ISSUE BRIEF: PUBLIC SECTOR RESEARCH FUNDING

The issue in a nutshell

This brief focuses on the nature and dynamics of existing funding regimes for public sector research (PSR) and the impact these regimes have on the contributions of publicly-performed research to innovation. In regards to public funding, we distinguish between: block grant based regimes, where the majority of research funds are allocated directly to institutions according to particular formulae, performance indicators or budget negotiations among actors; and project-based regimes where scientists obtain project funds from external sources competitively. Although the largest proportion of funding for PSR comes from governmental sources (either federal/national or state/regional), the private sector is also a source of funding for public research through contract research and service provision. This issue is extremely relevant for STI policy because funding is one of the major instruments used to steer the science and innovation system. Many countries have introduced reforms in their research funding systems in order foster excellence, knowledge transfer and socio-economic innovation, reducing the proportion of institutional funding without “strings attached”.

The current trend towards more selective and competitive funding was established some years ago. In addition, countries that increased their government budgets have often fed the investment towards specific programmes such as centres of excellence or towards the advancement of priority-specific research sectors. Some countries also implemented performance-based research evaluation systems with significant consequences for research funding at the institutional level. The prioritisation of research excellence has also been reflected in recent counter-cyclical trends in PSR funding in some countries. Indeed, although in the past general levels of public R&D funding have normally mirrored the financial cycle, however, recently divergent paths between countries have been observed during the period of fiscal consolidation (OECD 2009a).

There is debate about whether the increasing reliance on competitive project or program funding at the expense of block grant and long-term institutional funding has pressured public sector research resulting in an emphasis on short-term, low-risk projects and away from longer term fundamental research. There are also concerns about whether this negatively affects an institutions’ capacity to invest in infrastructure. It is difficult to balance performance-based funding approaches with giving autonomy and flexibility to public research institutions. Programme-oriented funding also raises some concern in non priority areas. In either case, the diversification of the funding portfolio of public sector research organisations in relation to interactions with more social and economic actors may positively affect innovation performance. However, the conditions that generate markets and research users are not the same for all scientific and technological areas. Likewise, institutional arrangements in different PSR organisations may either hinder or favour specific funding strategies. The degree of external research funding diversity (i.e. number of different agencies and foundations) has also affected institutional arrangements by increasing the pluralism of funding sources.
Who are the main actors?

The main actors related to this issue include both the recipients of funding, such as Higher Education Institutions (HEIs) and PROs, and the funders themselves such as governments (federal/national and state/regional), international organisations, intermediary organisations (research councils), agencies (national and international), business, private foundations and donors. In some countries, PROs may also fund their own institutes and researchers through intramural research. In addition, legislators, advisory bodies and organised interest groups also play relevant roles such as contributing to agenda setting and influencing budget allocations. Finally, in systems where performance-based funding exists, evaluation agencies and commissions are also relevant actors. A recent trend in most countries has been the diversification of actors involved and the greater complexity of the relations among them as well as increased funding competition.

Governments are traditionally the major funders of public sector research. Governments fund research either directly or indirectly. Direct funding occurs through particular departments with competencies in the STI domain and they often have their own mission-oriented public research organisations and large national research centres within their charts. Conversely, indirect funding occurs through intermediary research funding organisations such as research councils or research agencies. Governments show increased interest in improving their scientific output internationally but are providing less funding without “strings attached”, thereby strongly emphasising scientific excellence and performance.

