ACTIONS BRIEF ON PUBLIC RESEARCH ORGANISATIONS (PROs)

Roles performed

For some time, the population of research organisations has experienced a trend of increasing diversity. The term public research organisation (PRO) is used to refer to a heterogeneous group of research performing centres and institutes with varying degrees of “publicness”. This is understood in broad terms as the level of governmental influence on their research activities and funding, rather than just mere ownership (Crow and Bozeman 1998).

We can distinguish between four ideal types. First, traditional mission-oriented centres (MOCs) are owned and sometimes run by government departments or ministries at the national and sub-national levels; their role is to undertake research in specific topics or sectors in order to provide knowledge and technological capabilities to support policy-making. Second, public research centres and councils (PRCs) perform (and in some cases fund) basic and applied research in several fields; these overarching institutions tend to be of considerable size in several countries representing a significant share of the national R&D capabilities. Third, Research Technology Organisations (RTOs), also known as industrial research institutes, are mainly dedicated to the development and transfer of science and technology to the private sector and society; although some of them are owned by government, in general, the administrative links of RTOs with governments tend to be looser than the rest. RTOs, often in the semi-public sphere and in the non-profit sector. Finally, a fourth group of publicly supported research institutes of diverse size, labelled as Independent Research Institutes (IRIs) perform both basic and applied research focused on “issues” or “problems” rather than just fields. In many cases IRIs may be termed as “semi-public” as they are founded under different legal forms and work at the boundaries between public and private, but develop their activities with substantial public support and/or participation of public representatives in their governance.

In many countries social demands to expand the missions of traditional PROs and also to create new ones have led to some changes. MOCs, as a result of their tighter links to governmental bureaucracies, are likely to have experienced fewer changes lately; in fact, some have diversified their roles and outputs to include measurement, certification and standardisation. PRCs have kept their focus on traditional roles by providing a science base for the innovative capacities of their country through research and training, but with more pressure on technology transfer and a diminishing funding role. However, in some countries, their role as research funders has been diminished in favour of external funding agencies and councils. RTOs have become more important in their role of linking research and private sector innovation and increasingly access markets and competencies internationally. The IRIs usually have been created more recently, sometimes in the context of particular programmes. In many cases, they are highly innovative in organisational terms and some of them have outstanding performances.
Therefore, the different PROs, depending on their particular profile, perform a variety of roles. These include: basic and applied research; policy support; training; knowledge and technology transfer; service provision; research funding; technological facilities; and standardisation and certification. The trend towards diversification of roles in PROs was identified a decade ago (Eurolabs 2002). It is difficult to ascertain whether increasing competition for funding will lead to a shift from role diversification to specialisation; this shift, however, is unlikely to occur in a policy context where PROs increasingly face multiple demands.

