

## CHAPTER 3

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# THE ROLE OF EVIDENCE AND EXPERTISE IN RESEARCH FUNDING AGENCIES

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CRESO M. SÁ, MERLI TAMTIK, AND ANDREW KRETZ

### INTRODUCTION

In an era of heightened expectations and constrained resources for academic research, funding agencies need to navigate a challenging policy environment. Internationally, science policy has been reconfigured around technological innovation agendas and economic goals (Lundvall and Borrás 2006). With this shift, government funding for university research has been increasingly directed toward “strategic” fields, objectives, and modes of support. The emphasis has been on the relevance and impact of research outcomes, particularly on technological applications. Such shifts in research policy have been documented across continents (e.g., Dill and van Vught 2010). Funding agencies figure prominently in the literature as vehicles for many of these new policy agendas, yet they have remained in the background as agents of policy formation and implementation.

Over the past decade, political expectations that public agencies should become more responsive and accountable are transforming the agenda and strategies of research funding agencies. In Canada, there has been a shift away from hierarchical, top-down accountability (by the federal government, granting agencies, and researchers) toward less hierarchical administration (Doern 2009). The focus is now on “clients” and “service delivery,” emphasizing networks and partnerships and shared ways of funding (see also Axelrod et al. 2011). In this sort of environment, where effectiveness in public policy-making is paramount, evidence-based

policy-making has taken on the mantle of reliable and informed decision-making (Howlett 2009). Yet for funding agencies, uncertainties around evaluating research output and impact drive a need to develop and implement new approaches and share best practices.

Since World War II, funding agencies in North America and beyond have relied on peer review as a legitimate way of making judgments about public investments in science (Geiger 1993; Doern 2009). The institution of peer review is thus deeply ingrained in the fabric of research funding systems and is an important element in the normative authority of science around the world (Drori et al. 2003). The culture of scientific expertise related to peer review pervades much of what funding agencies do, particularly adjudicating grant applications. While studies on peer review focus on the dynamics of expert judgments in science (Chubin and Hackett 1990; Lemont 2009), little is known about how or when research funding agencies employ experts and use evidence to make decisions about policy and programs. Our study addresses this gap by examining the practices of major funding agencies in Canada, the United States, and Europe.

## THEORETICAL FRAMEWORK

This chapter draws on literature focusing on evidence-based policy and practice (Oakley 2000; Sanderson 2002; Nutley, Walter, and Davies 2007). Below we sketch different approaches to the use of evidence in policy; we then review relevant studies.

There are various viewpoints among scholars and policy-makers about what best counts as evidence in decision-making processes. Typically, evidence-based policy-making involves the use of the best available evidence in policy processes (Nutley 2003; Davies 2004). However, it is possible to distinguish among three main theoretical approaches to evidence use: outcome-based, methodological, and conceptual (see Table 1 below).

The *outcome-based* or *instrumental* approach is the one most often described in the public policy literature, emphasizing evidence use for producing policies that work. Davies (2004) argues that research-based evidence helps people make well-informed decisions about policies, programs, and projects to enhance policy development and implementation. By applying a process of theoretically informed empirical analysis, governments can learn from past experience, avoid repeating errors, and, as a result, better apply new techniques to resolving problems (May 1992; Sanderson 2002).

The *methodological* approach focuses on empirically rigorous ways of producing data. This approach has been promoted in literature involving medical studies and typically has a positivist focus, stressing the value of quantitative methods. Nutley, Walter, and Davies (2007) are critical of this approach and note that evidence-based policy is commonly defined

**TABLE 1**  
**Different approaches to evidence use**

<i>Approach</i>	<i>Type</i>	<i>Examples from literature</i>
Outcome-based/ instrumental	Evidence use has a technical nature, aiming to produce policies that work. The focus is on the effectiveness and efficiency of public policies.	Nilsson et al. 2008; Davies 2004; Oakley 2000; Plewis 2000; Majone 1989
Methodological	A movement that focuses on a particular methodology for producing a specific form of evidence. It favours primarily quantitative studies, systematic reviews, and meta-analyses of experimental research.	Radaelli 2004; Chalmers 2003
Conceptual	A broad approach that focuses on the larger influence of the body of social-scientific knowledge on "policy thinking." Recognizes the tacit and experiential knowledge of the practitioner and the views of the societal actors.	Nutley, Walter, and Davies 2007; Culyer and Lomas 2006; Hammersley 2005; Bowen and Zwi 2005

Source: Authors' compilation.

in a narrow sense: as systematic reviews and meta-analysis of research studies. This relatively fixed view of evidence overshadows other sources of evidence documented in the literature.

In contrast, the *conceptual* approach frames evidence use in a broader sense, considering scientific research to be one of many possible sources of evidence (e.g., Nutley 2003; Bullock, Mountford, and Stanley 2001). Other sources of information are considered, such as evaluation studies, routine monitoring of data, expert knowledge, and information from consultations with interest groups. Bowen and Zwi (2005) differentiate among five types of evidence: empirical research (randomized control trials, observations, qualitative studies, time series analysis), knowledge and information (expert groups consultations, published reports), ideas and interests ("expert knowledge" of individuals, personal opinions, and views), politics (information relevant to the agenda of government, political risk assessment, opportunity, and crises), and economics (finance and resource implications, cost-effectiveness, opportunity costs).

