

# Changing allocation models for public research funding: an empirical exploration based on project funding data

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The objective of this paper is to perform an experiment of quantitative assessment on changes in allocation mechanisms and in their underlying delegation models, using the quantitative information and the descriptions of national funding systems produced in the PRIME project funding activity. Delegation has been explored through changes in instrument portfolios and in evaluation modes, as proofs of an evolution in research governance. Some common trends can be identified: the reinforcing of both priority setting and peer review processes. The general result of our analysis is that some change in delegation modes took place, but there is not a simple transition from one delegation regime to another.

**P**UBLIC RESEARCH FUNDING and its evolution over time can be examined from different perspectives, for example, through changes over time in funding volumes (Irvine *et al.*, 1991), the portfolio of instruments used (McGeary and Smith, 1996) or the organisational structures put in place for allocating it (van der Meulen, 1998).

A very specific view on public funding has been developed in science policy studies in terms of delegation models (Braun, 2003); this approach interprets the relationship between the state and the scientists as one of delegation and then tries to characterise funding policies and instruments in terms of their underlying delegation models. The interest and specificity of this analysis lies precisely in the attempt to link the concrete instruments used to allocate public research funding to the more abstract categories of delegation modes developed in science policy, and thus to the general features of the relationship between the state and science system.

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The implication is that changes in the overall framework of research policies should be translated into changes in the allocation mechanisms of public funding; conversely, an analysis of funding instruments should allow us to test some hypotheses on changing research policy frameworks, beyond the simple reading of official declarations and documents and, in particular, to assess empirically the change from a science-based policy to a more policy-driven model, where the state tries to steer research more actively towards policy goals (Guston, 2000; Elzinga and Jamison, 1995).

However, until now, this has proved to be rather difficult, since systematic and comparable information across countries on funding systems and the quantitative importance of the different instruments was lacking, because official R&D statistics largely disregarded the consideration of instruments and allocation mechanisms (Lepori, 2006b). The main objective of this paper is to perform a first experiment of quantitative assessment on changes in allocation mechanisms and in their underlying delegation models, using the quantitative information and the descriptions of national funding systems produced in the PRIME project funding activity (Lepori *et al.*, 2007, this issue).

We are thus interested in testing the hypothesis of a shift from a blind delegation mode to modes entailing

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a more active role of the state, if possible to measure quantitatively the size of this shift and, finally, to understand whether the evolution has been similar across countries. As we will discuss later, this experiment is quite limited, since we use data on just four countries and the available information covers only public project funding and thus cannot give a complete view of the delegation relationship.

The organisation of the paper is that we first present the theoretical basis of the analysis of the evolution of the funding allocation policy. Then we deal with the research questions, the methodology for the analysis and data sources. Next, we examine the main changes in the types of instrument used for the R&D funding allocation. Finally we develop the analysis of the R&D project evaluation processes by country.

### Theoretical background

The evolution of funding policies can be analysed in terms of delegation modes, proposed for studying science policy and the implicit paradox faced by policy-makers of matching two potentially conflicting issues: "to guarantee maximum welfare benefits, without violating the independence of scientists and their organization" (Braun, 2003).

According to Braun (2006), the relationship between state and scientists can be seen as one of delegation when policy-makers ask the agent to do something that they cannot do by themselves because of lack of capability and knowledge, in exchange for the state transfer of financial resources (Coleman, 1990). Thus, the principal and the agent are linked by a relationship of mutual interest, since the principal needs the agent to fulfil a specific task (performing research as needed for policy objectives, such as welfare and economic development), while today the science system depends almost

entirely on the state for the resources needed to perform its functions (Braun, 2003).

However, since the political system and the science system pursue different objectives and follow different rules, policy-makers face a number of problems: how to be sure to choose the best scientists (adverse selection problem); how to get scientists to do what politics want (responsiveness problems); and how to avoid scientists trying to achieve their own objectives instead of fulfilling the delegated tasks (moral hazard problem).

The whole issue is complicated by information asymmetry between the principal and the agent, which makes it difficult and costly for the principal to control whether the agent fulfils the delegated tasks. Hence, the different delegation mechanisms can also be interpreted as a trade-off between the cost of gaining sufficient information for selection and control on one side and the risks of adverse selection and moral hazard on the other.

Braun puts forward four options available to policy-makers for reducing the risk of the research investment: to find a balance between conflicting interests by creating consensus and interaction spaces (one example is the creation of new institutions, such as public-private networks); changing career patterns (reputation and career mechanisms); using intermediaries of trust (peer review, where scientific experts are chosen as adviser to the principal, and research institutions, which settle procedural requirements for addressing the scientists' behaviour); and funding agencies, where there is explicit delegation and the higher the uncertainty about the preferences, objectives and outcomes (as in basic research, for instance) the higher the autonomy given to the funding agency.

In the last case, which is of particular interest here, the characteristics of delegation are determined by: a) the amount of discretion policy-makers grant to funding agencies; b) the procedures of control they have (that is, procedural requirements such as *ex-ante* evaluation); c) how funding agencies position themselves between the principal and the agents, and the dynamics of this positioning.

### Changing delegation models

On this basis, Braun identifies five delegation modes that have characterised science policy in different periods. Thus, "blind delegation", where the state allocated funds to research institutions without external conditions, characterised the post-war period until about the 1980s. It was left to the scientists to decide on the contents of science policy based on internal procedures such as peer review and scientific publications.

Later on, an allocation based on external price signals, given by priorities and specific research objectives, defined by the political system, joined the first mode. Control is still based on the peer-review system, with some special conditions attached. As

Braun underlines, this “incentive mode” was not strongly constraining and scientists were free to choose under which kind of funding to work. Moreover, as underlined by a large literature, since the scientific careers and the institutional environment were unchanged, working within research programmes represented a cost for scientists in terms of time and outcome.

