Final Report

Evaluation of Research in Strategic Areas

Strategic Partnership Grants for Projects

June 2018

NSERC CRSNG

Canada

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List of Acronyms

CRP	Collaborative Research and Development
FRR	Final Research Reports
GBA+	Gender-Based Analysis Plus
HQP	Highly Qualified Personnel
IP	Intellectual Property
NAMIS	NSERC's Award Management Information System
NRC	National Research Council
NSERC	Natural Sciences and Engineering Research Council of Canada
OECD	Organisation for Economic Co-operation and Development
R&D	Research and Development
S&T	Sciences and Technology
SPG-P	Strategic Partnership Grants for Projects
SSHRC	Social Sciences and Humanities Research Council

Acknowledgements

This evaluation was conducted in collaboration with the staff of Program Evaluation and Beyond Inc., Circum Network Inc. and the SSHRC and NSERC Evaluation Division. The contribution and collaboration of many individuals have made this evaluation possible. We wish to thank all of those who participated in data collection, provided information, and answered our questions. We would especially like to thank, in no particular order: Strategic grant recipients, their partners, and the unfunded applicants for sharing their time and insights by responding to surveys and participating in interviews and the staff of the Strategic program for providing guidance throughout the process.

Executive Summary

This report presents the evaluation of NSERC's Research in Strategic Areas program, which comprises Strategic Partnership Grants for Projects (SPG-P) and the Strategic Partnership Grants for Networks (presented under separate cover).[1] The evaluation explores a range of activities that are meant to connect researchers with end users in key strategic target areas in order to enable the transfer of knowledge, technology and expertise that increases Canadian prosperity. Conducted between September 2016 and October 2017, the evaluation covers applications submitted between 2000 and 2011, with funded projects completed during 2003-2013. This 10-year span was chosen to allow sufficient time for outcomes in terms of products, services, processes, and policies to have occurred. The evaluation is based on a secondary data analysis, online surveys (funded and non-funded researchers and partners, as well as HQP trained as part of Strategic projects), case studies, a literature / document review and key informant interviews.

The Strategic Project Grants Meet a Real, Important Need.

In the current context, where supporting innovation has been recognized as a government-wide priority, SPG-P occupies a unique niche as one of the few funding opportunities to provide substantial funding for collaborative research that, because of its high-risk nature, might not otherwise be undertaken. It functions as a two-way bridge between discovery research and collaborative research with partner organizations, and meets an important need for both researchers and partners.

The federal government and NSERC have a necessary role in delivering the Strategic Grants, which is strongly aligned with current federal government priorities, as well as objectives and expected outcomes outlined in the NSERC 2020 Strategic Plan.

The Strategic Project Grants Contribute to the Production and Use of Knowledge.

There is a broad dissemination of research and almost all researchers have shared the results of their project with partner organizations. Only in a very small number of cases are research results not transferred to partners. Half of the partners had already used the results and another 20% were likely to use them in the future. There is a correlation between the use of project results and the time elapsed since they were produced, as it takes at least ten years or more before research results are used by partners.

The Strategic Project Grants Contribute to the Public Debate.

The evaluation showed that the funded projects are influencing public debates and that the knowledge they generate is being used by decision-makers. It is unreasonable to expect any one project, on its own, to have a direct impact on public debates. However, producing credible scientific data is crucial. The contribution to the public debate is influenced by three factors: 1) partners involved in decision-making forums, accelerate the transfer; 2) researchers are not necessarily informed of or involved in the transfer process, and some feel that this is not their role; 3) a large number of partners contributing to the project who have ties with organizations that contribute to decision-making supports the process of exercising influence and making recommendations. Many different stakeholders are involved, and not all of them come from public-sector organizations. The time lapse between the availability of knowledge and its application varies. It is affected by various factors, such as policy priorities, the level of media

[1] http://www.nserc-crsng.gc.ca/_doc/Reports-Rapports/Evaluations/SNGReport2015_e.pdf

coverage of a given issue, the existence of a triggering event, and the degree of public and pressure groups awareness. Measuring impact in the field of public policy is not easy, therefore it would be useful to reflect on the strategies to be implemented to better document it.

The Strategic Project Grants Support the Development of Industry Partners.

Measuring the SPG-P contribution to an economic gain for the private sector is proving challenging. Even more so as, obtaining a positive return on investment is not a specific goal of the SPG program, since most of the funded projects are relatively early-stages and high risk, both scientifically and commercially. However, the SPG program does focus on research that can at least potentially be used over the mid- or long-term for commercial or public good applications. Economic gain should be viewed more broadly than commercialization as it can encompass the use of knowledge, the enhanced organizations' R&D receptivity or capacity and can also support a company decision-making process. Participation in SPG-P contributed quite strongly to overall R&D receptivity and capacity, and to some extent to human or financial investments in R&D but not more than unsuccessful SPG projects funded through other sources. Participation in SPG-P also contributed to increase in the skills and knowledge base of the partner organizations; future business and/or R&D direction, with SPG-P results being used in decision-making about strategic business orientations; visibility in their sector was highlighted as very important to improve their competitive situation worldwide. Researchers were less likely to indicate that their research had resulted in intellectual property agreements, patents and licenses. This finding is consistent with the nature of high risk and early-stage research, which is generally less likely to produce IP that needs to be protected.

Under-Represented Groups Experience the Same Level of Success, but the Perception of Barriers Persists.

The identity factor does not seem to have an impact on access to funding and the data show an increased presence of women and visible minorities over the past decade. More non-funded applicants than funded applicants reported experiencing barriers. Gender, followed by identifying as a member of visible minority group and choosing French as the language of preference are the main barriers. However, there is no information available to better understand their precise nature or degree, except with regard to the language factor: researchers feel pressure to submit their applications in English so as not to reduce their chances of success. The ability of young female researchers to secure partnerships with industry while in the early stages in their careers was mentioned as an area where NSERC could take action. Finally, the lack of data on persons with disabilities and Indigenous people raises the question of "if" and "how" they could be better documented.

The Strategic Project Grants Support a Variety of Collaborations and the Development of HQP.

Nearly half of the partnerships are the result of previous direct collaborations with the same partners. Collaborations enhance both the synergies and the complementarities among the various disciplines and fields of expertise involved. This is of particular benefit to HQP. The amount of the contribution and the nature of the partner (public versus private) are important factors: when the contributions are above the median amount, or the partners come from the public sector, previous collaborations are more common. A significant proportion of the collaborations are multidisciplinary. Multidisciplinarity occurs primarily in the natural sciences and engineering, and to a lesser extent in the social sciences. About one-third of the projects are also multisectoral. Collaborations were reported with 40 different countries. In the international

partnerships, universities and university consortia played essential roles in bringing potential collaborators together and identifying opportunities for jointly funded work.

HQP benefit from participation in SPG-P through being exposed to partners and acquiring both research and soft skills (although research skills to a greater extent), which is reported to have made positive effects on their career development. Experience working directly with partners, whether acquired through SPG-P or other funding, is pivotal to becoming more employable across the academic-industry continuum.

The Strategic Project Grants are Managed Effectively.

Overall, it appears that the SPG-P funding opportunity is delivered in an efficient manner. The cost-efficiency analysis revealed that the average cost to administer $1 of grant is 4.55¢. In comparison, the Research Partnerships' grants cost is 6.55¢ for $1 of grant and 4.93¢ for NSERC's grant programs. The operating expenditure as a percentage of total program expenditures for SPG-P is 4.4%, which is lower than the percentage for the Research Partnerships (6.0%) and similar to the ratio for NSERC (4.7%). In general, SPG-P is as cost-efficient as NSERC's overall grant programs and more cost-efficient than the Research Partnerships' grant programs.

Recommendations

1. **The federal government should continue to fund Strategic Partnership Grants.** In the current context where supporting innovation has been recognized as a government-wide priority, Strategic Partnership Grants occupy a unique niche as one of the few funding opportunities to provide substantial funding for collaborative research that, because of its high-risk nature, might not otherwise be undertaken. In addition, Strategic Grants are NSERC's only source of funding that supports the development of public policy. It functions as a two-way bridge between discovery research and collaborative research with partner organizations and meets an important need for both researchers and partners. The federal government and NSERC have a necessary role in delivering the Strategic Grants which is strongly aligned with the current federal government priorities, as well as objectives and expected outcomes outlined in the NSERC 2020 Strategic Plan. It is therefore recommended that the SPG-P be continued, provided that funding longer-term, collaborative research projects and projects involving public sector partners continues to be a priority for NSERC.
2. **It is recommended that the program retain the requirement for partners from public organizations to actively participate in collaborative research, but the range of potential partners should be broadened to include organizations that are well positioned to use the research results and leverage them to strengthen public policy—for example, not-for-profit organizations or Northern communities.** The evaluation demonstrated that collaboration between academic researchers and government organization representatives is critical to public policy impact. It also showed that a wider range of stakeholders can contribute to public policy development. It may therefore be worthwhile to encourage other forms of collaboration and rethink the tools to be implemented in future to better document the nature and extent of the strategic projects' contribution to the public debate.
3. **The Research Partnership Directorate should consider how to best document and measure the influence of identity factors on an applicant's ability to obtain funding.** Although the evaluation did not reveal significant differences in the success rates of under-

represented groups for which data are available, survey evidence suggest a perception that some barriers exist, particularly for women and to some extent for Francophone researchers. Also, the absence of data for Indigenous people and people with disabilities precluded an assessment of the extent to which they experienced identity-related barriers.

1 Introduction

This report presents the evaluation of NSERC's Research in Strategic Areas program, which comprises Strategic Project Grants and the Strategic Network Grants (presented under separate cover). Conducted between September 2016 and October 2017, the evaluation covers applications submitted between 2000 and 2011, with funded projects completed during 2003-2013. This 10-year span was chosen to allow sufficient time for outcomes in terms of products, services, processes, and policies to have occurred.

The purpose of the evaluation is to provide the Natural Sciences and Engineering Research Council of Canada (NSERC) senior management with information to support decision-making about the Strategic Partnership Grants for Projects (SPG-P). The evaluation will also help ensure that NSERC is meeting the requirements of section 42.1 (1) of the *Financial Administration Act* and the Treasury Board Secretariat's *Policy on Results*.

1.1 Strategic Partnership Grants for Projects Profile

1.1.1 Objectives and Expected Outcomes

The SPG-P funding opportunity was launched in 1977 by the National Research Council (NRC) and subsequently transferred to the NSERC when it was established in 1978. The goal of the SPG-P is to increase research and training in targeted areas that could strongly enhance Canada's economy, society and/or environment within the next 10 years. It funds early-stage research projects in targeted areas that are revisited every five years.[2] The biggest proportion of projects falls within: Environment (25% of projects), Biosciences (21%), Information & Communications (19%), and Manufacturing (18%).

The program rationale aims to:

- Encourage university and non-academic researchers to work together on early-stage research and on interdisciplinary projects in target areas of national importance;
- Ensure that Canada has enough HQP with the skills needed by user organizations in target areas;
- Contribute to the industry's capacity to use university research in order to improve competitiveness and productivity in areas of national importance;
- Increase the government capacity to use university research to contribute to policy making.

The logic model for SPG-P is presented in Appendix 2.

1.1.2 Partnership Requirements

Funded projects must involve potential end users. A distinguishing feature of SPG-P is that partners may be: Canadian-based industry that can apply the research results in a way that generates wealth or employment; and/or Government organizations that can apply the research

[2] Current target areas are: Advanced Manufacturing; Environment and Agriculture; Information and Communications Technologies; and Natural Resources and Energy. The complete list of strategic target areas for SPG-P projects during the period 2000-2015 is located in Appendix 1.

results in a way that strengthens public policy. According to Final reports submitted by researchers, 36% of funded projects involved at least one government partner, and 13% had only government partners. It is worth noting that the participation of a government organization in the project together with private companies did not necessarily imply that the project aimed to contribute to strengthening public policy.

It is expected that partners are actively involved through in-kind contributions in all aspects of the research: development of the project/network; collaboration in the research and training; and validation of the market potential of the results. Cash contributions, although not required, may also be provided. According to the NSERC administrative database, more than one fourth (28%) of Strategic projects, funded between 2000 and 2011, included some cash contributions from partners, with a median contribution of $30,000 per project.

1.1.3 Funding and Success Rates

The projects funded by Strategic Partnership Grants can be carried out over periods from one to three years. There is no maximum or minimum grant amount. Funds may be used for direct costs including students, post-doctoral fellows, consumables or equipment.[3] Success rates are affected by the number of applications submitted, the budget available and the complexity of the projects proposed.[4] Administrative data show that success rates have been more or less stable since 2003 with the exception of spikes in 2007 and 2008 due to additional funding allocations and a decline, to 16.7%, in 2011 due to decrease in funding (Table 1). It is worth noting, however, that success rates increased again to 25.8% in 2012 and 23.9% in 2013 because the number of applications decreased.[5] For the period 2000-2011, the success rate averaged 31% but fluctuated considerably (between 17 and 48%) from year to year. Over this period, there was no significant difference in success rates between target areas, i.e. applicants had equal chances of being funded irrespective of the target area of their proposals.

Table 1 presents the total number of applications, awards, success rates and grant sizes for the period 2000-2011. Over the decade 2000-2011, over $619.6M was awarded representing 1,540 grants, with an average grant size of roughly $420,000.

[3] Applicants who require equipment to conduct the research must incorporate their request for equipment (up to a maximum of $150,000 for major items or systems) into the research proposal and justify the need for the equipment to conduct the research.

[4] Depending on the complexity of the project, the range is typically between $80,000 and $325,000 per year. http://nserc.ca/_doc/Professors-Professeurs/SPG-_FAQs_e.pdf

[5] These figures are not presented in Table 1 as they are out of scope for the evaluation, but they are noted as they represent a reversal of a downward trend.

Table 1: Annual Applications, Awards, Success Rate & Expenditures (2000-2011)

Competition Year	Number of applications	Number of Awards	Success Rates	Total Awarded	Average Total Grant
2000	270	124	45.9 %	$53,456,364	$431,100
2001	320	99	30.9 %	$46,727,945	$471,999
2002	305	105	34.4 %	$50,236,949	$478,447
2003	421	108	25.7 %	$42,439,691	$392,960
2004	356	99	27.8 %	$39,090,843	$394,857
2005	389	90	23.1 %	$37,297,305	$414,415
2006	431	137	31.8 %	$52,786,898	$385,306
2007	639	309	48.4 %	$91,472,038	$296,026
2008	391	153	39.1 %	$64,097,772	$418,940
2009	465	122	26.2 %	$53,754,814	$440,613
2010	547	123	22.5 %	$55,462,492	$450,915
2011	425	71	16.7 %	$32,860,380	$462,822
	4,959	1,540	31.0%	$619,683,491	$419,867

Source: NSERC Award Management Information System (NAMIS).