Research funding organisations are publicly-funded bodies responsible for co-ordinating and funding the overall system and also particular areas of research. Their budget may come from specific governmental departments or directly from legislative bodies. They are important meeting places for research actors and the political administration in order to balance both political and scientific logics (Braun 1998). They occupy a key position in the research system, especially in project-based funding regimes. The research councils' main task, traditionally, is to organise part of the funding relationship between governments and research organisations (and/or individual researchers and groups) as a peer review-based competition for project funding (Rip 1994). In most countries, we have witnessed a transformation of these intermediary bodies. Their role is now more complex and includes additional tasks related to public policy priorities and the promotion of structural changes via programme funding. The extent to which the governance of the research councils is intertwined with (and even dominated by) the scientific community varies across countries. The relative capacity of the councils to act strategically and to be real intermediaries between the state and science depends partly on that variance (van der Meulen 1998).
In the past, the profiles of the different PSR organisations were more differentiated and their missions more specialised. The diversification of roles for many of the different public research actors (universities, public research centres, etc.) led to common missions for research, knowledge transfer and innovation which in the past were distinctive of some PSR actors more than others. Accordingly, in response to the common need for external funding sources, the diverse organisations located in the PSR behave as collaborators (in order to gain critical mass) and as competitors. They also engage in interactions with the same political actors, apply to similar research councils and agencies and compete for the support of the business sector.

What arrangements characterise public sector research funding?

Institutional block funding provides research organisations with a stable basis for research activities. This can help them to acquire funding from other sources, provides them with a certain degree of autonomy in the selection of their research; and allows them to build up expertise in new fields. Conversely, a surplus of block funding may de-incentivise organisations and researchers to look for funding from other sources. When referring to institutional block funding, it is useful to make a distinction between: “pure block funding”, where recipients have a relatively large discretionary power on how to use these funds; and “ear-marked funds”, which can only be used to cover specific expenses such as the salary costs of permanent staff. Many countries have undergone a shift away from block funding in favour of more project funding. However, most European research systems are still characterised by a higher share of block funding when compared to the US system (Lepori et al. 2007). Several countries have introduced new performance based approaches to the distribution of institutional funding (OECD 2010). For example, the United Kingdom, Australia and New Zealand have implemented national evaluation frameworks based on a different combination of quantitative and/or qualitative indicators (Coryn et al. 2007, OECD 2010). Funding agencies use these evaluation outcomes as part of a funding formula used to distribute part of the block funding among HEIs. Therefore, this approach introduces an element of competition for block funding based primarily on relative research performance, doctoral training and/or the ability to acquire project and other external funding. New block funding can also be used to set up new centres or institutes. These have included organisations set up to do interdisciplinary research or collaborative centres such as PRO-HEI and Public-Private hybrids. In the latter case, block and project funding comes from both public as well as private sources.
However, project-based funding gives funding organisations more control over research. One rationale for increasing the relative share of competitive funding is that it is expected to yield relatively higher returns in terms of knowledge creation and research output. Increasing the share of project funding can be used further to make research organisations more responsive to socio-economic needs as these considerations can play an important role in funding decisions. The organisations providing project funding use different mechanisms. The first responsive mode refers to broad calls for investigator-driven, bottom-up proposals in which researchers apply for funding. This approach is primarily used by research councils to fund basic research. A second thematic mode is for research funding bodies to dictate predefined areas in which researchers can apply. Frequently, such projects require extramural and sometimes international collaboration. The European RTD Framework Programmes follows this mechanism as do research councils who aim to fund specific areas, interdisciplinary or strategic research. From the 1980s onwards, thematic strategic research and high tech development programs have become important in the US, in Japan, the EU and in China. A third mode offers funding for predefined research projects. This is used for consultancy and project funding by private and public organisations who want to address a particular problem. These projects may be offered directly to a particular research organisation or group. Alternatively these projects can be advertised through public tenders for researchers or research organisations to place a bid. Both block and project funding are used, in part, to pay for the salaries of scientific staff. Finally, another type of public research funding which is often grouped with project funding is the funding of individual (especially younger) researchers through fixed term grants and fellowships. A growing share of scientific personnel costs is financed in this manner, often following competitive calls for applications.

