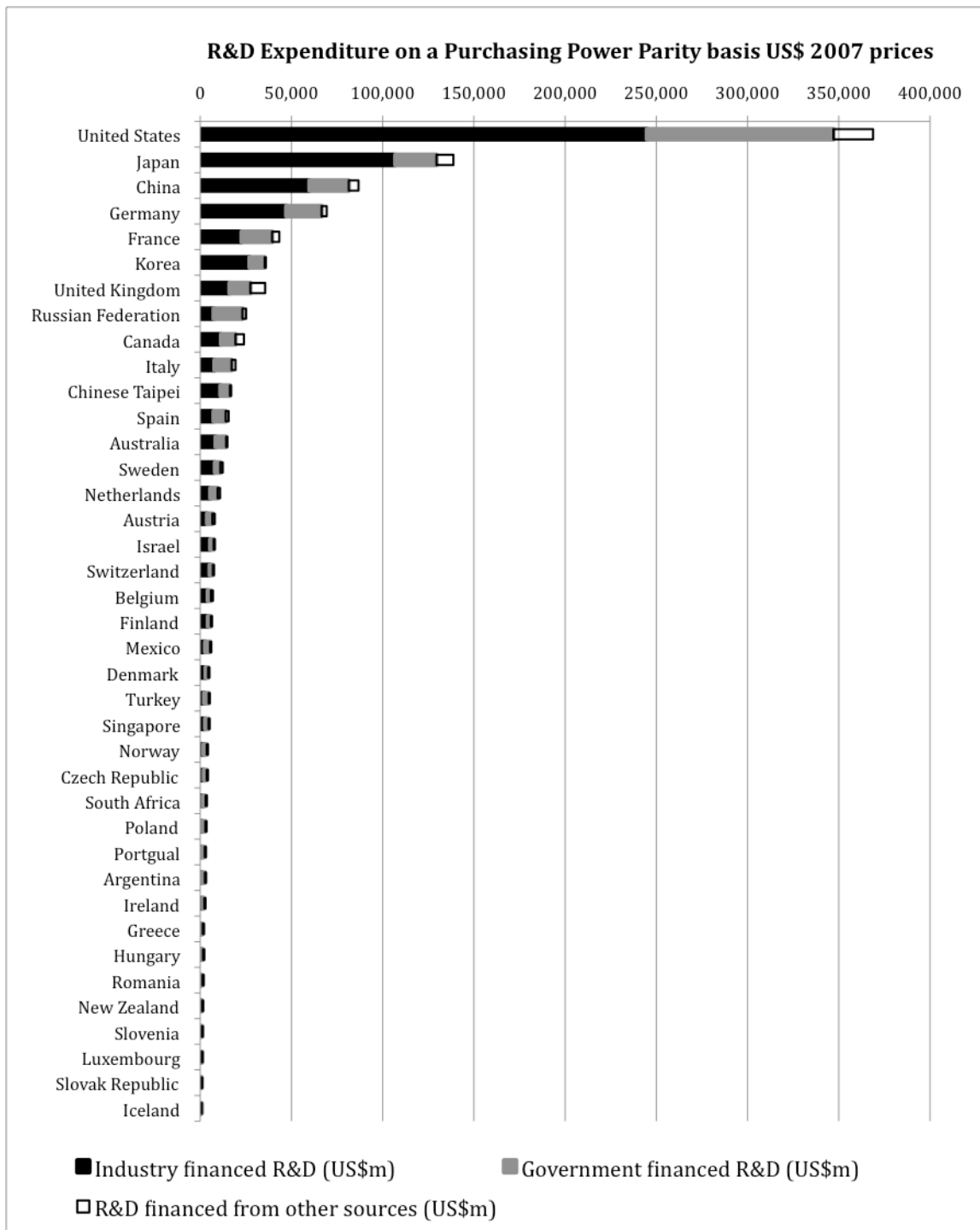
3.1 The measurement ethos

The points made above highlight the importance of measurement and assessment. If the community of nations are to make clear where they stand in regard to openness and reciprocity in research funding then a new type of comparative dataset is required.

The general principle can easily be grasped by considering the global distribution of national R&D expenditure. This is provided in the following graph, which uses OECD R&D data collected from all OECD economies augmented by official OECD estimates of the R&D expenditure levels of key emerging economies (notably China).

³ It is significant that pre-publication data sharing policies are currently being developed by some research funding bodies – but progress in rolling out such a cooperative regime is slow.

Ranked national R&D expenditure broken down by source of finance, 2007



Source: OECD (2009) Main Science and Technology Indicators

There are two key points to note in the context of this discussion.

Firstly, these imbalances in the sheer scale of national R&D expenditure highlight the fact that the smaller economies have much to gain from adopting open and reciprocal policy stances. Rather paradoxically, it is however the larger science powers that tend

to have better articulated strategies for effective international engagement in research (this is a notable feature of the US policy stance⁴).

Secondly, it would be useful to develop a version of this international ranking that highlights both relative openness in research funding (the proportion of national R&D accessible by overseas researchers) together with the comparative absolute levels of national funding that are open in this sense. This type of dataset would allow for:

- different degrees of national openness at a particular point in time to be assessed and communicated;
- time trends in openness to be monitored and their implications assessed.

This type of overview would, in turn, draw the attention of policy-makers worldwide to the importance of policy stances that emphasise openness and reciprocity, in so doing helping to implement the policy directions highlighted in the first part of this paper.