1.2 Evaluation Questions

The evaluation questions, located in Table 2 below, were developed in consultation with SPG-P staff and management. The questions pertaining to performance are explicitly linked to the expected outcomes noted in the funding opportunity's logic model found in Appendix 2. A working theory of change was also developed to identify necessary preconditions supporting the long-term goals. This was based on a review of relevant documents, academic and gray literature, and consultations with external experts in the change domains. The theory of change was then used to support the analysis and the development of an impact model.

Table 2: Evaluation Questions

Design and Delivery
1. To what extent have under-represented groups participated in SPG Projects?
Effectiveness: Achievement of expected outcomes
2.1 To what extent and how have SPG Projects facilitated multidisciplinary (including social sciences), multisectoral and international collaborations to address research challenges?
2.2 What has been the impact of SPG Projects on the training and employment of HQP?
2.3 To what extent and how have the knowledge and technology created/ generated through SPG Projects been used for government organizations to strengthen public policy?
2.4 To what extent and how have the knowledge and technology created/ generated through SPG Projects been used for private sector's economic gain?
Relevance: Continued need for the program, alignment with federal government priorities
3.1 To what extent are the objectives of SPG Projects aligned with NSERC's and Government of Canada's prior and current priorities, including the NSERC 2020 Strategic Plan?
3.2 What niche do SPG Projects occupy in the discovery to innovation continuum of NSERC programs?
Efficiency: Resource utilization in relation to the production of outputs/outcomes
4. To what extent are SPG Projects being delivered in an effective and cost-efficient manner?

1.3 Methodology

The extent to which SPG-P has achieved its expected outcomes was explored using multiple lines of qualitative and quantitative evidence, maintaining, to the extent possible, continuity with tools from previous evaluations. The methodology includes a secondary data analysis, online surveys (funded and non-funded researchers and partners, as well as HQP trained as part of Strategic projects), case studies, key informant interviews and a literature/document review. The evaluation aimed to establish incremental program impact on new or improved products, services, processes, public debates, policy and regulations, as well as on participating researchers and HQP. This was achieved through comparisons between funded and non-funded researchers and partners, and case studies documenting ways in which partner organizations have used and benefitted from the research. The evaluation matrix and the methodological map (Appendix 3 and 5) illustrate which lines of inquiry were used to inform each evaluation questions.

1.4 Limitations

Two main methodological limitations related to the evaluation of SPG-P had to be addressed:

- *Low response rates in surveys, particularly of non-funded researchers and partners.* Whereas the response rate for funded researchers reached 27% (n=720), it was lower in the other samples: 12% (n=316) for non-funded researchers, 10% for funded partners (n=260), and 6% (n=193) for non-funded partners. Practices to increase response rates were followed in the course of the evaluation, such as sending regular reminders to survey respondents. In addition, given the patterns of non-response, ex post weights were devised to compensate and to provide descriptive results of each population with an exception of HQP (as no population data was available for students and postdocs) that could conform better to reality. Nevertheless, readers should be aware that those respondents, especially partners, included in the data may not be representative of their intended populations.
- *Establishing incremental contributions to the overall intended outcomes of the program is challenging.* To establish the counterfactual case ("*What would have happened in the absence of the Strategic grant*"), the surveys compared outcomes, reported by researchers and partners, in funded applications to non-funded applications. Given the lower response rates (non-funded) these comparisons must be interpreted with caution for two reasons. Non-funded projects that went ahead anyway may have been the strongest among the non-funded and would have succeeded eventually in being funded from any source. If these projects retained the specific features of SPG-P funding, such as significant partner engagement in the research, the specific source of funding may be immaterial to outcomes.

Considering the volume of information provided through all lines of evidence, these limitations did not prevent the evaluation from adequately covering all evaluation issues and questions.

2 Relevance

In the current context where supporting innovation has been recognized as a government-wide priority, SPG-P occupies a unique niche as one of the few funding opportunities to provide substantial funding for collaborative research that, because of its high-risk nature, might not otherwise be undertaken. It functions as a two-way bridge between discovery research and collaborative research with partner organizations and meets an important need for both researchers and partners. The federal government and NSERC have a necessary role in delivering the Strategic Grants. SPG-P is strongly aligned with the current federal government priorities, as well as objectives and expected outcomes outlined in the NSERC 2020 Strategic Plan.

2.1 Why Early-Stage Collaborative Research Funding in Targeted Areas is Important

While Canada is recognized for the strength of its academic research, it has yet to reach its full potential when it comes to translating research discoveries into innovation and commercialization projects. Overall, Canada spends less on R&D than the average OECD country, and this disparity is steadily widening (NSERC, 2017a, p. 11).[6]

The goals of the funding opportunity resonate with the Canada's S&T Strategy "Seizing Canada's Moment: Moving Forward in Science, Technology and Innovation" adopted in 2014. The S&T Strategy regards partnerships between the business, academic, and public sectors as an essential element for accelerating the pace of discovery and commercialization. It speaks to the fact that the cost and complexity of research demand that partnerships be fostered to enable academia, as well as the private and public sectors, to use their unique capabilities, interests, and resources to generate greater social and economic opportunities. The necessity of investments in scientific research, including "an appropriate balance between fundamental research to support new discoveries and the commercialization of ideas", is further reiterated in the Minister of Science Mandate Letter.[7]

The S&T Strategy acknowledges the importance of focusing on strategically important areas with an opportunity to build national strengths. To gain a competitive edge in areas critically important to Canada, federal support across all disciplines is required for both discovery and application driven research. The strategy outlines research priorities that are of strategic importance to Canada to support "a greater integration of innovative technologies, products and processes" and creates "great benefits for Canadians and key Canadian sectors". All the current SPG-P target areas are well aligned with those identified in the strategy. The SPG-P funding opportunity target areas align well with the updated research priorities identified in the 2014 S&T Strategy and three quarters (74%) of the funded researchers indicated in the survey that advancing research and training in specific target area(s) was one of the reason they applied for a Strategic grant.

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[6] Source: Evaluation of Commercialization of Research: Centres of Excellence for Commercialization and Research Evaluation Report (2017) http://www.nserc-crsng.gc.ca/NSERC-CRSNG/Reports-Rapports/evaluations-evaluations_fra.asp

[7] Office of the Prime Minister. Minister of Science Mandate Letter. Retrieved from: http://pm.gc.ca/eng/minister-science-mandate-letter.

By serving as a bridge between fundamental and applied research, SPG-P is strongly aligned with the 2020 Strategic Plan's objective to strengthen the dynamic between Discovery and Innovation. Strategic Partnership grants enhance opportunities for discovery research and, at the same time, provide opportunities for partner organizations to work closely with universities.

No other research funding program has the same unique combination of features than SPG-P funding opportunity (funds research in target areas addressing national priorities, is competition-based, focuses on early-stage collaborative research, engages public and private sector partners, and does not require cash contributions from partners). It is also one of few funding programs to provide substantial funding for collaborative research that, because of its high-risk nature, might not otherwise be undertaken.

2.2 SPG-P on the Discovery-to-Innovation Continuum

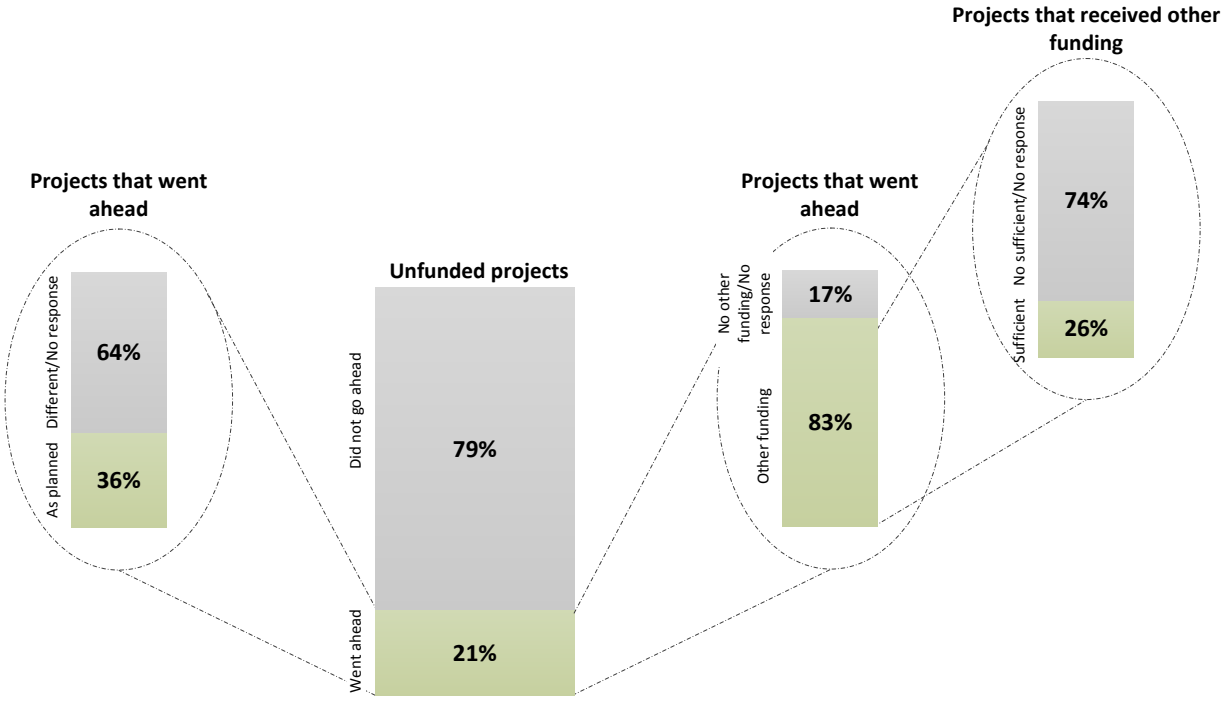
Following the path of a researcher's NSERC support provides an illustration of how they move along the discovery to innovation continuum. Discovery funding provides a foundation for exploring fundamental issues, while other research funding programs provide researchers with opportunities to work collaboratively with industry or government. There is, however, no linear or predictable pathway that would lead from a strategic project to a collaborative research and development grant, but rather, steady movement driven by the level of maturity of the projects and possible opportunities for collaboration. The mapping presented below is based on the case studies, and traces the path followed by ten researchers through the funding offered by the Council.

2.3 Absence of SPG-P Funding: Consequences and Impacts on Research

SPG-P remains the most essential source of funding for high-risk research in the industrial setting and 73% of unfunded projects did not go ahead in the absence of the SPG-P funding.

Given that research funds are also available from other public and private organizations, it is important to understand the incremental contribution of SPG-P: what would have been funded regardless, and by whom. SPG-P remains the most essential source of funding for high-risk research in the industrial setting. The researcher survey data show that three quarters (73%) of unfunded projects did not go ahead in the absence of the SPG-P funding. Of the 21% of unfunded projects that went ahead in the absence of the SPG-P funding, only one third (36%) of those projects were implemented in the same way as proposed in the SPG-P application. Also among the 21% of the unfunded projects, 83% went ahead with other sources of funding. When another funding source could be identified, it was common that it was not at the same level as SPG-P, and the project had to be modified. Only 26% of the surveyed researchers agreed that funding from other sources for the projects that went ahead in the absence of SPG-P had been sufficient to a high extent. For the unfunded projects that went ahead differently than what was originally planned, most of the modifications to the projects included reduced scope of the research design or model and reduced involvement of HQP. Details can be found in Figure 1 below.

Figure 1: Description of How Projects Went Ahead without SPG-P Funding.



Source: Researcher survey

According to surveyed researchers, 29% of the projects that went ahead without SPG-P funding and that were funded by other sources were funded by NSERC's CRD. Other main funding sources included other NSERC grant (27%), provincial government grant programs (24%), industrial partners (20%), other federal programs (13%), and government partners (10%) This suggests that partners actually considered the project less risky than their SPG-P application suggested, since they, at that point, had committed cash contributions.

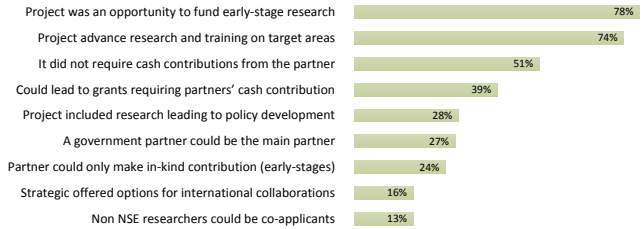
Similar results were obtained from non-funded partners surveyed: only 23% of them responded that their projects had proceeded without SPG-P funding (36% responded that their projects had not proceeded, and 41% of respondents did not know whether they had or not).

The data indicate that SPG-P plays an instrumental role in funding early-stage partnered research projects involving academia and other sectors, which, for the most part, would have not have been conducted otherwise. It is worth noting that researchers are more sceptical than partners about a possibility of having their research funded in the absence of SPG. Almost half (43%) of researchers compared to 26% of partners surveyed said that their project "Would definitely not have proceeded if it had not been funded through SPG-P."

Researchers' Journey along the Discovery to Innovation Continuum

Case Study Highlights

Why SPG-P was identified as the best options by researchers?



Source: Survey SPG-P funded researchers

Relevance from the perspective of the research community and partners

SPG-P is a low-risk opportunity to gain knowledge and strengthen relationships, for ideas that are not yet considered to be on a definite track to commercialization or policy development.

1) A very important attraction factor for researchers and partners alike is the low entry threshold for partners who are interested in but wary of early-stage research with little likelihood of short-term return on investment: it does not require cash contributions. The lack of requirement to make cash contribution facilitated an ability to participate in the project for two thirds (66%) of the surveyed partners and for more than half (56%) of the researchers surveyed.
2) Strategic is considered to be of an attractive size and duration, allowing sufficient funds for longer-term and larger scale research than, for example, Engage grants (which are much shorter and smaller) or Discovery grants (which are longer but usually smaller).
3) Strategic is seen as large and long enough to ensure participation of partners, researchers and HQP, without the perceived constraints of CRDs (e.g., finding partners willing to provide 50% cash contribution and closer involvement in collaboration at all stages that translates into more time required for partners to regularly interact with academic researchers.

Source: 2018 SPG-P evaluation

HOW TO READ THIS VISUAL

Ten funded SPG-P researchers were selected as part of the case studies.

Each color represents one researcher. Selected colors are aligned with the methodological map. For example the red stars represent the same strategic area. The sum of the stars allow to follow their path within NSERC's innovation continuum.

SPG-P selected for the case studies are identified by an additional circle under Strategic Partnership.