The distribution of funding among competing proposals is often based on a system of peer review where experts assess the quality of the proposal according to predefined criteria. These criteria may include scientific merit as well as socio-economic considerations. Peer reviewer’s opinions are collected and analysed by a committee consisting of scientists and/or administrators from the funding body. These committees make a final decision, which can be informed, although not solely determined, by the reviewers’ assessment (Van den Besselaar 2010). Research councils, the EU framework programs and some foundations rely primarily on this approach. Peer review has its strengths and weaknesses but some funding organisations, such as the US DARPA, take a different approach whereby a strong scientific manager is given the responsibility to decide which research projects to fund (Hackett, 2010). An issue which may partially determine the success of this approach in attracting high quality applications is its legitimacy and acceptance among researchers. In general, the scientific manager will need to possess a strong scientific reputation and is assessed on the basis of project outcomes. Bibliometric analyses of researcher trajectories can inform both approaches to the distribution of funding. Given its limitations, no research funding body is known to rely entirely on this at present.
What institutions and ideas shape public sector research funding arrangements?

As an institution, science has evolved according to a set of normative beliefs that guides its practice (Merton 1942). After WWII the “social contract” between government and science was based on “faith” and delegation where financial resources and autonomy were provided in exchange for outputs of a self-governed scientific community (Price 1954). The classical policy statement was represented by the Report “Science: The endless frontier” (Bush 1945). This traditional social contract between science and the state was known as the “republic of science” (Polanyi 1962). As such, the interaction between different actors became more complex and eventually led to the institutionalisation of research councils and agencies as intermediaries (Rip 1994). Although these intermediary bodies have been traditionally populated by the scientific elite and therefore appear to be immune to external pressures, they are equally influenced by managerial and political influences (Kleinman 1995). At this time, there was still a large amount of diversity found between these intermediary institutions between different countries. This institutional diversity was partly explained by the extent to which the state delegated the control of research goals, evaluation and funding decisions to scientists (a trust based regime) (Whitley 2003).

At the end of the 1970s, the above social contract collapsed due to the increasing distrust of politicians about the scientific “integrity and productivity” (Guston 2002), the emerging socio-economic demands to the scientific enterprise (OECD 1971) and the “neo-liberal” approaches to science policy in some countries (Lave et al 2010). As a result, new words like “incentives” and “principal-agent relationships” (Braun 1993) emerged under “new public management” models of science policy (Boden, et al. 2006). Those changes in the framing have significantly affected the dominant mode of funding public research, both in universities and public research centres. Previously in some countries, PSR received large portions of funding through direct state allocation (block grants or earmarked funds). This has recently started to change, and the trust-based funding regime was replaced by performance-based regimes (Coryn et al 2007, Hicks 2009, OECD 2010, Sorlin 2007). While keeping the traditional competitive funding model for project grants alive, ongoing transformations occur in many countries that have associated the amount of “block grants” with some measurement of evaluation of performance.
While previously, the targeting and prioritisation of funding by Governments focused on “socioeconomic relevance” and “emerging technologies”, a separate transformation of the values underpinning science policy refers to a greater emphasis on the funding of research that takes place in “Pasteur’s quadrant” (Stokes 1997). This refers to research which is both fundamental in its understanding while also providing solutions to practical problems. Other academics have labelled this paradigmatic change as a move from traditional ‘Mode 1’ research to ‘Mode 2’ research that has a broader transdisciplinary, social and economic context (Gibbons et al. 1994). Another model elaborating on this change is known as the “Triple-Helix” (Etzkowitz and Leydesdorff 2000). The emergence of new legitimate models of public science funding and functioning is accompanied by the creation of new types of public research centres with diverse funding portfolios (OECD 2011). Funding regimes therefore, are informed by this “new” social contract and a need to comply with increasing social and political demands for research performance, efficiency and accountability (OECD 2010).

PSR funding is still an issue governed by stable expectations from the public science actors in regards to periodical flows of public funding (through multi-annual R&D Plans, annual and open calls, Performance Based funds, etc.). Despite the increasing internationalisation of research, a process of convergence or reduction of the national diversity in funding arrangements and dominant regimes is unlikely.

What incentives are at play in public sector research funding?