The conceptual perspective of evidence use has increasingly broadened the earlier, more technical ideas that were prevalent in the 1980s. From this perspective, "evidence" incorporates deliberation, debate, and argumentation in relation to the ends of policy in addition to the ethical and moral implications of alternative courses of action. Sanderson (2006)

argues that the use of evidence depends on its relevance to the “normative worlds” of policy-makers and practitioners and to the complex judgments that they must make on appropriate courses of action.

The influence of evidence on policy, then, occurs in its use of communicative learning processes to reshape or reconstruct the cognitive and normative frames of policy-makers and professionals. In this context, several authors recognize the increasing value of professional knowledge (Griew 2009; Head 2010). Griew (2009) emphasizes the need to engage with practitioners and officials who implement policies and who know particular policy contexts, proposing that such interactions lead to effective implementation of policy. In line with this viewpoint, Mullen (2004) defends the importance of educating practitioners to use evidence-based practices.

One important consideration is the point at which evidence is used in the policy process. Bowen and Zwi (2005) discuss phases in the use of evidence and relate them to the factors influencing decisions. In the introduction phase of evidence use, the framing of the problem determines what type of evidence is searched and used. Then, in the interpretation phase, evidence is synthesized and evaluated according to participants’ beliefs and potential conflicts of interest. In the final, application phase, various sources of evidence are weighted, prioritized, and transformed into policy.

Other research confirms that evidence is used differently and for disparate purposes in the policy process. For instance, Whiteman (1985) differentiates among three types of evidence use: substantive, elaborative, and strategic. *Substantive* use of evidence occurs in the initial phase of decision-making, where there is no strong commitment to a specific solution. Policy-makers search broadly for evidence to help them develop a position on an issue, which must often satisfy governmental and administrative perspectives. Decision-makers employ *elaborative* use, on the other hand, to extend and refine existing policy positions. If they have already made a strong commitment to a well-defined position, they employ the third type of evidence use, *strategic*. Strategic use entails advocating or reconfirming the merit of a given policy position.

Following this line of work, Thomas (2001) identifies four stages in governments’ policy formulation process – appraisal, dialogue, policy formulation, and consolidation – each involving a different emphasis on evidence use. At the appraisal stage, evidence is identified and collected in research reports, expert testimonies, and stakeholders’ perspectives on a policy problem. At the dialogue stage, stakeholders engage in communication and debate, and different expert perspectives on policy issues are articulated and synthesized. In the policy formulation phase, evidence has a formal and technical nature, and studies are typically conducted to consider potential policy alternatives. In the consolidation phase, policy-makers have an opportunity to give the stakeholders feedback on the emergent policy design.

Of course, evidence use is not the only factor contributing to decision-making in policy design, implementation, and evaluation (e.g., Mulgan 2003; Davies 2004). Several authors have studied the role of knowledge in the policy-making process and have unveiled a variety of factors that potentially influence the use of evidence (e.g., Weiss and Bucuvalas 1980; Whiteman 1985; Lester and Wilds 1990; Bowen and Zwi 2005). Policy decisions may be shaped by the interactions of knowledge, environmental conditions, and political actions, among other factors (Haas 1992; Sabatier 1986; Sabatier 1988).

The literature also depicts how social contexts can influence the use of evidence in policy-making. Majone (1989) highlights how policy-making is rooted in specific institutional and organizational contexts. The general understanding of the policy-making process as a communicative process emphasizes how policy dialogue and arguments are shaped by the rules, conventions, and power structures of the policy-making context (Lindblom 1959; Bowen and Zwi 2005; Sanderson 2006). In this view, decisions are influenced by a range of actors, including legislators, public officials, other agencies, and constituents and clients (Weiss and Bucuvalas 1980). Practitioners seek to not simply deal with policy problems on a “technical” basis using pure evidence, but also to cope with ambiguity on a “practical” basis, making judgments about the appropriateness of policy action in relation to a range of technical, political, moral, and ethical concerns (Sanderson 2006). In making such judgments, practitioners need to rely on evidence (in particular, on the tacit and experiential knowledge of practitioners), but they must also address other diverse considerations. As a consequence, in the interest of consensus-building and political rationality, practitioners may overlook the best technical solutions.

Finally, conceptual models in the literature help to understand the use of evidence in public agencies. In a review of activities designed to promote research use in social care in the United Kingdom, Walter et al. (2004) identified three broad ways of thinking about and developing research-informed practice. These different approaches are encapsulated in three models: (i) the research-based practitioner model, (ii) the embedded research model, and (iii) the organizational excellence model. The research-based practitioner model assumes that it is the responsibility of the individual practitioner to identify and remain informed about the latest research developments, then use them to influence day-to-day professional activities. In contrast, in the embedded research model, evidence use is achieved indirectly by becoming ingrained in systems, processes, and standards of practice. In the organizational excellence model, evidence use lies in the successful development of research-minded organizational structures, processes, and cultures. Moreover, there will usually be significant organizational adaptation of evidence and ongoing learning within teams and through partnerships

with universities and other bodies that facilitate the creation and use of knowledge. Although these three approaches were first applied to evidence use in the social care sector, Nutley, Walter, and Davies (2009) report that they reflect much of what is happening to promote research use in other fields.