3 Evaluation Findings

3.1 Prerequisites for Projects' Success

The theory of change postulates that SPG-P grant proposals are most likely to be successful (in terms of being awarded funding and in producing useful knowledge) when they are co-developed based on a real need or opportunity as seen from the partners' perspective. This assumption means that researchers must have a good understanding of why those needs or opportunities are arising, and how they fit with their own research expertise.[8]

3.1.1 Partner Involvement

The evaluation showed that partners are involved in the projects various phases and that their contributions are especially important with regard to supporting and conducting research activities and to training students. Three factors influencing partner involvement can be identified: level of contribution, areas of research and type of partner (public versus private): 1) a contribution above the median amount is associated with more active involvement in all phases of the project; 2) partners' involvement is greater in the environmental sciences, biosciences and safety and security; 3) these areas are dominated by partners from government organizations who are more involved than industry partners.

Nature and Degree of Involvement

More than a third of the researchers and partners surveyed indicated that the partners were involved in the development of the research question and the planning of the research. The projects that were part of case studies also evidenced a wide range of partner involvement throughout the co-development of the proposal or the research process (before and during the funding period).When their involvement was extensive, the proposal was developed jointly and there was an approval process that required partners' consent with the proposed research before the proposal could be submitted. In other cases, partners were able to review the proposal before committing to it. Because of prior collaboration on SPG-P, some case study researchers were confident that they knew their partners' interests well enough to be able to develop the proposal without a formal co-development process.

The low success rate of SPG-P was brought up by researchers in one third of case studies, as well as by representatives of the research community and private and public sectors in key informant interviews, as a disincentive for partner participation. Those who raised this issue suggested that when applicants and potential partners consider their chances of being funded as low, they would be reluctant to waste time on developing project proposals that would most likely be unsuccessful.

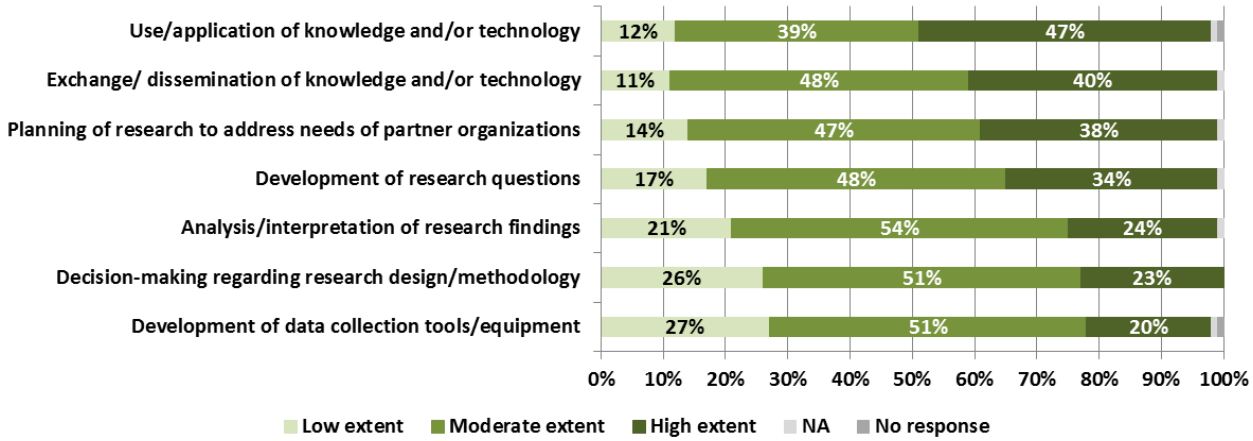
According to the researcher survey, partner involvement during the project was greatest in terms of being available for consultation and being part of regular discussions (87%). Providing materials, equipment and facilities was the second most important way for partners to be

[8] "The degree of involvement of the supporting organizations in: (a) developing the proposal; and (b) during the course of the project": http://www.nserc-crsng.gc.ca/_doc/Professors-Professeurs/SPG_Application_e.pdf; Strategic Partnership Grants for Projects 2016 Competition Application, Evaluation Criteria and Reporting. Note the difference in role connotation between "partner" and "supporting organization".

involved (70%). Finally, partners were also involved in research activities either in supervising HQP (41%) or in conducting research activities integral to the project (40%).

Details regarding the extent of involvement of the partner in the various research phases are presented below.

Figure 2: Partner Involvement in Research Phases



Source: Partner survey (n=255)

Factors Influencing Partner Involvement

Three factors influencing partner involvement can be identified: target area of research, type of partner (public versus private) and level of contribution. There were significant differences in the extent of partner involvement among target areas, with partners more likely to be involved in projects in the Environment (66%), Biosciences (57%) Safety and Security (54%), compared to Manufacturing (45%), Information and Communication (44%) and Energy (43%). Grants with government partners were significantly more likely to report higher partner involvement than industry-only projects (64% versus 46%). The level of partner involvement was significantly related to grant size, with larger grants exhibiting greater involvement of partner. As expected, grants with greater partner cash and in-kind contributions (as a proportion of the award value), were significantly more likely to have experienced higher partner involvement (60% of researchers indicating high level of partner involvement when the contribution was above the median, versus 40% when the contribution was below the median).[9]

[9] Source: Final reports: Overall median from all grants in the evaluation period.

3.1.2 Collaborations

Nearly half of the partnerships are the result of previous direct collaborations with the same partners. These collaborations enhance both the synergies and the complementarities among the various disciplines and fields of expertise involved. They are of particular benefit to HQP. Here again, the amount of the contribution and the type of partner (public versus private) are important factors: when the contributions are above the median amount, or the partners come from the government sector, previous collaborations are more common. A significant proportion of the collaborations are multidisciplinary. Multidisciplinarity occurs primarily in the natural sciences and engineering, and to a lesser extent in the social sciences. About one-third of the projects involve multiple sectors.

The theory of change postulates that SPG-P grant proposals are most likely to be successful (in terms of being awarded funding and in producing useful knowledge) when funded research and partner teams have a history of successful collaboration, high level of mutual trust and long-term engagement: almost 50% of researchers indicated previous collaborations.

Overall, almost half of the researchers (47%) indicated in their Final reports that they had previously collaborated with their partners. Researchers from partnerships with at least one government partner were significantly more likely to have been involved in prior collaborations (56% versus 43% with private sector partners). Grants with greater total partner contributions in cash and in-kind were significantly more likely to have involved prior collaborations (51% had previous collaboration with the partners when the contribution was above the median, versus 43% when the contribution was below the median). Only 18% of the researchers indicated the project to be a new collaboration.

Case studies confirmed the projects were reinforcements of existing collaborations, or further development of a relatively recent collaboration into a stronger, ongoing partnership. Researchers reported prior history of successful collaboration with at least one of the researchers/partners involved in the project. However, the SPG-P projects allowed for development of new collaborations bringing together new team members with different perspectives, complementary expertise but common interests. Instances were reported where subgroups of researchers had gone on to submit subsequent proposals with the same and new partners and researchers, in different configurations. These proposals either addressed emergent research problems building on the SPG-P work, or headed in new research directions. Not surprisingly, given that a majority of SPG-P projects are ongoing relationships, the collaborations fostered by these grants appeared to be quite robust and those involved in the case studies found the partnerships very effective.

> "(The Strategic project) had a big impact. The biggest impact that I see is that I have gone from being an individual researcher to being more of a collaborative researcher. (…) (The project) was a source of interactions and allowed to address bigger problems that cannot be addressed by one researcher or one researcher's lab."
>
> SPG-P Case Study Participant, Funded Researcher

Approximately two-thirds of the researchers were collaborating with the same partners on the same or other research after the completion of their SPG projects and about half of them collaborated with other partners on the same research. A majority of surveyed partners (62%) reported that, as a result of the project, they were in an ongoing collaboration with universities, of which 69% were strongly related to the project they had responded about. Researchers were

asked if there had been further collaboration involving a partnership as a result of this project and more than a third answered that they had a publicly funded project with industrial partners or with government partners (respectively 42% and 34%). Around one in five answered that they had a contract with industrial partners or a publicly funded project with other type of organizations (respectively 21% and 19%). Seventeen percent had no further research collaboration, of which nearly half (47%) said that it was because an opportunity to work with the partner organization has not arisen.

One of the case studies perfectly illustrates the potential arising from a funded project. In this case, the SPG-P project led to the creation of two new partnered entities: a new joint NSERC–industrial research chair, and a new international unit in France. In both cases, these partnerships were highly promising from a collaborative research standpoint.

> "(The project) strengthened the partnerships between the industry partner and the research community, provided a common space for researchers and industry, accelerated technology transfer and established multidisciplinary work teams. (…) The project has also led to the creation of a joint international unit that provides access to the full funding network of the programs in France and in the European Union."
>
> SPG-P Case Study Participant, Funded Researcher

Overall, projects in the Environment area are more likely to maintain links with partners (73%) compared to those in Manufacturing (59%). Projects with at least one government partner were significantly more likely to be continuing to collaborate with the same partners on the same research (71% versus 62% for the industrial partners). In all cases, linkages are more likely to be maintained after larger grants and after grants with larger partner contributions.

3.2 Knowledge Dissemination, Transfer and Use

For research results to contribute to private sector economic gain or government policy change, they first have to be transferred to the partners who can then carry them into the next stages of application. Several lines of evidence examined the extent to which SPG-P results are produced, transferred and then used by partners. There is a broad dissemination of research and almost all researchers have shared the results of their project with partner organizations. Only in a very small number of cases research did results not transfer to partners. Half of the partners had already used the results and another 20% were likely to use them in the future. There is a correlation between the use of project results and the time elapsed since they were produced, as it takes at least ten years or more before research results are used by partners. The evaluation showed that the projects funded influence the public debate and contribute to the competitive advantage of the industry partners.

3.2.1 Knowledge Dissemination

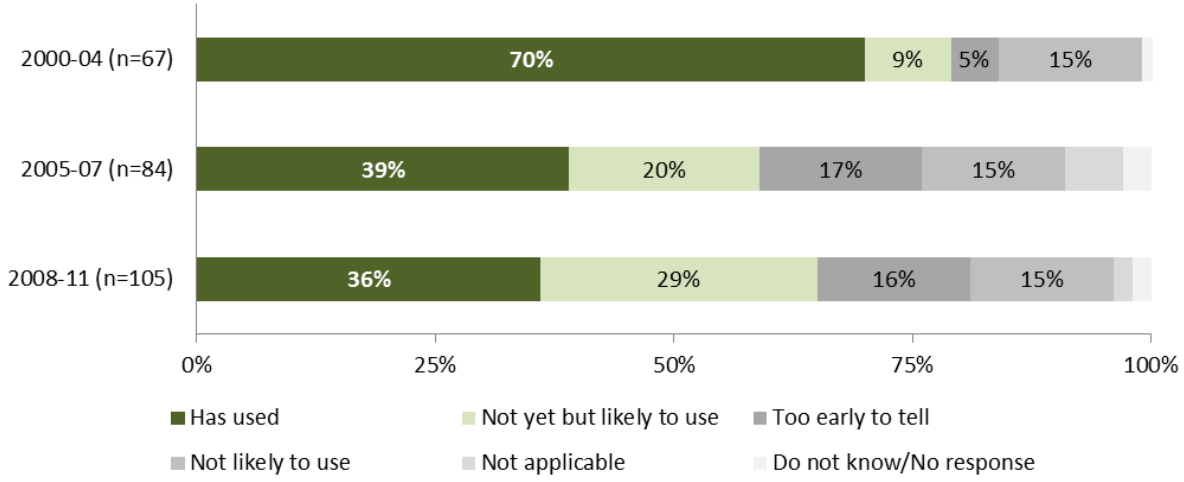
Overall, there is a broad dissemination of research and almost all SPG-P researchers have shared the results of their project with partner organizations; as per as the file review, only in a very small number of cases, about 2%, were research results not transferred to partners. Sharing of results occurs through a broad array of channels, but occurs most often through informal discussions (91%) and formal publications (78%) and to a lesser extent through reports provided to the partners (62%) or as a result of the partners participating in the research (61%). This is supported by the surveyed partners where 81% of them indicated that the results were transferred through informal discussions and correspondence and 73% through reports.

Projects with government partners were more likely to have transferred results though participation in the research and formal publication. There were no systematic trends by theme areas, other than greater participation by Environment and Safety and Security partners in the research as a means of transfer (74% and 73%). Partners in larger grants were more likely to have had results transferred as a result of participation in the research. Overall, grants that had larger total cash and in-kind contributions from partners were more likely to use most of the methods for transferring results to them, with the exceptions being informal discussions and formal publications, which were equally prevalent regardless of contribution size. Grants that had larger total in-kind contributions from partners were more likely to use informal discussion, direct participation and formal publications to transfer results to partners.

3.2.2 Knowledge Transfer

Overall, the partner survey revealed that 50% of the partners had already used the results and another 20% were likely to use them in the future. There is a correlation between the use of project results and the time elapsed since they were used; in most cases, it takes at least ten years or more before research results are used by partners. Partners who were involved in projects funded in earlier years (2000-2004) were more apt to indicate that project results were used (70% in comparison with 39% for projects funded in 2005-2007 and 36% for projects funded in 2008-2011). It is worthy of note that a consistent proportion of partners would not use the project results, regardless of when the project was funded: 15% of partners considered it unlikely that they would use research results of Strategic projects.

Figure 3: Reported Use of SPG-P Research Results by Funding Period



Source: Partner survey (n = 256)

The breakdown by target area shows that the types of potential use are quite strongly linked to the target areas. For example, use of research results to develop or improve a product is present in projects in the Information and Communication (94%) and Manufacturing (93%) target areas, but less so in projects in the Environment target area; conversely, projects in the Environment are far more likely than those in other target areas (95%) to have been used or to have the potential for contributing to policies, regulations or standards. The data show an expected pattern in the ways research results have or will be used by type of partner; with greater likelihood for use for

product development among projects with only private sector partners, and greater likelihood of use in policies, regulations or standards for projects with at least one government partner.

The size of partner cash contributions had an impact on three response categories related to the type of potential use; grants with larger partner contributions were more likely to be used in relation to enhancing skills and knowledge of personnel in the partner organization, improving an existing service, and contributing to a policy, regulation or standard. The size of partners' in-kind contribution to the SPG-P (as a proportion of the total award), was systematically related to improving an existing service, and contributing to a policy, regulation or standard, with greater use of the results in these ways among grants with larger partner contributions.

3.2.3 Knowledge Use: Contribution to Public Debate and Policy Change

The evaluation showed that the funded projects are influencing public debates and that the knowledge they generate is being used by decision-makers. It is not unreasonable to expect any one project, on its own, to have a direct impact on public debate. However, producing credible scientific data is crucial. The contribution to public debate is influenced by three factors: 1) the presence of partners, who are involved in decision-making forums, accelerates the transfer; 2) researchers are not necessarily informed of or involved in the transfer process, and some feel that this is not their role; 3) having a large number of partners contributing to the project who have ties with organizations that contribute to decision-making supports the process of exercising influence and making recommendations. Many different stakeholders are involved, and not all of them come from public-sector organizations.