The Australian Government has, for example, committed to the further opening of national research and innovation programmes to international participation. In its *Powering Ideas* policy statement, released in 2009, and in government announcements made before and since, the guidelines for programmes such as Australian Research Council grants and fellowships, the CSIRO's Flagship Collaboration Fund and the R&D tax credit, have all been deliberately altered to boost international collaboration and investment. Further work is now clearly required to situate these policy changes within the context of efforts of other governments, and to demonstrate the effectiveness and take-up of these changes.

3.2 Formulating a basic system of metrics

There are two components of a basic system for measuring openness and reciprocity in national research and innovation funding regimes:

- (1) defining what openness means in practice and establishing how to measure the 'open' proportion of each nation's research and innovation budget; and
- (2) deploying this openness metric in order to measure the absolute level of open funding in each nation and the relative proportion of that nation's research and innovation funding that is open.

Whilst the second component is a straightforward matter of calculation, the first component involves considering the more complex, and potentially more contested, issue of defining what openness means. For instance, should one restrict the application of this metric to the formal rules and guidelines or should we extend the scope of the metric to also take into account the practical implementation of those rules and guidelines? If this extended approach is taken, how extensive should the list of factors considered be? In all likelihood, the most useful outcome would be a

⁴ The United States has an explicit policy framework for assessing international gaps in scientific and technology capability (in practice used to verify continued leadership in most fields) and for reporting in Federal Departments' international engagement and the benefits that this engagement generates for the US. The internationally aware stance has been influenced by work carried out by the *RAND Corporation* together with the *National Academy of Sciences* (NAS) via the *Committee on Science, Engineering, and Public Policy* (COSEPUP).

metric that covers both the formal rules and guidelines and the practical implementation of these rules and guidelines.

To use a pertinent example, a nation may have a funding scheme in theory fully open to overseas researchers (who could apply for funding and take up the position or do the work in that donor nation). However that nation may also impose such strict and onerous visa requirements that in practice make it almost impossible to actually take up the award.

One fairly simple approach would be to adopt the following three-stage calculation (referred to as the ‘Three C’s method’):

Capacity: the quantum of funding available [converted to €]⁵;

Commitment: the extent to which a funding mechanism allows for international access [measured on the scale C_1 $0 < x < 1.0$]; and

Clarity: the extent to which guidelines are easily grasped by an international researcher in a timely manner [measured on the scale C_2 $0 < x < 1.0$].

Capacity ($\epsilon_{\text{AVAILABLE}}$), commitment (C_1) and clarity (C_2) can then be related in the following simple equation:

$$\epsilon_{\text{OPEN}} = \epsilon_{\text{AVAILABLE}} \times C_1 \times C_2$$

The use of this equation would allow us to calculate the value of funding that is open both in *theory* and in *practice*.

Hence if a programme had a budget of €12m, scored 0.8 on the Commitment scale (C_1) and 0.5 on the Clarity scale (C_2) it would be assessed as having an openness funding value of €4.8m.

$$\text{e.g. } \text{€}4.8\text{m} = \text{€}12\text{m} \times 0.8 \times 0.5$$

It would then be a simple matter to use the estimate of ϵ_{OPEN} to calculate both relative and absolute openness in different national research and innovation funding systems (by summing openness funding values for all national programmes) and then to move on to compare, and indeed rank, nations in these terms.

For some purposes it may be preferable to use the simpler ‘openness’ index of *commitment* (C_1) \times *clarity* (C_2) as this would provide a useful measure of the extent to which different nations are achieving openness in research funding.

The hardest technical challenge in implementing this method would be to agree a suitable means of translating details of funding programme rules and guidelines into a score from 0.0 to 1.0 in a manner that is credible, transparent and can be replicated world-wide. Perhaps the best approach would be to define a hypothetical ‘gold standard’ for a fully open funding programme as a basis for assessing relative proximity to that gold standard. A rating scale could then be used to assess real funding programmes against this hypothetical gold standard.

⁵ In practical application the choice of a comparison currency, and whether Purchasing Power Parity (PPP) measures are used will have a significant effect on the results. For example, the application of PPP measures to China’s rapidly growing R&D expenditure has tended, in Chinese eyes, to over-state China’s R&D because whilst R&D labour is still relatively cheap in international terms China must pay for imported scientific instruments in US dollars (thus offsetting the advantages of cheap R&D labour).

Indeed, it could be very attractive to add a standard ‘openness’ user rating system to funding programme websites. This would allow data reflecting real user views on *commitment* (C_1) and *clarity* (C_2) to be collected.

4. Conclusions

This paper has attempted to articulate why openness and reciprocity in national research and innovation policy stances matters and how these aspects of national funding regimes can be measured.

The next steps are to implement this approach experimentally and assess the accuracy and usefulness of the results obtained in the context of the ACCESS4EU programme as a whole.

The first step in this implementation process would be to circulate this paper more widely within the European Commission and to all active ACCESS4EU projects and to stimulate a dialogue over these issues (perhaps via a workshop in Brussels held in association with another widely attended event).

It would also be useful to prepare a follow-up paper on the metrics issues that would:

- define a hypothetical ‘gold standard’ fully open research funding programme;
- develop suitable indices for assessing real funding programmes against the hypothetical benchmark;
- develop a simple website user feedback mechanism to populate the test indices; and
- test this metrics system, and website user feedback mechanism, for three selected nations (including Australia).

Such a paper could be prepared by a small cooperative partnership effort involving ACCESS4EU projects in two other nations.

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