Nutley, Jung, and Walter (2008) suggest that these three models may be best suited to different circumstances. However, they note that while a combination of models is likely to be required in practice, combining them is not straightforward. One or more models may dominate another or produce tensions in an organization. For example, the assumption of professional autonomy that underpins the research-based practitioner model may clash with the constraints placed on individual practitioners in the embedded research model. Using these models to examine evidence use among research funding agencies raises interesting questions because these agencies have a historical, normative commitment to abide by expert judgment and valuations when making decisions; they often employ researchers as program officers; and they systematically interact with the scientific community on various levels.

## THE STUDY: INVESTIGATING RESEARCH AGENCIES

According to the literature reviewed above, evidence-based practices involve a variety of knowledge sources, purposes, and processes that might shape decision-making in research funding agencies. Building on this literature, the following research questions guided this study:

- How are evidence and expert advice used by research funding agencies when designing and evaluating programs?
- How are decisions made about program design?
- Why is the method used perceived to be valuable?

To address these questions, we sought to obtain qualitative data from leading public funding agencies in Canada, the US, and Europe. The study was delimited to funding agencies primarily in the natural sciences and engineering fields. Agency websites were reviewed to identify potential informants, including individuals in positions relevant to program design and evaluation. Response to invitations to participate was mixed: some agency departments co-operated, while others chose not to co-operate. Agency administrators were often cautious about providing access to their staff.

Snowball sampling was used throughout the study. In most cases, our requests were mediated by the administrator of an agency well positioned to refer our team to potential informants. In all, 17 participants were interviewed<sup>1</sup> from the following funding agencies: in Canada, the Canadian Institutes of Health Research (CIHR) and the Natural Sciences

and Engineering Research Council of Canada (NSERC); in the US, the National Institutes of Health (NIH) and the National Science Foundation (NSF); in Europe, the European Research Council (ERC). (For details about these agencies, see Table 2 below.)

**TABLE 2**  
**Characteristics of selected research funding agencies**

Feature	Agency				
	CIHR	NSERC	NIH	NSF	ERC
Country	Canada	Canada	US	US	EU
Date established	2000 (after merger of two federal organizations)	1978	1950	1950	2007
2010 budget	CAN\$1.03 billion	CAN\$1.06 billion	US\$31.2 billion	US\$6.87 billion	€1.1 billion
Mission (quoted from website)	To excel, according to internationally accepted standards of scientific excellence, in the creation of new knowledge and its translation into improved health for Canadians, more effective health services and products and a strengthened Canadian health-care system	To help make Canada a country of discoverers and innovators for the benefit of all Canadians	To seek fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to enhance health, lengthen life, and reduce the burdens of illness and disability	To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense	To encourage the highest quality research in Europe through competitive funding and to support investigator-initiated frontier research across all fields of research, on the basis of scientific excellence
Governing body	Governing Council (members drawn from private and public sectors)	Council (members drawn from private and public sectors)	Office of the Director	One director and the National Science Board	Scientific Council (made up of scientists)
Relationship with government	Federal agency	Federal agency	Federal agency	Federal agency	Autonomous body

Source: Authors' compilation.

These agencies receive different proportions of the research funding available in their countries and regions. In Canada, NSERC received approximately 20 percent, and CIHR 22 percent, of the 2010 federal research funding distributed among four funding agencies (Statistics Canada 2011; NSERC 2010; CIHR 2011). In the US, the budgets of the NIH and NSF corresponded to approximately 21 percent and 4 percent, respectively, of the total federal funding allocated to research and development in 2010 (NSF 2012). The ERC is unique as a European-level research funding body because most research is supported at the national level across the member states (van Vught 2010).

Informants had the following professional roles: members of advisory bodies (3), senior administrators (4), program directors (7), and support staff (3). Informants participated in semi-structured telephone interviews, each of which took approximately 30 minutes to conduct and was audio-recorded and transcribed. In addition to conducting interviews, we obtained publicly available policy documents and other publications from each agency's website and examined them to analyze their policies regarding program design and evaluation (see the Appendix at the end of this chapter). We used content analysis (Budd, Thorp, and Donohew 1967; Krippendorff 1980; Weber 1996) to investigate the nature, focus, and targets of these strategic documents. We then used qualitative data analysis techniques to organize, code, and analyze the interview data (Miles and Huberman 1994; Strauss 1987). For inter-rater reliability, we independently coded the transcript data and then integrated the codes into a general set of themes.