In addition to knowledge creation and dissemination, research-based evidence developed through SPG-P grants proposals can contribute to public policy in multiple ways by informing public debates, being responsive to needs and opportunities and by supporting the development of policy solutions. However, the influence of scientific research on policy development is difficult to pinpoint. Measuring the influence of any one project in particular is not quite realistic, given the variety of issues and especially because the factors taken into account when developing these policies, which are always multifactorial as opposed to more targeted research projects.

Moreover, as research on the impact of scientific knowledge on policy development shows, there are many elements that have to be considered. First, scientists do not necessarily provide consensual opinions. Second, as political scientist Éric Montpetit[10] has stated, whether or not a decision on a particular issue requires scientific knowledge, government policymakers rarely receive such information directly from researchers; instead, it tends to be filtered through the media, politicians, and public opinion. Third, in the context of public policy development, there is often a perception that a single policy-maker laws or policies, when in fact, major policy decisions actually result from numerous discussions and consultations among various stakeholders. These include the media, politicians, and the public opinion, all of whom act as intermediaries in multiple forums. Collaboration among the various stakeholders and their credibility in the public sphere are also important for clearly defining the issues and advancing the discussions in this sphere. Time is therefore of the essence not only in producing but also in applying scientific knowledge. Despite these challenges, the production of credible scientific knowledge remains an important means of informing public debates by helping policymakers to

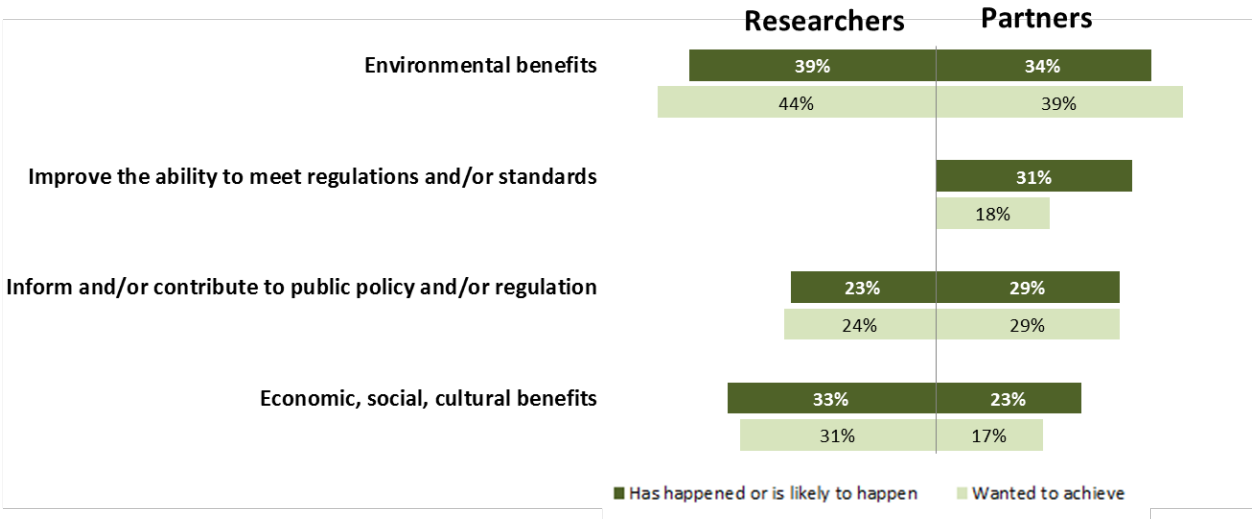
[10] http://www.acfas.ca/publications/decouvrir/2015/04/sciences-elaboration-politiques-publiques

better understand the complexity of the issues that they must address. As Andrew Petter puts it, Peer-reviewed science and a context that fosters evidenced-based policy over policy-based evidence are required to support good policy-making."[11]

> "The research results are providing useful bases for governments to improve their effectiveness in managing and regulating a variety of challenging problems (...) We have been supportive of the related research since it implies significant environmental and socio-economic benefits for the Provinces."
>
> SPG-P Case Study Participant, Governmental Partner

Partners and researchers alike were more apt to be pursuing environmental benefits (researchers: 44%; partners: 39%) than economic, social, or cultural benefits (researchers: 31%; partners: 17%). According to survey data, 24% of funded researchers and 29% of funded partners intended to use their Strategic project for informing and/or contributing to public policy or regulation (Figure 4). Eighteen percent of funded partners aimed to improve their ability to meet regulations and/or standards. When project outcomes are compared in light of expectations, it appears that SPG projects are able to help partners meet their goals in terms of policy and regulation, as expectations were either met or exceeded, and there is the possibility that results may continue to have an impact in the future. For example, when the partners were asked if the project had informed or contributed to public policy and/or regulation, 29% indicated that it already happened and an additional 16% indicated that it is likely to happen. Similarly, 13% of funded researchers indicated that the project already had an impact on public policy and/or regulation and an additional 10% that it is likely to have one in the future. Researchers who participated in earlier projects (2000-2004) were more likely to report an impact on public policy and/or regulation (18%) than in more recent competition years (2005-2007, 11%; 2008-2011, 7%). This supports the expectation that the more recently funded projects may still lead to an impact on public policy and/or regulation in the future.

Figure 4: Funded Researchers' and Partners' Expectations vs Outcomes



[11] Andrew Petter (2016), President and Vice-Chancellor, Simon Fraser University The Art of Policy Making: What's Science got to do with it? https://www.sfu.ca/pres/petterspeeches/2013/201310.html

Source: Partner and researcher surveys (n=256, n=720) Note: Researchers did not have to answer the question “Improve the ability to meet regulations and/or standards”, as it was decided that it is more related to the partners.

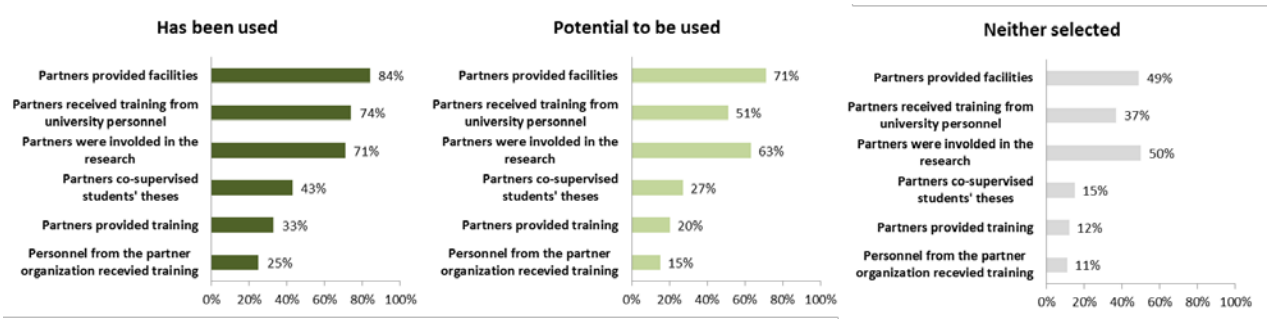
> “(In an organization involved in managing fishery resources), production of scientific data is essential. Without research data, no decisions can be made. (Also), within the international advisory policy group of which I am a member, the development of the responses given to the participating organizations is based directly on the production of the most recent scientific data. Participating in the strategic project reduced knowledge-transfer time, because it gave me access to this knowledge without having to wait for it to be published.”
>
> SPG-P Case Study Participant, Government Partner (Member of an international advisory policy group)

The case studies in this evaluation confirmed that Strategic Project Grants can influence the development of policies and, more broadly, public debate. Four of the case studies that contributed to public debate and policy development were in the fields of the environment, biology, safety and security. All of the projects examined in this case study were found to have engaged in the essential first steps of producing and disseminating knowledge within a relatively short time. This does not include the scientific production that is known to still be ongoing. According to the final reports, the case studies projects led to 323 articles/reports and 320 conferences/presentations/posters. Once knowledge is accessible through publications, conferences and presentations in specialized forums, the amount of time that elapses between the availability and the application of the knowledge varies and is influenced by a range of factors beyond the researchers’ control, such as government priorities, level of media coverage of a given issue, the existence of a triggering event, and the degree of public and pressure groups awareness.

The case studies revealed that the projects with the greatest ability to influence policy development had the following three major characteristics: 1) partners who are involved in decision-making forum speeds up the transfer (for example, in one of the case studies, the presence of a partner who was involved in an international working group enabled the transfer of knowledge within two years, before the project had even been completed); 2) researchers are not necessarily informed of or involved in the transfer process, and some feel that this is not their role; 3) having a large number of partners involved in the project with ties to organizations that contribute to decision-making supports the process of exercising influence and making recommendations.

This is supported by data from the Final reports, where the use of SPG-P results for policy, regulation or standard was significantly associated with ongoing partner linkage. Projects where results had been used to support policy are significantly associated with collaboration with partners on the same research or other research. There is also significant association with the nature of partner involvement. In instances where results have been used or have had the potential to be used for policy, regulation or standards, partners have been more engaged, providing facilities, training to students and university personnel, receiving training from university personnel and even by being more involved in the research (Figure 5).

Figure 5: Extent of Partner Involvement in SPG-P by Use for Policy, Regulation or Standard



Source: Final reports

In this context and in order to try to take into account the contribution of funded projects to public debate, their possible impact on public policies as well as on growth and economic gain, a linear modelling was developed which identifies these elements, as well as the main milestones in the process of influencing and contributing to public debate and the economic sphere. This model, necessarily highly simplified, does not claim to represent a projection of reality, but instead attempts to determine the moment at which one can hope to capture the influence of the research funded by the Strategic Project Grants.

3.2.4 Knowledge Use: Contribution to Growth and Economic Gain

Participation in SPG-P contributed quite strongly to overall R&D receptivity and capacity, and to some extent to human or financial investments in R&D but not more than unsuccessful SPG projects funded through other sources. Participation in SPG-P also contributed to increase in the skills and knowledge base of the partner organizations; future business and/or R&D direction, with SPG-P results being used in decision-making about strategic business orientations; visibility in their sector was highlighted as very important to improve their competitiveness worldwide. Researchers were less likely to indicate that their research had resulted in intellectual property agreements, patents and licenses. This finding is consistent with the nature of high risk and early-stage research, which is generally less likely to produce IP that needs to be protected.

Measuring the SPG-P contribution to an economic gain for the private sector is proving challenging. Even more so as, obtaining a positive return on investment is not a specific

> "We knew that this kind of research takes time, so we were not looking for something fast. We mainly wished to educate ourselves on possible ways to improve the technology. The objectives were to learn more about the technology so it could help the core business. Promote research and science in a field beneficial to our enterprise was exactly what we were trying to do".
>
> SPG-P Case Study Participant, Industrial Partner

goal of the SPG program, since most of the funded projects are relatively early-stages and high risk, both scientifically and commercially. However, the SPG program does focus on research that can at least potentially be used over the mid- or long-term for commercial or public good applications. Economic gain should be viewed more broadly than commercialization as it can encompass the use of knowledge, the enhanced organizations' R&D receptivity or capacity and can also support a company decision-making process.

Impacts on Partner R&D Capacity

Whether or not the specific project results have been used, SPG-P participation may have benefitted partner organizations by increasing their R&D capacity and potential competitiveness.

In the survey data, partners were more likely to report improvements in the research knowledge base and overall R&D capacity than investments in R&D as a result of the project. While 81% of funded partners reported an improved research knowledge base and 60% reported increased overall R&D capacity, less than half of that number (28%) reported increased internal R&D budget. This is consistent with data from Final research reports: among projects with private sector partners, 29% of researchers reported that partners had used the results as a stimulus for future R&D. The case studies found that there has been a systematic increase in the skills and knowledge base of the partner organizations involved. Participation in research collaboration is seen by industrial partners as an added value when teaming up with top level university fundamental researchers. A major type of impact on private sector partners documented in case studies was on future business and/or R&D direction, with SPG-P results being used in decision-making about strategic business orientations. Visibility in their sector was highlighted as very important to improve their competitive situation worldwide.

Intellectual Property (IP) Management

Intellectual property management or protection activities undertaken by researchers are an indication that research results were considered to have commercial potential. SPG-P grants have resulted in some forms of intellectual property protection, i.e. have produced outputs that are considered advanced enough on a commercialization scale to warrant IP protection (e.g. Technology Readiness Level 4 or higher). The most common outcome of this type is the filing of patent applications, for which there were 116 (15.5% of projects) between 2005 and 2011, with an additional 57 (7.6%) in progress. This was followed by execution of 95 (12.7%) nondisclosure or confidentiality agreements (17 (2.3%) in progress). Most of the choices appear relevant to only a very small subset of grants.

This finding is consistent with the nature of high risk and early-stage research, which is generally less likely to produce IP that needs to be protected.