**Box 1: Ideal types of Public Research Organisations (PRO)**

<table>
<thead>
<tr>
<th>Ideal types</th>
<th>Acronym used in the text</th>
<th>Status</th>
<th>Main focus</th>
<th>Recent changes</th>
<th>Examples</th>
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<tbody>
<tr>
<td>Mission oriented centres.</td>
<td>MOC</td>
<td>Owned and sometimes run by government departments or ministries at the national or sub-national level.</td>
<td>Perform research in specific topics or sectors; support to policy making.</td>
<td>Some diversification of outputs to include measurement, diversification and standardisation</td>
<td>National research centres specialised in agriculture (CSIRO - Australia), defence and aerospace (NASA – US), energy &amp; environment (NREL – US; CERI - Canada, CIEMAT - Spain), health (INSERM - France).</td>
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<tr>
<td>Public research centres and councils.</td>
<td>PRC</td>
<td>Overarching institutions of considerable size.</td>
<td>Perform (and in some cases fund) basic and applied research in several fields.</td>
<td>More pressure on technology transfer. Diminishing funding role.</td>
<td>CNRS-France; CNR-Italy; CSIC-Spain, Max Planck Society-Germany; NRC-Canada; CONACYT-Mexico; Polish Academy of Sciences; Russian Academy of Sciences; Chinese Academy of Sciences.</td>
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<td>Research technology organisations</td>
<td>RTO</td>
<td>Often in the semi-public sphere (although some are owned by governments); private not for profit. Also known as industrial research institutes.</td>
<td>Link research and private sector innovation; development and transfer of S&amp;T to the private sector and society.</td>
<td>Increasing internationalisation to access markets and competencies</td>
<td>Fraunhofer Society – Germany; TNO – Netherlands; VTT Finland; Tecnalia – Spain; SINTEF - Norway</td>
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<tr>
<td>Independent research institutes.</td>
<td>IRI</td>
<td>Semi-public; founded under different legal forms, at the boundaries between the public and the private sector.</td>
<td>Perform basic and applied research focused on issues or problems.</td>
<td>More recently created, highly innovative in organisational terms and outstanding performance.</td>
<td>“Centres of excellence”; “cooperative research centres”; engineering research centres”; “competence centres” “Multidisciplinary research centres”. CNIO – Spain; INMEGEN - Mexico.</td>
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*Note: Own elaboration. The list of examples is not exhaustive and there are some national organisations that do not fit into one ideal type*
Motivations and interests

The diverse institutional arrangements of PROs also influence their relative capabilities to select and perform roles within the innovation systems and, specifically, their strategic capacity to adapt to changes. Some types of PRO have very specific and stable missions, but all of them are subject to change and adaptation processes. These changes have mostly been policy-driven. While in some countries we have witnessed privatisation (Boden et al. 2004) and transfer of ownership to universities, the main mechanisms have been changes in funding regimes or reduction of public support (Schimank and Stucke 1994) together with the emergence of new normative models of research centres with a strong emphasis on scientific excellence, knowledge valorisation and transfer to firms and service to society (Cruz and Sanz 2007).

Increasing demands for research that is both relevant and excellent, as in the so called "Pasteur’s Quadrant" (Stokes 1997), have led MOCs, PRCs and IRIs to aim for greater management flexibility and to search a diversification of funding sources in order to increase their autonomy. RTOs are more market-driven, but they are equally subjected to the policy framework or paradigm dominant in the field. In fact, many of them belong to the non-profit sector where government is the major customer or the main driver behind their creation and existence. In the near future, it is unlikely that there will be "radical" innovations in the core motivations and interests of PROs altogether, but rather incremental adaptive processes and reforms with different speeds depending on their typology.

The question of which institutional arrangements allow PROs to perform roles that combine excellence and relevance is not an easy one. Two main institutional dimensions affect the capacity of PROs to select and perform their roles: First, the autonomy of the PRO with respect to the political system as regards its budget, employment and structure. This autonomy is likely to be lower in MOCs than in others. However, it is not high in the case of PRCs either because governments tend to keep a considerable degree of control over employment and funding. In the case of PROs that are strongly dependent on the state, the ease of establishing new goals is limited unless the state directly allocates new resources (Whitley 2010). IRIs and RTOs usually have more flexibility to determine employment conditions, resource allocation and organisational structures. This greater autonomy allows certain types of PROs, which often operate as non profit foundations, more strategic margins of manoeuvre.

The second dimension refers to the internal distribution of authority. Within PROs, the distribution of authority between the central headquarters, the institutes’ directors and the researchers, varies across cases. In systems where such distribution is decentralised and researchers very autonomous, PROs may find it harder to develop strategic approaches towards role selection. As a result the overall profile of the PRO will tend to be the aggregate of the individual preferences and orientations of the researchers. There probably has to be some degree of internal centralisation in the form of managerial leadership for the PRO to plan strategically (Cruz et al 2011). Additionally, the international scientific reputation of the director, as it implies increased internal recognition and acceptance, might reinforce strategic implementation within the PRO.
In regards to incentives, the behaviour of traditional PRCs, especially of those whose governance is dominated by scientists, is mostly shaped by the reward structure of science. The incorporation of public policy goals in research funding might incentivise the diversification of goals. In this respect, PROs have traditionally put more emphasis in the production of research that may lead to useful and applicable results to industry than universities. Many PROs already retained property of inventions made by their employees before universities did following the abolishment of the professor’s privilege and legal changes similar to the Bayh-Dole Act implemented in the US in 1980 (OECD 2003b).