Since the mid 1970s, the reduction in public funding has modified the situation (see the literature on ‘steady state’: Ziman, 1987; Cozzens, 1990). Some policy-makers used this situation strategically to reduce unconditioned funding (both institutional and project) to push scientists to accept conditioned programme funding and thus reinforce political price signals. As Braun points out, the costs to scientists increased and therefore the risk of moral hazard too (“austerity delegation”).

In the 1990s, two new modes emerged that try to find more efficient solutions to the problem of delegation. First, following the new public management discourse, relational contracts have been introduced between the state and research performers defining in broad terms what the agent is supposed to do in exchange for the transferred resources (Braun, 2003; 2006). The novelty of this “contract delegation” model lies in its nested delegation structure, where the state defines a contract with a whole research organisation and then leaves to their internal management the steering of individual scientists. These reforms should allow scientific institutions to undertake more strategic management of research priorities and introduce an *ex-post* evaluation and conditioned funds granted to scientific institutions. The implementation of the reform is still highly jeopardised (see Paradeise *et al*, forthcoming), and leaves room for hybrid solutions.

Finally, another institutional innovation has been the introduction of “network delegation” through instruments promoting and funding networks of research institutions with private companies and social stakeholders. This delegates to the internal mechanisms of the network the precise definition of priorities and activities, leaving to the state only general control on the working of the network as a whole.

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**Different delegation modes can co-exist, so they can condition the performers’ behaviour and choice to a greater or lesser extent: science policy-makers have to deal with an increasing heterogeneity of actors and networks, making it more difficult to impose their own goals on the research system**

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We notice that, in reality, different delegation modes can co-exist and consequently they can condition the performers’ behaviour and choice to a greater or lesser extent. As underlined by the literature, science policy-makers have to deal with an increasing heterogeneity of actors and networks, and heterogeneity makes it more difficult to impose their own goals on the research system (Rip and van der Meulen, 1996).

Moreover, the different institutions and policies together do not constitute a coherent contract (van der Meulen, 2006), while, in the application of the delegation relationship, research funding organisations (funding intermediaries) are often able to exclude the principal from the contract process (Caswill, 2003). Finally, it has been shown that, in the case of research programmes, the principal-agent theory is not able of capturing the cumulative and collective consequences of the relationship it aims to describe, since the long-term shaping of research priorities is co-produced by the interdependent relationships between researchers and their funding organisations (Shove, 2003).

## Research issues, methodology, data sources

The general assumption we will test in this paper is that in the long run the relationship between government and scientific institutions evolved from a trust-based mode (blind delegation) to directed funding based on incentives. Since the 1990s, this has moved in two directions: a ‘nested delegation’, that is, the embedding of the incentive mode into a contract delegation between the state and the scientific institutions; and/or a sort of delegation to networks, that is, the support for self-organising networks of co-operation with the user systems. This requires the development of suitable proxies to map funding instruments and their characteristics to delegation modes.

We will develop this analysis for the specific domain of public project funding, defined as money attributed to a group or an individual to perform a research activity limited in scope, budget and time, normally on the basis of the submission of a project proposal describing the research activities to be carried out (Lepori *et al*, 2007, this issue). This leads to a major limitation of our analysis, because we cannot control for changes in the allocation of general funding and, in particular, for the extent of the introduction of contract delegation through the contractual arrangements with research organisations. Thus, our results should be understood as a limited test of changes in allocation modes rather than as an analysis of changes in the overall delegation model between state and scientific community.

The data and qualitative descriptions have been collected within the general methodology of the project (Lepori *et al*, 2008), integrated with specific information on allocation mechanisms delivered by

the national correspondents. Moreover, the analysis is limited to four out of six countries participating in the project, since at that time full information on the Netherlands was not available while the French case is too specific to be included (Thèves *et al.*, 2007, this issue). These limitations have to be considered when interpreting the results.

#### Mapping instruments to delegation models

Mapping the project funding instruments to the delegation models identified by Braun proves to be a complex undertaking, given the diversity of the instruments and the multi-dimensional nature of some of them in the countries considered. For example, while we will generally identify programmatic research as a marker of an incentive delegation mode, we should be aware that the degree of detail in the definition of the priorities and the tasks to be accomplished varies considerably, for example, among programmes covering broad thematic areas with a large freedom to choose topics within their area and programmes for which quite detailed topics are prescribed, such as European programmes.

However, as a very first approximation, we consider the following categories of project funding instruments that broadly correspond to some of the delegation models:

- responsive mode projects and grants are taken as a case of blind delegation (free projects);
- research programmes with defined themes are taken as a case of incentive delegation (programmes);
- instruments funding research networks are taken as a case of network delegation (networks).

We will compute the share of these instrument categories in the total project funding volume, as a measure of the relevance of the corresponding delegation mode within project funding.

#### Examining selection and evaluation processes

The changes in delegation modes are also supposed to produce effects on the selection and control

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mechanisms of research. Braun (2003) underlines that blind delegation allows a complete abstention of policy-makers from any action able to influence the functioning of science. On the other hand, the incentive delegation model requires the setting up of mechanisms for priority setting, for reviewing applications against political relevance, for designing and funding the programmes, and for monitoring procedures and measurements of the research outputs. Finally, in the network model, decisions are delegated to the network and monitoring activities are reduced, because of the “difficulty in defining adequate measures”. The principal acts only as a facilitator, helping institutions to co-ordinate (Braun, 2003).

Thus, we expect that evaluation processes of public project funding evolved from an *ex-ante* selection process, based on the judgement of the beneficiary’s community, towards a double (*ex-ante* and *ex-post*) evaluation process, where external actors are involved, economic impact criteria are included and the *ex-post* evaluation has an effect on future government allocation choices. Thus, only the combination of changes in funding instruments and evaluation processes gives a representation of how delegation modes evolved in the various countries.

To test this hypothesis, we examine the following features of project funding instruments:

- the composition of the evaluation committee: presence of external members; members from abroad; stakeholder representatives;
- the methodologies and criteria for the project selection, including, for example, the use of criteria such as scientific quality; economic impact; social impact; internationalisation;
- the presence of intermediary and *ex-post* evaluation of projects and of their results and its effects on funding and on priority settings.