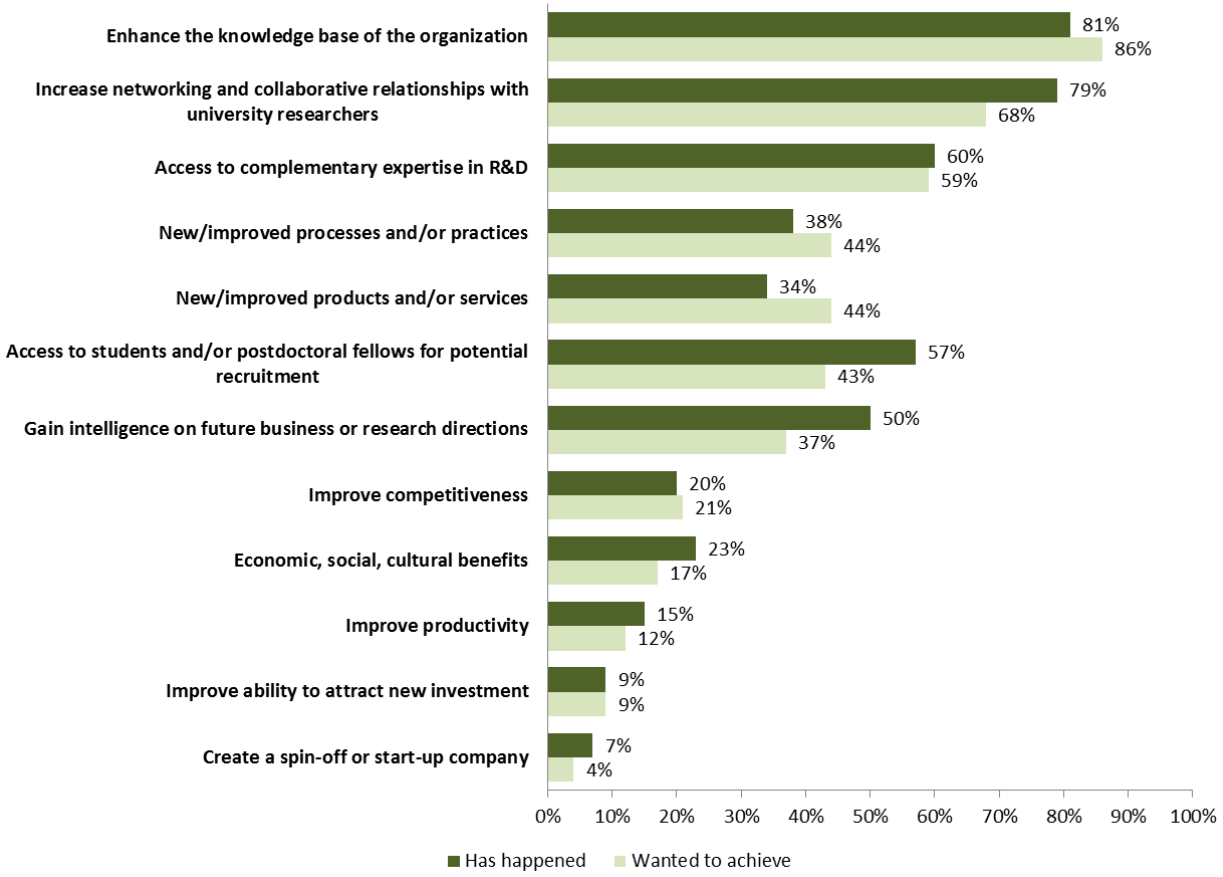
Productivity and Competitiveness

Fifteen percent of surveyed funded partners reported impacts on their productivity and one in five reported an increase in competitiveness (20%). When project outcomes are compared in light of expectations, this can be seen as a fairly positive impact on partners productivity and competitiveness, as expectations were either met or exceeded, and, as noted earlier, there is a possibility that results may continue to have an impact in the future. Among those that reported improved competitiveness, the most frequently reported impacts were indirect, such as improved competitive position and increased market visibility. Too few partners reported impacts on sales (n=5) and revenue (n=3) to analyze. A case study project Final research report emphasized that

the research had been "central in launching [our organization] as a producer of biochar" and that the project "became a springboard for initiating large-scale investments in biochar as an eco-friendly industry in Canada". This was echoed by the partner during the case studies.

In the surveys, around a third of the partners (34%) and researchers (28%) indicated that the project had an impact on products and/or services and more than one third of partners (38%) and researchers (32%) indicated that the project had an impact on processes and/or practices (Figure 6). These results are only slightly lower than expectations, since 44% of the funded partners indicated that they wanted to create or improve products, services, processes or practices.

Figure 6: Funded Partners' Expectations vs Outcomes



Source: Partner survey (n = 256)

> "The significance of this project to our company and its future is enormous... It is probably the biggest thing or most exciting thing that this company has done in the last 30 or 40 years. Well before I was involved here. "
>
> SPG-P Case Study Participant Industrial Partner

Nonetheless, results from several cases studied (three out of 10) were considered to have high potential for economic gain. In these, partners in the private sector had begun to gear up for this by investing in further R&D and the infrastructure necessary to support business development in line with the research results (although one case was careful to note that SPG-P was not the only contributor to this expansion). This speaks to the need for different mechanisms, each providing a piece to the puzzle. In some of the most successful case studies in

terms of economic outcome achievement, the private sector partner may, in fact, be close to achieving business gains. Knowledge from the research increased beyond the organization's initial expectations and affected its future business direction. It has moved forward to acquire the necessary certifications and approvals in the direction of commercialization. This is not in the initially foreseen area, but one with potentially stronger business opportunities.

3.2.5 Modelling the Impact of the Strategic Project Grants

In an attempt to capture the possible impact of the funded projects on public policy and economic development, a linear modelling was developed. This model, based essentially on the case studies, is necessarily a simplified representation, but it does attempt to determine the moment at which one can hope to capture the influence of the research funded by the Strategic Project Grants.

As the modelling shows, not all of the projects studied led to observable changes. There were instances, among the case studies that involved policy-relevant research, where the results appeared to have had no detectable impact on policy. Other case studies showed a range of impacts, including a fairly significant increased understanding of issues that could inform future policy or business direction, as well as an increased understanding in other areas, especially in environmental protection and stewardship and sustainable development. There was also an instance where researchers were aware of the potential impacts in terms of refocusing debates in their respective fields (specifically, that the species damage they demonstrated could be used in debates about mining regulations). Case studies also suggested that SPG-P grants may lead to future impact. In one case study, an attempt was formally made to use research findings to support the adoption of a policy; however, this attempt failed due to lack of government and public support for the changes sought, although practice changes have been adopted as a result of the research findings. In another case study, results appear to have supported decision-making regarding the environmental impact of a construction project which raised public concern: the research results confirmed that the concern was unfounded.

> "The research undertaken (…) is significant in developing technologies to control pollution impacts (…) in the Prairies Provinces and their watersheds. Deployment of effective environmental technologies and management measures developed through this project will benefit surrounding communities and the industry."
>
> SPG-P Case Study Participant Industrial Partner

SPG-P Contribution to Public Policy & Economic Gain

Case Study Highlights (N=10)

Long term, uncertainty & environmental influences are the common pieces

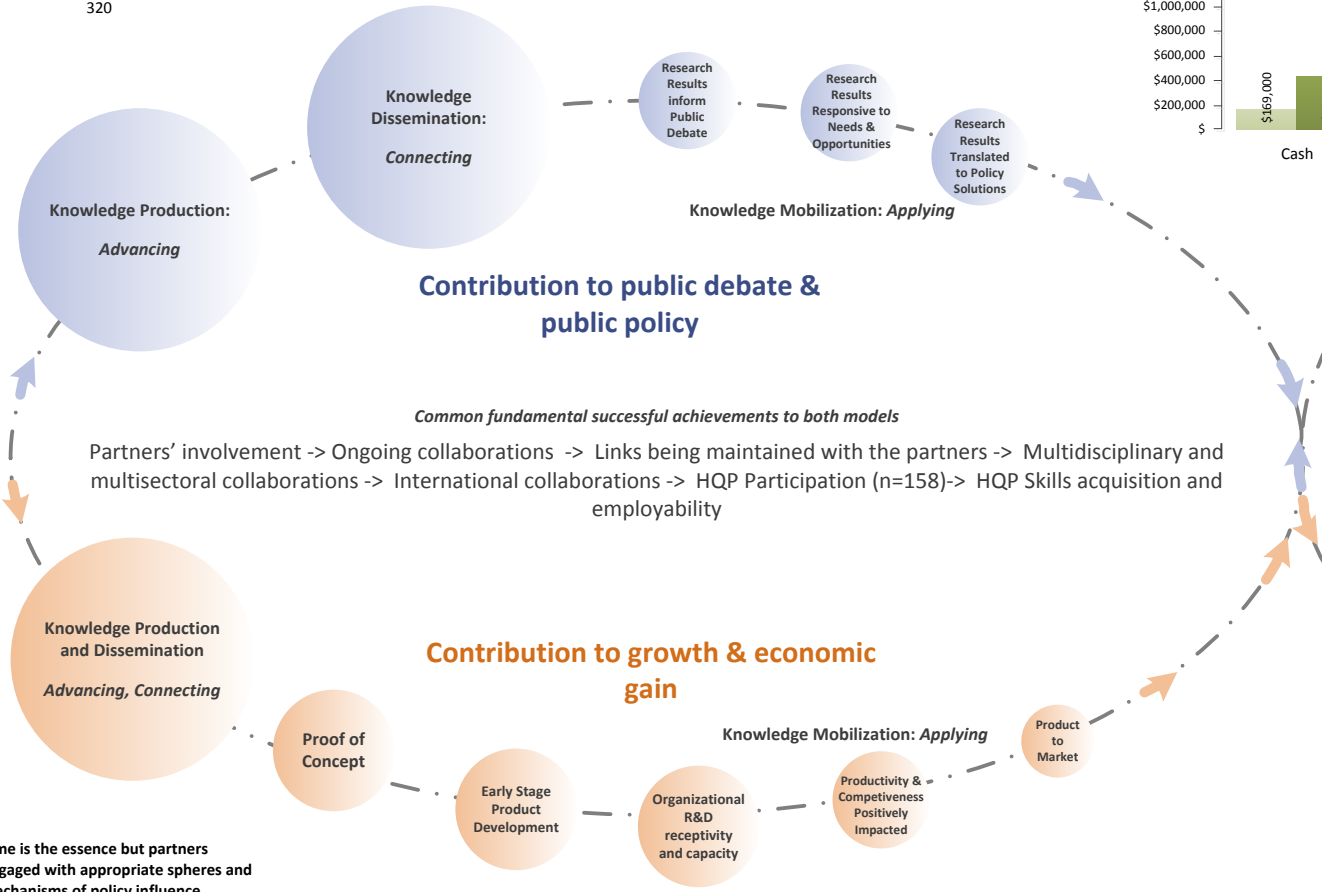
TOTAL NUMBER OF PUBLICATION/CONFERENCES/PRESENTATIONS AT THE END OF THE SPG-P FUNDING

Type of Publications	Number of Publications
Articles or reports	240
Articles co-authored with non-academic partner	83
Conferences/presentations/posters	320

TOTAL NUMBER OF HQP INVOLVED

HQP Level	Number of HQP
Undergraduate students	43
Master	48
Doctoral	48
Postdoctoral	19

SUM OF THE PARTNERS' CONTRIBUTION IN PROJECTS SELECTED FOR THE CASE STUDIES



Moving from economic gain to policy development

"In Europe, several major car manufacturers have adopted this technology. As new technologies are being developed, social and political issues will need to be addressed".
Case Study Participant, Funded Researcher

Borders are grey and there is an intersection

Moving from policy development to economic gain"

"The Genomic selection and association mapping of Atlantic salmon populations supports stock management decisions which will also have economic implications".
Case Study Participant, Funded Researcher

Factors supporting promising partnerships and research impact:

- **Funded proposals were co-developed based on real need/opportunity seen from partner perspective & research teams understanding of how private sector/government operates.** *Partners and researchers share the same perception and according to Final Reports, partners were involved to a great extent in 49% of projects, and were directly involved in research in 50% of projects. Their involvement was greatest in terms of being available for consultation (97%) and being part of regular discussions (83%).*
- **Funded research and partner teams have history of successful collaboration, high level of mutual trust, long-term engagement:** *Almost 50% of researchers indicated previous collaborations. Up to 65% are still collaborating with the partners after their SPG-P. Partners' contribution are higher than what was committed.*
- **Partners' contribution is important.** *It directly influences their level of involvement with greater involvement in larger grants (60% of partners highly involved when contribution is above the median versus 40% when below the median). Some areas show more involvement than others with partners more likely to be involved to a great extent in projects in the Environment, Biosciences and Safety and Security.*

- **Time is the essence but partners engaged with appropriate spheres and mechanisms of policy influence knowledge mobilization.** *Half of partners had already used the results and another 20% had not used the results as yet but were likely to use them in the future. There is a correlation between the use of project results and the elapsed time. It takes at least ten years or more before research results are used by partners.*

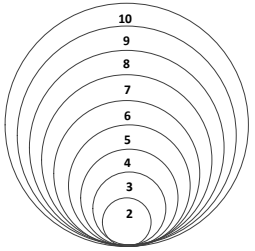
Factors influencing the influx & quality of applications

- **Risk/potential gain ratio is acceptable to partner organizations.** *The findings suggest that partners are well aware of the level of risk in SPG projects, and that the low-threshold design makes it acceptable.*

- **Universities broker and support partnerships.** *There is evidence that universities support partnership, especially effective in international collaborations.*

- **Applicant pool of partnerships finds program sufficiently attractive compared to alternatives at given moment.** *Not only do applicants find SPG-P sufficiently attractive, they find it more attractive than the alternatives, but because of its size, duration and absence of partner financial contribution, not the partnership component per se.*

Legend
N = Number of Case studies



3.3 Multidisciplinarity and Multisectorality

A significant proportion of the collaborations are multidisciplinary. Multidisciplinarity occurs mainly in the natural sciences and engineering and to a lesser extent in the social sciences. About one-third of the projects are also multisectoral.

For more than two thirds (69%) of the funded researchers surveyed, the SPG-P projects directly resulted in multidisciplinary research collaborations. These collaborations included an average of 2.6 different disciplines. Some projects had up to 8 disciplines involved and 7% also integrated disciplines outside natural sciences and engineering, which included health, social sciences and humanities.

> "For the chemists, the project provided the chance to learn a great deal about aquaculture, which was an unknown area of expertise. For biologists, it provided a first experience with magnetic resonance methods. The openness to the potential of other disciplines was tremendous, especially for the students, and enabled the development of a highly distinctive research approach used by some 10 laboratories worldwide."
>
> SPG-P Case Study Participant, Funded Researcher

Case studies showed that SPG-P projects successfully engaged with multiple disciplines within and outside the natural sciences and engineering (2 within the Natural Sciences and Engineering and 1 outside). For example, one case study involved urban planning and architecture, which are disciplines closer to the social sciences. For researchers, whose area of specialization differed from the main focus of the project, it provided them with an opportunity to work in a multidisciplinary environment, communicate with other researchers, and come up with new research ideas and models. Moreover, in case studies that involved multidisciplinary collaborations, it was reported that the collaborations were particularly beneficial for HQP. They became exposed to research ideas and worldviews to which they may not otherwise have been exposed, hence broadening the span of their knowledge and experience. Nearly a third of the Strategic projects (30%) also resulted in multisectoral research collaborations.

3.4 International Collaborations

SPG-P funds joint research projects between Canadian researchers and researchers through concurrent calls for projects with international granting agencies. Current participating organizations are the Agence nationale de la recherche in France and the Ministry of Science and Technology in Taiwan. Being part of the NSERC international strategy to increase scientific collaboration, the concurrent calls for joint research projects aim to strengthen the collaboration between research and innovation communities in order to "achieve world-class scientific and technical results, leading toward new innovative technologies." Eighteen percent of surveyed researchers indicated that they had intended to include international collaborators in their project and more than twice as many, 40%, said the project resulted in international collaborators.

Collaborations with 40 different countries were reported. Among the countries from which collaborating researchers come, the most common was the United States, with 48 researchers in the survey indicating that they had collaborators from that country, followed by France (n=13) and Germany (n=7).

