Evaluation of NSERC's Postdoctoral Fellowships (PDF)

FINAL REPORT

Submitted to:

Natural Sciences and Engineering Research Council of Canada (NSERC)
350 Albert St.
Ottawa, Ontario
K1A 1H5

EKOS RESEARCH ASSOCIATES INC.
March 8, 2013

EKOS RESEARCH ASSOCIATES

Ottawa Office
359 Kent Street, Suite 300
Ottawa, Ontario
K2P 0R6
Tel: (613) 235 7215
Fax: (613) 235 8498
E-mail: pobox@ekos.com

Toronto Office
181 Harbord Street
Toronto, Ontario
M5S 1H5
Tel: (416) 598 8002
Fax: (416) 533-4713
E-mail: toronto@ekos.com

www.ekos.com

EXECUTIVE SUMMARY

NSERC's Postdoctoral Fellowships (PDF) were established in 1978 to support a core of the most promising researchers, Canadian citizens and permanent residents, at a pivotal time in their careers, that is after they complete their PhD studies and before they become formal independent researchers. The evaluation covered the period from 2000 to 2011. The purpose of the evaluation was to provide NSERC senior management with an assessment of the program's relevance and performance. The evaluation questions were developed in consultation with the Scholarships and Fellowships Division senior management, and address the core evaluation issues laid out in the *Directive on the Evaluation Function* (2009).

Multiple lines of evidence were employed to answer all evaluation questions, including a document/literature review; an administrative data review; interviews with Vice-Presidents of Universities, Research, and Deans of Engineering; members of Selection Committees; representatives of the Canadian Association for Graduate Studies (CAGS) and the Canadian Association of Postdoctoral Scholars (CAPS); on-line focus groups with current fellows; as well as web-based surveys of applicants (both funded and unfunded) and supervisors. The evaluation design benefitted from a number of strategies to ensure reliability of the evaluation findings (e.g., multiple lines of evidence, using unfunded applicants as a comparison group, and a census approach in a survey of applicants). Although the evaluation methodology had a number of limitations (e.g. potential response bias and limits to qualitative methods), they were carefully taken into consideration making the overall evaluation strategy strong in providing the basis for reaching conclusions for all issues and questions.

Relevance

The evaluation found that development of HQP at the postdoctoral level is a key ingredient in stimulating R&D in Canada and there is a continuing need to provide postdoctoral fellowships. The direct funding provided through the PDF program gives applicants an opportunity to obtain relevant research experience within an academic setting, and also provides them the freedom to work with the research group or researcher of their choice. Postdoctoral experience is critical to securing research-intensive positions in academe, particularly in science disciplines. The objectives and outcomes of the PDF program are clearly consistent with both departmental and governmental strategic planning, and the program is seen to be contributing to the success of the federal S&T strategy. Although other sources of postdoctoral support exist, the PDF program is seen to occupy an important niche in postdoctoral funding in Canada, as a prestigious award that offers independent training to the "best and brightest".

Design

The evaluation explored to what extent the duration and amount of the award are appropriate. The evaluation found that approximately one in four fellows and academic supervisors are not satisfied with the award amount as they consider it insufficient to provide an appropriate standard of living. No more than half of fellows receive top-ups from their host institutions and the fellowship award remains the most significant source of income for most. Funded PDFs report slightly lower annual earnings during the fellowship than unfunded applicants who pursued alternative fellowship opportunities. Half of funded applicants do not receive any benefits. Literature review also suggests that PDF is not competitive with other awards.

The evaluation shows that two years is generally deemed to be a suitable duration for the award. Over four in ten funded applicants spend 24 months or less as postdoctoral fellows. However there is a fair amount of dissonance

expressed from the majority view, particularly in life sciences and those who completed their PDF outside of Canada. Overall, satisfaction with the design and delivery of NSERC services is high, although the timing of NSERC decisions and notification of applicants appears to be a source of frustration for some applicants.

The evaluation confirmed that there is a need to define the role and treatment of postdocs more clearly and systematically. NSERC could further support the development of postdoctoral fellows by providing them additional professional development opportunities, guidance and opportunities for exchange, particularly given the fact that not all will pursue an academic career. An increase in the number of PDFs is not supported by data available which indicates that the supply of postdoctoral candidates exceeds faculty hiring, and that this situation is expected to continue in the foreseeable future.

Effectiveness

In assessing the program's effectiveness, the evaluation looked at the impact that the program had on the fellows' ability to conduct independent research and development, experience and skills gained during the program, opportunities to produce and disseminate research results, building collaboration, developing personal research networks, as well as the ability to obtain research-intensive employment in academia, industry and government.

Postdoctoral experience in general has positive impacts on fellows, both funded by NSERC and those who pursued alternative fellowships. All fellows have considerable engagement in research activities during their postdoctoral fellowships, such as data collection, data analysis, dissemination, proposal writing, teaching, peer reviews. Fellows gain skills in areas that are integral to their transition as independent researchers. The greatest improvement occurs in skills pertaining to research ability and potential, as well as overall experience and knowledge of their discipline. A majority of fellows also report increases in professional skills such as report writing and publications, and in personal skills such as critical and creative thinking and leadership. Gains in skills in teaching and mentoring are more limited.

Most postdoctoral fellows report increasing their personal research network as a direct result of their fellowship. Postdoctoral fellowships typically involve collaboration, most often within the discipline of the fellow. Not surprisingly, funded applicants who completed their fellowship in Canada are more likely to collaborate with Canadian researchers, while those who pursued their fellowship outside Canada report international collaborations. Interestingly, those who completed their fellowship in Canada are twice as likely to report international collaborations as international fellows report collaborations with Canadians.

In addition, the evaluation demonstrated that participation in the PDF program, in particular, had further positive impacts on fellows. PDF recipients have additional opportunities to engage in varied dissemination activities following their fellowship – funded applicants have engaged in more dissemination activities and more often than unfunded applicants. Most funded applicants were engaged in at least one dissemination activity during their fellowship, and they most commonly report preparing peer-reviewed articles.

Nearly all funded applicants are employed full-time. Fellows most often report working for universities. In fact, employment in universities is more predominant among funded applicants than unfunded applicants, and unfunded applicants are less likely to report being in tenured positions. Close to three-quarters of funded applicants are employed in very research-intensive positions and the same proportion are employed in Canada.

The evaluation also examined motivating factors and impacts of holding postdoctoral fellowships outside of Canada. Almost half of funded and unfunded applicants completed their fellowships abroad. Funded applicants who undertook

their PDF abroad more often identify positive impacts from their fellowship in terms of skills development. Some stakeholders worry, however, that not all fellows will choose to return to Canada after an international fellowship. But the evaluation suggests that for those who are currently employed outside of Canada, the location of their postdoctoral tenure (i.e., whether their PDF was held in Canada or abroad) appears to have little influence on their future intentions to return to Canada.

Efficiency and Economy

NSERC's administrative costs for delivering the PDF program are low (4.9 per cent over the 10-year period from fiscal year 2001-2002 to 2010-2011) and the administration of the program appears to be efficient. The operating ratio for the program has trended downward fairly consistently from 5.9 per cent in FY 2001-03 to 4.5 per cent in FY 2010-11.

Overall Conclusions and Recommendations

Overall, the evaluation found that the PDF program is relevant, efficient, and meets an ongoing need. The program contributes to the stimulation of R&D and provides applicants an opportunity to obtain relevant independent research experience within an academic setting. PDF recipients exhibit better results in some areas in comparison with unfunded applicants, e.g. employment in tenured positions and engagement in research dissemination activities. Finally, the findings suggest that the administration of the program is working well overall, but some further improvements could help ensure that the most effective and efficient means are being used to achieve program outcomes. The evaluation resulted in the following recommendations:

- **Recommendation 1:** Explore options to increase the financial support available to PDFs.
- **Recommendation 2:** Consider increasing development and networking opportunities for PDF fellows.
- **Recommendation 3:** Consider moving up the time-frame of decisions to accommodate PDF applicants.

TABLE OF CONTENTS

1. INTRODUCTION

The Natural Sciences and Engineering Research Council of Canada (NSERC) engaged EKOS Research Associates Inc. to carry out a joint evaluation of the Postdoctoral Fellowships (PDF) and Industrial R&D Fellowships (IRDF) programs. This report presents the findings from the evaluation of the Postdoctoral Fellowships (PDF).

1.1 POSTDOCTORAL FELLOWSHIPS (PDF)

a) Program Description

NSERC's Postdoctoral Fellowships (PDF) were established in 1978 to support a core of the most promising researchers, Canadian citizens and permanent residents, at a pivotal time in their careers, that is after they complete their PhD studies and before they become formal independent researchers. The fellowships are also intended to secure a supply of highly qualified Canadians with leading-edge scientific and research skills for Canadian universities, industry, and government. The full PDF program description can be consulted online at: http://www.nserc-crsng.gc.ca/Students-Etudiants/PD-NP/PDF-BP_eng.asp.

b) Program Statistics

Table 1.1 presents competition results for the PDF program for the period 2000-2011.

Table 1.1: PDF Competition Results, 2000-2011

Competition Year	Total # of applications	# of awards taken up*	# of unsuccessful applications	# of offered but declined awards	# of withdrawn and rejected applications**	# of interrupted and deferred awards**
2000	729	186	467	42	34	
2001	672	191	399	46	36	
2002	722	195	437	39	51	
2003	795	197	511	38	49	
2004	982	239	686	37	20	
2005	976	241	679	36	20	
2006	1,050	215	749	38	46	2
2007	1,134	211	843	42	37	1
2008	1,195	207	919	38	26	5
2009**	1,252	220	966	33	32	1
2010**	1,442	244	1055	37	101	5
2011**	1,479	145	1249	36	47	2
Total:	**12,428**	**2491**	**8960**	**462**	**499**	**16**

Source: NSERC – NAMIS as of May 9, 2012

* Includes terminated awards, termination requests, transferred awards, transfer requests, extended awards, extension requests, and awards with awardees on paid parental leave, but does not include interrupted awards or interruption requests

** These applicants were not surveyed

Note that this table contains duplicate records of individuals as unsuccessful applicants can reapply in subsequent competitions. The actual total number of unique applicants for competition years 2000 to 2011 is 10,319. Of these 10,319 unique applicants: 66 per cent are male; 29 per cent are female; and 5 per cent are unidentified by gender. This ratio remained consistent over the whole evaluation period.

c) Program Resources

Table 1.2 presents NSERC budget expenditures for the PDF program for the fiscal years 2000-2001 to 2011-2012.

Table 1.2: PDF Program Budget, Fiscal Years 2000-2001 to 2011-2012

Fiscal Year	PDF
2000-2001	$11,987,543
2001-2002	$11,370,199
2002-2003	$11,718,100
2003-2004	$14,379,045
2004-2005	$15,681,782
2005-2006	$18,257,012
2006-2007	$14,858,544
2007-2008	$15,196,560
2008-2009	$15,443,576
2009-2010	$16,376,512
2010-2011	$17,001,714
2011-2012	$13,974,451

Source: NSERC

1.2 EVALUATION OBJECTIVES AND SCOPE

The evaluation covers the period from 2000 to 2011 and addresses issues pertinent to relevance and performance as outlined by the Treasury Board[1], as well as design and delivery issues identified by NSERC management. Since the evaluation aims to measure what impact the program has had on participants and whether immediate and intermediate outcomes have been achieved, the majority of participants included in the evaluation completed their fellowships no later than fiscal year 2010-2011. These participants applied to PDF during competition years 2000-2008. Participants who applied before competition year 2000 were not included to avoid memory bias (i.e. inability to recall what happened during the fellowship), as well as to ensure that information obtained is not outdated. At the same time, opinions of recent or current fellows were important to answer some of the evaluation questions (e.g., those related to the value and duration of awards). In these cases, some qualitative evaluation methods (focus groups with funded applicants) included fellows who were still being funded (i.e., whose fellowship was still ongoing) at the time of the evaluation.

[1] Treasury Board, *Policy on Evaluation*, 2009.

2. METHODOLOGY

This evaluation employed multiple lines of qualitative and quantitative evidence to address the evaluation questions and indicators identified in the evaluation matrix. Each of the data collection methods is described in turn below.

2.1 DOCUMENT AND LITERATURE REVIEW

Documentation and literature reviewed included documents produced by NSERC, Government of Canada, Canadian Association of Postdoctoral Scholars (CAPS), and Canadian Association for Graduate Studies (CAGS). Literature from other sources was also identified through an online search and by consulting those interviewed for the evaluation.

2.2 KEY INFORMANT INTERVIEWS

A series of key informant interviews were conducted, exploring the full range of evaluation issues including relevance, design and delivery, impacts and cost-effectiveness. A total of 16 targeted interviews were completed with the following respondent types:

- Vice-Presidents of Universities, Research; Heads of Departments; as well as Deans of Science and Engineering (10 interview respondents);
- Members of the PDF program selection committees (2 respondents);
- Representative of the Canadian Association for Graduate Studies (CAGS) (1 interview);
- NSERC senior management and program staff (1 group interview);
- A representative of the NSERC Committee on Grants and Scholarships (COGS) (1 interview); and
- A representative of the Canadian Association of Postdoctoral Scholars (CAPS) (1 interview).