The changing landscape of public sector funding has had the effect of incentivising certain HEI and PRO behaviours. The allocation of funding, either through block funding, competitive project grants or via the private sector are influential tools to frame behaviours and strategies. Incentives can be offered by governments or by organisations. They can be collective, allowing organisations the opportunity to generate their own resources and priorities, or individual, such as personal bonuses and other rewards. As the government emphasis on research accountability grows, HEIs and PROs will continue to plan strategically to meet government expectations by offering incentives. These incentives reflect the government’s increasing focus on scientific excellence and generating socio-economic outcomes from research.

One such incentive used by governments is the use of ‘research priorities’ to allocate separate sources of funding thereby incentivising certain research behaviours and fields. Examples include targeting specific research fields; encouraging collaboration between research and industry; or setting specific growth targets for public research output and graduate numbers. In Australia and Norway, for example, government research funding is targeted at research within distinct priority areas (DISR, 2010). Governments will tend to set research priorities that are relevant to the country’s economic and social needs but also consolidate research excellence. Other incentives from governments for public research may be associated with PhD student recruitment and completion; high impact publishing; extramural and/or international collaboration; and attracting foreign research talent.
As a result of changes in research policies and the creation of specific research priorities, PROs and HEIs have responded by incentivising desirable behaviours on an organisational level. Indeed, organisations may concentrate resources in areas of research that will guarantee the most reward. By aligning their organisational objectives with government research priorities for funding, research organisations and universities produce benefits associated with their reputation and prestige through positive research evaluations. In addition, research organisations offer personal incentives to encourage researcher behaviours that will generate the highest reward from governments in terms of funding and prestige. Personal incentives could take the form of salary increases and/or promotion for high impact publishing as well as successful industry/commercial engagement. Direct financial incentives for researchers who engage with high impact publishing are already well established in a number of organisations such as some Danish HEIs and on a more informal basis in Australia.

**What scope is there for policy intervention to reform public sector research funding?**

Public research funding is one of the major instruments for steering the science system. Policies affecting public research funding involve changes in funding volumes, and changes in the allocation of funds mainly via i) modifications in the portfolio of funding instruments, and/or ii) in the organisational structures responsible for the allocation of funds (OECD 2003; Poti and Reale 2007).

Traditionally, policies aimed at public research funding have been justified by market failures arising from the inherent public nature of scientific research. Markets fail to provide sufficient incentives for investment in research due to its non-appropriable character, and its risky and intangible nature. As a result, the private sector provides ‘sub-optimal’ levels of investment and government support must ensure the provision of the basic research required for innovation and economic growth. In the last decade, the adoption of a systemic perspective of research and innovation activities has provided additional policy rationales. Within this view, the rationale for government intervention in support of public research goes beyond a simple market failure argument. It implies the need to embed policies in a broader context, and a shift from top-down to network steering in order to deal with systems imperfections or failures (OECD 1998; Arnold 2004). These failures are generally associated to particular research system’s interaction structures which are characterised by: i) a lack of key participants (absence of actors with specific capabilities) and/or ii) a lack of or a low effectiveness of the existing interactive behaviour within the research system.
Systemic failure rationale confer on government policy an additional influential role, not only to ensure the provision of high quality research but also as a means of: i) improving the institutional set up and opportunities for constructive interactions that better encourage preferred paths of research, and ii) favouring actions to overcome path dependence and existing ‘lock-ins’ into inefficient research trajectories. Instances of path dependence and systemic lock-ins rooted in institutional rigidities and organisational capabilities constraints are, for example, the limits often imposed on research councils as a result of their legacy. Research councils generally face limits in how they can divert funds from one established research field to newly emerging fields, or alternative priority research areas. They normally want to maintain capabilities (which take quite a long time to build up) in fields in which they have invested for a long time and in which a large community of scientists are already active in their system. Another example is the constraints imposed on public funding in many countries due to its commitment to finance the salaries of civil servants, PRO researchers and university professors. These constraints also limit the margin for policy to influence funding, particularly in times of economic downturn.