Resources

PROs manage four types of resources related to funding, human resources, infrastructure and reputation.

PROs get a significant part of their financial resources allocated through direct transfers from government (national and state-regional). These resources may come directly from particular departments or ministries with competencies in particular STI domains or indirectly, through a diversity of intermediary organisations such as Research Councils or Research Funding Agencies.

Globally, in the last decades, despite the predominante role of block grant and direct transfers, governments have put more emphasis on competitive and program funding as a way to steer research and implement priorities, although block grants still represent the highest share of public funding for PROs. This trend has raised some concerns on behalf of PROs in regards to their long term capabilities to address frontier and fundamental research or to provide independent advice to governments (Nedeva and Boden 2006). Changes in the funding regime have not affected all PROs equally. Depending on the specific sector or field, but also the level of control they have over their own budgets, some types of PROs are better equipped to compete, collaborate and contract with other actors. Additionally, some IRIs are the outcome of new lines of public funding under different programs (excellence centres, cooperative research centres, engineering research centres, etc.).

The trend towards diversification of funding sources has been happening for some time and it is likely to become a stable feature of PROs. The business sector is another funding source for PROs in exchange for research contracts, service provision, patent and copyright licensing etc. Some PROs, in particular RTOs, strongly engage with the business sector as a vital customer and stakeholder. Donors, charities, etc also play a relevant funding role in some countries. The critical issue remains to what extent private sector actors influence and/or bring resources to the agenda.
Human resources are also vital for the research and innovation enterprise. Traditionally PROs have employed most of their human resources permanently and covered their (increasing) costs from earmarked institutional funding directly from governmental sources. This situation has changed profoundly in the last decade. Changes in the funding structure of PROs have led to an increase of part-time and fix-term employment where costs are often covered by external, competitive and non competitive funding sources. More and more new positions are funded under project-based arrangements.

A trend toward “dualisation” of employment structures within some systems is slowly taking place, especially in PROs that are not autonomous to control the management and planning of their staff. However more autonomous and flexible PROs, such as the IRIs, that have been created to avoid the rigidities of state employment status, provide stability through performance-based periodical evaluations, and are able to set up more flexible salaries and rewards.

In regards recruitment two trends have been observed, both related to greater openness of the PRO to their environment. That is the case of PRCs that aim to recruit internationally, competing with universities for the best talent. Second, they actively engage in exchanges and interactions with higher education institutions and with the business sector; this results in inter-sectoral mobility patterns (OECD, 2008).

Scientific and technological infrastructures are essential for the performance of PROs. The change in the funding structures may affect the ability to invest in facilities as project-based funding tends to have short time spans and mainly cover current expenditures and small equipment. In order to address this some governments have set up specific programmes to support investments in infrastructure and the creation of large scale research facilities at the national and international level (; ITER, ESFRI as a Forum in the European Union, etc.).

Finally, on the side of intangible resources, PROs increasingly have to obtain, manage and aim to improve their reputation and visibility. In a time of growing diversification of the roles that the different public sector research actors (including Higher Education Institutions-HEI) select and perform, PROs have to face competition and engage in collaboration. At the same time, PROs need to keep the distinctive roles and missions they have traditionally addressed. In a more competitive environment and due to the existence of “credibility cycles” (Rip 1994), tangible and intangible resources are strongly linked. This interrelation is likely to increase in the future.