2.3 ONLINE FOCUS GROUPS WITH FUNDED APPLICANTS

Three online focus groups were conducted with current funded applicants. The composition and language of the three focus groups was as follows:

- One focus group conducted in English with funded applicants pursuing their fellowship outside Canada (12 fellows were recruited, and 11 participated);
- One focus group conducted in French with fellows in Canada and outside (6 participants were recruited and four participated); and
- One focus group conducted in English with fellows pursuing their fellowship within Canada (11 participants were recruited and 9 participated).

2.4 Review of Administrative Data

Administrative data analyzed as part of the evaluation include the following:

- NAMIS Data: The NSERC Award Management Information System (NAMIS) database provided descriptive statistics on participants, as well as the sampling frame for surveys.
- PDF Exit Survey: NSERC conducts annual exit surveys with funded applicants to collect data on their experiences, perceptions and opinions, as well as current employment status and future plans. Exit survey data from funded applicants who received awards in competition years 2003 to 2007 was reviewed. PDF Career Survey: NSERC also conducts a survey of PDF funded applicants to explore longer-term career outcomes of participants. The career survey is conducted biannually, seven years after the fellowship has been completed. The 2009 career survey results were reviewed for this evaluation.

2.5 Surveys

A number of surveys were conducted as part of this evaluation:

- ***Funded applicants:*** A survey of funded applicants who received a fellowship between 2000 and 2008 was conducted. The survey was conducted as a census; all participants from this period were invited to respond to the survey.
- ***Unfunded applicants:*** A survey of unsuccessful applicants and successful applicants who declined the award between 2000 to 2008 was also conducted. The survey was conducted as a census; all unfunded applicants from this period were invited to respond to the survey. This survey provided a comparison point to successful applicants.
- ***PDF supervisors:*** A random sample of PDF supervisors from the period of 2000 to 2008 was invited to respond to the survey.

Table 2.1 provides the final sample size for each survey population, the response rate, and the corresponding margin of error for each survey at a .95 confidence level (i.e., 19 times out of twenty).

Table 2.1: Response Rates

Survey	Original Sample	Final Sample	Response Rate	Margin of Error
PDF Academic Supervisors	461	461	143 (31%)	+/- 7.0%
PDF Funded Applicants	1,523	1523	628 (41%	+/- 3.2%
PDF Unfunded Applicants	2,845	2845	605 (21%)	+/- 3.8%

Each of the survey samples was examined in terms of the representativeness of the respondents to the overall population based on available sample characteristics. Weights for PDF funded and unfunded applicants were calculated based on year of the competition, as respondents who applied in more recent competition years were over-represented in comparison to the overall population of recipients from 2000 to 2008. Weights for PDF academic supervisors were based on discipline, as respondents in mathematical disciplines were over-represented in comparison to the PDF supervisors' sample, and respondents in physical sciences, engineering and earth science

disciplines were under-represented. Furthermore, it can be noted that the distribution of disciplines in the sample of PDF supervisors is similar to that of the funded PDF applicants.

2.6 DATA RELIABILITY AND LIMITATIONS

Overall, the evaluation methodology is strong in providing the basis for reaching conclusions for all issues and questions using multiple lines of evidence. The primary strategies employed to ensure reliability of evaluation findings involved:

- ***Multiple lines of evidence:*** Multiple lines of quantitative and qualitative evidence were used to consult stakeholder groups (funded and unfunded participants, program stakeholders and academic supervisors) as part of the evaluation. Where possible, findings from different lines of evidence are compared and contrasted to draw findings and conclusions. Qualitative as well as quantitative feedback was obtained from current fellows through the survey and focus groups conducted.
- ***Comparison group:*** The survey of unfunded applicants (unsuccessful applicants and applicants who declined the PDF award) provided a comparison group to funded applicants. This made it possible to compare funded and unfunded applicants on employment outcomes, and also compare the experience of unfunded applicants who pursued alternative fellowship opportunities to that of funded applicants.
- ***Census of funded and unfunded applicants and use of weighting to mitigate response bias:*** The surveys of funded and unfunded applicants were based on a census of all applicants to the program between 2000 and 2008. Respondents to the survey were compared to the original sample for differences, and weighted to remove any potential bias resulting from these differences.
- ***Consultation of different stakeholder groups:*** The evaluation consulted a number of different respondent groups on key evaluation issues, including funded applicants, unfunded applicants, academic supervisors, program stakeholders (e.g., key stakeholders within universities, members of the selection committee, CAGS, COGS and CAPS), and program staff.

There are limitations with the evaluation methodology, however, that were carefully taken into account when conducting the analyses. The limitations and mitigation taken to address these include:

- ***Potential response bias:*** Many of the respondent groups consulted as part of this evaluation (e.g., funded applicants, staff, academic supervisors) have a vested interested in the PDF program. As such, their responses are potentially biased toward favourable program outcomes. This limitation was addressed by the inclusion of a comparison group (unfunded applicants) and by the triangulation of the various lines of evidence in the analysis and reporting.
- ***Limits to qualitative methods:*** In interviews and focus groups, a limited number of respondents were consulted. As a result, it is not possible to know if findings are generalizable to the broader population of stakeholders (e.g., university representatives, funded participants). This limitation is addressed by the triangulation of qualitative and quantitative lines of evidence in reporting.

3. POSTDOCTORAL FELLOWSHIPS: FINDINGS

3.1 RELEVANCE

a) Continued Need

Evaluation Question 1: To what extent is there a continued need to provide fellowships?

Development of HQP at the postdoctoral level is widely believed to be a key ingredient in stimulating R&D in Canada – the federal S&T Strategy, for example, identified it as one critical success factor for building economic competitiveness through S&T. Across all disciplines, there are approximately 6,000 postdoctoral fellows in Canadian universities, with this number being expected to grow while universities are under pressure to hold hiring into the faculty ranks until the economy recovers.[2] The high level of demand for the PDF program also points to its relevance. From 2000 to 2011, NSERC received 12,428 applications to the PDF program, of which approximately 20 per cent were awarded. Through the PDF program, NSERC funds a small fraction of the total cohort of postdoctoral fellows in Canada.

According to funded applicants, the PDF award is important in their training as a researcher. The predominant reasons for applying for a PDF are to increase applicants' research experience in an academic setting, followed by a desire to work with a particular scientist or research group, developing research networks, and the fact that it is not possible to obtain an academic researcher position without a postdoctoral experience. A smaller proportion indicate that they applied for the PDF because they did not have a job offer. Unfunded applicants are more apt to identify a lack of firm job offer as a primary reason for applying for a PDF. The primary reasons for applying for a PDF are echoed by the exit survey conducted by NSERC.

Debates with regard to the balance of providing direct support to PhD graduates through training programs (e.g., institutional training, fellowships, and career development awards) versus training supported by research grants are ongoing in Canada and other countries. Recent reports, published in the United States by the National Academy of Sciences[3] and the U.S. National Institutes of Health[4], argued that (in contrast to training supported through grants) formal training programs are peer reviewed not only for the excellence of the science proposed, but also for the excellence of the proposed training and the training potential.

Key Finding: Program stakeholders interviewed, funded applicants and academic supervisors identify a continuing need to provide postdoctoral fellowships. This is supported by the literature and documents reviewed. Program demand also suggests an ongoing need. The direct funding provided through the PDF

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2 Canadian Association for Graduate Studies (CAGS), *2010 Presentation to the Senate Standing Committee on Social Affairs, Science and Technology*.

3 Committee on Research Universities; Board on Higher Education and Workforce; Policy and Global Affairs; National Research Council, *Research Universities and the Future of America: Ten Breakthrough Actions Vital to our Nation's Prosperity and Security*, 2012.

4 National Institutes of Health, *Biomedical Research Workforce Working Group Report*, 2012.

program provides applicants an opportunity to obtain relevant research experience within an academic setting, and also provides them the freedom to work with the research group or researcher of their choice.

b) Fellowship as Necessary Requirement

Evaluation Question 1.1: To what extent is a postdoc a necessary requirement to obtain a research intensive position in academe or industry?

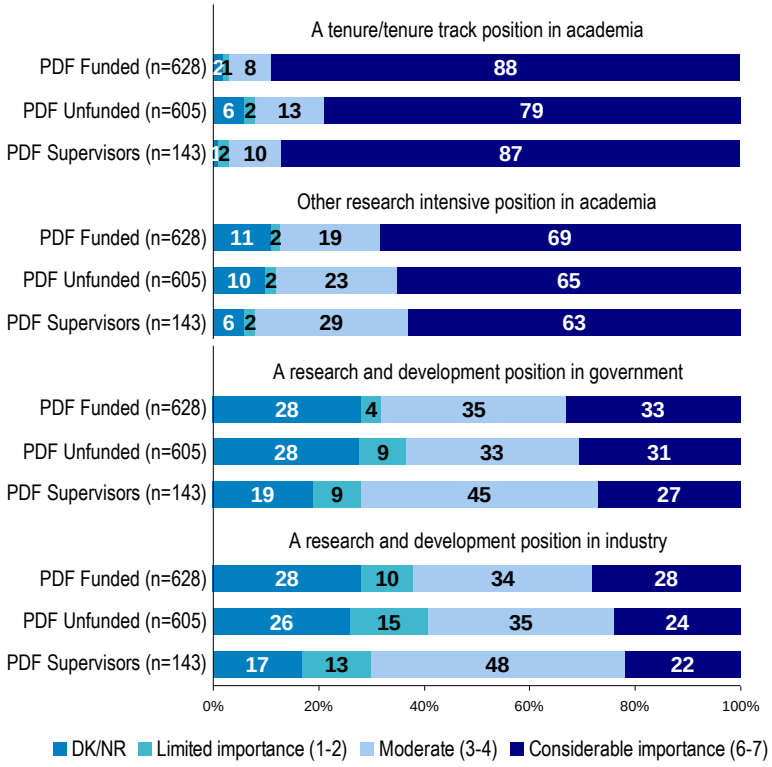
Findings from several lines of evidence suggest that a postdoctoral fellowship is critical to obtaining employment in academe, but is less important in terms of obtaining research intensive positions in government or industry. In the academic environment, a postdoctoral fellowship is described by key informants as being "part of the culture", and as a "requirement" for employment. Interview respondents commonly express the opinion that PhDs are not ready to make the transition to an academic position and that a postdoctoral fellowship allows an individual to gain independence as a researcher, develop a publishing record, sharpen research skills, work in a different environment, and develop collaborative relationships and a network. There is a sense among interview respondents that the need or importance of postdoctoral fellowships varies by discipline. Many interview respondents underscore the importance of postdoctoral fellowships in the sciences. Others indicate that a fellowship is becoming more important in engineering disciplines – due, in part, to a tighter job market. These findings are also supported by survey responses.

Some interview respondents underscore that not all PDFs will remain in academe and that some will obtain employment in industry. Postdoctoral fellowships, regardless of whether they are in industry or academe, contribute to supporting the ongoing development and employment of PhD graduates. A postdoctoral fellowship is an opportunity to develop a CV, gain independent research experience, and to develop a publication record.

A postdoctoral fellowship is perceived to be a crucial stepping stone to a fellow's next career move. Approximately seven in ten funded and unfunded applicants surveyed say that a postdoctoral fellowship is a requirement to obtain a research-intensive position in their discipline. The majority of key informants (across all respondent types) and focus group participants also indicate that postdoctoral experience is an important factor or prerequisite in hiring decisions.

Importance of Fellowship in Securing Employment

"In your professional experience, how important is the independent research experience gained through a postdoctoral fellowship in securing employment in the following sectors in your discipline?"



EKOS Research Associates Inc.

PDF/IRDF Evaluation – Funded/Unfunded Applicants, PDF Supervisors Survey, 2012

Key finding: Postdoctoral experience is viewed as being critical to securing research-intensive positions in academe, and of lesser importance for positions in industry or government. This is particularly true for candidates in science disciplines (vs. engineering).

Evaluation Question 1.2: To what extent is a postdoc considered an important credential in the assessment of Discovery Grant applications among first time applicants?

All applications for the Discovery Grants program submitted by first time new applicants[5] for competition years 2002-2011 were reviewed by NSERC in order to assess whether there is an association between having postdoctoral experience (not limited to NSERC's PDF program) and success among first time applicants in NSERC's Discovery Grants program.

Over the ten year period, the majority of applications (58.6 per cent) were submitted by first time new applicants who had postdoctoral experience. With the exception of engineering and computer sciences, more than one-half of applications cited postdoctoral experience in each discipline over the whole period. However, the

5 First time experienced academic and first time experienced non-academic applicants were not included in the analysis.

incidence of postdoctoral experience among new applicants has been declining (from 63.6 per cent in 2002 to 50.3 per cent in 2011).

Although statistically significant, success rates among first time new applicants with postdoctoral experience are only marginally higher than those without (i.e., 72.2 vs. 67.8 per cent respectively). Over the ten-year period, success rates among both groups declined at the same rate as the overall success rates.

The Physical and Life Sciences are the two disciplines with the highest incidence of applications from people with postdoctoral experience. Applicants from these disciplines follow the overall trend. Although applicants with postdoctoral experience had a greater likelihood of being successful earlier in the ten-year period, this tendency has diminished; in the 2011 competition, applicants without postdoctoral experience in the Physical and Life Sciences were as likely as those with this experience to be successful in obtaining Discovery Grant funding.