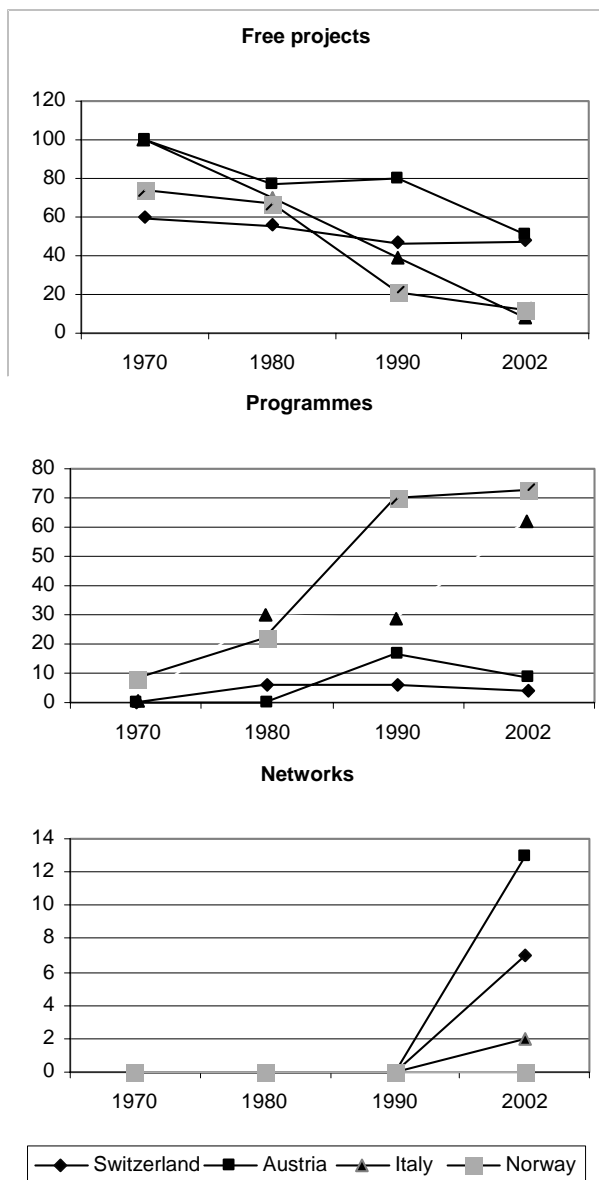
#### Changing instrument portfolios

In this section, we analyse the evolution of the portfolio of project funding instruments in the four countries considered and its evolution over time; we translate this in terms of the prevailing delegation mechanism.

Table 1 lists the main funding schemes by three categories of instrument and by country. We exclude international funding schemes, since they do not reflect the evolution of national delegation modes. Nevertheless, their introduction shows a relevant change: the increase of a variety of funding sources and the trend towards multi-principal relationships for scientific agents (see van der Meulen, 2006). Figure 1 shows the share of the different types of instrument as a percentage of the overall volume of project funding by country and by year (1970, 1980, 1990 and 2002).

Table 1. Project funding instruments considered

Country	Free projects and grants	Programmes	Networks
Switzerland	SNF free research projects and person grants; CTI collaborative projects	SNF National research programmes and priority programmes	SNF National Centres of Competence in Research
Italy	CNR contracts and contributes; FAR bottom-up projects; PRIN-COFIN	CNR/finalised projects; FAR PNR; FIT; FIRB; FIRS	Excellence R&D centres
Austria	Total Austrian Science Fund; Jubilaumsfonds- Direkt; individual research projects; general programmes	Innovation and Technology Fund (ITF); Take Off; A 3; GEN-AU; House of the Future	SFB; KPlus; Kind-Knet;
Norway	Project support and grants by Research councils	National priorities programmes; council programmes; programmes basic research; strategic support; large and targeted programmes; Government projects	R&D networks (only after 2002)



**Figure 1. Share of instruments categories in total project funding**  
 Notes: Percentage of the three instrument categories over the total national project funding volume; only national funds, except for Switzerland where international funds are also included  
 For detailed tables and figures see Poti and Reale (2007)

*Free projects and grants*

Free funding schemes dominated public project funding in Switzerland throughout the period. The free projects managed by the Swiss National Science Foundation (SNF) for academic research were the main instrument, representing 50% of the total project funding in 1970. The relative weight of this instrument decreased over the 30 years, from 50% to 31% of project funding (PF) (including international funds).

The other two free instruments were: the grants to individual people managed by SNF, with a relative weight of 8% of PF, remaining more or less stable over the years; and the collaborative projects for applied research between universities and industry, managed by the Commission for Technology and Innovation (CTI), which had a negligible role in the 1970s, but grew during the 1990s and, in 2002, represented 10% of total PF. In sum, in 30 years, the free project funding instruments all together decreased only slightly (from 60% to 48%).

A bottom-up approach characterised 100% of Austrian R&D project funding in the 1970s, through projects funded by the Austrian Science Fund (FWF) and the Industrial Research Promotion Fund (FFF); both were highly independent intermediary bodies aiming respectively to fund scientific research and to promote industrial research and development. Projects were proposed by individual actors and selected by an in-house review system.

Over time, FFF projects maintained their relevance, but the internal evaluation mode changed towards an impact evaluation. At the end of the 1990s, new schemes for academic beneficiaries were introduced (individual research projects). Free project instruments in Austria maintained their relevance over time, but they were accompanied by an 'internal change' of the evaluation mode and by a decrease of importance in relative terms (from 100% to 51% of PF), given the incentive-oriented instruments introduced since the 1980s and managed directly by the ministries.