Three of the case studies highlighted formal collaborations with research teams in France, and another involved collaborations with individual researchers outside Canada. In international

partnerships, universities and university consortia played essential roles in bringing potential collaborators together and identifying opportunities for jointly funded work. As an example, the agreement between NSERC and France's Agence nationale de recherche provided the application, review, and funding mechanics, but the prior work of jointly developing research questions and partnerships would not have happened without the involvement of the universities. Case study grants involving international collaborations were particularly successful in using their respective research teams and environments complementary strengths to advance their research work in ways that would not have otherwise been possible. Here again, trainees had the opportunity to visit other laboratories and experience equipment and techniques that they might not have encountered in Canada alone.

> "One of the differences between the collaborations with French researchers and with Canadian researchers is that the French researchers favor the fundamental aspect and the conceptualization rather than the transfer to the marketplace and potential use by industry.
>
> SPG-P Case Study Participant, Industrial Partner

In the case of international collaborations with the Agence nationale de la recherche, SPG-P was a logical and appropriate choice due to a signed Memorandum of Understanding between NSERC and the Agence nationale de la recherche. According to one of the researchers involved in the awards, the funding model was appropriate to the nature and scope of the project. Besides, the French partners had an interest in the program which was similar to the interest of the Canadians, i.e. an opportunity to participate in a project that was risky and innovative without the necessity to provide cash contribution.

3.5 Impact on HQP

HQP benefit from participation in SPG-P through being exposed to partners and acquiring both research and soft skills (although to a greater extent, research skills), which is reported to have made positive effects on their career development. Experience working directly with partners, whether acquired through SPG-P or other funding, is pivotal to becoming more employable across the academic-industry continuum.

3.5.1 HQP Participation

According to the researcher survey, the average number of HQP is significantly higher in projects funded through SPG-P than in projects that did not receive a Strategic grant and were funded through other sources. Researchers tended to involve more undergraduate and Master's students (3.1 and 2.8 per project respectively) than PhD students (2.4) and postdoctoral fellows (1.3). Table 1 summarizes the total numbers and the average number of HQP participating in the funded and non-funded SPG-P projects during the evaluation period, as reported by their academic supervisors.

Table 3: Number and Type of HQP Involved in SPG Projects (Funded vs. Unfunded projects)

	Funded			Non-funded		
	No. of projects involving HQP	Average number of HQP involved	No. of HQP involved	No. of projects involving HQP	Average number of HQP involved	No. of HQP involved
Undergraduates	487	3.1	2,268	43	0.6	211
Masters	569	2.8	2,002	50	0.4	139
Doctoral	595	2.4	1,692	52	0.3	107
Postdoctoral	470	1.3	942	32	0.2	64
Total no. of projects	720			316		

Source: Researcher Survey

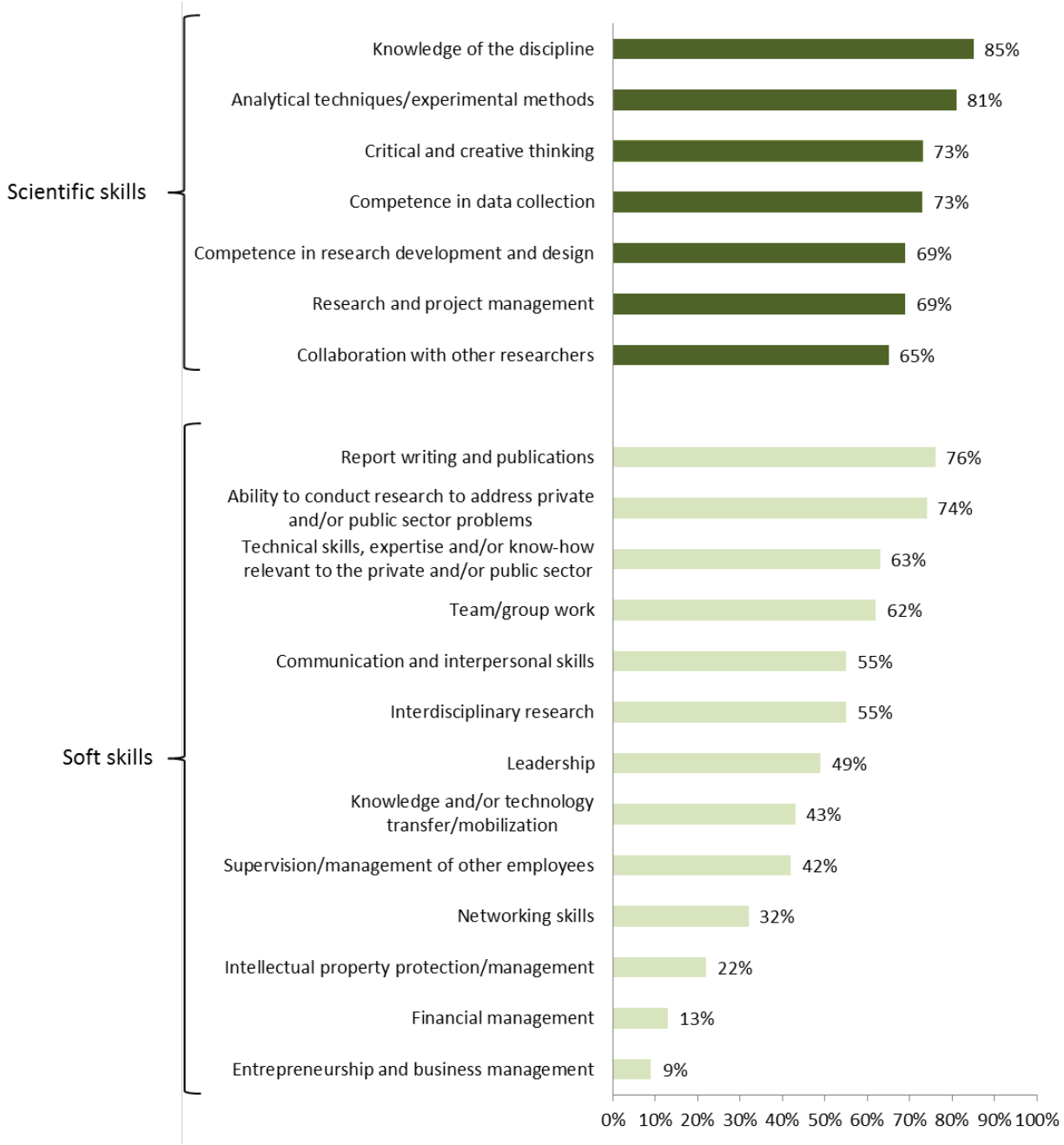
3.5.2 Skills Acquisition and Employability Gains through SPG-P Projects

According to the Final Report analysis, most HQP trained as part of Strategic projects were exposed to partners, most often through sharing research results with them (81%) and through discussing the project directly with partners to obtain their input (78%). Almost one-third (31%) worked directly in partners' facilities or were jointly supervised by partners (26%).

When surveyed about the types of skills they had gained through their participation, HQP were more likely to report research skills (of the type that could be acquired through any type of research program) than "soft" skills that prepared them for work in industry or government (see Figure 67).

Researchers and HQP interviewed for case studies indicated that through the SPG-P grant work, HQP acquired applied research skills that made them more attractive to both academic and industrial employers. This was particularly true when the HQP had worked directly in the partner facilities (as opposed to only attending meetings there) and acquired not only technical skills but also organizational, communication, and project management skills. HQP perceived that these skills had them an advantage in advancing their career. For Masters-level HQP interviewed, having successfully completed their work reassured employers that the trainee would be able to function well and quickly in a real-world organization. For doctoral and postdoctoral level HQP who are aiming for academic careers, these "soft" skills have had the benefit of preparing them to work in large-scale research programs involving collaborations not only with a single industry partner, but with academics from many institutions and partners from many settings.

Figure 7: Skills Acquired by HQP



Source: HQP Survey (n = 130)

3.5.3 Impacts on HQP Employment

The vast majority of students and postdocs who participated in SPG-P are currently employed full time (74% of those who responded to the survey). Approximately one tenth of them is either employed part time (8%) or continues their academic training (13%). Only 4% of HQP reported that they were not employed, half of whom were not looking for any work. Of those who are employed, almost half (44%) work for academia, one third (35%) for the private sector, and 15%

for government. One quarter of the 216 surveyed partners in the funded projects reported that they had hired an HQP.

Three-quarters (74%) of HQP surveyed strongly agreed that their participation in the SPG-P project had a positive influence on their career path, and 70% that it had improved their chances of obtaining employment in their field. About half (52%) of surveyed HQP indicated that their skills and experience are better matched with those required in their current job as a result of their SPG-P participation. Almost two-thirds, 62%, reported that the experience gained in the SPG-P is important for their current job, possibly related to the finding that for 66%, their current job relates closely to their field of academic training. Also, about half (55%) of surveyed HQP strongly agreed that participation in the SPG-P had a positive impact on their ability to collaborate with private companies, government, and/or not-for-profit organizations. About 40% of partners strongly agreed that "Students and postdoctoral fellows were more "job-ready" for employment in industry than they would have otherwise been because their skills / experience better matched those required for their current employment".

Case studies findings suggested that an important impact of SPG-P participation for PhD and postdoctoral trainees was providing them with a wider range of choices for their careers. They felt confident that they would be able to succeed in both industrial and academic settings, and in some cases, were weighing both options. Conversely, one of the PhD students interviewed who had worked mainly in a fundamental science laboratory in the SPG-P regretted that he had not been exposed to industrial experience, indicating that this was going to limit his career options compared to his cohort.

Among the PhD-level HQP interviewed for the case studies (who may have been more easily reached for interviews than those working for industry because they were still at the university) it seems that academic jobs were the preferred career objective. Master's students and some of the PHDs interviewed held a variety of roles, including: further training; research associate positions in the same or other universities; and positions in related industry sectors , in some cases research-related and in some cases not. Several HQP from the case studies had been hired by the SPG-P grant partner organization. In case studies linked to potential policy change, case studies found that some HQP had been hired in related government and non-governmental organizations positions. Employed HQP interviewed for the case studies all indicated that the SPG-P contribution to their employability and employment had been very strong, and in some cases pivotal or essential.

3.6 Participation of Under-Represented Groups and Perceived Barriers

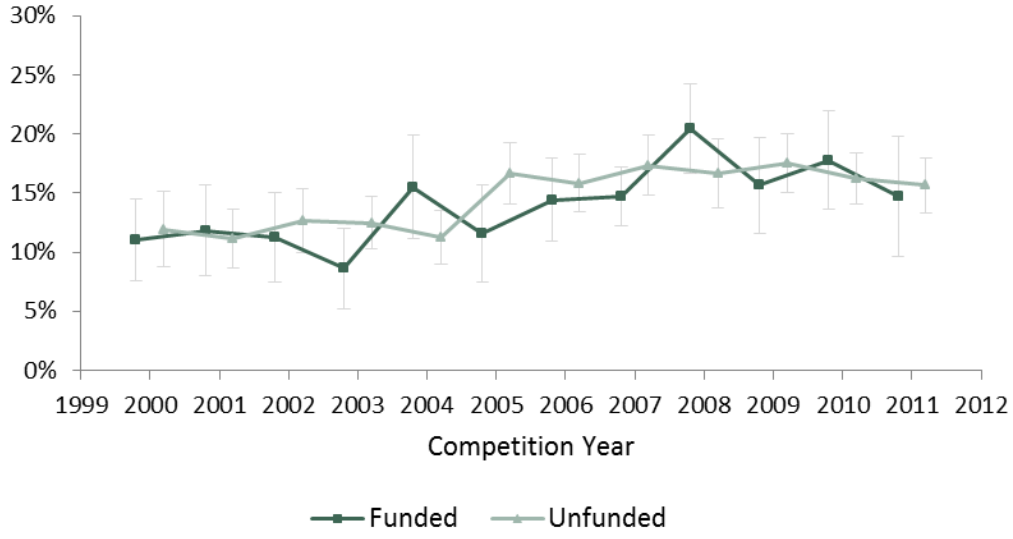
The identity factor does not seem to have an impact on access to funding and the data show an increased presence of women and visible minorities over the past decade. More non-funded applicants than funded applicants reported experiencing barriers. Gender, followed by identifying as a member of visible minority group and choosing French as the language of preference are the main barriers. However, there is no information available to better understand their precise nature or degree, except with regard to the language factor: researchers feel pressure to submit their applications in English so as not to reduce their chances of success. The ability of young female researchers to secure partnerships with industry while in the early stages in their careers was mentioned as an area where NSERC could take action. Finally, the lack of data on persons with disabilities and Indigenous people raises the question of "if" and "how" they could be better documented.

NSERC is committed to better understand the influence that identity factors may have on the applicants' ability to obtain funding, thus supporting the federal government's renewed commitment to gender-based analysis plus (GBA+). This form of analysis is used to examine the repercussions that a policy, program, initiative or service may have on diverse groups of men and women. It provides a better understanding of gender equality and diversity concerns. The evaluation focused on the participation of traditionally under-represented groups in the sciences and engineering: women, members of visible minorities, persons with disabilities, and Indigenous people. However, because too few respondents identified themselves with the latter two groups, so the analyses dealt essentially with gender and visible minorities. In addition, the official language chosen for submitting grant applications was analyzed separately. This last aspect should be treated with caution, because some researchers (essentially, Francophones) are submitting their grant applications in their second language.

3.6.1 Participation of Under-Represented Groups

The gender-based analysis of the administrative data does not show any significant differences in applicants' success rates (Figure 8). There is a significant difference in the proportion of female that received a grant as a function of the research area. The proportion of female is higher in Environment and in Biosciences (18%) than in Information and Communication (11%) or in Manufacturing (8%). All areas combined, the pool of candidates, dominated by men, is evolving very slowly. The impact of the importance of female role models was particularly emphasized in the case studies: "*It is important to provide role models for women and make sure that women know this is a field that is engaging and exciting and not gender sensitive.*" SPG-P Case Study HQP

Figure 8: Percentage of SPG-P Applications Submitted by Women: Funded Versus Unfunded 2001-2011



Source: NSERC's Award Management Information System (NAMIS) (n = 4,883)
Note: Years for funded and unfunded are the same. Dots are offset to reduce overlap.

Representation of visible minorities follows the same pattern. While they represent 10% of the applicants financed in 2000, their proportion is around 20% from 2005 and remains stable until 2011.

3.6.2 Barriers Perceived by Respondents from Under-Represented Groups

Four percent of funded researchers in the survey responded that their personal identity was related to moderate or significant barriers when applying for a Strategic grant.[12] This proportion is significantly higher for unfunded researchers (12%). Unfortunately, no additional information was provided to help contextualize what constitutes a high versus moderate barrier or why their personal identity was related to experiencing a barrier.

Barriers Related to Gender

Fifteen percent (15%) of the funded researchers responded that they experienced barriers attributed to their gender when applying for a Strategic grant (6% high barriers and 9% moderate barriers). A significantly higher proportion of unfunded female researchers (32%) responded that they experienced barriers attributed to their gender when applying for a Strategic grant (7% high barriers and 25% moderate barriers).