## FINDINGS

The analysis points to the importance of examining evidence use in four distinct processes: agenda-setting, program design, monitoring, and evaluation. In each process, funding agencies select and use evidence in different ways. Moreover, four themes emerged from the analysis that cut across each of these processes: the role of evidence, source of expertise, motives for evidence use, and constraints on evidence use. These processes and themes are summarized in Table 3 below.

### **Agenda-setting**

Agenda-setting is characterized by gathering ideas and input from various stakeholders. The main type of evidence includes information received from expert consultations – both within the agencies themselves and with the academic community – and information deriving from government strategies and policies. Whereas an internal approach relies on the expertise of agency staff and members of agency advisory bodies, an external approach concentrates on consultation with outside experts and



**TABLE 3**  
**Analytic categories used to assess evidence use**

<i>Analytic category</i>	<i>Process of evidence use in programs</i>			
	<i>Agenda-setting</i>	<i>Program design</i>	<i>Monitoring</i>	<i>Evaluation</i>
Role of evidence	Instrumental (to promote ideas)	Operational (to finalize ideas)	Analytical/descriptive (to assess progress)	Analytical/evaluative (to analyze results)
Source of expertise	Stakeholder groups: board/council members, political stakeholders, scientists, industrial stakeholders, administrative staff	Input from administrative staff, other national and international funding agencies, board/council members, peer review	Internal/external expertise (evaluation units, statistical databases, publication databases)	Internal/external expertise (evaluation units, hired consultants, peer review)
Motives for/drivers of evidence use	Promote/interpret/resist ideas, accomplish mission, establish legitimacy, build prestige	Secure most appropriate application of ideas agreed upon	Monitor and evaluate accomplishment of program goals, relevance, and accountability	Demonstrate accountability, accomplish mission, establish legitimacy, build prestige
Constraints on evidence use	Conflict among various ideas, political pressure, government mandates, accountability	Bureaucratic requirements, predefined government mandates	Lack of short-term measurable outcomes (e.g., from fundamental/basic research)	Lack of data available for recently started grants

Source: Authors' compilation.

stakeholders from multiple sectors. Evidence has an instrumental nature as it is used for practical reasons to initiate discussions on a new scheme.

Agencies typically involve experts in their decision-making structures to facilitate consultation across fields and sectors. NSERC, for example, has a governing council composed of external experts representing industry, government, and academia. CIHR receives input from the 13 interdisciplinary "virtual" institutes whose advisory boards, likewise, draw on the contributions of a diverse group of national and international representatives of the public, private, and non-profit sectors, including the research community and health practitioners. In some cases, the agencies respond to the ideas generated by their own board members or

make decisions based on the information brought to them by program administrators.

At some agencies, such as the NSF, scientific experts are employed as program officers. They contribute to agenda-setting by voicing ideas and concerns regarding program creation and management. Each directorate of the NSF has a standing advisory committee composed of domestic and international experts who meet every six months to review the directorate's programs. The committee's advice is supplemented by outreach to professional organizations and by a Committee of Visitors for various areas of responsibility, and both groups examine individual programs and whole divisions. An alternate approach is to ask the members of a directorate's advisory committee to provide specific advice about future scientific priorities.

At the ERC, the Scientific Council members, all renowned scholars, provide input into new programs based on their professional expertise. The Scientific Council is the highest decision-making body in the ERC, making sure that the ideas and suggestions of the researchers are represented and accounted for in decisions.

An informant reflects on the creation of a new program based on the experts' experience.

Nobody in the [advisory body] went away and produced six pages [of] statistics or whatever. I think it was from their knowledge of the scientific situation ... that individuals in there decided that we should develop a new scheme. (Interview, 6 October 2011)

Research funding agencies rely heavily on external consultations with the scientific community to set priorities. Many staff members in the agencies remain actively engaged as working scholars and build relationships with their disciplinary communities. Agencies employ various approaches to canvass the views of experts during agenda-setting. A common mechanism for agencies framing a new program or initiative is a workshop or set of workshops. Scholars are invited to participate in meetings and formulate consensus opinions about developments in their academic fields. Such events help to establish expert views of the research landscape. Informants suggested that this reliance on the scientific community for direction builds trust and increases the legitimacy of funding agencies in the scientific community.

I consider it as a strength ... this recognition that even though there is internally scientific expertise, which is a big part of the agency ... the running of the program is in the hands of scientists. (Interview, 24 October 2011)

The bottom-up input that we get is a strength, ... that we're getting the input from our ... research community to address their needs. (Interview, 14 October 2011)

There are other ways of involving experts in an agenda-setting process. Recently, the NSF's Directorate for Social, Behavioral & Economic Sciences (SBE) solicited white papers from the research community on one or more of three topics: fundamental research issues, the capacities required to pursue the research, and the infrastructure to support it. The project was announced by e-mail distributed to all NSF and SBE principal investigators and individuals associated with other federal agencies, professional societies, organizations, and academic departments. In addition, academic associations, philanthropic associations, and several boards at the National Academy of Sciences were consulted. At the same time, the SBE's Advisory Committee wrote an independent complementary report, suggesting ideas and making recommendations for the future research landscape. The SBE's final report combines the latter with the input from the academic community to outline the directorate's future strategies and priorities.