In Italy, 100% of the project funding instruments in 1970 were free projects and the main instrument (61% of PF) was an applied research-oriented bottom-up scheme (FAR), funded by the Ministry of Research (MRST), whose beneficiaries were private companies. Later this instrument reduced its importance (25% in 1990), since many other schemes were introduced and we consider that, in the more recent period (the 2000s), the nature of the FAR free project instrument changed, since a policy aim was imposed and now the scheme is mostly devoted to firms located in the less developed regions of the country.

The second free project scheme was the free grants devoted to individual researchers, mainly in universities. It was managed by the National Research Council (CNR), the main intermediary agency, under the Ministry of university and research (MIUR) control. The research themes were selected by the agents and no priorities affected the research design. The relative weight of these instruments decreased from 39% in 1970 to 15% in 1980 and 6% in 1990. They were stopped in 1999, when CNR lost its role as a funding agency. Finally, a low amount of funding was devoted to academic research through a specific instrument (Cofin-PRIN), whose weight remained around 7%.

In Norway, free projects and grants represented around 74% of total PF in 1970. They were managed by research councils, in particular, the NTNF (the Norwegian Council for Scientific and Industrial Research), funding applied and industrial relevant projects, and by NAFV (the Norwegian Research Council for Science and the Humanities), funding academic projects. The evolution of the instruments followed the changes of these agencies and, in particular, the merger of the Norwegian research councils at the beginning of the 1990s (Skoie, 2001). This led to an enlargement of the mission in both the councils. Over time, the weight of the free instruments strongly decreased (20% in 1990 and 12% in 2002).

### *Programmes*

National Research Programmes (PNRs) in Switzerland date back to the mid 1970s (Lepori, 2006a). Each PNR was devoted to a single theme of socio-political relevance and about 55 programmes were launched between 1975 and 2004. The subjects were chosen by the Government, while the whole programme and the selection process were managed by the SNF. Their relative weight was always low: around 6% in 1980 and 1990 and 4% in 2002).

At the end of the 1980s, project funding was seen as the instrument for implementing political and technological priorities, but priority-oriented project funding did not displace pre-existing funding, since it was based on "additional" financial means. A new scheme, SNF Priority Programmes, was introduced in 1992 funding strategic-oriented research, in

collaboration with industry, but without funding private research directly.

In Switzerland, the evolution towards incentive delegation mode of project funding was thus limited, while the main change was external, that is, the development of the European Framework Programme and the decision by Switzerland to participate in it. At the end of the 1990s, national thematic programmes lost their political importance and SNF re-directed these funds towards more academic instruments (Lepori, 2005). In 2002, funding of programmes represented 20% of the total project funding, if we include the European Framework Programme, and only 4%, if we exclude it.

In Austria, a major change happened in the 1970s, when the Federal Ministry for Science and Research (BMWF) was established. The Ministry did not touch the autonomy of the two pre-existing agencies, but top-down programmes were introduced between the 1970s and the 1980s. In 1987, the Innovation and Technology Fund, was introduced, steered by a policy-dominated board (Kuratorium) and partly administered by FFF.

This Fund was dissolved in 2003, but a large variety of incentive-oriented instruments (programmes) were introduced during its existence. Some of these programmes addressed specific technological areas (biomedicine; energy systems) or political issues (university–industry collaboration). However, from the 1990s, R&D programmes did not continue their growth and their weight is at present significantly lower than free project instruments (25%, if we include the European Framework Programme, only 9%, if we exclude it).

In Italy, programmes started early, from the mid-1970s, within the academic context: the CNR finalised projects were multi-year projects of practical relevance and academic research, based on additional and specifically devoted resources coming from the MIUR. In 1980, they represented 30% of the total project funding. Even though they were controlled by Government and inspired by the idea of the transfer of results, the finalised projects never evolved into an effective collaboration between industry and university. They did not involve a large number of industries nor users in their steering institutions.

They started to receive less funding in the 1990s and ended in 2000s. A new instrument was introduced in the 2000s supporting basic research (FIRB, Basic Research Investment Fund), managed by the Government through strategic projects for the development of scientific knowledge or of multi-sectoral technologies. This specific instrument represented 20% of total project funding in 2002.

During the 1980s, priority was given by the Government to incentive-type instruments devoted to innovation. New instruments were introduced, among which the National Research Programmes, based on a priority-setting activity of the Ministry of Research and on university–industry collaboration. Relatively

low resources were allocated (4% of PF in 1990) to this instrument, which ended in the 1990s.

Other instruments were: the fund for technological development (FIT), with sectoral priorities, amounting to around 10% of PF; ministries funding projects (in particular, in the agriculture and health sectors); and a part of the European Structural Fund going to research projects (PON). PON amounted to around 2.8% of PF in 2002. At the beginning of the 2000s, the incentive-type project funding weighted around 62% of total PF.

R&D funding instruments in Norway underwent a relevant change around the 1990s when R&D programmes (National Priorities Programmes, council programmes and Government projects) grew significantly. With the reform of 1993, the existing five research councils were merged into one (NFR), with six sub-councils organised as mission-oriented. In all cases, the Government fixed the priorities, and the Board of each (sub)-council was composed of a mixture of researchers and users who were responsible to a large number of stakeholders. The weight of the incentive-type of instrument was around 70% of project funding in 1990 and in 2002.

### Networks

In all the countries considered, research networks are a more recent instrument (2000s) and often the political discourse was more important than the practice. In terms of network delegation, they should be a means for the government to facilitate a knowledge sharing among different actors, giving the research organisations and scientists a way of self-organising innovation networks with user systems.

In Switzerland, National Competence Centres for Research (NCCR) started in 2000; they were large co-operation networks between Swiss universities, managed by SNF. Private companies can participate but at their own cost. This instrument finances applied academic research in specific research fields with the aim of building networks of competence in selected domains. The choice of the domains is oriented to academic disciplines and scientific excellence. NCCR represented 7% of PF in 2002.