Barriers Related to Being Identified as a Member of Visible Minority

Researcher's survey data shows that 17% of the funded and unfunded researchers identified themselves as a member of visible minorities. Only 1% of the funded researchers responded having experienced high barriers related to their status. Significantly more unfunded researchers (11%) answered that high barriers encountered when applying for a Strategic grant were related to being part of a visible minority group. Approximately one in five funded and unfunded experienced moderate barriers related to their status.

3.6.3 The Language Factor

Chi square test showed that the percentage of applications made by French and English PIs did not differ significantly ($p = 0.73$) among funding statuses (around 11% French and 89% English; Table 4).

Table 4: Number of applications by the language preference of PI and by funding status (% by column)

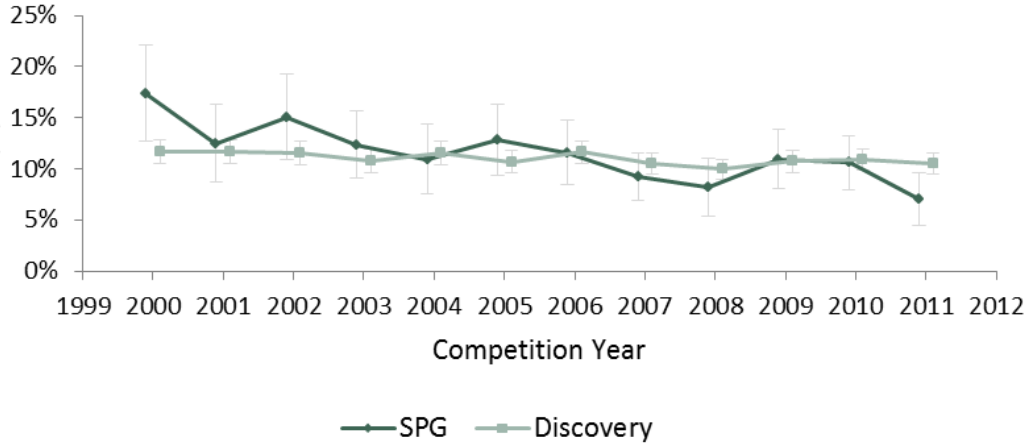
Language	Funded (n = 1540)	Unfunded (n = 3419)	Total (N = 4959)
French	10.9%	11.3%	11.2%
English	89.1%	88.7%	88.8%
Total	31.1%	68.9%	

Although the analysis of the language factor did not yield any significant results in terms of success rates, the proportion of proposals for which French is the applicant's preferred language

[12] The extent to which researchers experienced barriers was assessed via a 7-point scale, where 1 meant "absolutely no barriers" and 7 meant "significant barriers". The scale was collapsed into the following categories "High barriers" (6-7), "moderate barriers" (3-5) and "low barriers" (1-2).

has decreased over the past decade, and the trend becomes clearer when one compares Strategic Project Grants with Discovery Grants (Figure 9).

Figure 9: Percentage of Successful Applications for which French is the Applicant's Preferred Correspondence Language



Source: NSERC's Award Management Information System (NAMIS).

Note: Years for funded and unfunded are the same. Dots are offset to reduce overlap.

Even so, only 1% of funded and non-funded researchers responded that they experienced barriers attributed to language when applying for a Strategic Project Grant. Researchers could express themselves about barriers in an open-ended question, and there were recurring comments about; 1) the perception that the selection committees might not be sufficiently able to understand French; 2) the feeling that the choice of French may limit the pool of potential reviewers.

Also, although identity factors do not seem to influence applicants' ability to obtain funding, there are some perceived barriers, especially for women. In particular, the question of young female researchers' ability to secure partnerships with industry while they are in the early stages of their careers was mentioned in the interviews as an area where NSERC could take action.

Furthermore, the lack of data on certain groups prevents appropriate analyses, and the possibility and feasibility of rectifying this situation should be examined. Some respondents underscored the value of working with Indigenous researchers and communities, particularly in the environmental field, and also noted the lack of reliable data on the presence of Indigenous people in scientific fields.

3.7 SPG-P Operational Efficiency

Overall, it appears that the SPG-P funding opportunity is delivered in an efficient manner. A common measure of the operational efficiency of the NSERC grant programs is to assess the ratio of administrative expenditures[13] in relation to the total amount of grant expenditures (i.e. funds awarded). This ratio represents the cost to NSERC of administering $1 of grant funds. A funding opportunity's operational efficiency may also be presented as the percentage of administrative expenditures within the total expenditures for the funding opportunity. Table 5 presents the SPG Projects (SPG-P) administrative costs (operating expenditures). For this study, the costs associated with Services Provided to NSERC without charge[14] were not included in the calculation as they augment the operating costs while they were not actually expenditure. The Direct Salary amounts include the Employee Benefits Plan.

Table 5: SPG-P Expenditures (2011-2012 to 2015-2016)

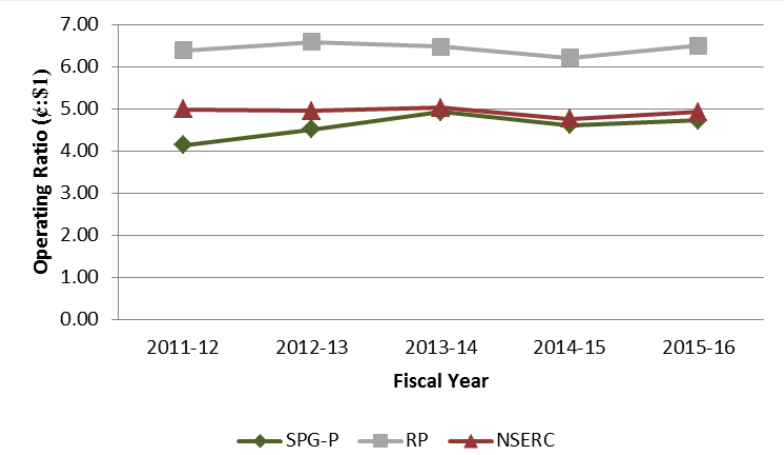
Expenditure Categories	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	Total
Administrative Expenditures	$2,018,312	$1,858,382	$1,698,531	$1,658,364	$1,698,773	$8,932,361
Total Direct Costs	$1,007,818	$943,331	$952,074	$972,778	$1,040,057	$4,916,058
Direct Salary	$860,133	$843,314	$850,783	$885,055	$934,818	$4,374,104
Direct Non-Salary	$147,685	$100,017	$101,290	$87,722	$105,239	$541,954
Indirect Costs	$1,010,494	$915,051	$746,457	$685,586	$658,716	$4,016,303
Grant Expenditures	$48,734,844	$41,219,587	$34,510,758	$36,000,622	$35,914,295	$196,380,106
Total Program Expenditures	$50,753,156	$43,077,969	$36,209,289	37,658,986	$37,613,068	$205,312,468
Operating Ratio (¢:$1)	¢4.14	¢4.51	¢4.92	¢4.61	¢4.73	¢4.55

[13] Administrative expenditures include the direct and indirect costs of administering the program. Direct costs include salary and non-salary expenditures, which relate to the adjudication of the award, post-award management, corporate representation and general administration of the Research Partnerships Directorate. Indirect costs include common administrative services for NSERC, such as Human Resources, Finance and Awards, IT, etc. Both direct and indirect costs are included in the total calculation of costs and estimated using the ratio of total SPG-P awards to total NSERC grant funds.

[14] Services provided to NSERC without charge consist of accommodations provided by Public Service and Procurement Canada, contributions covering the employer's share of employees' medical and dental insurance premiums provided by Treasury Board Secretariat, audit services provided by the Office of the Auditor General, etc.

The average cost to administer $1 of grant is 4.55¢. In comparison, the grants cost in RP is 6.55¢ for $1 of grant and 4.93 for NSERC. The operating expenditure as a percentage of total program expenditures for SPG-P is 4.4%, which is lower than the percentage for the Research Partnerships (6.0%) and similar to the ratio for NSERC (4.7%). In general, SPG-P is as cost-efficient as the NSERC overall grant programs and more cost-efficient than the Research Partnerships grant programs (Figure 10).

Figure 10: Operating Ratios for SPG-P, Research Partnerships and NSERC



Source: NSERC financial data

4 Main Findings and Recommendations

4.1 Conclusions

The Strategic Project Grants Meet a Real, Important Need.

In the current context, where supporting innovation has been recognized as a government-wide priority, SPG-P occupies a unique niche as one of the few funding opportunities to provide substantial funding for collaborative research that, because of its high-risk nature, might not otherwise be undertaken. It functions as a two-way bridge between discovery research and collaborative research with partner organizations and meets an important need for both researchers and partners.

The federal government and NSERC have a necessary role in delivering the Strategic Grants which is strongly aligned with the current federal government priorities, as well as objectives and expected outcomes outlined in the NSERC 2020 Strategic Plan.

The Strategic Project Grants Contribute to the Production and Use of Knowledge.

There is a broad dissemination of research and almost all researchers have shared the results of their project with partner organizations. Only in a very small number of cases research results not transferred to partners. Half of the partners had already used the results and another 20% were likely to use them in the future. There is a correlation between the use of project results and the time elapsed since they were produced, as it takes at least ten years or more before research results are used by partners.

The Strategic Project Grants Contribute to the Public Debate.

The evaluation showed that the funded projects are influencing public debates and that the knowledge they generate is being used by decision-makers. It is not unreasonable to expect any one project, on its own, to have a direct impact on public debates. However, producing credible scientific data is crucial. The contribution to public debates is influenced by three factors: 1) the presence of partners, who are involved in decision-making forums, accelerates the transfer; 2) researchers are not necessarily informed of or involved in the transfer process, and some feel that this is not their role; 3) having a large number of partners contributing to the project who have ties with organizations that contribute to decision-making supports the process of exercising influence and making recommendations. Many different stakeholders are involved, and not all of them come from public-sector organization. The time lapse between the availability of knowledge and its application varies. It is affected by various factors, such as policy priorities, the level of media coverage of a given issue, the existence of a triggering event, and the degree of public and pressure groups awareness. Measuring impact in the field of public policy is not easy, therefore it would be useful to reflect on the strategies to be implemented to better document it.

The Strategic Project Grants Support the Development of Industry Partners.

Measuring the SPG-P contribution to an economic gain for the private sector is proving challenging. Even more so as, obtaining a positive return on investment is not a specific goal of the SPG program, since most of the funded projects are relatively early-stages and high risk, both scientifically and commercially. However, the SPG program does focus on research that can at least potentially be used over the mid- or long-term for commercial or public good applications. Economic gain should be viewed more broadly than commercialization as it can encompass the

use of knowledge, the enhanced organizations' R&D receptivity or capacity and can also support a company's decision-making process. Participation in SPG-P contributed quite strongly to overall R&D receptivity and capacity, and to some extent to human or financial investments in R&D, but not more than unsuccessful SPG projects funded through other sources. Participation in SPG-P also contributed to an increase in the skills and knowledge base of the partner organizations; future business and/or R&D direction, with SPG-P results being used in decision-making about strategic business orientations; visibility in their sector was highlighted as very important to improve their competitiveness worldwide. Researchers were less likely to indicate that their research had resulted in intellectual property agreements, patents and licenses. This finding is consistent with the nature of high risk and early-stage research, which is generally less likely to produce IP that needs to be protected.

Under-Represented Groups Experience the Same Level of Success, but the Perception of Barriers Persists.

The identity factor does not seem to have an impact on access to funding and the data show an increased presence of women and visible minorities over the past decade. More non-funded applicants than funded applicants reported experiencing barriers. Gender, followed by identifying as a member of visible minority group and choosing French as the language of preference are the main barriers. However, there is no information available to better understand their precise nature or degree, except with regard to the language factor: researchers feel pressure to submit their applications in English so as not to reduce their chances of success. The ability of young female researchers to secure partnerships with industry while in the early stages in their careers was mentioned as an area where NSERC could take action. Finally, the lack of data on persons with disabilities and Indigenous people raises the question of "if" and "how" they could be better documented.

The Strategic Project Grants Support a Variety of collaborations and the Development of HQP.

Nearly half of the partnerships are the result of direct collaborations with the same partners in the past. These collaborations enhance both the synergies and the complementarities among the various disciplines and fields of expertise involved. This is of particular benefit for HQP. The amount of the contribution and the type of partner (public versus private) are important factors: when the contributions are above the median amount, or the partners come from the public sector, past collaborations are more common. A significant proportion of the collaborations are multidisciplinary. Multidisciplinarity occurs primarily in the natural sciences and engineering, and to a lesser extent in the social sciences. About one-third of the projects are also multisectoral. Collaborations were reported with 40 different countries. In the international partnerships, universities and university consortia played essential roles in bringing potential collaborators together and identifying opportunities for jointly funded work

HQP benefit from participation in SPG-P through being exposed to partners and acquiring both research and soft skills (although research skills to a greater extent), which is reported to have made positive effects on their career development. Experience working directly with partners, whether acquired through SPG-P or other funding, is pivotal to becoming more employable across the academic-industry continuum.

The Strategic Project Grants are Managed Effectively.

Overall, it appears that the SPG-P funding opportunity is delivered in an efficient manner. The cost-efficiency analysis revealed that the average cost to administer $1 of grant is 4.55¢. In

comparison, the grants cost in RP is 6.55¢ for $1 of grant and 4.93 for NSERC. The operating expenditure as a percentage of total program expenditures for SPG-P is 4.4%, which is lower than the percentage for the Research Partnerships (6.0%) and similar to the ratio for NSERC (4.7%). In general, SPG-P is as cost-efficient as NSERC's overall grant programs and more cost-efficient than the Research Partnerships' grant programs.

4.2 Recommendations

1. **The federal government should continue to fund Strategic Partnership Grants.** In the current context where supporting innovation has been recognized as a government-wide priority, Strategic Partnership Grants occupy a unique niche as one of the few funding opportunities to provide substantial funding for collaborative research that, because of its high-risk nature, might not otherwise be undertaken. In addition, Strategic Grants are NSERC's only source of funding that supports the development of public policy. It functions as a two-way bridge between discovery research and collaborative research with partner organizations and meets an important need for both researchers and partners. The federal government and NSERC have a necessary role in delivering the Strategic Grants which is strongly aligned with the current federal government priorities, as well as objectives and expected outcomes outlined in the NSERC 2020 Strategic Plan. It is therefore recommended that the SPG be continued, provided that funding longer-term, collaborative research projects and projects involving public sector partners continues to be a priority for NSERC.