As with the overall trend, success rates in Engineering and Computer Sciences, regardless of postdoctoral experience, have been declining in the past decade, although at a greater rate in Engineering. Applicants in these discipline groups have the lowest incidence of postdoctoral fellowships and their success in the Discovery Grants program has *not* been dependent on this type of experience. In contrast, applicants in the Mathematical and Earth Sciences are generally more successful when they have postdoctoral experience ($p=0.05$). Despite the decline in the success rates of these disciplines, this association has not changed over the past decade.

Key Finding: Over the ten-year period examined, the majority of first time new applicants to the NSERC Discovery Grants Program had postdoctoral experience, although the incidence of new applicants with postdoctoral experience has been declining. Applicants with postdoctoral experience have a marginally higher success rate than those without experience, although the gap in success rates has also declined.

c) Alignment with Council and Federal Priorities

Evaluation Question 2: Does the PDF program continue to be aligned with NSERC and government-wide priorities in the area of science and technology?

The PDF program is aligned with NSERC's Program Activity Architecture (PAA) under People. NSERC's Report on Plans and Priorities (2011-12) notes that successfully conducting research and putting new knowledge to work requires a pool of highly qualified people. Universities offer the best training ground for the next generation of researchers—our human capital—whether they ultimately work in industry, in postsecondary institutions or in the public sector.

With respect to alignment to federal priorities, within the *Whole-of-government framework*[6], the Supporting Students and Fellows program activity supports the Government of Canada Outcomes: Economic Affairs; Innovative and Knowledge-based Economy. NSERC's focus on people, including supporting fellows at the postdoctoral level maps closely to the federal Science and Technology (S&T) strategy which identifies a People Advantage as one of three advantages key to Canada's future prosperity[7]. The federal strategy emphasizes that government will contribute directly to creating a People Advantage by supporting opportunities that help increase the

6 http://www.tbs-sct.gc.ca/ppg-cpr/frame-cadre-eng.aspx. Accessed February 13, 2012

7 Mobilizing Science and Technology to Canada's Advantage (2007)

supply of the highly qualified and globally connected S&T graduates that businesses need to succeed. The strategy emphasizes the important role post-secondary institutions play in developing the knowledge and skills Canadians need to build a sustainable national competitive advantage for Canada based on S&T. The strategy furthermore emphasizes that the Government of Canada will enhance opportunities for S&T graduates in order to help create a people advantage.

Key Finding: The objectives and outcomes of the PDF program are consistent with both departmental and governmental strategic planning.

d) Federal Government Role

Evaluation Question 3: Is there a necessary role for the federal government in providing the PDF program?

There is a strong role for government in stimulating R&D activities and capacity which are important ingredients for international competitiveness and for stimulating a knowledge-based economy. NSERC has a full range of programs supporting science and engineering students all the way through their academic career and provides leadership in these areas nationally.

Results from the survey of PDF supervisors indicate that the NSERC PDF has been an important source of funding for those postdoctoral fellows whom they supervised since 2000. One-half of the PDF supervisors surveyed (51 per cent) say they would not have hired their most recent postdoctoral fellow in the absence of the PDF award.

Significant proportions of funded applicants surveyed think it unlikely they would have had the same opportunities to conduct research after their PhD without a PDF. Only one in five funded applicants is confident that they would have gone on to work with their supervisor or at their PDF tenure organization if they had not received NSERC funding (21 per cent). Two in five say that it is very unlikely they would have continued a working relationship with their supervisor or organization (39 per cent). This is confirmed by the survey of unfunded applicants in which only 30 per cent of respondents who secured a fellowship indicate that they did in fact work for the same researcher as identified in their PDF application[8].

NSERC PDF funding is an important source of postdoctoral funding, but is one of numerous sources of support for PhDs seeking research experience in a university environment. A 2009 survey of postdoctoral fellows in Canada by the Canadian Association of Postdoctoral Fellows indicated that 50 per cent of respondents identify their supervisor's research grant as the primary source of their salary, while federal granting agencies (including NSERC) are the second most frequent source at 18 per cent[9]. Other sources of postdoctoral support include fellowships offered by provincial government, by private foundations and by foreign governments.

Other postdoctoral fellowship opportunities available identified by interview respondents includes the prestigious Banting fellowship. However, as one key informant noted, the Banting award is well-endowed but

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8 Unfunded applicants who received postdoctoral fellowships other than those by NSERC may have obtained a fellowship award from another source, or may have obtained a postdoctoral position funded from other sources (e.g., research grants). No distinction was made between these sources in the survey questionnaire.

9 Canadian Association of Postdoctoral Scholars, *A postdoctoral crisis in Canada: From the "Ivory Tower" to the "Academic Parking Lot"*, 2009.

represents a small minority of all awards, creating disparity with typical PDF recipients. The majority of interviewees note that other sources of postdoctoral funding include funding provided for a postdoctoral position by a primary investigator within their research grant. However, these postdoctoral positions are described as less suited to create independent investigators, given that they do not offer the same level of freedom, independence and prestige offered by the PDF. Also, support is provided through programs like the Industrial Research Assistance Program (IRAP) at the National Research Council (NRC); however, interviewees note that IRAP funds projects more so than people. The program assumes there will be collaboration with a university, and there is a more elaborate requirement in terms of the application process. Interview and focus group respondents describe alternative fellowship programs as secondary or complementary to the NSERC PDF award, given both the prestige of the PDF award (making it more highly prized than many alternatives), and the overall need or demand for postdoctoral fellowship opportunities in Canada.

When asked to indicate what they would have done in the absence of the PDF award, focus group participants said that they would have pursued a postdoctoral opportunity funded through a research grant or principal investigator in the place of the PDF. However, these participants believe that this would have given them far less freedom in terms of their research focus and project.

Many key informant interview respondents and PDF focus group participants further note that the NSERC PDF award is prestigious. According to most key informants, the niche of the PDF is that it supports high calibre fellows and is "the benchmark for all other fellowship programs". The PDF award is generally viewed by key informants and focus group participants as highly prized, providing the fellow a freedom that is unavailable otherwise to pick the most appropriate labs in Canada and the world to get the best experience possible. While several key informants note that NSERC only funds a fraction of postdoctoral fellows in Canada, they note that the PDF award fills an important niche because it provides Canada's "best and brightest" the freedom and independence to obtain the postdoctoral experience available.

Key Finding: NSERC's role in providing postdoctoral fellowships in academe is perceived as necessary by program stakeholders. While the PDF is identified as an important source of postdoctoral fellowship funding in Canada, other sources of postdoctoral support do exist, with the most common source being research grants. Provincial governments, other granting bodies and private foundations also provide postdoctoral fellowships in academe in Canada. The PDF is seen to occupy an important niche in postdoctoral funding in Canada, as a prestigious award that offers independent training to the "best and brightest". Furthermore, stakeholders and successful participants underscore that the freedom the direct funding provided by the PDF offers participants to select the lab and project of their choice is a key advantage or strength of the program. This enables funded participants to obtain the best possible postdoctoral training in light of their career objectives.

3.2 Design and Delivery

Evaluation Question 4: How appropriate is the duration and amount of the award?

a) Award Amount

The PDF award provided by NSERC is $40,000 annually for two years. The value of the award has remained unchanged since 2004, when it was increased from $35,000.

Two in five PDF supervisors surveyed as part of the evaluation say they usually top up a fellow's award (39 per cent), with the average top-up amount for their most recent fellow being around $11,500. Supervisors from engineering disciplines more often provide top-ups and provide a larger top up on average than supervisors from science disciplines. The amount of the top-up provided by supervisors is illustrated by Table 3.1. PDF supervisors surveyed identify research grants as the most common source of funds for top-ups (88 per cent).

Table 3.1: PDF Supervisor Top Ups

Question	% of PDF Supervisors
Do you usually top up the amount of the NSERC fellowship (i.e., in addition to the $40,000 per year provided by NSERC)? (n=143)	39%
How much was the top-up for your most recent NSERC postdoctoral fellow per year? (n=55)	
<$5,000	8%
$5,000 to $9,999	23%
$10,000 to $14,999	29%
$15,000 or more	24%
Don't know/no response	16%
Mean top-up provided	$11,455
Median top-up provided	$10,000

While many funded applicants receive top ups or income through other sources, the PDF award remains a significant source of their income during fellowship. The survey of funded applicants found that fellows in the science disciplines, in particular, are likely to have relied completely on NSERC funding for their income compared to those from engineering disciplines.

The mean and median earnings for unfunded applicants are slightly higher than that of funded participants, although unfunded applicants report greater variability in earnings (Table 3.2). Funded applicants in engineering disciplines report higher fellowship earnings (reporting an average fellowship amount of $49,000 compared to $44,000 for those in science disciplines), and are more apt to report earnings of $60,000 or more (19 per cent do).

Table 3.2: Fellowship Earnings[10]

Amount Received	Funded applicants (n=628)	Unfunded Applicants who obtained alternate fellowship (n=309)
<$40,000	10%	28%
$40,000 to $44,999	46%	19%
$45,000 to $59,999	26%	26%
$60,000 or more	9%	18%
Don't know/no response	9%	9%
Mean earnings	$44,978	$46,777
Median earnings	$40,000	$44,000

[10] Three outliers were removed to calculate the mean and median.

The total amount funded applicants have received annually (including NSERC and host institution contributions) has fluctuated over time according to survey results, demonstrating some growth over time. There have been fluctuations from year to year, but with an overall pattern of growth from 2000 to 2008. Similarly, findings from the survey of PDF supervisors suggest that the proportion of institutions or supervisors who top up the NSERC award has increased over time.

In an international benchmarking study undertaken by NSERC in 2011[11], the PDF award ranked in the bottom half of international awards examined in terms of value, suggesting it may not be competitive. Canada's S&T Strategy emphasizes the importance of ensuring that awards are internationally competitive in order to achieve our goal of "attracting the world-class graduates that Canada's research community and economy need".[12]

Total Direct Costs of PDF Project

The survey of PDF supervisors inquired about total direct research costs associated with the project component worked on by their most recent PDF program fellow, including materials, specimens, equipment, user fees, and other costs and excluding the fellow's salary. The total direct costs reported are shown in Table 3.3.

Table 3.3 Direct Costs Associated with Project or Project Component PDF Worked On

Direct Cost Reported	%
Less than $10,000	21%
$10,000 to $19,999	17%
$20,000 to $39,999	29%
$40,000 or more	17%
Don't know/no response	16%
Median = $20,000	

n=143, Survey of PDF Supervisors

Benefits

One-half of funded applicants surveyed did not receive any benefits (51 per cent). This proportion is fairly consistent throughout the whole evaluation period (i.e., competition years 2000-2008).

Four in ten academic supervisors surveyed report that postdoctoral fellows at their university always receive benefits as part of their terms of fellowship; while almost one-third (31%) state that PDFs never receive benefits at their institution; and one-quarter say that it depends on the situation: benefits are negotiated case-by-case. It is worth noting that 18 per cent of PDF supervisors did not respond to this question. Funded applicants who remained in Canada are more apt to report receiving no benefits; while those who pursued their fellowship abroad more often report receiving medical, dental and drug plan benefits.

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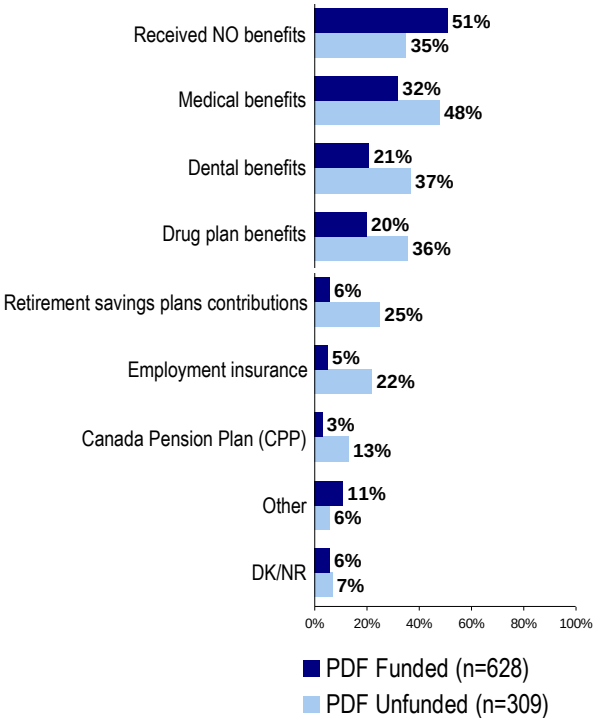
11 *Report on 2011 International Benchmarking Study: NSERC Scholarships and Fellowships*. Research Grants and Scholarships Directorate, June 2011.

12 Mobilizing Science and Technology to Canada's Advantage (2007). Page 79

Benefits Provided/Received During Fellowship

"Did you receive any health, drug, dental or other benefits during your fellowship?"