Research funding agencies also hold consultations with experts from outside academia. For instance, CIHR has an external process by which it holds workshops and conferences and invites stakeholders from several sectors in an effort to prioritize funding areas. Pressure for relevance appears to be impacting not only the evaluation of programs but also the general policies and operations of the agencies themselves. As a result, decisions about funding schemes are the result of a balancing act in which accountability to important stakeholders and relevance factors have to be taken into account. For instance, one rationale given for creating a new grant program at one agency was to increase support from industry, which was seen as being crucial to the agency's efforts to increase the budget it received from the government. As one informant noted,

Part of the new programs can be implemented to satisfy the needs of the government as well as the needs of the community. So ... that's why I would say new programs are put into place.... The [agency] took that information and went away and essentially designed the program.... It tried to satisfy the government's desire for high impact. (Interview, 22 September 2011)

Pressure for relevance has also encouraged a change in policy at the ERC. Informants referred to a debate involving the European Commission (EC) regarding the relevance of its funding programs and expected accountability. The ERC faces pressure to increase its funding of relevant research, which is measured by economic contribution and job creation, as opposed to funding basic research, where measurable indicators are not so evident.

The experience of agency staff is an important factor in agenda-setting. The interviews revealed that staff members are involved in this process by monitoring and comparing national and international research funding initiatives. Funding agencies are actively learning from one another and adapting programs to meet desired goals.

We would compare ourselves to the US, to the UK, to Germany, France, Australia, as another ... comparable-sized economy. And depending on the particular programs or goal ... I mean, if there's programs relating to a desire to increase international collaboration ... maybe look at what's happening in emerging economies – China, India, Brazil, and so on. (Interview, 7 October 2011)

There are many national schemes ... with [a] similar goal. And of course we also did our homework with [respect] to schemes of NSF and NIH in the States. So we looked at how these schemes [are] run by these organizations. (Interview, 24 October 2011)

Practices and lessons learned from other funding agencies provide evidence for the policies and organization of many agencies. Informants cited Canada, the US, and European countries as the main national and international reference points for benchmarking their own policies. Our findings reflect previous arguments that the US is the most strategic destination for general policy-learning for funding agencies (Balzat 2006; Dill 2010) and that agencies also look elsewhere for information.

### **Program design**

In the process of program design, evidence is used to finalize ideas generated in the agenda-setting process to create new programs. Evidence used in this process includes mixed types of data (from evaluations and reports on similar schemes) and input from consultations with stakeholders. Political factors shape the goal and design of funding schemes as well.

Programs are usually developed over a long period of time, drawing on different sources of input and the layering of knowledge as ideas settle in. Ideas about a new funding scheme undergo several readings in the process of designing a program, and evidence from benchmarking and expert judgment is considered. Program officers often collect relevant evidence, including from similar programs operating nationally or internationally, then compare them and suggest what information should be incorporated and what should be disregarded. The following comment of an agency officer is typical:

I wouldn't say that the origin of the scheme was strictly evidence-based, but the design of the scheme was evidence-based in terms of ... looking at examples of similar schemes with similar aims. (Interview, 6 October 2011)

In the program design phase, agency staff draw heavily on reports produced using input from scientific committees and information from stakeholders. If a program is expected to respond to government strategies, predefined program criteria are also incorporated into the design.

The main focus during this process is polishing the general ideas and distilling them into workable programs. This process can be quite lengthy. As the idea about a new program evolves, changes are made and different types of comparisons used. As an informant describes,

I spent probably two years working, producing papers for the [advisory body] to kind of refine their ideas for this new scheme.... At different points ... it looked like it was going to be focused on a particular thing, then we would look at schemes that were like that. As the idea developed ... we would go and look at other schemes.... So we had a look at some schemes by NSF and ... [agencies] in Europe. (Interview, 6 October 2011)

In addition, the peer review panels at various funding agencies have an important influence on the design of new programs. These panels make suggestions about how programs can be improved, what criteria should be used in evaluating the proposals, and what requirements should be changed to best accomplish a program's goals. Based on the information collected from the peer review panels or evaluation reports, the need to change specific aspects of a program is brought to the attention of an agency's decision-making body.

Political imperatives also influence program design, in both formal and informal ways. Informal political influences are a result of administrative constraints and pressure to distribute awards more equally among regions, universities, and researchers. In the case of formal political influences, there are often predefined objectives shaping research funding agency agendas and actions. For example, Canada has seen an increase in the number of programs and initiatives with predefined objectives, such as the innovation and commercialization that NSERC is expected to deliver.

This increased pressure for inter-government agency collaboration is also apparent at the NSF, where a core strategy is to promote partnerships with academic institutions, private industry, and state and local governments. Pressures for relevance at the NSF have since the 1980s, in fact, influenced the design of a series of programs (Geiger and Sá 2009). Recently, in part to pre-empt governmental influence on program design, the Scientific Council of the ERC created the Proof of Concept funding scheme, which funds researchers previously supported by the ERC so that they can take their ideas to the marketplace.