A higher variety of policy instruments have been recently implemented to encourage changes in public research funding that are aimed at addressing systemic failures via: encouraging inter-institutional and interdisciplinary research; overcoming institutional and structural systemic rigidities; increasing the flexibility and autonomy of research institutions; incentivising and promoting researchers (especially young researchers); and facilitating networking between relevant institutions (OECD 2003). Policy actions to achieve these goals involve for example: i) The creation of more flexible and competitive funding mechanisms attached to new and specific programmes which address specific priority areas (examples: Italian Basic Research Investment Fund (FIRB); Swiss National Research Programmes, PNRs); ii) Finance support for competitive research projects in research areas that call for inter-institutional and interdisciplinary collaboration that are designed to encourage the establishment of emerging research fields and new research teams; to involve industry in more basic research; to facilitate private and public cooperation; and the transfer of research results to innovation.

How can public sector research funding arrangements be assessed?

Many of the changes in PSR funding have increased the pressure for researchers to produce results that satisfy both business and societal needs, raise the level of interaction with other actors and at the same time continue to pursue scientific excellence. These general goals are, however, not always consistently translated by each of the numerous funding mechanisms available, by the level of funds granted or evaluation schemes.
A thorough assessment of the dynamics and influence of PSR funding would require, as a first step, answering the question of whether the portfolio of funding mechanisms in place responds to an underlying policy mix or it is, instead, simply the sum of different tools. Funding tools can either reinforce one another in a healthy, competitive environment or be overlapping, highly fragmented, potentially inconsistent and result in increased red tape so that an assessment of the overall coherence of PSR funding would need a complete inventory of PSR funding tools. This inventory should also consider eligibility conditions; objectives and evaluation systems; initial funding conditions ‘on paper’; final allocation of funds; and differences across research disciplines in addition to qualitative information about the perceptions of researchers about funding schemes. Practically, given the large amount of information required for an overall assessment of PSR funding dynamics, having access to statistics of not only the aggregate funds available, but also the field of application, origin (public, private), type (competitive, non-competitive) and target (generic, oriented to solving specific problems) of funding instruments would be useful as a starting point.

A second step would need analysing the individual and combined effects of the different funding mechanisms on PSR dimensions such as structure, links with industry, internationalisation, performance and access to research data/results. This would imply a more holistic assessment of the impact of changing funding regimes on PSR, going beyond the assessment of impacts of individual instruments and avoiding the risk of falling into mechanical quantitative approaches (e.g. simple counts of contracts, patents and publications).

Both traditional and novel indicators could illustrate how possible changes in individual researcher behaviour and universities and/or PRO strategy reflect changes in the funding regime. Possible examples include: i) Structure: evolution of the size (number of researchers, number of institutions) and composition (countries of origin, seniority) of research groups applying for and benefiting from the funds; ii) Links with industry: number and size of R&D and consultancy contracts, shared facilities (e.g. joint R&D labs), co-application of patents, business ownership of patents invented in the PSR, patent licensing agreements, co-authorship in scientific publications, co-application for funds, software licenses, PhD training in firms; iii) Internationalisation: foreign institution collaboration, international mobility of researchers, foreign PhD students and post-doctoral researchers; iv) Performance: scientific publications in high impact journals, number of citations, size and country composition of international patent families, patent grants, royalties from licensing agreements, number and survival of spinoffs; v) Access to research data and results: institutional digital repository activity, open access publishing and scientific articles re-using publicly funded research data.
Unfortunately, many of these suggested indicators are not yet readily available. Other indicators may be deemed as private information (e.g. terms of contract research and licensing agreements). However, proxies of many of the above indicators can still be obtained from large databases for scientific publications and patents. Qualitative information from researcher surveys about the perception of changing funding regimes and their impact would also yield relevant information about the intended and unintended effects of PSR funding on the quality, availability and directions of research, as well as the longer term effects on innovation performance.

References and further resources


OECD (2011), Actor Brief on Public Research organizations (PROs).