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PDF/IRDF Evaluation – Funded/ Unfunded Applicants Survey, 2012

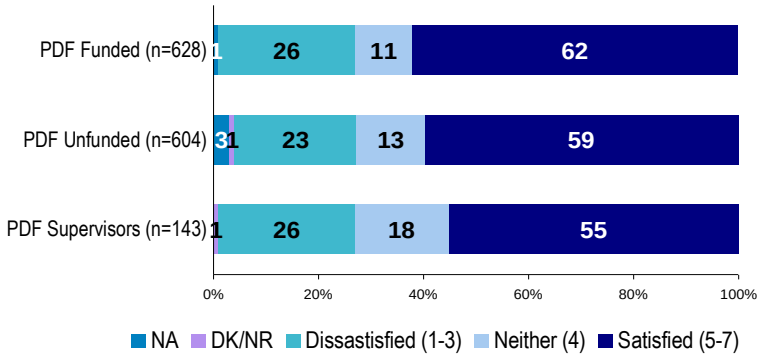
When fellows do receive benefits, these are usually funded by research grants (81 per cent).

Appropriateness of Award Amount

Findings from surveys and qualitative sources show some dissatisfaction with the current PDF award amount. Funded applicants most satisfied with this amount are in mathematics and engineering, while those in the life sciences (who more often report lower earnings) are more likely to find this amount unsatisfactory (37 per cent do). Dissatisfaction with the award amount has grown over time. A total of 17 per cent of funded applicants who applied to the program between 2000 and 2003 report being dissatisfied with the award amount, compared to 31 per cent of those who applied in 2007 and 2008.

Satisfaction with Award Amount

"How satisfied are you with the amount of the award ($40,000 per year)?"



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Furthermore, only just over half the funded applicants surveyed (56 per cent) agreed that the PDF award was sufficient to provide an acceptable standard of living during the postdoctoral fellowship (while 30 per cent disagreed indicating that their standard of living was not acceptable).

Qualitative methods revealed a variety of reasons why the majority of key informants and focus groups participants find the current award amount to be inadequate. The amount is described as not high enough to attract the best and brightest candidates, and as not keeping pace with inflation. The introduction of taxation on awards has also decreased the relative value of the award in those universities where postdoctoral fellows had not been considered as employees and their fellowships had not been taxable. In fact, Statistics Canada data suggests that doctoral graduates who intend to enter the labour market directly following their PhD earn more than those who intend to pursue a postdoctoral fellowship[13]. The difference was largest in the life sciences. This illustrates an important earning gap between those undertaking postdoctoral work versus those entering the labour market directly; suggesting that the value of postdoctoral awards are on average significantly lower than potential earnings that can be obtained by pursuing employment.

However, some key informants express concern that raising the amount of the PDF award would be to the detriment of the number of candidates supported. A minority of interview respondents and focus group participants feel that the current value is appropriate, although some acknowledge that the appropriateness of the award may vary by region based on differences in cost of living.

For those who are not satisfied with the current amount of the PDF award, feedback from interviews and surveys indicates that a more acceptable amount would be in the range of $50,000-$55,000. Funded applicants surveyed suggest a more appropriate amount of about $51,900, on average, while unfunded applicants suggest the award be $53,000 and supervisors suggest an increase to around $50,000 (Table 3.4).

13 Expectations and Labour Market Outcomes of Doctoral Graduates from Canadian Universities. http://www.statcan.gc.ca/pub/81-595-m/81-595-m2011089-eng.pdf

Table 3.4: Appropriate PDF Award

What do you think the award amount should be per year for a postdoctoral fellow?	Funded Applicants (n=238)	Unfunded Applicants (n=228)	PDF Supervisors (n=61)
<$50,000	18%	18%	32%
$50,000 to $59,999	57%	51%	45%
$60,000 or more	18%	22%	16%
DK/NR	8%	8%	7%
Mean	$51,865	$52,934	$50,045
Median	$50,000	$50,000	$50,000

In interviews and focus groups, suggestions arose for other non-monetary options to increase the award value, such as tax-free awards, a separate travel budget, benefits, and/or a relocation allowance as methods of increasing the value of the award. Many participants across all groups feel that the PDF award could be supplemented, at a minimum, with additional funds for professional development (e.g., travel to conferences), to cover direct research costs or to cover relocation costs. Others feel that the award should take into consideration the family situation of the fellow (stating that many have children and face higher living costs).

Influence of Award Amount on Fellowship Location

The amount of the PDF award generally had positive impacts or no impact on applicants' choice of location and tenure organization. Fewer than one in ten funded applicants report negative impacts of the amount on their choice of location or tenure organization. It is interesting to note that the amount of the fellowship award is more apt to have a negative or no impact on the choice of fellowship location for unfunded applicants.

Key Finding: Some postdoctoral fellows (no more than half) receive top ups from their host institutions; this is true of both funded applicants and unfunded applicants who obtain alternative fellowship funding. Research grants are the most common source of additional earnings or top up. However, top-ups are often modest and the fellowship award remains the most significant source of income for most. Despite the fact that the PDF is seen as a prestigious award, funded applicants report slightly lower annual earnings during the fellowship than do unfunded applicants who pursued an alternate fellowship opportunity. It is interesting to note, however, that unfunded applicants who declined the PDF award report significantly higher fellowship earnings than do unsuccessful applicants. Furthermore, based on an international benchmarking study undertaken by NSERC, the PDF award ranks in the bottom half of international awards examined in terms of value, suggesting it is not competitive with other awards.

Receipt of benefits by fellows during the PDF fellowship is not universal; at most half receive benefits such as medical, dental or drug benefits.

Views on the appropriateness of the PDF award vary. While over half report satisfaction with the current award amount; a significant minority of fellows and academic supervisors report being dissatisfied with the amount and do not consider it sufficient to provide an appropriate standard of living. Introduction of taxation

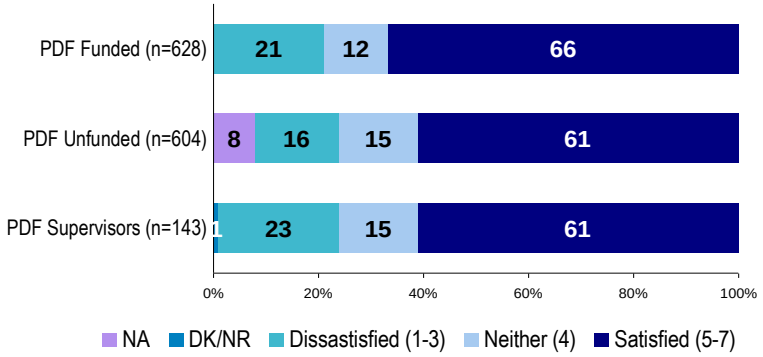
on fellowships has also decreased the relative value of the award in those universities where postdoctoral fellowships had not been taxable. Satisfaction with the amount appears to vary by discipline and by fellowship location. The amount is perceived as less appropriate for fellows located in regions or cities with a higher cost of living, or for those who completed their fellowship abroad. Funded applicants from engineering disciplines (who tend to report higher earnings during fellowship) are less often dissatisfied. Some suggest non-monetary options to increase the award value, such as tax-free awards, a separate travel budget, benefits, and/or a relocation allowance as methods of increasing the value of the award.

b) Award Duration

Along with the amount of the PDF award, the duration of the award is another measure where there is a fair amount of dissonance expressed from the majority view. Survey results and qualitative methods reveal a majority opinion that the award duration of two years is appropriate, but as with the award value, there is a significant minority who feels otherwise.

Satisfaction with Award Length

"How satisfied are you with the two-year length of the PDF fellowship?"



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Survey results point out significant pockets of dissatisfied stakeholders, including applicants in the sciences (particularly life sciences) who more often express dissatisfaction with the award length. Funded applicants who completed their PDF outside Canada are also more apt to be dissatisfied with the length of the award (24 per cent compared to 17 per cent of those who remained in Canada). In fact, survey respondent groups who more often expressed dissatisfaction with the award length also reported spending a longer time overall as a postdoctoral fellow (see Section 3.3, g) Postdoctoral Experience). It should be noted that although most funded applicants, as well as unfunded applicants who pursued other fellowships, spent more than 24 months as postdoctoral fellows, a significant minority of both groups (i.e., 43 per cent) did, in fact, spend 24 months or less.

Of those who feel two years in not appropriate, most would prefer to see the program length be three years. The most common justifications for lengthening the PDF term are based on the perceptions that more time is needed to develop and conduct a research project; that this is how much time is required to conduct significant work

making a contribution to the field; and that it more accurately corresponds to the average length of time required to conduct a postdoctoral program.

Key Finding: Two years is generally deemed to be a suitable duration for the award, although in life sciences disciplines, this may not be adequate time for recipients to gain relevant experience. The duration of the award is also less satisfactory for those who left the country to undertake their PDF. Satisfaction with the current length was much higher among stakeholders interviewed than among survey respondents. In fact, over four in ten funded applicants spend 24 months or less as postdoctoral fellows, suggesting that the length is appropriate for many.

c) Other Design Elements

Satisfaction with other aspects of NSERC design and services is high (among funded applicants, unfunded applicants, supervisors, and stakeholders interviewed), although satisfaction levels are consistently higher among funded applicants than among unfunded applicants.

Survey results also indicate a high level of satisfaction with program delivery, although satisfaction is much weaker with the promptness of notification on the outcome of application (with 10 per cent of funded applicants and 23 per cent of unfunded applicants expressing dissatisfaction on this point). Focus groups participants also expressed some frustration with the timing of decisions. In the view of these respondents, the notification of the PDF award comes too late, or approximately one month after other hiring and award decisions are made.

The Administration and Training of Postdoctoral Fellows in Canada

The Canadian Association of Postdoctoral Scholars undertook a survey of postdoctoral fellows in Canada in 2008 (across all disciplines and obtaining support from all sources), as well as a survey of administrative practices in postsecondary institutions supporting fellows. Findings from this research found that the administration and training of postdoctoral fellows varies significantly from institution to institution. The diffuse organization of postdoctoral training leaves this class of highly qualified personnel in a vulnerable position: neither graduate students, nor faculty members – they represent a heterogeneous group of poorly defined “apprentice” scientists. As such, postdoctoral fellows do not generally have well defined expectations of employment, commensurate or even normalized pay scales, performance evaluations, and benefits. Based in part on these findings, the Canadian Association for Graduate Studies presented a number of recommendations concerning postdoctoral fellowship administration and practices generally in Canada[14], including the need to:

- Establish a nationally accepted definition of a postdoctoral fellow in Canada;
- Establish a clear status for postdoctoral fellows at Canadian institutions;
- A need to broaden skills development opportunities for postdoctoral fellows as well as establish clear training guidelines in recognition of the fact that only a minority will obtain tenure track appointments; and
- Facilitate the granting of appropriate stipends and extended benefits for postdoctoral fellows.

[14] Shifting Ground of Postdoctoral Fellowship Policy and Practice, Canadian Association for Graduate Studies, November 2010.

Satisfaction with Number of PDFs Supported by NSERC

The appropriate number of postdoctoral fellows or fellowships in Canada is an issue that has been examined by stakeholders. There is some concern that increased numbers of postdoctoral fellows in Canada is a reflection of the imbalance of supply and demand for scientists generally and tenure track positions particularly. CAPS (2009) believes that this imbalance of the number of postdocs compared to the academic careers available creates a "parking lot mentality" for highly qualified personnel[15], a smaller and smaller proportion of whom will be successful in finding the tenure track positions their supervisors are training them for. External factors will affect young scientists, such as hiring freezes at Canadian universities, the end of mandatory retirement, and universities turning to part-time untenured lecturers[16]. At the same time, postdoctoral fellows are identified as playing an important role in research in Canada, and experts underscore the importance of investing in postdoctoral fellows directly to help universities and private enterprise hold onto talent that will enable us to compete.[17]

Opinion on the issue whether the number of NSERC postdoctoral awards is appropriate is divided: many support an increase in the number of PDF awards, although the concern was frequently heard in interviews and focus groups that stakeholders do not wish to see the value of the award diminished in order to support an increase in participants. Furthermore, some argue that the current number of awards is appropriate.

A 2009 report by CAPS based on a national survey of postdoctoral fellows addressed the issue of career prospects. While postdoctoral positions are typically undertaken with the goal of a faculty or equivalent position, the ratio of postdoctoral fellows to available faculty positions is increasing as a result of a decline of new faculty position openings[18]. CAPS reports that the proportion of PhDs who will become university professors is decreasing. Furthermore, Statistics Canada reported a relative decline in the proportion of PhDs who were university professors from 34 per cent in 1986 to 24 per cent in 2001 despite a 93 per cent growth in the total number of PhDs over the same period[19]. Further decreases were expected given that enrolment in doctoral programs is far outpacing the increase in full time university professors. In 2007/2008, enrolment at the doctorate level was 40,400, an increase of 62 per cent from 2001/2002[20]. In 2007, Canadian universities granted 4,800 doctorate degrees, and there were approximately 6,000 postdoctoral fellows in Canada, while Canadian universities hired 2,616 new full time university teachers that year. It is clear from these numbers that the majority of postdoctoral fellows will not be entering into academic positions.

Key Finding: The design and delivery of NSERC services is considered highly satisfactory, particularly the application process and eligibility criteria. The delivery of award payments is identified as the most important service provided by NSERC and the large majority report being satisfied with this. However, the timing of NSERC decisions and notification of applicants is a source of frustration for some (with a preference identified to see earlier notification of awards).

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15 A postdoctoral crisis in Canada: From the "Ivory Tower" to the Academic "Parking Lot". Canadian Association of Postdoctoral Scholars, 2009

16 Shifting Ground of Postdoctoral Fellowship Policy and Practice, Canadian Association for Graduate Studies, November 2010.