The main constraints on using evidence and expertise in program design are bureaucratic requirements resulting from agencies' interdependent relationship with governments. These requirements involve setting dates for budget cycles, creating technical procedures for hiring people, and submitting reports. Agencies view the bureaucratic constraints on this process as potentially influencing the overall quality of a program. One informant provides an example that, although atypical, serves as an example of these issues.

The bureaucracy demanded that the person whom we want to appoint as an expert should send in a letter from the institute that the person is good enough for the job. Now, can you imagine? That is a Nobel Prize winner being invited, and he has to bring a letter from the director of the institute that he is good enough for the job. (Interview, 18 October 2011)

During program design, the conceptual ideas of the agenda-setting process are refined by the input received from administrative research and the information retrieved from the peer-review expert panels. This process is technical and operational, requiring more expertise and evidence about program design and administration, as agency staff seek to make the program cycle work as smoothly as possible.

### Monitoring

The monitoring process starts after research projects have been funded, when agencies start collecting information about the early impact of grants. This process continues through the lifespan of sponsored programs. In this process, evidence is used as agencies track and review programs, assess researcher performance, and identify potential areas in which policies will need to change in the future. The evidence that agencies collect in this phase concerns both program administration (e.g., grant application data) and research results and performance.

During the monitoring process, agency decision-makers note that information about programs is considered together with agency priorities and their own expertise. Selected information from both the application data and research productivity indicators is reportedly used in discussions with governments and external stakeholders. For instance, the NSF uses information from its annual reports when demonstrating its performance to Congress, as mandated by the *Government Performance and Results Act* of 1993. Similarly, key informants from NSERC report an increasing trend in accounting to government and stakeholders, and the ERC must submit a budget each year to the EC – an example of how evidence directly supports the agency's requests.

Agencies tend to collect information from applications for internal circulation and to inform the administration of their own programs. This includes information on applicant pools, which agencies use to identify potential gaps or opportunities in their support of academic investigators. Application data, including application rates, applicants' demographics, proposed topics, and grant success rates, are collected, then used to inform policy decisions about the direction and scope of current funding programs.

[A] very good example in this respect is the low participation of women researchers in the call... When we see these numbers, we go and look at

the population, the potential population that could apply... So we try to see whether this low percentage of participation is representative of the presence of women in senior positions. (Interview, 24 October 2011)

Program monitoring also involves collecting evidence of research productivity and “excellence” in funded projects. All agencies have policies regarding the collection of scientific reports from funded investigators to keep them up to date on the progress of research. For example, the ERC collects mid-term reports, and the NSF collects technical project reports for all funded projects every year. Agencies also perform a bibliographic analysis of papers resulting from sponsored programs. In addition to researching publications, the ERC looks for awards connected to funded research, how much a funded project has contributed to the career of a researcher (in the case of certain grants), and any evidence of international collaboration. The following quotes expand on this:

We do our own monitoring [through] international databases ... we are monitoring also the award of various scientific prizes, and we see whether [our] grantees are being included in [the] list of awardees. (Interview, 24 October 2011)

We would expect from our grantees that ... their research is published in the highest-level journals, and this is essentially evidence [of] successful projects. (Interview, 13 October 2011)

The data collected in the monitoring process is used to inform agency decision-makers about the progress of individual programs. Program data give program officers and administrative offices information on the progress of funded projects and the way funds are being used. Depending on the agency, these decision-makers are program officers, division directors, or scientific councils.

## **Evaluation**

The evaluation of programs provides a significant source of evidence for making decisions about their sustainability and whether they are meeting accountability requirements. Agency staff appear to consider the first step in program evaluation as occurring during the panel review of submitted grant applications. Subsequently, agencies conduct program evaluations at various points in the life cycle of sponsored programs. The evidence collected in this process depends largely on the goal of a program and the expected outcomes. In general, agencies face mounting pressure to demonstrate the effectiveness and impact of their investments in research, and this creates challenges for evaluating programs.

When asked to discuss the use of evidence, agency officials usually referred to their practices regarding peer review. Funding agencies' historical reliance on peer review is commonly used to demonstrate their commitment to expert judgment. When agencies are adjudicating proposals, experts assess the merit and promise of grant applications as individuals or as members of review panels. Agency staff often take the approval of a proposal as evidence of excellent research and a wise investment of agency funds. In this way, the peer review process is seen as part and parcel of agency efforts at evaluation.

Agencies use formative and summative evaluations across programs. In addition to annual or mid-term reports, they use final project reports to collect evidence of funded projects. Output indicators (e.g., publications, citations, patents) are usually then used to assess programs. There are growing pressures on agencies to evaluate the success of programs in terms of the impact of the research results; indicators include the number of jobs or products created as a direct result of a funded research project. One informant referred to such indicators as evidence of a research project's relevance or impact, which evaluators seek as evidence of an agency's investment in economic development and the social good. The apparent connection between the grant awards for research and the benefit to society provided by the research serves as evidence to justify the agency's decisions.