Interactions

The interactions in which PROs engage with other PROs, HEIs, and private firms take place at three levels. These are: 1) bottom up interactions at the researcher level; 2) interactions of PROs promoted by policy-makers and funding agencies; and 3) the strategic interactions in which PROs leadership engage themselves.
Many of the relationships between PROs and other organisations take place at the level of individual researchers who are involved in research projects with other researchers in PROs, HEIs and private firms. The interaction with private and public organisations can also take the form of provider-customer relations in which the PRO offers consultancy services, does contractual research projects, sets up licensing agreements of IPR protected knowledge or engages in other forms of knowledge and/or technology transfer. PROs receive part of their funding from these latter types of interactions, with it being a relatively more important share of their income for RTOs than for PROs specialised in basic research. Reductions in the institutional funding of PROs over the past decade(s) have led many of these organisations to attempt to increase their revenues from these alternative sources of funding (Sanz and Cruz 2003). A greater emphasis on patents and technological innovation in the evaluation of different types of PROs is another factor stimulating this development (OECD 2009a). This has been accompanied by the growth in patents filed and licensed by PROs and the number of spin-off companies in which their research findings are commercialised (EC, 2009).

A second type of relationship between PROs and HEIs on the one hand and PROs and private firms on the other, is the establishment and functioning of hybrid organisations in which more than one type of organisation participates. Some PRCs have a long history in the set up of hybrid (sub-) organisations with HEIs such as the French CNRS with its mixed research units; other PRCs, such as the Spanish CSIC and the German Max Planck Society, have joined the practice more recently. PRCs, MOCs, and RTOs have also engaged in establishing hybrid organisations in which the R&D laboratories of private firms take part, such as the Leading Technology Institute (The Netherlands), Cooperative Research Centres (Australia), K-Plus Competence Centres (Austria), and National Networks of Technological Research (France) (OECD 2004).

Motivations for engaging in these activities include greater access to resources but also increased possibilities to engage in commercially relevant research and ways for commercialising research findings. Both the formation of PRO-HEI hybrids and PRO-private sector hybrids has been actively promoted by governments and funding bodies rather than being initiated by PROs themselves.

Third, PROs also engage with other partners to meet strategic goals. These goals include visibility, resource generation and/or socio-economic impact. In the future, relations with the environment are expected to increasingly become an organisational function.
Extramural and international collaboration has increased worldwide. Over the past decade some large PRCs, such as the CNRS and the Max Planck Society, have embarked on a strategy of offering designated institutional support for international collaboration. These initiatives take many different forms ranging from formalised collaborative networks to the establishment of international joint laboratories with research organisations in other countries (Jonkers and Cruz 2010). The motivations for engaging in this strategy include a quest for greater international visibility and prestige that can translate into greater access to talent and resources. Several RTOs, such as the German Fraunhofer Society and the Dutch TNO, have also engaged in the set up of subsidiaries and representative offices in foreign countries where the main aims are to attract contract research and consultancy projects for the institutes of the "mother" organisation. Tapping into local knowledge pools may also be a consideration.

**Sensitivity to policy intervention**

The ability of PROs to respond to policy driven changes will depend on their strategic adaptive capacity, which will differ in each type of PRO. The adaptive capacity of a PRO is determined by its specific institutional arrangement and organisational structure (i.e. autonomy degree in budget allocation, employment structure, internal distribution of authority), as well as by its researchers’ adaptive behaviour, goals and incentive structures.

Policy interventions aimed at increasing the flexibility of PROs include new normative models and forms of employment, institutional reforms, and the establishment of more open organisational forms (OECD 2009b). PROs characterised by a lower level of autonomy in their decision making and behaviour will be more sensitive to this type of measure. In a similar manner, policy measures involving changes in the level of public research support will not have an equal effect in each type of PRO. In general, PROs characterised by a having a more diversified portfolio of funding sources, a greater proportion of funding coming from private interactions, and a higher capacity for non-government related resource generation will be less sensitive to policy interventions involving reductions in the level of financial support.