17 Canadian Association for Graduate Studies (CAGS) 2010 Presentation to the Senate Standing Committee on Social Affairs, Science and Technology.

18 A postdoctoral crisis in Canada: From the "Ivory Tower" to the Academic "Parking Lot". Canadian Association of Postdoctoral Scholars. 2009.

19 http://www.statcan.gc.ca/pub/88f0006x/88f0006x2007002-eng.pdf

20 A postdoctoral crisis in Canada: From the "Ivory Tower" to the Academic "Parking Lot". Canadian Association of Postdoctoral Scholars. 2009.

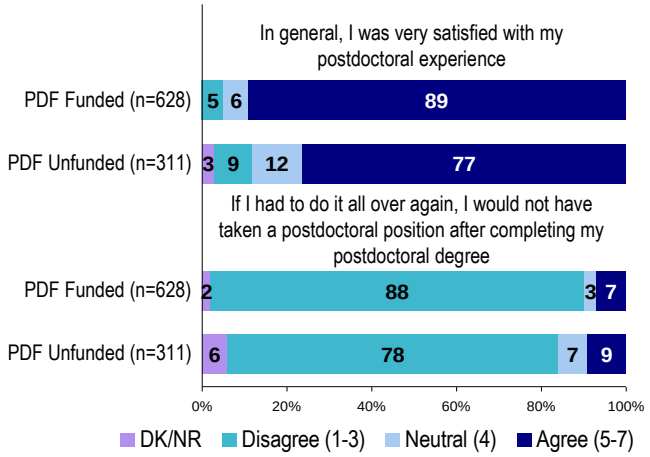
The number of PDFs being supported is contentious: some feel more should be supported, while others would consider this to be a disservice to those who receive funding. It is clear that not all postdoctoral fellows will be successful in obtaining a tenured position given the shortage of openings compared to prevalence of PhDs. Furthermore, an increase in the number of PDFs is not supported by data available which indicates that the supply of postdoctoral candidates exceeds faculty hiring, and that this situation is expected to continue in the foreseeable future.

Other research conducted of postdoctoral fellows generally in Canada identifies considerable variability in the administration and training of fellows from one institution to another, and suggests a need to define the role and treatment of this class of HQP more clearly and systematically. There is also some suggestion that NSERC could further support the development of postdoctoral fellows by providing them additional professional development opportunities, guidance and opportunities for exchange, particularly given the fact that not all will pursue an academic career.

d) Overall Satisfaction and Suggestions for Improvement

Overall satisfaction with the PDF program is high.

Overall Satisfaction with Fellowship Experience



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PDF/IRDF Evaluation – Funded/ Unfunded Applicants Survey, 2012

Nearly all funded applicants (97 per cent) responding to the survey said they would recommend applying for an NSERC postdoctoral/Industrial R&D fellowship to recent PhDs. In particular, many respondents pointed to the flexibility and freedom associated with receiving outside funding. In getting funding from NSERC, fellows have the choice as to where they want to hold the fellowship and what kind of research they want to conduct. Respondents also often pointed to the experience gained from a PDF position, or the prestige of an NSERC PDF, often saying "it looks good on a CV."

Funded applicants provided positive ratings of the capabilities of their host department. Ratings are somewhat more moderate for the facilities and technical capabilities of host department. A majority of exit survey

respondents provided positive ratings to the support they received from their research supervisor during the award. Eight in ten (79 per cent) agree that they received useful feedback from their supervisor. While most fellows responding to the exit survey viewed the role played by their supervisor and/or principal investigator positively, only 45 per cent agree that the university does a good job of making postdocs feel like they are a part of the academic community (with 36 per cent disagreeing), suggesting they felt less well supported by the host university at large.

Suggestions for improving the program tend to echo earlier findings presented regarding design, including dissatisfaction with award amount, the timing of award decisions, and overall support provided to fellows. . Overwhelmingly, their suggestions most often related to funding level.

In one focus group, participants also suggested that it might be useful if PDF participants were provided with a booklet or guide by NSERC on "so you're doing a postdoc". They suggested that NSERC could provide tips to new fellows based on what other participants have learned from their experience, including the importance to focus on building a network, looking for opportunities to write grants, and "think big picture". Two thirds of supervisors surveyed also provided suggestions for improvement. Oftentimes, like the suggestions from the applicants, the suggestions pertain to either increasing the number of awards given out or increasing the funds or benefits somehow.

Key Finding: Satisfaction with the PDF program experience is high. Funded applicants express relatively greater satisfaction with their fellowship experience than do unfunded applicants who pursued alternative fellowship opportunities.

3.3 SUCCESS/IMPACTS

a) Engagement in Research

Evaluation Question 6.1: To what extent does the program have an impact on the fellow's ability to conduct independent research and development in Natural Sciences and Engineering?

Participants in PDF focus groups describe being highly involved in research, and as having a significant amount of independence in their postdoctoral position. They describe being actively engaged in most aspects of research, including defining questions and developing strategies; data collection; analysis; dissemination activities; and writing grants or proposals. Fewer participants have been involved in technology transfer or teaching.

Survey findings also suggest funded applicants have considerable engagement in research activities. Over eight in ten funded applicants responding to the survey describe having had considerable involvement in the dissemination of research results, defining the research question or problem of interest, and data analysis. Over seven in ten report considerable involvement in developing strategies or approaches to address research problems and in data collection. Funded applicants are far less apt to report considerable involvement in other activities.

There are no significant differences between unfunded applicants who pursued an alternate fellowship and funded applicants in terms of involvement in a number of activities (data collection, data analysis, dissemination, proposal writing, teaching, peer reviews). Unfunded applicants are, however, somewhat less likely than funded PDF participants to have been engaged in defining the research question and developing strategies or approaches, but are more apt to have made a moderate (rather than limited) contribution to the provision of administrative support

and transfer of technology. This is consistent with earlier qualitative evidence presented which underscores the freedom and prestige associated with the PDF award compared to other postdoctoral fellowship opportunities.

Findings from the survey of PDF supervisors show similar results, indicating that supervisors agree that their most recent fellows are most often involved in the same key activities. Supervisors report considerable engagement of funded applicants in dissemination, data analysis, and research design.

According to more than seven in ten supervisors surveyed, the most important skills developed during a PDF that will ensure fellows are better prepared to become independent researchers (in academe or industry) are: the ability to conduct research independently, knowledge of the discipline, competence in research development and design, report writing and publications, and critical and creative thinking. These are largely in line with what has been demonstrated as the key areas that postdoctoral fellows are involved in. Finally, 89 per cent of PDF supervisors' surveyed state that the PDF fellow supervised had a positive impact on their research productivity. Eighty-four per cent of PDF supervisors surveyed also report being satisfied with the research contribution of the most recent NSERC postdoctoral fellow to their research program.

Key Finding: Funded applicants report being highly involved in research and as having considerable independence during their postdoctoral fellowship. Applicants are most often involved in activities relating to the definition of research questions, the dissemination of research results, in the identification of strategies or approaches to address research questions, and data collection. While there are no significant differences among funded applicants and unfunded applicants with postdoctoral experience with regard to their involvement in a number of research activities, funded applicants are still somewhat more likely to have been engaged in defining the research question and developing strategies or approaches. PDF academic supervisors report that PDFs are gaining skills in areas that are of high importance to future success as independent researchers in academe or industry.

b) Skills Development

Evaluation Question 6.2: What professional, technical and scientific experience and skills do fellows gain during the program?

Evaluation Question 6.3: To what extent do postdoctoral fellows gain teaching and/or mentoring experience?

Applicants and academic supervisors of PDF recipients were asked a series of questions to explore research, professional, and personal skills gained as a direct result of the postdoctoral experience. These findings are presented below. Exit survey respondents were also asked to rate their perceived level of improvement in a number of skills as a direct result of their NSERC PDF award immediately following completion of their fellowship. The greatest area of improvement as rated by exit survey respondents was consistent with survey results.

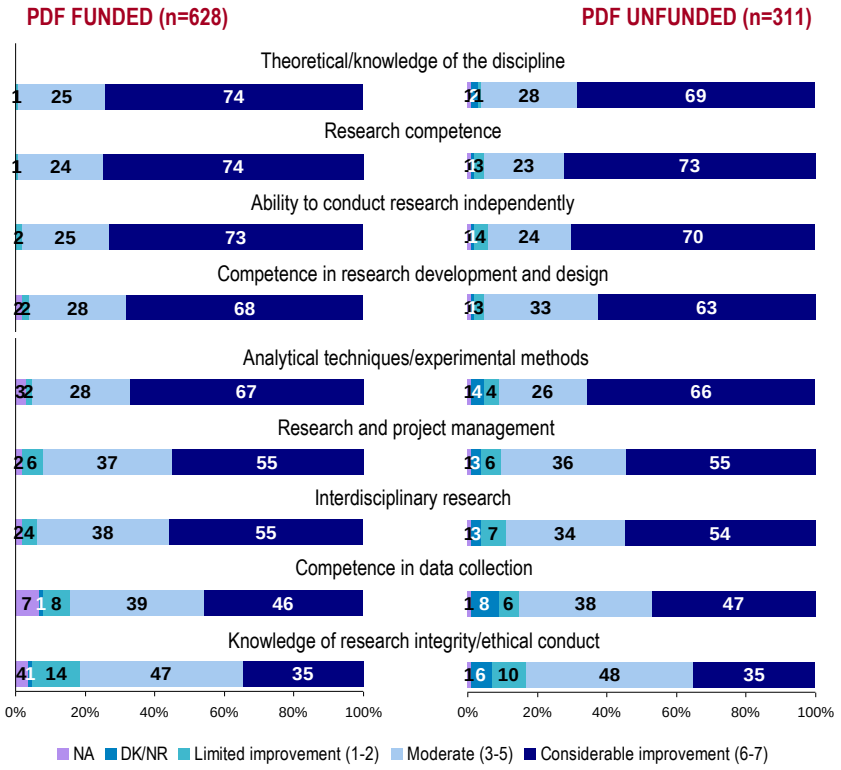
Fellows and their supervisors most often identify considerable impacts from participation on skills pertaining to research ability and potential. There is no significant difference in self-reported research skills gained between funded applicants and unfunded applicants who pursued alternative fellowship opportunities.

PDF recipients in the life sciences disciplines were considerably more likely to report large improvements in their analytical techniques and experimental methods and data collection competence, and those in science disciplines were more likely to report large improvements in their research competence. Funded applicants

who pursued a fellowship abroad more often identify a considerable improvement in a number of skills including the ability to conduct research independently, research competence, competence in design and development, data collection, leadership and theoretical knowledge of the discipline.

Impact of PDF on Skills – Research Ability & Potential

"To what extent do you feel that your skills and level of experience improved in each of the following areas as a direct result of your postdoctoral fellowship?"



EKOS Research Associates Inc.

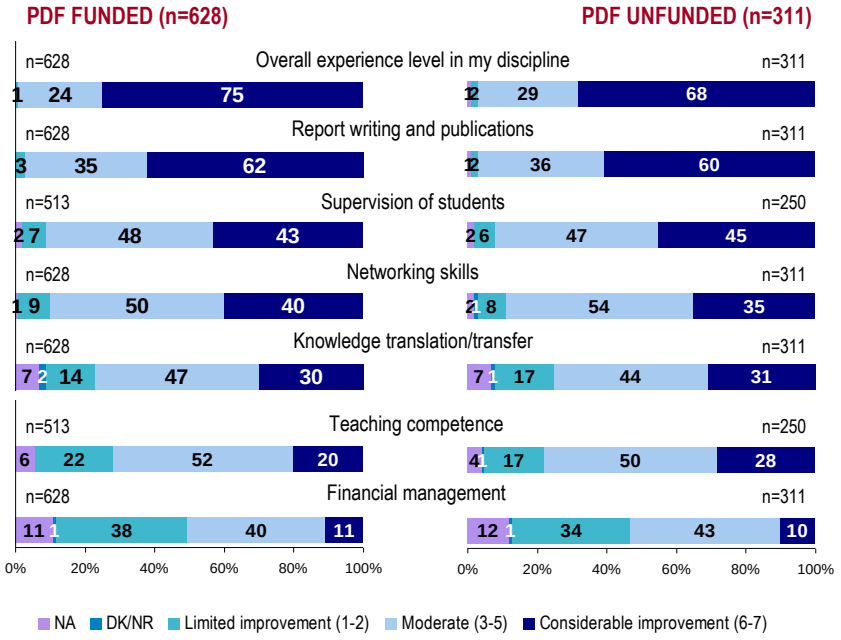
PDF/IRDF Evaluation – Funded/ Unfunded Applicants Survey, 2012

In terms of professional skills, funded applicants surveyed are most likely to report considerable improvement in their overall experience level in their discipline, followed by their skills in report writing and publications. Unfunded applicants who pursued alternate fellowship opportunities are more likely to report a considerable improvement in teaching competence, whereas funded applicants are more likely to report a considerable improvement in their overall experience level in their discipline.

Fewer focus group participants describe gaining experience or skills in teaching or the supervision of students, as fewer describe actively undertaking these activities. Focus group participants also describe fewer impacts from their PDF experience in terms of their professional or personal skills (in comparison to gains in research skills).