Internationally, agencies are really striving to develop the metrics that allow you to say that these are the socio-economic benefits that came out of a particular program of research. (Interview, 31 October 2011)

This trend toward evaluating and measuring research has led to an ongoing search for methodologies, indicators, and standards. For instance, Canada's Minister of Industry, on behalf of NSERC, requested in 2011 that an international panel of experts be formed; its mandate was to conduct an assessment of approaches used nationally and internationally to evaluate research performance and the indicators that enable comparisons across areas of research in the natural sciences and engineering. Using this information, NSERC expects to develop a methodology, in consultation with key stakeholders, that will enable it to make objective budgetary allocations based on performance assessments.

Heightened accountability has also increased funding agencies' reporting requirements. One informant described the challenges flowing from the pressures described above when capturing the economic benefits of research.

Assessing at a dollar level the impact of a particular program of research is extraordinarily hard for everyone. This is a socio-economic impact, and it's exceedingly difficult [to measure]. Thirty years later you can say, look



at the impact that it had. Look at the dollars that just saved us. Just look at the lives it has saved. That, that's often hard to assess in the short term. (Interview, 31 October 2011)

Funding agencies are being confronted by demands to provide objective, quantifiable metrics for processes that are complex and that current assessment models do not measure. While traditional scholarly contributions such as publications remain the primary indicators of success, indicators of technology transfer and economic impacts are increasingly being used. Agencies are including the number of patents, licences, and spinoffs created as a result of funded research as evidence when evaluating the impact of funded research projects that are more applied in nature.

The emphasis that agency evaluations are now placing on the academic, social, and economic impact of research as an indicator of excellence and success demonstrates the larger shift in accountability. Several participants observed that their respective agencies were “under [a] great deal of pressure to spend public money wisely and responsibly” (Interview, 6 October 2011). Participants were quick to point out that the scientific merit of grant proposals was the only consideration in decisions to fund research. Still, when reflecting on political and accountability pressures, one participant commented,

We are under immense pressure to ... account for things that are political, like how many grants there are in each jurisdiction and why it is [not] equally balanced. (Interview, 6 October 2011)

Another participant at a different agency noted,

You know, we *do* focus on excellence. And if, in competitions, that means that there is less money going to [region], that is likely something that we might come under criticism for. (Interview, 7 October 2011)

Evaluation reports and analyses of output indicators all have an essential role to play in the decisions affecting program design. It is suggested that their impact varies, from terminating an existing funding program to establishing a new one. Informants reflected as follows:

Well, it's resulted in the termination of programs. And it's also resulted in the expansion of programs ... or in a pilot being, you know, made permanent. I mean, it has everything in between. (Interview, 7 October 2011)

We will then monitor the results. And if it is sort of positive, we will continue, and otherwise, we will discontinue this type of grants. (Interview, 11 October 2011)

I would say there's a very high use of evaluation [reports]. I have ... program directors and VPs who come looking, and the president, who comes looking for data. (Interview, 7 October 2011)

Program evaluations and reviews are performed routinely and address particular concerns. For example, NSERC recently established an International Review Committee to address concerns that the Discovery Grants Program – its largest program – inefficiently supports researchers to world-class standards. The committee's subsequent report constitutes one part of NSERC's review of the program.

Overall, it is apparent that the evaluation process is crucial to improving funding schemes. By synthesizing the various streams of evidence collected from panel reviews, program evaluations, and project reports, agency staff learn about the strengths and weaknesses of their programs. Incorporating the best available evidence into program design is seen as crucial to establishing the agencies' legitimacy because it demonstrates the tangible results and value added by the grants they distribute. By providing evidence on socio-economic impact and scientific contributions, agencies are able to prove the relevance of their programs.

## CONCLUSION

Funding agencies have historically relied on the expertise of the academic community to make important decisions about how to allocate research funding. Researchers, usually guided by the principles of trust, informality, and discretionary decision-making, have collectively decided the direction of research fields and financial support for research projects (Dill and van Vught 2010; Henkel and Kogan 2010). In recent decades, however, attempts by governments to enlist university research in national innovation agendas, alongside heightened expectations for public agencies to demonstrate relevancy and accountability, have changed the policy environment. There is greater pressure on research funding agencies to respond to the needs of politically defined priority areas and produce public benefits such as jobs, local economic growth, and socially useful products (Dill and van Vught 2010; Greenberg 2007).

These trends have sparked debate and criticism. It is believed that the greater pressure being placed on funding agencies and research institutions to generate prescribed outcomes is having negative impacts on academic science, including limiting the originality of research and de-emphasizing interdisciplinary research (Dill 1998). The emphasis on having performance information drive resource allocation can also have unintended consequences that are detrimental to the health of research systems. A study conducted by the Organisation for Economic Co-operation and Development (OECD) indicates that performance-based research funding systems in OECD countries decrease institutional

equity, reduce the diversity of research, and do not necessarily enhance economic relevance (OECD 2010).