In Austria, a plurality of research networks schemes were introduced in the 2000s. One of the more relevant (5.5% of PF in 2002) is the *KPlus*, managed by the Ministry for Transport, Innovation and Technology (BMVIT). It has to establish long-term structures of collaboration. The focus lies in pre-competitive and high-level research and it is inspired by the Swedish Competence Centre Programme. Today, *KPlus* is part of the MAP Thematic Network (Best Practices for Multi Actors and Multi Measures Programmes in research, technology and development policy), with a focus on science–industry co-operation and on exchanging experience and knowledge among different countries on the challenges of managing complex, modern programmes.

The Long-Term Research Projects (SFB), founded by FWF and amounting to 2% of PF in 2002, are transdisciplinary research programmes within a time-frame of up to ten years. A special promotion supports the realisation of complex research projects and gives the possibility of establishing ‘centres of excellence’ at universities. The condition for the set-up of a SFB is a positive assessment by a group of international experts. Furthermore, these experts regularly evaluate the project’s scientific activities after it has received a grant from the FWF. Currently, there are 12 such research units in Austria. In 2002, research network schemes all together represented 13% of the total PF.

In Italy, the research networks, intended as joint research centres, are a recent instrument, introduced by the National Research Programme 2005–2007 of the Ministry of Research. They are of three types: technological districts, with the aim of strengthening the collaboration between firms and regional governments to support the local economic growth; joint public–private laboratories (open to international collaborations) for sustaining the national participation in international research programmes; the development of a network of public–private laboratories of excellence for the realisation of basic “mission-oriented” research, where Government defines some large thematic orientation. The last two types are funded by the new instrument FIRB and, in 2002, amounted to 2% of PF.

In Norway, Government attributes two different aims to research networks: to reinforce the national research system and to promote academic research. The rationale is that internationally competitive research is only possible through long-term support. One way of raising the quality, efficiency and visibility of Nordic research is the creation of Nordic Centres of Excellence (NCoE). This programme started in 2003 (that is, out of data collected). The programme is funded by the Nordic research councils, Nordic Council of Ministers, and NordForsk.

A NCoE is a network of excellent groups of scientists, collaborating within a defined field of research. At present, five Nordic Centres of Excellence Programmes are active: one in the field of global change (four centres); one in molecular medicine (three centres); one in social sciences and the humanities (four centres), one in welfare research (two centres); and one in food, nutrition and health (three centres).

### Overall results and comments

In all four countries, the 1970s were characterised by the dominance in project funding of free projects and grants, thus following the blind delegation regime. However, the later evolution was different: not only was there a different portfolio instrument mix in the 30 years considered, but the same instruments had a different internal evolution. Thus, we can roughly consider the evolution in Switzerland and

Austria together, and Italy and Norway together, looking at the internal differences in the same time period.

In 30 years, the free projects came through various paths to represent around half the total project funding in Switzerland and Austria. In Switzerland, this represented a return to the situation in the 1970s, after a moderated change resulting from some national incentive-oriented programmes. In Austria, a change in the internal evaluation mode characterised the FFF programmes, devoted to private companies, being the most relevant free projects scheme in 2002. In both countries, the incentive type instruments did not assume an important role at national level, while, if we include the European programmes, this typology registers a share of around 20% of total project funding.

In Italy and Norway, the pattern was different. Free projects lost their relevance almost completely, leaving room for incentive type instruments, but, again, important differences characterise the two countries. In Italy, the funding allocation role of CNR, the scientific intermediary agency, was terminated in the 1990s and MIUR had total responsibility for project funding allocation. The CNR finalised projects were abolished and replaced by a different instrument (the Fund for Basic Research, FIRB), where thematic areas are established by Government, and the selection and evaluation is under Government control. As for the funding of free projects devoted to firms through the FAR instrument, political objectives were imposed, together with a better check on firms' outcome, a key piece of information for future access to public funds.

On the other hand, in Norway political discourses on supporting the transfer of scientific knowledge, collaboration between university and industry and sustaining industrial and national competitiveness became the mission of the new Research Council. Therefore the relevance of the incentive instruments is softened by their management by intermediary agents, keeping a certain degree of independence from the Government. The Norwegian Research Council has been defined by Braun as a strategic agency responding to problems raised by both the

scientific community and external actors (see also Slipersæter *et al*, 2007, this issue).

Finally research networks are a new instrument in all four countries, mainly responding to the political goal of promoting a critical mass of competences for complex research projects, open to international collaboration and striving to attract the best scientists. They are thought of as instruments in which highly qualified representatives of the scientific community, in some cases together with highly qualified representatives of the technology community, are free to build their own research agenda, within some broadly defined boundaries.

### **Selection and evaluation: nothing has changed?**

As already mentioned, an expected effect of changes in delegation modes is the reinforcement of the *ex-ante* evaluation processes (in terms of composition of the evaluation committees) and of the effects of *ex-post* assessment exercises, together with a diversification of criteria and methodology (from criteria mainly focused on scientific quality, to a mix of criteria including economic and social impact and internationalisation; from external peer review to a mix of instruments including tools such as bibliometrics, econometrics and cost-benefit analysis). In sum, evaluation is supposed to follow the general evolution of research governance predicted by Braun's assumptions on the shift in delegation modes.

Because of the lack of direct information on selection/evaluation processes of each funding instrument in Austria and Norway, these countries have been discussed on the basis of administrative sources (mainly political documents, specific surveys and documents on the web), which generally are more focused on the overall selection/evaluation processes applied by the managing agency than on the specificities of the single instrument. Another limitation is that, according to the available information, we could not go inside the peer-review processes to understand how practices are really implemented (for example, whether peers are chosen differently or if they have different evaluation criteria).

#### *Free projects*

The evaluation procedures for free projects are shown in Table 2.

In Switzerland, free projects managed by SNF are evaluated, with no major changes, by a committee composed of academics using (largely international) peer review, without quantitative criteria and ranking. Criteria refer to the scientific quality of the proposal and reputation of the proponent, and no other assessment follows after the decision for individual projects. No major changes in this procedure can be observed over time.