Impact of PDF on Skills – Professional Skills

"To what extent do you feel that your skills and level of experience improved in each of the following areas as a direct result of your postdoctoral fellowship?"



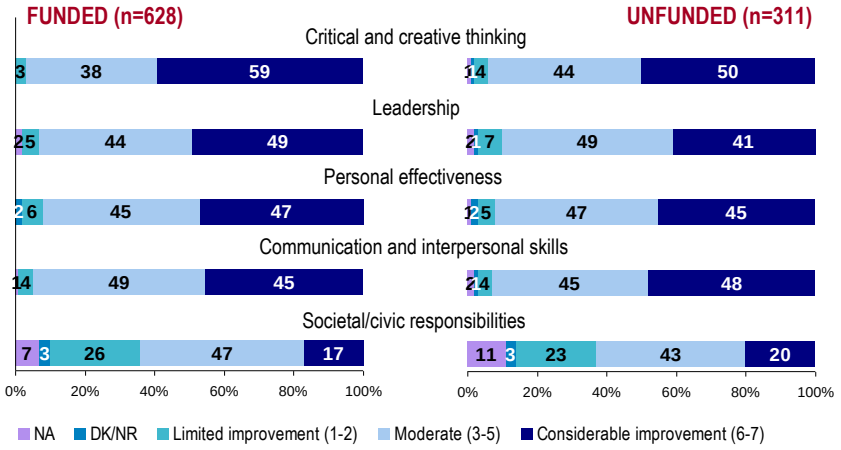
EKOS Research Associates Inc.

PDF/IRDF Evaluation – Funded/ Unfunded Applicants Survey, 2012

With regards to personal skills, funded applicants responding to the survey most often identify considerable improvement in critical and creative thinking (59 per cent), and are more likely to report an improvement in this skill than are unfunded applicants who pursued alternate fellowship opportunities. Funded applicants are also somewhat more likely to identify a considerable improvement in leadership skills as a direct result of their fellowship.

Impact of PDF on Skills – Personal Skills

"To what extent do you feel that your skills and level of experience improved in each of the following areas as a direct result of your postdoctoral fellowship?"



EKOS Research Associates Inc.

PDF/IRDF Evaluation – Funded/ Unfunded Applicants Survey, 2012

Recipients of Industrial R&D fellowships (IRDFs) were asked similar questions with regard to the skills gained as a result of their participation in the IRDF program. There is no significant difference in reported improvements in professional and personal skills reported by PDF participants in comparison to IRDF participants. IRDF participants more often report considerable improvement in knowledge translation, financial management, leadership skills, communication and interpersonal skills and in societal/civic responsibilities (compared to PDF participants); but PDF participants more often report considerable improvement in report writing, networking, and critical and creative thinking.

PDF supervisors surveyed were also asked to identify skills that the most recently supervised PDF fellow improved as a direct result of the fellowship. These results are consistent with the findings from the survey of funded applicants to the effect that they identify considerable impacts from participation in PDF primarily on skills pertaining to research ability and potential.

Key Finding: Postdoctoral experience, in general, results in considerable improvement in the skills of fellows, especially those pertaining to research ability and potential, as well as improvement to overall experience. A majority also report increases in professional skills such as report writing and publications, and in personal skills such as critical and creative thinking and leadership. There are few significant differences in self-reported skills gained between funded PDF participants and unfunded applicants who pursued alternative fellowship opportunities. Funded applicants employed in very research-intensive positions were more likely to report a large improvement in many areas. Gains in skills in teaching and mentoring are more limited.

c) Research Dissemination

Evaluation Question 6.4: To what extent does the program have an impact on fellows' opportunities to produce and disseminate research results?

Funded applicants participating in focus groups report being actively engaged in producing and disseminating research results during their fellowship.

The NSERC exit survey completed by funded applicants immediately following the conclusion of their fellowship captured data on research dissemination activities during the fellowship. The vast majority of funded applicants engaged in at least one research dissemination activity during their fellowship. Only three per cent (or 14 respondents) did not engage in any research dissemination efforts. PDF participants most commonly report preparing peer-reviewed articles (92 per cent). Three-quarters report having delivered conference presentations; and over half prepared conference proceedings or delivered poster sessions.

Evaluation survey findings indicate that funded applicants have generally engaged in more dissemination activities since their application for a PDF than unfunded applicants and more frequently as well (Table 3.5). This is true for all unfunded applicants in general, including unfunded applicants who pursued an alternate fellowship opportunity.

Table 3.5: Research Dissemination Activities Since Application to PDF

Activity	Funded applicants		Unfunded Applicants	
	% Yes (n=628)	Mean Number of times	% Yes (n=584)	Mean Number of times
Prepared peer-reviewed articles	98%	15.6 (n=553)	96%	10.6 (n=501)
Delivered conference presentations	92%	13.5 (n=505)	86%	10.6 (n=432)
Delivered poster sessions	77%	7.9 (n=419)	73%	7.6 (n=365)
Prepared conference proceedings	69%	11.8 (n=371)	68%	9.6 (n=331)
Delivered workshop presentations	64%	5.2 (n=338)	53%	5.2 (n=257)
Prepared book chapters	44%	2.3 (n=243)	38%	1.8 (n=185)
Prepared patents	18%	3.1 (n=98)	14%	2.5 (n=70)

Funded applicants who are employed in universities and who have tenured positions in particular are more apt to have engaged in most dissemination activities (with the exception of preparing patents). The same patterns are true of unfunded applicants.

Key Findings: Most funded applicants engage in at least one dissemination activity during their fellowship, and most commonly report preparing peer-reviewed articles. Findings suggest that engagement in dissemination activities increases over time and that funded applicants have additional opportunities to engage in varied dissemination activities following their fellowship. Findings indicate that funded applicants

have engaged in more dissemination activities and more often than unfunded applicants. This supports qualitative findings that the PDF program is supporting the best and brightest, and providing candidates the best possible development opportunities by providing them the freedom to choose where they will pursue their fellowship.

d) Fellowships Abroad

Evaluation Question 6.5: What has been the impact of the PDF program on knowledge transfer from abroad?

Option to Pursue Fellowship Abroad

The importance of the continued option to pursue a PDF outside Canada was explored in focus groups with participants and in key informant interviews. Participants generally viewed this feature of the PDF Program design positively, indicating that it is a real benefit to have the freedom to choose where and with whom they will work during their fellowship. In key informant interviews, a majority agreed that the option to pursue the PDF outside Canada remains important. Some interview respondents, however, express some concerns that not all fellows will choose to return to Canada, and question whether or not this option should be more limited than in the past.

Consistent with this concern, survey results indicate that funded applicants who pursued the fellowship outside Canada are less likely to be currently employed in Canada (Table 3.6). However, while roughly one quarter (28 per cent) of funded applicants who completed a fellowship abroad and are employed abroad have no current intention to return to Canada, the same is true of funded applicants who completed their fellowship in Canada (25 per cent).

Table 3.6: Employment Location of Funded Applicants

	% Completed PDF in Canada	% Completed PDF Outside Canada
Where currently employed:	(n=**274**)	(n=**293**)
In Canada	83%	65%
Outside Canada	17%	35%
Intend to return to Canada in foreseeable future:	**(n=45)**	**(n=103)**
Yes	42%	35%
No	25%	28%
Do not know	33%	38%

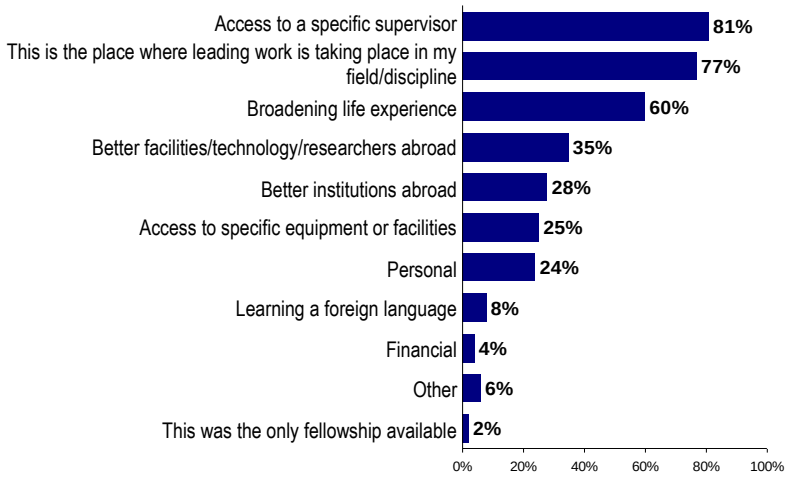
Fellowships Conducted Abroad, Motivating Factors

Roughly half the funded applicants surveyed completed their fellowship in Canada (51 per cent). Findings from unfunded applicants are very similar, with 52 per cent of those who completed a postdoctoral fellowship indicating that they did so in Canada. A large proportion of those who pursued their fellowship outside Canada completed the fellowship in the US (35 per cent of funded applicants and 21 per cent of unfunded applicants).

Some factors that influenced funded applicants' decision to complete their fellowship abroad are research-related while others are more personal.

Factors Important to Decision to Pursue Fellowship Abroad

"In your opinion, what factors had an impact on your decision to complete your fellowship abroad?"



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n=319

PDF/IRDF Evaluation –Funded/ Unfunded Applicants Survey, 2012

As reported under Evaluation 6.2, funded applicants who pursued a fellowship abroad more often identify a considerable improvement in a number of skills including the ability to conduct research independently, research competence, competence in design and development, data collection, and theoretical knowledge of the discipline.

Key Finding: Most stakeholders and fellows view the option to pursue the PDF outside Canada as important; in their view, candidates should have the opportunity to obtain the best experience possible regardless of location. The desire to work with a specific supervisor or where leading work is taking place often contribute to the decision to undertake the PDF outside Canada, and completing a fellowship internationally is seen to yield benefits in terms of developing a research network, obtaining experience and launching a research career. In fact, funded applicants who undertook their PDF abroad more often identify positive impacts from their fellowship in terms of skills development. Some stakeholders interviewed worry, however, that Canada may lose HQP as a result. Survey results indicate that fewer funded applicants who pursued a fellowship outside Canada, in fact, are currently employed in Canada. However, for those who are currently employed outside of Canada, the location of their postdoctoral tenure (i.e., whether their PDF was held in Canada or abroad) appears to have little influence on their future intentions to return to Canada.

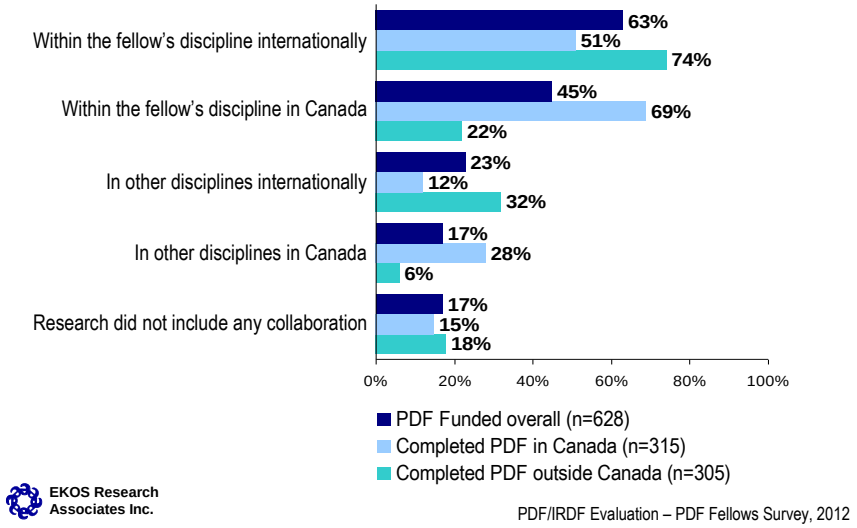
e) Collaboration

Evaluation Question 6.6: What has been the impact of the PDF program on building collaboration between organizations within Canada as well as abroad?

Survey findings suggest that postdoctoral fellowships typically involve collaboration. Only 17 per cent of funded applicants surveyed did not collaborate with anyone outside their organization during their fellowship. Collaboration is more often within the discipline of the fellow. Findings from unfunded applicants who completed a fellowship are not significantly different.

Not surprisingly, funded applicants who completed their fellowship in Canada are more likely to collaborate with Canadian researchers, while those who pursued their fellowship outside Canada are more apt to report international collaborations. Interestingly, those who completed their fellowship in Canada are twice as likely to report international collaborations as international fellows report collaborations with Canadians.

Collaboration Within Discipline and In Other Disciplines During PDF



Key Finding: Survey findings suggest that postdoctoral fellowship typically involve collaboration, most often within the discipline of the fellow. Findings from unfunded applicants who completed a fellowship are not significantly different from findings obtained for funded applicants. Collaboration during the fellowship with other researchers in Canada is less common among funded applicants who completed their fellowship outside Canada.

f) Employment Impacts and Outcomes

Evaluation Question 6.7: What has been the impact of the PDF program on the fellows' ability to obtain research-intensive employment in academia, industry and government?