Our findings reflect contemporary policy change and show that although the academic community continues to play an important role in setting priorities, funding agencies regularly interact with a variety of stakeholders to generate policy ideas and gather input. With the expectation to be responsive to stakeholders' needs and support relevant research, funding agencies serve as "intermediary organizations" (Bielak et al. 2008), connecting their commitment to scientific excellence with various government agendas and the interests of various professional groups and industry associations. In a measurement-driven context, these multi-faceted interactions increase expectations for shared decision-making and drive efforts to monitor and evaluate sponsored research.

The matrix that emerges from our analysis – differentiating among the role of evidence, source of expertise, motive for evidence use, and constraints on evidence use in each process related to funding programs – is consistent with previous studies. Klein (2003), for one, suggests that different stages of the policy process call for different types of evidence. As discussed above, research funding agencies use a large variety of evidence sources, and they relate to the distinct needs of each process in the funding cycle. Professional knowledge and expertise are typically prevalent in the agenda-setting process. The program design process further uses professional knowledge, in addition to evidence from efforts to benchmark best practices, evaluations, and reports on the respective schemes. The evaluation process, similar to the monitoring process, focuses on output indicators gathered from project reports. Throughout the life cycle of agency funding programs, various evidence sources interact with political pressures and organizational issues to generate decisions about program design, administration, and assessment.

Consistent with the literature (e.g., Bowen and Zwi 2005), funding agencies use evidence and expert advice for different reasons and disparate purposes. Our findings show that evidence and expertise are used for instrumental, operational, and analytical purposes. Evidence is used for instrumental reasons to turn policy ideas into practices being promoted by stakeholders in government, the scientific community, and industry. Funding agencies play the role of mediators that articulate and translate policy ideas into practice. In the decision-making process, decisions about promoting, interpreting, or negotiating ideas based on the specific rationale or interest of a stakeholder are made based on evidence and expertise. Evidence is also used for operational and technical reasons when decisions about the most appropriate strategies for delivering policy ideas need to be made. It is often agency staff who use evidence for operational reasons to establish specific program requirements. Evidence is used to demonstrate or predict the result of a specific strategy or program design by reporting what works or has worked in similar funding schemes and

convincing decision-makers to take a specific course of action. Finally, evidence and expert advice are used for analytical reasons to monitor and evaluate the results of programs.

In using the various practices discussed above, funding agencies embody elements of the three models identified by Walter et al. (2004) as broad ways of thinking about and developing research-informed practice: the research-based practitioner model, the embedded research model, and the organizational excellence model. Research funding agencies embody elements of these three models: at some agencies, program officers or administrators are expected to be experts in their fields (the research-based practitioner model); agencies remain accountable to governments for collecting and reporting internal data (the embedded research model); and agencies themselves are responsible for collecting and disseminating evidence (the organizational excellence model).

Some have suggested that the presence of these three models in an organization may produce tensions (Nutley, Jung, and Walter 2008). However, contrary to such suggestions, these models appear to peacefully coexist in research funding agencies. Many of the practices of these agencies are well described by an interactive perspective on research use (Nutley, Jung, and Walter 2008). Agency officials need to continually adapt input from the scientific community to different contexts and situations. The preferences of stakeholders (i.e., the scientific community, industry, government) interact with the experiences and expertise of agency staff as they consider different forms of evidence. Moreover, the research community, program managers (often members of the research community), and stakeholders engage in ongoing relationships that lead to the development of protocols and programs that influence agency management (as described in the embedded research model). Finally, agencies experiment, evaluate, and develop programs and projects based on evidence and partnerships with stakeholders (as in the organizational excellence model). The composition of research funding agencies – embedded as they are in communities of research and practice – and their interactive use of evidence seem to reduce any tensions that might otherwise arise in employing different models of evidence use.

Our analysis is consistent with the literature emphasizing the broad, conceptual approach to understanding the use of evidence in policy and practice, including the important role of professional expertise (Nutley, Walter, and Davies 2007; Hammersley 2005). It also builds on studies showing the various means by which evidence is used in public agencies (Walter et al. 2004) by detailing the use of evidence across multiple organizational processes in research funding agencies. By doing so, this work takes another step toward clarifying the role of funding agencies in developing research policy.

## NOTE

1. All interviews conducted for our study were confidential, as per research ethics requirements. The names of the interviewees are therefore withheld.

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## APPENDIX

**Publications and documents reviewed by agency**


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<i>Agency</i>	<i>Publications and documents reviewed</i>
CIHR	Strategic plan (2011–14); annual reports (2009–10, 2010–11); financial plans (quarterly, 2011, budget 2008)
NSERC	Guidelines for application reviews (engineering and applied sciences, interdisciplinary research); plans for financial grant distribution (2009, 2010, 2011)
NIH	Grants Policy Statement (2011); grants process overview; biennial reports of the director (fiscal years 2008 and 2009)
NSF	Proposal and Award Policies and Procedures Guide (2011); Rebuilding the Mosaic (2011); Budget Request to Congress (fiscal year 2012); strategic plan (2011–2016)
ERC	Annual reports (2009, 2010); minutes of council meetings (nine sets, October 2009 to June 2011); organizational reviews (2005, 2009), guides for peer reviews: Starting Grants and Advanced Grants, Proof of Concept (2011)

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