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**Research networks are instruments in which highly qualified representatives of the scientific community, sometimes together with highly qualified representatives of the technology community, are free to build their own research agenda, within some broadly defined boundaries**

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Table 2. Evaluation procedures for free projects

Country	Composition of committee	Methodology	Criteria	Intermediary, <i>ex post</i> evaluation	Effects	Type of Instrument
Switzerland	Academic only	Peer review by external experts	Scientific quality	No evaluation after decision for individual projects	Project results relevant for new applications based on reputation	SNF — free research projects and person grants
Switzerland	Council with a mixed composition (academics, private economy, state): State influence heavily present	Evaluation by committee members, sometimes with support from external experts	Innovation and economic potential of projects	No evaluation after decision for individual projects	Project results relevant for new applications based on reputation	CTI — collaborative projects
Italy	Academic only	Peer review by external experts	Scientific quality	No evaluation after decision for individual projects	Project results relevant for funding allocation to the institutions	MIUR — PRIN-COFIN
Italy	Academic only	Evaluation by committee members	Scientific quality <sup>a</sup>	No evaluation after decision for individual projects	Project results relevant for new applications based on reputation	CNR — Contracts and contributes
Italy	Committee composed of experts	Evaluation by committee members sometimes with support from external experts	Innovation and economic potential of projects	Intermediary with survey and site visits	No effects	FAR bottom-up projects
Norway	Mixed composition (academic + external experts)	International peer reviews	Scientific quality	No evaluation after decision for individual project	Project results relevant for new applications based on reputation	Research councils — project support and grants
Austria	NA	Peer reviewing by external, mostly international experts	Scientific quality <sup>a</sup>	NA	NA	FWF — Austrian Science Fund
Austria	Mixed (academic + economy)	Evaluation by committee with support of external experts	Technological quality of projects, of firm, economic value of project, economic and managerial performance of company	Evaluation of whole instrument	NA	FFF — general programmes

Notes: <sup>a</sup> Scientific quality of both the project proposal and the project leader

Free projects and grants managed by the Swiss Innovation Agency are devoted to promoting university–industry collaboration. Innovation and potential economic exploitation are the criteria used by the evaluation committee, which sometimes used external experts. The committee included mixed competences: from academia; from the State; and from the private sector, with the State playing a strong role. No intermediary or *ex-post* evaluation was applied and no major changes occurred in the evaluation scheme.

In Austria, on the one hand, FWF funded academic free projects and grants on the basis of peer reviewing with the involvement of external, mostly international experts. The evaluation of FWF funding activities (Arnold, 2004) outlined that the review criteria traditionally have been scientific quality of the project and of the research team, and appropriateness of the budget. In 2003, new criteria were added (implication

of the project for other branches of science, potential socio-economic impact). Moreover, the judgement of external reviewers in some cases were decisive, while in others it was considered only as advice.

On the other hand, FFF funded programmes based on bottom-up proposals of companies, selected for funding on the basis of an internal peer review. The systematic use of evaluation was substantially improved from the mid-1990s, although evaluation capabilities that were internal to agencies were not yet present (Jörg, 2004). FFF underwent an evaluation process, which included the way the agency assesses its project portfolio, from 1992 to 2002 (Arnold, 2004). The procedure addressed the technological quality of the projects and of the submitting firm, the economic value of the results and the economic and managerial performance of the company. In recent years, national efforts to establish a homogeneous

system of evaluation have increased: FFF adopted the standards elaborated by the Austrian Platform for Evaluation of Research and Technology for the assessment practices.

The historical Italian free projects (managed by CNR from 1968 until 1999) did not undergo any evolution. On the contrary, they remained stable over 30 years with the selection made by the CNR disciplinary committees on the basis of scientific quality. Free projects devoted to innovation had a structure similar to the Swiss CTI projects as to methodology and criteria, but with a different (only technical) committee composition, because they are not public-private collaborative projects and intermediary evaluation is carried out. No changes occurred in this scheme until 1999, when the instrument was terminated.

The other free project instrument, PRIN-COFIN, was managed by MIUR. It shifted from a system based on experts' review to a formally structured peer-review system. Moreover, the success rate of applicants entered into the funding formula of the university. No other modifications can be outlined: peers selected for reviewing are generally academics, no intermediary or *ex-post* evaluation was implemented and the selection remained based on scientific quality of the project proposal and of the project leader.

Before 1993, selection and evaluation processes of the three mission-oriented councils in Norway were mostly organised according to scientific disciplines, sub-committees were in charge of funding decisions for each area. The committees had a mixed composition (members from academia, industry, public institutions and Government), which was decided partly to represent stakeholders' interests and partly to include scientific competences (individual merit). The committees were relatively free to define their own evaluation procedures, based on peer review, and the extent of use of external referees was different across disciplines and councils. Selection criteria were mainly scientific excellence, especially for NAVF. Since the establishment of the NFR in 1993, the evaluation procedures have become more streamlined, as use of international peer reviews and scientific merit as selection criteria have become widespread.

### Programmes

The evaluation procedures for research programmes are shown in Table 3.

The selection/evaluation processes of research programmes in Switzerland were basically the same: each program had its own committee. The