Only one per cent of PDF funded applicants surveyed are not currently working or seeking employment. Nearly all funded applicants surveyed (90 per cent) report being employed full time. Table 3.7 contrasts the employment profile of funded applicants to unfunded applicants, with respondents who indicated that they were still completing a fellowship removed. Funded applicants are more likely to work for universities than unfunded applicants and more often report working for tenured and tenure-track positions. PDF recipients from more recent competition years are less often employed within universities and more often employed by industry, government, and not-for-profit organizations. The proportion of PDFs employed within universities has trended downward from 85 per cent (competition year 2000) to 77 per cent (competition year 2008). It is worth noting that 14 per cent of unfunded applicants were still completing a postdoc at the time of evaluation.

Table 3.7: Employment Profile of Funded applicants and Unfunded Applicants

	Funded applicants	Unfunded Applicants
Current Employment Status:	**(n=628)**	**(n=605)**
Working full time	90%	80%
Working part-time	2%	2%
Completing postdoctoral fellowship	6%	14%
Not working and looking for work	1%	4%
Not working and not looking for work	0%	1%
On leave from full time position	1%	1%
Other	2%	3%
Sector of Employment:	**(n=608)**	**(n=567)**
University	80%	71%
Industry	10%	14%
Government	8%	13%
Not for profit	2%	3%
Type of University Position	**(n=477)**	**(n=392)**
Tenured position	39%	28%
Tenure-track position	39%	31%
Non-tenure track position	7%	16%
Non faculty position	8%	14%
Other	7%	10%

Nearly three quarters (73 per cent) of PDF participants who responded to the survey are employed in Canada. There is no significant difference between funded and unfunded applicants, but those in tenured positions were particularly apt to be employed in Canada (85 per cent are). Most funded applicants cite reasons related to job prospects as the main reasons they chose to leave Canada. For example, 73 per cent cited a job offer from abroad as the main reason, while 62 per cent referred to limited Canadian opportunities for work in their field.

A breakdown of activities funded applicants identify as related to their current or recent employment position is provided in Table 3.8.

Table 3.8: Main Activities within Employment: Funded applicants and Unfunded Applicants

Activity	% Identifying as a main activity related to employment position	
	Funded applicants (n=602)	Unfunded Applicants (n=554)
Research and development	93%	90%
Teaching	68%	57%
Management/administration	43%	34%
Consulting	9%	12%
Product development	5%	8%
Sales/Marketing	2%	2%
Outreach, communication, and related activities	2%	2%
Student supervision, mentoring	1%	1%
Report writing, presentations, editing	1%	1%

Close to three-quarters of funded applicants surveyed report their current or recent employment position as being very research intensive (73 per cent). Funded applicants are more apt than unfunded applicants to report being in very research-intensive positions.

Overall, research skills are identified by funded applicants and unfunded applicants surveyed as most critical in their current or recent employment position (Table 3.9). There are few differences between funded and unfunded applicants in terms of required research skills, although funded applicants more often identify a requirement for research and project management skills, and knowledge of research integrity/ethical conduct. In terms of professional and personal skills, funded applicants are more apt to identify teaching competence, experience supervising students, financial management skills, and leadership skills as skills required for their position.

Table 3.9: Skills Identified as Required in Employment

Skill	% Indicating Skill is Required in Current/Recent Position	
	Funded applicants (=554)	Unfunded Applicants (n=475)
Research skills		
Ability to conduct research independently	98%	97%
Theoretical knowledge of the discipline	95%	96%
Research competence	96%	93%
Analytical techniques/experimental methods	90%	89%
Research and project management	90%	84%
Competence in research development and design	84%	83%
Knowledge of research integrity/ethical conduct	81%	73%
Interdisciplinary research	73%	70%
Competence in data collection	75%	71%
Professional skills		
Report writing and publications	99%	96%
Overall experience level in discipline	85%	84%
Supervision of students	73%	33%
Networking skills	71%	64%
Teaching competence	63%	28%
Knowledge translation/transfer	63%	65%
Financial management	59%	43%
Personal Skills		
Communication and interpersonal skills	98%	95%
Critical and creative thinking	97%	94%
Personal effectiveness	90%	85%
Leadership	89%	82%
Societal/civic responsibilities	48%	42%

Funded applicants most often report their PhD degree, and their postdoctoral experience as key factors that contributed to their current or recent employment. In contrast, significantly fewer unfunded applicants identify their postdoctoral experience as key (Table 3.10).

Table 3.10: Factors Contributing to Obtaining Employment Position

Factor	"In your opinion, which of the following factors helped you to obtain the position that you hold/held?"	
	% Funded applicants (n=603)	% Unfunded Applicants (n=555)
PhD Degree	92%	87%
Postdoctoral experience	89%	57%
Industrial experience	11%	15%
Teaching/work experience	3%	6%
Personal contacts, networks	2%	3%
Publications	3%	1%
Other	7%	15%

Almost three quarters (73 per cent) of funded applicants surveyed describe the job training they received in their fellowship as being considerably useful in preparing them for their current position or career. Most funded applicants surveyed agree that the experience they gained during their fellowship strongly improved their chances of obtaining the type of employment they wanted (85 per cent). Three-quarters agree that their fellowship experience increased their desire to pursue a career in research or teaching (77 per cent). Finally, seven in ten funded applicants agree that postdoctoral experience was a requirement for their position.

Key Finding: Nearly all funded applicants surveyed report being employed full time. Fellows most often report working for universities. Employment in universities is more predominant among funded applicants than unfunded applicants, and unfunded applicants less often report being in tenured positions. Unfunded applicants also tend to report lower employment incomes than do funded applicants. This supports qualitative findings that PDFs are the best and brightest and are obtaining the best possible development opportunities through the PDF.

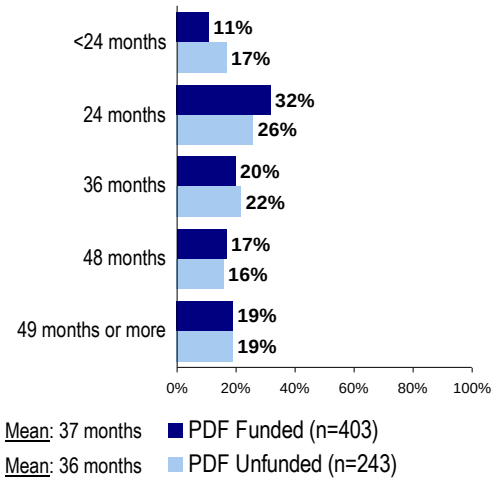
Close to three-quarters of funded applicants report employment in very research-intensive positions; most report the research they are undertaking in their employment as being closely related to their fellowship; and identify their PhD degree and their postdoctoral experience as key factors that contributed to their employment. These factors are less commonly reported by unfunded applicants.

Nearly three quarters of funded applicants are employed in Canada. Those employed outside Canada often cite reasons related to job prospects as the main reasons they chose to leave Canada. Of those funded applicants currently employed outside Canada, over one-third have plans to return to Canada and a similar number are undecided.

g) Postdoctoral Experience

More than half of funded applicants (59 per cent) who participated in the survey have only completed one postdoctoral fellowship, including their NSERC award; while 34 per cent completed two; and six per cent completed three or more. Results for unfunded applicants are virtually identical (59 per cent completed one fellowship and 38 per cent two or more).

Length of Time Spent as Postdoctoral Fellow



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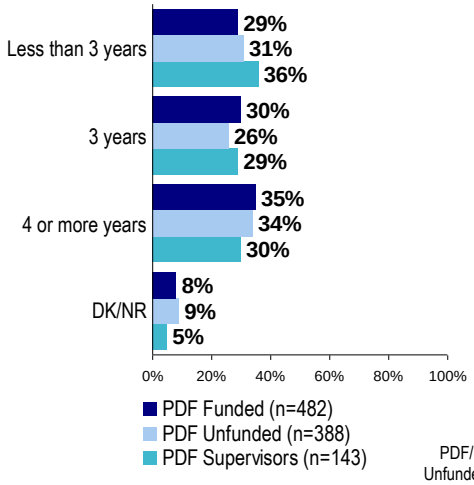
A few key informants who commented on the optimum number of postdoctoral fellowships that should be completed agree that one or two is the norm. A majority said the optimum number of years is between two and five years. Nearly half (47 per cent) of funded applicants surveyed state that one postdoctoral fellowship is optimal, and another 40 per cent believe two. Fellows in life sciences are more apt to spend 49 months or more as postdoctoral fellows (29% as opposed to 19% overall).

Respondents to the survey of PDF supervisors are in agreement with applicants, in that 61 per cent believe that one postdoctoral fellowship is the ideal number for an individual to obtain a tenure track position in academe in their discipline.

Optimal Length of Time Spent as Postdoctoral Fellow

"What are the optimum number of years spent as a postdoctoral fellow that are required for an individual to obtain a tenure track position (PDF supervisors)/a research intensive position in your discipline (PDF fellows and unsuccessful applicants)?"



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PDF/IRDF Evaluation – Funded/ Unfunded Applicants Survey, 2012

Key Finding: Most funded applicants (and unfunded applicants) complete one or two postdoctoral fellowships in total. Funded applicants spend an average of 37 months as a postdoctoral fellow. Views on the optimum number of fellowships and period of time spent as a fellow closely resembles this reality.

h) Personal Research Networks

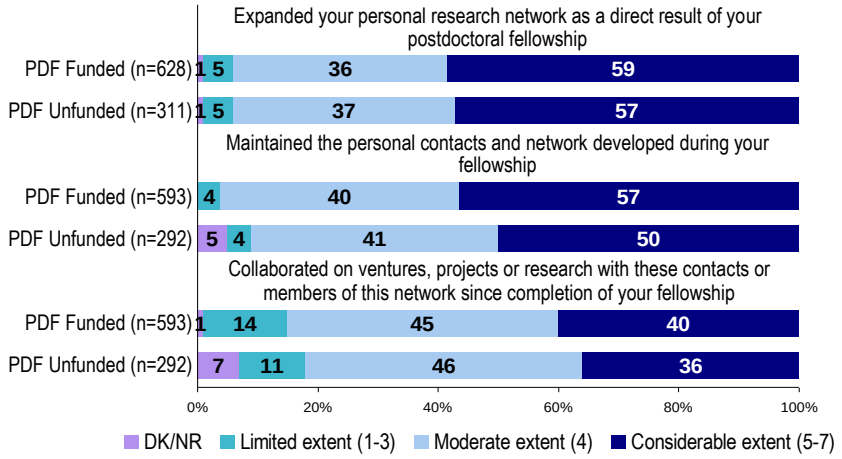
Evaluation Question 6.8: What has been the impact of the PDF program on developing and expanding personal research networks?

PDF focus group participants report having established or expanded their personal research network as a direct result of the PDF fellowship. A few respondents note that their network has been expanded through electronic, rather than personal, contact with other researchers, given a lack of travel opportunities or funds. Some suggest, again, that additional travel funds from NSERC could contribute here. PDF focus group participants were unanimous in agreeing that this strengthened or expanded personal research network would be important to their future career.

More than half of the funded applicants surveyed (59 per cent) indicate having expanded their personal research network to a considerable extent as a direct result of their postdoctoral fellowship.

Impact of Fellowship on Personal Research Networks

"To what extent have you..?"



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Key Finding: Most postdoctoral fellows (funded applicants and unfunded applicants who obtained other fellowships) report increasing their personal research network as a direct result of their fellowship. Furthermore, most report maintaining this network to at least some extent, and collaborating on research with members of this network since completion of their fellowship.

3.4 Cost Effectiveness

Evaluation Question 9: Are the most effective and efficient means being used to deliver the program?

One way to assess the efficiency of program delivery is the ratio of operating expenditures to the total amount of funds awarded (i.e., the operating ratio). The operating ratio indicates the administrative cost for every dollar of a fellowship awarded and is expressed below as a percentage.

Overall for this period, the PDF operating ratio was 4.9 per cent. The percentage is slightly higher than the percentage for the Research Grants and Scholarships Directorate (4.3 per cent) and is on a par with the percentage for NSERC as a whole (4.9 per cent) for the same time period. The operating ratio for the program has trended downward fairly consistently from 5.9 per cent in FY 2001-03 to 4.5 per cent in FY 2010-11.

Evaluation Question 10: Can the efficiency of the PDF program be improved (i.e., can program outputs be achieved in a more affordable manner?

According to key informant interview respondents, the only possible approach available to reducing the administrative costs of the PDF program would be to move to a virtual approach for the review of applications, eliminating in-person meetings held in Ottawa each year (thus eliminating travel costs). However, the two PDF Selection Committee members interviewed stated a strong preference for in-person meetings.

Key Findings: Stakeholders believe that the program is being delivered in the most efficient and effective means possible. The operating ratio for the program (4.9 per cent) is identical to that of NSERC as a whole, and similar to that of Research Grants and Scholarships. The operating ratio for the program has trended downward fairly consistently from 2001-2002 to 2010-2011.

4. Key Findings, Conclusions and Recommendations

4.1 Conclusions and Recommendations

a) Conclusions

The PDF program continues to be relevant and to meet an ongoing need. The postdoctoral experience provided by a fellowship is seen as being critical to obtaining employment in academe, particularly for science disciplines. This program is linked to departmental and governmental priorities, and NSERC is a natural home for this activity. While other sources of postdoctoral support exist in Canada, the PDF is seen as a prestigious award that offers independent training to the “best and brightest”.

The PDF program is well designed. Although overall satisfaction with various design elements and delivery of the program is high, there is some dissatisfaction with the current award amount. While some funded applicants receive top-ups to the award amount, the award remains the primary source of income for most fellows.