The influence of policy measures involving changes in funding regimes (for instance towards more competitive and collaborative project based funding) will also differ depending on a PRO’s adaptive capacity. PROs which are more flexible and able to compete for funding, as well as those which have more capabilities to collaborate and contract with other actors (e.g. RTOs and more recently MOCs) will be more responsive to these types of policy changes. However, reductions in public funding during economic downturns could put consolidated research bases of PROs at risk and also impinge their ability to access alternative funding sources.
The implementation of a set of policy measures that are suitable for all types of PRO is clearly challenging. In some PROs, the achievement of both research excellence and socio-economic relevance (e.g. via fostering collaboration and public-private interactions) can lead researchers to be confronted with contradictory incentives. Moreover, the degree to which the outcomes of performance evaluations are taken into account differ greatly across different types of PROs.

Finally, coupling fiscal adjustment with measures involving more control may be counterproductive for PROs. Indeed, PROs will tend to perform their various functions better if they maintain a relatively large degree of autonomy with which to reach their research goals.

Evaluation

Developing a single equitable evaluation strategy for PROs is made more difficult by their heterogeneity (OECD 2006). The purpose of research evaluation is to ensure that public funding is concentrated in areas of research with a higher probability of a return on the investment. Effectively evaluating PROs, that do not necessarily rely on public funding as a primary resource, will therefore depend on the objectives and roles performed under that specific PRO.

Currently PROs are already involved in a number of intra- and inter- organisational evaluations that are linked to various outcomes. For example, MOCs would have different intra-organisational evaluations, where the evaluation variables and resulting managerial decisions may be more ‘political’ than ‘scientific’. It is therefore difficult to evaluate MOCs alongside other PROs. Intra-organisational evaluations of PRCs and IRIs, for example, would relate more to research outcomes of individual researchers. Outcomes such as publication impact and success in competitive block funding would inform internal management decision related to the allocation of incentives and/or institutional block funding.

Inter-organisational evaluation, on the other hand, uses different variables. These variables include scientific determinants such as traditional peer review, citation analysis (including bibliometric indicators), patent analysis and an estimation of the social outcome (impact) of the research. Again, the proportion each variable contributes depends on the PRO being evaluated. Peer review favours all PROs and is the cornerstone of the quality control of research. Citation analysis dominates modern evaluation systems and is relevant for PRCs and IRIs but it is less so for MOCs and RTOs as a dual focus on research and social application makes a fair assessment using only this option difficult. Patent indicators are more suitable for PROs conducting research with close links to industry and in fields with higher patent propensity. Finally, assessing the socio economic impact of research is suitable for PROs with close policy making and industry links such as MOCs and RTOs. This option is less suitable for PROs where the socio-economic impact of basic research is not always evident and the unit of measurement does not reflect the main organisational objectives for research output.
A variety of PRO-specific evaluations and rankings are currently in operation. PROs can be evaluated by external agencies, international peer review, or, indirectly, by rankings. An example of the former is the Evaluation Agency for Research and Higher Education (Aeres) in France conducts specific evaluations based on the different combination of the variables described above and additional qualitative variables such as interviews with managers and employees. On the other hand, an example of rankings including PROs is the Scimago ranking which uses solely bibliometric indicators.

However, the outcomes of such evaluations and rankings are not currently linked with any official or direct financial consequences for PROs. Instead, the public availability of this evaluation and ranking information can still have indirect consequences. For example, it may be used by PRO administrators to identify areas of excellence (or not) and therefore fuel internal policies that reallocate resources. Further, a poor ranking can also not only translate as a bad reputation publicly, but also limits a PROs ability to build a culture of values that is independent of the criteria used to determine the rankings (Sanz and de Moya, 2010).

References and further resources


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