**Table 3. Evaluation procedures for research programmes**

Country	Composition of committee	Methodology	Criteria	Intermediary, <i>ex post</i> evaluation	Effects	Type of Instrument
Switzerland	Mixed (academic + state)	Peer review by external experts	Scientific quality; relevance to the theme and for policy or for economic development	No evaluation after decision for individual project: the whole instrument has been repeatedly evaluated	Project results relevant for new applications based on reputation	SNF — national research programmes; priority programmes
Italy	Mixed (academic + economy)	Evaluation by committee, sometimes support from external experts	Innovation and economic potential of projects	Intermediary	Possibility of stopping project funding	MIUR — FAR PNR
Italy	Mixed (academic + economy)	Peer review by external/international experts	Scientific quality; relevance to the theme Economic potential of the projects	Final foreseen by law; intermediary recommended by the Evaluation Committee	Possibility foreseen by law to stop project funding	MIUR — FIRB and FISR
Italy	Academic only	Evaluation by committee members	Scientific quality; <sup>a</sup> relevance to theme of programme	No evaluation after decision for individual projects	NA	CNR — finalised projects
Italy	Mixed (academic + economy)	Evaluation by committee members	Relevance to theme of programme	No evaluation after decision for individual projects	NA	Ministry of Industry — FIT
Norway	Mixed composition (academic + state + private)	International peer reviews	Scientific quality, partly industrial or economic relevance	No evaluation after decision for individual project	Project results relevant for new applications based on reputation	RC programmes; national priority programmes
Austria	Mixed (academic + economy)	NA	Economic and scientific impact	Evaluation of the whole instrument	Mostly 'legitimation' function	Ministries — funding instruments

Notes: <sup>a</sup> Scientific quality of both the project proposal and the project leader  
NA = not available

composition was mixed: both academics and experts from the private sector or the public administration were involved. The methodology was essentially a peer review based on international experts. Criteria focused on scientific quality and the relevance of the proposal to the theme of the programme and to political or economic development. The time of the evaluation was limited to the *ex-ante* phase, but all the instruments have been repeatedly assessed.

In Austria, a survey developed in 2000 on 110 measures developed by the ministries (mainly R&D programmes), showed that 30 project funding instruments were evaluated in the previous seven years. The focus of the exercises was mainly on economic and scientific impact (73% of evaluations), while processes, management and quality of work have lower rates (about 30%). As to the use of evaluations, most have a 'legitimizing function' (90%), while only 30% were used for re-allocating funds or for introducing substantial change of funding policy. These results demonstrate that evaluation, although strongly implemented, did not yet enter the decisional processes driving policy choices and funding allocation (Jörg, 2004).

In Italy, CNR finalised projects were large projects supposed to be more policy-oriented than free projects, but the selection processes were organised more or less in the same way. After the end of CNR funding instruments, two new programmes emerged in 2000, managed by MIUR: FIRB and a thematic-oriented instrument, FISR. Committees, with a mixed composition drove both selection and evaluation processes (academics plus representatives of the economic sector). There was a passage from criteria based on scientific quality to a more diversified set of criteria, according to the characteristics of the instrument. We note, on the one hand, the opening to external experts of the peer committees in charge of evaluation, in order to acquire reviews from

specialised scholars, thus assuring more precise and independent judgements. On the other hand, the enlargement of instruments did not include the implementation of *ex-post* evaluation.

As for the innovation-oriented programmes (FAR-PNR and FIT), they had more or less the same selection/evaluation processes until 1999: mixed committee, internal evaluation, no assessment after decisions on individual projects. After 1999, FAR was reformed while FIT remained stable. However, no major changes in evaluation are really visible in either case, except for the inclusion in FAR of a formal peer-review system for the selection of proposals. The reform foreseen by law remained largely ineffective.

In Norway, evaluation of the programmes had the same evolution as free projects. Research councils not strictly devoted to funding academic research applied scientific and industrial, or economic relevance criteria. For innovation-oriented instruments and projects dedicated to political problems, relevance criteria seem to have played a larger role in some areas. For instruments directly funded by Government, relevance has been more significant than for most of the funding allocated by research councils. Government officials have been in charge for decisions, often in close collaboration with the researchers performing the projects.

### Networks

The evaluation procedures for networks are shown in Table 4.

In Switzerland the selection process of National Centres of Competence was in two steps: first the selection made by a committee composed by academics, based on peer review by external, mostly international, experts, with scientific quality as the main criterion. The second step was the transmission of a short list of proposals to the

**Table 4. Evaluation procedures for networks**

Country	Composition of committee	Methodology	Criteria	Intermediary, <i>ex post</i> evaluation	Effects	Type of Instrument
Switzerland	Academic only for evaluation; final decision by ministry on a short list from SNF)	Peer review by external experts	Scientific quality	Intermediary evaluation after four-year period	Decision to fund second phase (four+four)	SNF — National Centres of Competence
Italy	Mixed (academic + economy)	Peer review by external experts	Scientific quality; relevance to theme of programme; economic potential of projects	Final foreseen by law; intermediary recommended by Evaluation Committee	Possibility foreseen by law to stop project funding	MIUR — excellence R&D centres
Austria	Mixed (academic + economy)	Peer review by external experts	Scientific quality; relevance to theme of programme; economic potential of projects	All funded centres have been evaluated mid-term and end; final evaluation of whole instrument	NA	Austrian Science Fund — <i>KPlus</i> competence centres

Notes: NA = not available

Government for final selection, based on research policy considerations. Intermediary evaluation is applied after the first four-year period and is linked to the decision about funding for the second four-year period.

In Austria too, the process of evaluation was in two steps. The first was the submission of a pre-proposal, which was evaluated with regard to its financial and organisational quality and its scientific and technical quality. The scientific peer review was supported by the Austrian Science Fund and included external auditors. Tenders evaluated positively were invited to submit a full proposal, which was evaluated by the committee and by six international auditors. Criteria applied were high scientific quality and the economic relevance of the research programme. Intermediate and *ex-post* assessment exercises were also developed for each funded initiative. Moreover, an assessment of the overall instrument was carried out. The objective of the assessment was the support for the strategic decision-making of the two responsible ministries regarding the future of the K-programmes and centres/networks.

In Italy, R&D networks had the same evaluation process as the FIRB, because they were included in that funding framework. In Norway, networks started from 2003 and no specific information was yet available.

### Discussion

Our analysis shows some interesting similarities in evaluation procedures and their evolution over time, together with a number of country-specific features. Each of the categories of project funding instruments we identified is characterised by a typical mode of evaluation (Table 5).

We notice that we need to distinguish between academic-oriented and innovation-oriented projects, since criteria, methodologies and committees are different. Programmes are linked to the emergence of government priority setting during the 1980s.