The average salary of funded applicants is $45,000, although the median is equal to the PDF award (at $40,000). Fewer than half of fellows typically receive benefits. Although the PDF award is seen as prestigious, unfunded applicants who pursued an alternative fellowship report slightly higher earnings. Furthermore, the award amount does not appear to be competitive compared to other awards offered internationally. The award amount appears to be most problematic for funded applicants from the life sciences (who are less likely to report other sources of earnings during their fellowship, and tend to spend a significantly longer period as a post-doctoral fellow) and those who leave Canada to undertake their PDF (who face higher expenses and also spend a somewhat longer period of time as a postdoctoral fellow). The direct costs of research projects funded applicants are engaged in, benefits provided and any top ups in earnings are typically funded from the research grants of supervisors. Despite some dissatisfaction with the award amount, there is a reluctance to see the number of applicants funded decline in order to provide an increase. Some fellows suggest increasing support by providing other supports and allowances (e.g., travel budget, relocation allowance, tax-free award, or benefits).

There is also some dissatisfaction with the current award length (two years). Again, length tends to be more problematic for funded applicants in the life sciences and those who pursue their fellowship abroad (who spend a longer period of time as a postdoctoral fellow overall). Most funded and unfunded applicants report completing one or two fellowships on average, with funded applicants spending 37 months on average as a postdoctoral fellow (and this length being considerably longer for candidates in the life sciences). The average length of the typical postdoctoral period underscores the importance of the financial and other support available to fellows. It should be noted, however, that four in ten funded applicants spend 24 months or less as a postdoctoral fellow, suggesting that the current duration is sufficient for many.

Another criticism of the PDF program delivery made by a minority of funded applicants concerns the timing of award notifications, noting that the notification comes later than other hiring and award decisions (which may leave applicants in the difficult position of having to decide on other opportunities before hearing from PDF).

A review of literature identifies potential concerns among external stakeholders regarding the administration and training of postdoctoral fellows more generally in Canada. They identify a need for greater standardization in the treatment and pay for fellows and potentially greater opportunities for development and training in recognition that not all fellows will establish an academic career. PDF fellows also identify the potential for additional training being provided during the fellowship, such as training in areas that would be useful regardless of whether they pursue a career in academia or not (e.g., financial management, leadership skills, project management).

There is no agreement on whether the program is supporting an appropriate number of candidates. PDF supervisors and external stakeholders are more often of the opinion that NSERC supports too few postdoctoral fellows, while fellows are more divided on the issue. Some fellows express the opinion that the number of fellowships should be maintained to protect the prestige of the award. External data and literature indicates that there is growing disparity between the number of tenure appointments available and the number of postdoctoral candidates, suggesting again that not all fellows will establish an academic career and underscoring the importance of a postdoctoral fellowship as training ground for different potential career paths.

The option to pursue the PDF outside Canada is viewed as important to provide fellows with the best development opportunities possible, although some express concern that highly qualified personnel may not return to Canada as a result. In fact, evaluation findings indicate that PDF fellows who completed their fellowship abroad are less likely to be currently employed in Canada. However, while one in four funded applicants who completed a

fellowship abroad and are employed abroad have no current intention to return to Canada, the same is true of funded applicants who completed their fellowship in Canada. This indicates that for those who are currently employed outside of Canada, the location of their postdoctoral tenure (i.e., whether their PDF was held in Canada or abroad) appears to have little influence on their future intentions to return to Canada.

Postdoctoral experience in general has positive impacts on fellows, both funded by NSERC and those who pursued alternative fellowships. All fellows have considerable engagement in research activities, such as data collection, data analysis, dissemination, proposal writing, teaching, peer reviews. However, funded applicants are somewhat more likely to have been engaged in defining the research question, developing strategies or approaches, and in financial management. Unfunded applicants are more apt to have made a moderate (rather than limited) contribution to the provision of administrative support and transfer of technology.

Fellows (both funded and unfunded) develop various skills (research-related, professional, and personal) as a direct result of their postdoctoral experience. The greatest impact occurs on skills pertaining to fellows' research ability and potential, such as knowledge of their discipline, ability to conduct research independently and overall research competence. PDF recipients are only more likely to report significant gains in their overall experience level in their discipline, in their critical and creative thinking, and in leadership skills. Most PDF supervisors also report that the PDF fellow supervised had a positive impact on their research productivity.

Postdoctoral fellowships typically involve collaboration, most commonly within the discipline of the fellow. Postdoctoral fellows also commonly report increasing their personal research network as a direct result of their fellowship.

In addition to the general impacts of holding a postdoctoral fellowship, participation in the PDF program, in particular, had further positive impacts on fellows. PDF recipients have engaged in more varied research dissemination activities and more frequently since application to the PDF program in comparison to unfunded applicants. This supports qualitative findings that the PDF program is supporting the best and brightest, and providing candidates the best possible development opportunities by providing them the freedom to choose where they will pursue their fellowship.

Evaluation findings also point to positive employment impacts specifically from the PDF program. The vast majority of funded applicants who have completed their fellowship are employed full-time, most often within universities (typically in tenured or tenure track positions). Most report being employed in research-intensive positions, positions closely related to their fellowship; and identify both their PhD and their postdoctoral experience as contributing to their employment. In contrast, unfunded applicants are less likely to demonstrate the same employment outcomes (e.g., working in universities, in tenured positions, in research-intensive positions). Skills PDF fellows identify as being required for their current employment position are generally consistent with the skills they report having developed during their fellowship.

b) Recommendations

Overall, the evaluation found that the PDF program is relevant, efficient, and meets an ongoing need. The program contributes to the stimulation of R&D and provides applicants an opportunity to obtain relevant independent research experience within an academic setting. PDF recipients exhibit better results in some areas in comparison with unfunded applicants (e.g., employment in tenured positions and engagement in research dissemination activities). Finally, the findings suggest that the administration of the program is working well overall,

but some further improvements could help ensure that the most effective and efficient means are being used to achieve program outcomes. The evaluation resulted in the following recommendations:

Recommendation 1: Explore options to increase the financial support available to PDFs.

The value of the PDF award has remained unchanged since 2004. The award remains the primary source of income for most, with funded applicants reporting average earnings of $45,000. It appears that the proportion of PDF supervisors who top up the NSERC award has increased over time, but those who top up the award remain in the minority (39 per cent). In fact, unfunded applicants who pursue an alternative fellowship opportunity report slightly higher earnings during their fellowship than do funded applicants. Furthermore, the award amount does not appear to be competitive in comparison to other awards offered internationally. The award value appears to be more problematic for candidates from the life sciences, those who are located in centers with a higher cost of living (in Canada or abroad) and possibly those with dependents. While there is a reluctance among stakeholders to see the number of candidates supported decline to increase the value of the award, dissatisfaction with the amount is growing and three in ten fellows indicate that the award was insufficient to provide an acceptable standard of living. On a related note, external stakeholders (based on literature) identify a need to standardize the administration and treatment of postdoctoral fellows more generally in Canada, although this is outside the sphere of control of NSERC. While this may not be completely within the control of NSERC, it would be worthwhile to explore any potential means of increasing the financial support available to PDFs, including:

- Increasing the award amount through an increase in program resources;
- The possibility of requiring a modest top-up from all supervisors and/or tenure organizations (who indicate that supervising a PDF fellow increases their research productivity);
- Encourage or explore ways in which universities could extend benefits to fellows within their institution and work towards greater standardization in the treatment of postdoctoral fellows;
- Possible relocation or travel stipends for those moving to distant locations or centers where the cost of living is high, such as provided within the USRA.

Recommendation 2: Consider increasing development and networking opportunities for PDF fellows.

Findings suggest that not all funded applicants will secure tenured positions within universities. External stakeholders and PDF fellows themselves suggest that fellows could benefit from additional opportunities for professional development activities on topics such as financial management, project management and leadership skills. This would further contribute to increasing the consistency of development and treatment of fellows (which is shown to vary from institution to institution), as well as preparing applicants for careers outside academe.

Recommendation 3: Consider moving up the time-frame of decisions to accommodate PDF applicants.

A minority of PDF fellows surveyed or included in focus groups expressed dissatisfaction with the timing of the announcement of the PDF award, stating that it occurred later than announcements for other fellowships and hiring opportunities. This occasionally leaves an applicant in the difficult position of deciding on another offer before hearing

if their PDF application was successful. Moving up the timing of announcements should be considered if it does not jeopardize the current efficient administration of the PDF program.

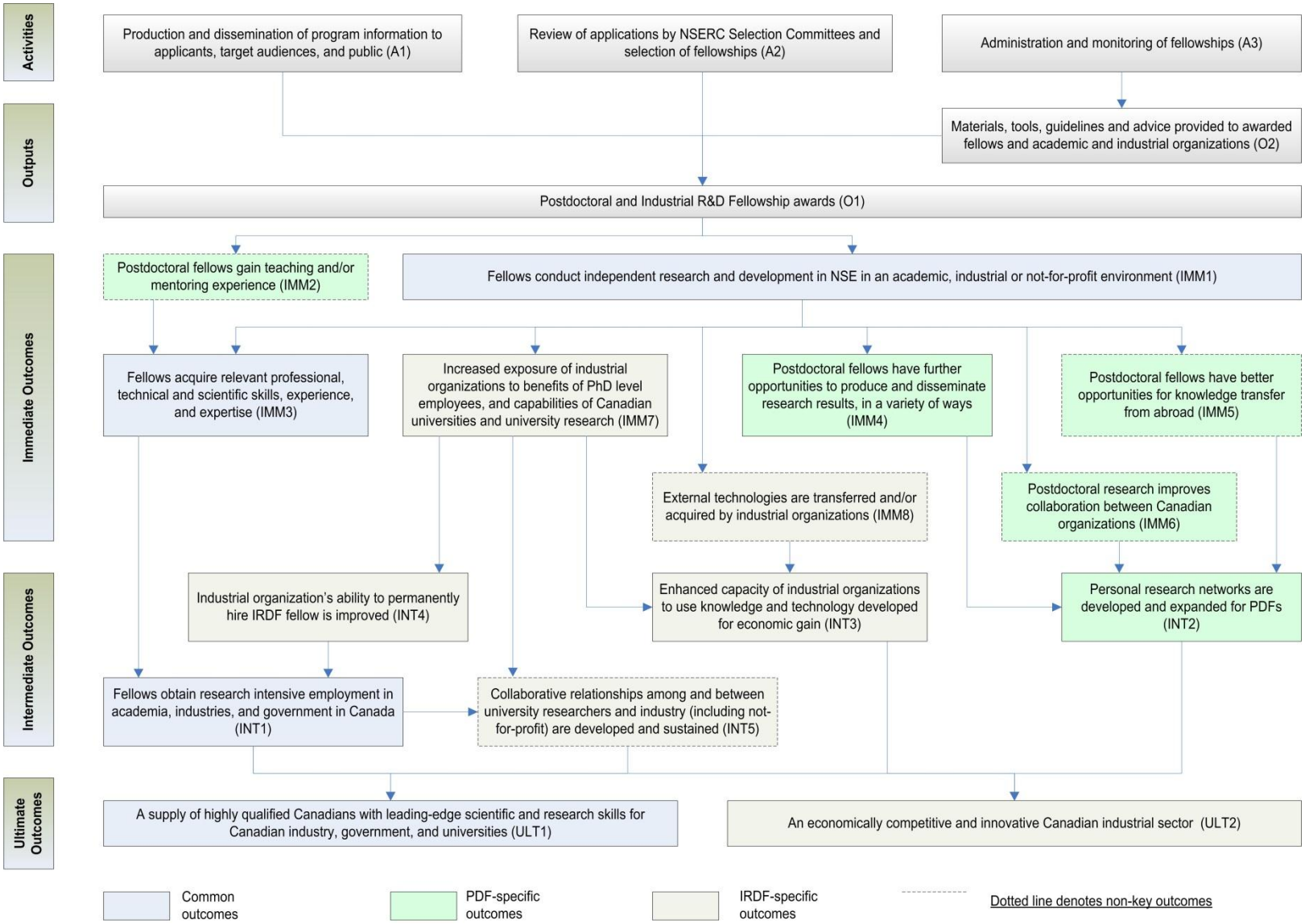
APPENDIX A. LOGIC MODEL

The logic model identifies the linkages between the activities of a program and its ultimate outcomes. It delineates the set of activities that make up the program and the sequence of outputs and outcomes that are expected to flow from these activities. As such, the logic model serves as a "roadmap", showing the chain of results connecting activities to the ultimate outcomes, and thus, identifies the steps that will demonstrate progress towards NSERC's achievements.

Exhibit 1 shows a joint Logic Model for the PDF and IRDF programs[21]. Four levels of performance are delineated in the Logic Model: activities and outputs, immediate outcomes, intermediate outcomes and ultimate outcomes. The expected outcomes include those that are common for both programs and those that are program-specific. The outcomes are colour coded: common outcomes are presented in blue; PDF-specific outcomes – in green; and IRDF-specific outcomes – in yellow. Dotted line denotes non-key outcomes, i.e. those outcomes that are not expected to occur in all cases.

[21] PDF and IRDF Evaluation Framework, NSERC

EXHIBIT 1: PDF-IRDF Logic Model



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