The situation in the four considered countries can be described as follows.

In Switzerland, SNF maintained a prominent role as an intermediary body in Government allocation policy. No push towards instituting stringent *ex-post* evaluation practices was present, while periodical evaluations of the instruments as a whole have been implemented, but with limited impact on policy.

Austria's PF system was characterised by the prominent role of the two intermediaries. In Austria, the emphasis placed since the mid-1990s on standards in evaluation practices for all the types of instrument is a signal of a tendency toward the introduction of the managerial paradigm in the State-scientists relationship, as indicated by the establishment in 2002 of a system of *ex-ante* and *ex-post* evaluation, such as the definition of a catalogue of criteria and guidelines for the impact analysis of R&D funding. However, at present evaluation practices have an impact only in terms of improving future programmes management and not on allocation of funding.

Italy over time did not show an evolution of evaluation practices going towards the relational contract delegation mode; funding evaluation still did not deeply affect funding allocation or priority settings.

In Norway before 1993, funding policy was mainly characterised by trust-oriented processes of selection/evaluation, while after 1993 targeted programmes were strongly implemented. Although information on Norway cannot be connected to a single funding instrument, it seems clear that the selection/evaluation processes of the councils remained stable over the period considered, adopting mainly a blind mode of delegation. This was challenged in the mid-1990s by the desire to give more room to criteria that refer to political priority setting or to economic added value.

Overall, changes in evaluation practices seem to be largely limited to the introduction of political priorities as explicit criteria in evaluation, in order to assess the compliance of the activities, and the extensive use of mixed committees in charge of evaluation. However, even in countries like Norway and Italy, where R&D programmes have become

**Table 5. Typical evaluation procedures for project funding**

	Free projects and grants (academic-oriented)	Free projects and grants (innovation-oriented)	R&D programmes	Networks
Composition of committee	Mainly academics	Mixed (academics, industry, government)	Mixed composition (academics, experts, economy)	Mixed composition (academics, experts)
Methodology and criteria	Peer review based on scientific quality	Economic potential of project	Peer review for scientific quality; economic and scientific impact, relevance to theme though the use of indicators	Peer review based on scientific quality
Final/intermediary evaluation, effects	Formal final evaluation, limited effects	Formal final evaluation, limited effects	Final evaluation of programme	Final evaluation of programme

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**Changes in evaluation practices seem to be largely limited to the introduction of political priorities as explicit criteria in evaluation, in order to assess the compliance of the activities, and the extensive use of mixed committees in charge of evaluation**

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dominant in project funding, this change was not accompanied by a coherent diversification of criteria and methodology according to priority setting: evaluation seems more or less still linked to peer reviewing based on academic/quality criteria. Government initiative toward evaluation in Austria was the only sign of possible ongoing change in delegation modes.

### Conclusion

Starting from the theoretical background of the delegation modes introduced by Braun (2003) to characterise public research funding, our paper aimed to discover which patterns of delegation can be detected by integrating quantitative indicators on government project funding with qualitative information on the processes of selection and evaluation of the funding instruments.

We recall that the general hypothesis is that a shift occurred in the last 30 years from a blind delegation mode, in which the state left to the scientific community most decisions on how to conduct research, to a more direct steering through incentives (with the state attempting to encourage the scientific community to work towards specific goals) and later in the 1980s and 1990s, to a more indirect steering, where a 'relational' contract between the state and the research organisations should allow a more efficient deployment of the state power of control. Network delegation can be seen (Braun, 2003) as a counterbalance of the scientific community steering, where heterogeneous, bottom-up or multi-level, types of control and co-ordination can co-exist, while the state is a facilitator of co-operation and trust building.

Thus, our hypothesis was that, over the 30-year period considered by the analysis, the instruments used for project funding evolved in accordance with the changes in the delegation mode and the evaluation processes were generally reinforced and extended, including strong *ex-post* controls.

Before coming to the results, we acknowledge

some relevant limitations of this exercise. First, we considered only project funding, without taking into consideration changes in the core funding for public research institutions. We looked mainly to national funding instruments, while, in the last few years, there has been a growth in the relevance of international programmes for funding research activity. Moreover, limited attention has been given to the role of the funding agencies and specifically of the intermediaries, which is still very relevant in three out of four of the countries examined (see Slipersæter *et al.*, 2007, this issue). Finally, we considered just four countries, which are not necessarily representative of the overall situation.

If we look at the combined result of our quantitative and qualitative analysis, generally some changes in delegation modes have taken place, but in a more moderate and additional way than the simple idea of a transition from one delegation mode to another. Moreover, we found different evolutions among the countries considered: free projects, which on average we assumed to correspond to a blind delegation mode, remained the most important instrument at national level in Austria and Switzerland, while, in Norway and Italy, R&D programmes, which we assume to correspond to incentive delegation mode, have become the dominant type of project funding instrument. We also found that the evolution towards programmes in the two former countries was mainly a result of the participation in international programmes, with the effect of a diversification of principals, if we keep the principal-agent scheme.

The importance of these shifts is somewhat weakened by the results concerning the selection process, since priority setting was not generally followed by a change in the evaluation process; thus, in all cases, peer review retained a central role in the selection and in three out of four countries intermediaries still largely manage the selection (even for policy-oriented programmes). Overall, changes in evaluation processes have been largely limited to the use of political priorities as explicit criteria for the evaluation and to the inclusion of representatives of the government or of industry in the decision-making committees; in none of the countries considered was *ex-post* evaluation having a relevant impact on the selection of beneficiaries.

Finally, the recent institutional changes towards a contractual relationship between the state and the scientific community cannot be checked by looking only at project funding. Also, the network delegation mode has been analysed only in terms of political discourse, given the very recent introduction of the new instrument. What does seem possible to identify, given the weight of this measure, is that it is to facilitate the self-organisation of a restricted group of excellent scientists, therefore not really 'balancing' the reform, which introduces control through evaluation of researchers.

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