2. **It is recommended that the program retain the requirement for partners from public organizations to actively participate in collaborative research, but the range of potential partners should be broadened to include organizations that are well positioned to use the research results and leverage them to strengthen public policy—for example, not-for-profit organizations or Northern communities.** The evaluation demonstrated that collaboration between academic researchers and government organization representatives is critical to public policy impact. It also showed that a wider range of stakeholders can contribute to public policy development. It may therefore be worthwhile to encourage other forms of collaboration and rethink the tools to be implemented in future to better document the nature and extent of the strategic projects' contribution to the public debate.

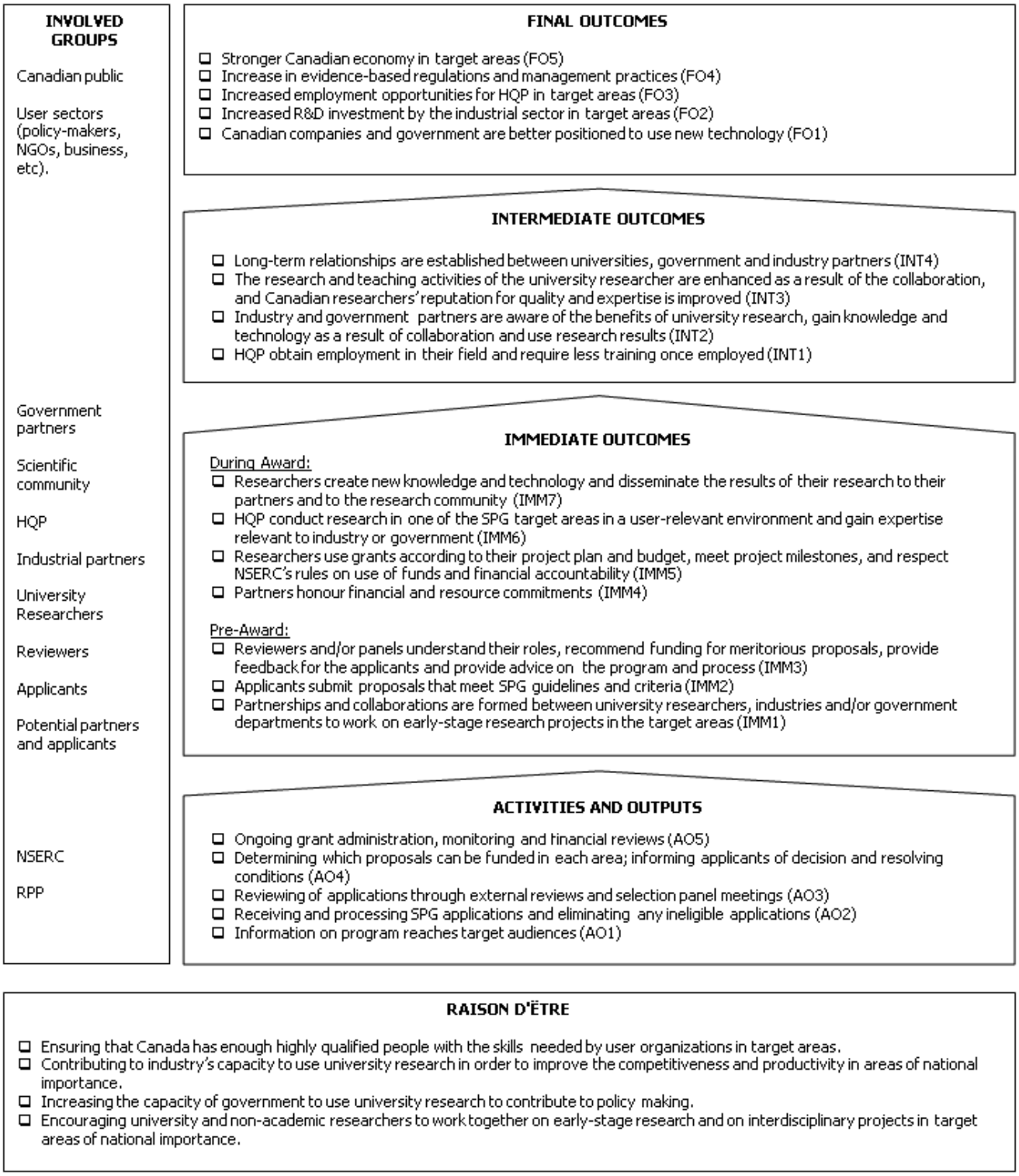
3. **The Research Partnership Directorate should consider how to best document and measure the influence of identity factors on an applicant's ability to obtain funding.** Although the evaluation did not reveal significant differences in the success rates of under-represented groups for which data are available, survey evidence suggest a perception that some barriers exist, particularly for women and to some extent for Francophone researchers. Also, the absence of data for Indigenous people and people with disabilities precluded an assessment of the extent to which they experienced identity-related barriers.

Appendix 1: Strategic Target Areas for SPG Projects during the 2000-2015 Period

2001-2003	• Biosciences • Environment and Sustainable Development • Information and Communications Technologies • Value-Added Products and Processes • New Directions
2004-2005	• Biosciences • Environment and Sustainable Development • Information and Communications Technologies • Value-Added Products and Processes
2006-2008	• Advanced Communications and Management of Information • Biomedical Technologies • Competitive Manufacturing and Value-Added Products and Processes • Healthy Environment and Ecosystems • Quality Foods and Novel Bioproducts • Safety and Security • Sustainable Energy Systems (Production, Distribution and Utilization)
2009	• Advanced Communications and Management of Information • Biomedical Technologies • Competitive Manufacturing • Healthy Environment and Ecosystems • Quality Foods and Novel Bioproducts • Safety and Security • Sustainable Energy Systems (Production, Distribution and Utilization)
2011-2015	• Environmental Science and Technologies • Information and Communications Technologies • Manufacturing • Natural Resources and Energy
2016-2017	• Advanced Manufacturing • Environment and Agriculture • Information and Communications Technologies • Natural Resources and Energy

Appendix 2: SPG-P Logic Model

The following diagram summarizes the SPG-P grant logic. A narrative description of each component follows.



Appendix 3: SPG-P Evaluation Matrix

Evaluation Questions	Indicators	Data Sources
1. Relevance: Continued need for program, alignment with federal government priorities, roles and responsibilities for the federal government		
1.1 To what extent are the objectives of SPG Projects aligned with NSERC's and Government of Canada's prior and current priorities, including the NSERC 2020 Strategic Plan?	1.1a Extent of alignment between the SPG-P funding opportunity objectives and Government priorities	• Document and Literature review
	1.1b Extent of alignment between the SPG-P funding opportunity objectives and priorities outlined in the NSERC 2020 Strategic Plan.	• Document and Literature review • Key informant interviews
1.2 What niche do SPG-Projects occupy in the Discovery to Innovation continuum?	1.2a Rationale for applying for SPG-P grants identified by researchers and partners who participated in multiple NSERC funding opportunities	• Survey of researchers • Survey of partners • Survey of unfunded researchers • Case studies
	1.2b Degree of fluidity in moving through funding opportunities toward Innovation: proportion of researchers who hold a Discovery Grant in the six years before and SPG project, and hold a CRD grant in the four years following that SPG project; case examples of sequencing across NSERC funding opportunities in the intended continuum.	• Administrative data analysis • Case studies
	1.2c Evidence of gaps in program landscape currently responding to challenges	• Document and Literature review • Case studies • Key informant interviews
2. Design and delivery		
2.1a To what extent have underrepresented groups (in terms of gender, Indigenous status, institution size and regional/linguistic distribution) participated in SPG Projects as researchers and partners?	2.1aa No. and % of participants in SPG Projects (partners, researchers, and HQP) representing the following categories and compared to NSE overall: • gender • Indigenous status • institution size • regional distribution • linguistic distribution • disciplines • industrial sector	• Survey of researchers • Survey of partners • Survey of unfunded researchers • Survey of HQP • Administrative data analysis
	2.1ab Comparison of gender ratio of applicants (successful and unsuccessful) with gender representation in NSE (disaggregated by	• Administrative data analysis

Evaluation Questions	Indicators	Data Sources
	disciplines)	
	2.1ac Extent and nature of barriers to participation in SPG Projects by underrepresented groups	• Survey of researchers • Survey of partners • Survey of unfunded researchers • Survey of HQP • Key informant interviews
2.1b What factors act as barriers and facilitators for researchers' and research partners' participation in SPG-P?	2.1ba Extent and nature of barriers/facilitators to participation in SPG Projects by private sector and government policy partners	• Survey of partners • Survey of unfunded partners • Key informant interviews
	2.1bb Extent and nature of barriers/facilitators to participation in SPG Projects by researchers 2.1bc Researchers' satisfaction with design and delivery features of SPG-P	• Survey of researchers • Survey of unfunded researchers • Key informant interviews
3. Effectiveness: Achievement of expected outcomes		
3.1 To what extent and how are the knowledge and technology created/generated through SPG-P grants used for private sector's economic gain?	3.1a Extent to which assumptions about partnerships are met • Partners include business units (not only internal R&D) • Funded research and partner teams have history of successful collaboration, high level of mutual trust, long-term engagement • Funded proposals were co-developed based on real need/opportunity seen from partner perspective & research teams understanding of how private sector / government actually operates	• Key informant interviews • Administrative data analysis • Case studies • Quantitative analysis of Final Reports
	3.1b Extent to which assumptions about funding environment are met • Partners find the risk/potential gain of investment ratio acceptable • Universities broker and support partnership • Applicant pool of partnerships finds program sufficiently attractive compared to alternatives at given moment • Application pool is not subject to disruption, displacement from other grants programs	• Key informant interviews • Case studies
	3.1c Extent to which assumptions about research conditions and processes are met • Long-term engagement of researchers with partners is maintained, over and above specific SPG • Ongoing HQP-trainee embedding with partner • Next-stage research conducted as necessary • Research results translated to potential products, processes, applications • Next-stage funders/partners are available, interested	• Case studies • Quantitative analysis of Final Reports

Evaluation Questions	Indicators	Data Sources
	• Partnerships engage with next-stage funders/partners toward product R&D, commercialization potential • Business opportunity continues to exist	
	3.1d Nature of impacts that SPG-P grants had on private companies: • Skills and knowledge base of organizations • Products and/or services • Processes and/or practices • Research and development capabilities • Productivity • Competitiveness • Ability to attract new investments • Future business and/or research direction • IP protection (patents, NDAs, confidentiality agreements, etc.) • Commercialization stage (licenses, spin-offs, etc.)	• Survey of researchers • Survey of partners • Key informant interviews • Quantitative analysis of Final Reports • Case studies
	3.1e Number and percentage of companies who report increase in company's R&D staff as a result of SPG Projects	• Survey of partners • Quantitative analysis of Final Reports
	3.1f Types of R&D expansion (e.g, commercialization R&D of specific SPG results; broader R&D expansion of the same line of R&D; pivot toward unexpected R&D area) as a result of SPG-P grants	• Case studies • Quantitative analysis of Final Reports
	3.1g Number and percentage of companies who report increase in company's R&D budget as a result of SPG Projects	• Survey of partners • Quantitative analysis of Final Reports
	3.1h Number and percentage of companies who report increase in company's sales as a result of SPG Projects	• Survey of partners • Quantitative analysis of Final Reports
	3.1i Number and percentage of companies who report increase in company's revenues as a result of SPG Projects	• Survey of partners
	3.ij Types of increase in growth as a result of SPG Projects	• Case studies
	3.1k Identified challenges/barriers related to effective use of SPG Projects for private sector	• Survey of partners • Case studies • Key informant interviews • Quantitative analysis of Final Reports
3.2 To what extent and how are the knowledge and technology created/generated through SPG	3.1a Extent to which assumptions about partnerships are met • Partners include policy/program implementation units (not only research) • Funded research and partner teams have history of successful collaboration, high level of mutual trust, long-term engagement	• Administrative data analysis • Case studies • Quantitative analysis of Final Reports

Evaluation Questions	Indicators	Data Sources
Projects used for government organizations to strengthen public policy?	• Funded proposals were co-developed based on real need/opportunity seen from partner perspective & research teams understanding of how private sector / government actually operates	
	3.1b Extent to which assumptions about funding environment are met • Partners find the risk/potential gain of investment ratio acceptable • Universities broker and support partnership • Applicant pool of partnerships finds program sufficiently attractive compared to alternatives at given moment • Application pool is not subject to disruption, displacement from other grants programs	• Key informant interviews • Case studies
	3.1c Extent to which assumptions about research conditions and processes are met • Long-term engagement of researchers with partners is maintained, over and above specific SPG • Ongoing HQP-trainee embedding with partner • Research results translated to potential policy solutions responsive to needs/opportunities and policy windows • Partnerships engage with appropriate spheres and mechanisms of policy influence through stakeholders • Social license exists for policy change	• Case studies • Quantitative analysis of Final Reports
	3.1d Examples and types of conceptual impacts (e.g.: contributing to the understanding of policy issues, reframing debates)	• Quantitative analysis of Final Reports • Survey of partners • Case studies • Key informant interviews
	3.1e Examples and types of instrumental impacts (e.g.: influencing the development of policy, practice or service provision, shaping legislation, altering behaviour)	• Quantitative analysis of Final Reports • Case studies • Key informant interviews
	3.1f Number and percentage of organizations reporting that projects funded through SPG-P resulted in initiating and/or strengthening public policy	• Survey of partners • Quantitative analysis of Final Reports
	3.1g Identified challenges/barriers related to effective use of SPG Projects to strengthen public policy	• Case studies • Quantitative analysis of Final Reports
3.3 What has been the impact of SPG projects on the training and employment of HQP?	3.3a Assessment of skills and experience (research and professional and international) acquired by HQP involved in SPG Projects	• Survey of HQP • Survey of partners • Survey of researchers • Case studies
	3.3b Assessment of match between HQP field of study, SPG experience and	

Evaluation Questions	Indicators	Data Sources
	current employment (i.e., job-readiness)	
	3.3c Number and proportion of HQP who are employed at partner organization and/or in a field or sector targeted by the SPG Projects	• Survey of HQP • Survey of partners • Survey of researchers
	3.3d Assessment of program contribution to HQP employment at partner organization and/or in field or sector targeted by network	
3.4 To what extent have SPG Projects facilitated multidisciplinary (including social sciences), multisectoral and international collaborations between the research community and partner organizations to address research challenges?	3.4a Number, type and characteristics of research collaborations (i.e., disciplines, size, research areas, etc.) established/maintained as a result of projects funded through SPG-P	• Administrative data analysis • Quantitative analysis of Final Reports • Key informant interviews
		• Survey of researchers and partners
	3.4b Extent to which SPG Projects have fostered collaborations (e.g., impact on type, nature and length of collaboration)	• Survey of researchers and partners
		• Key informant interviews
		• Case studies
	3.4c Perceptions of the effectiveness of research collaborations established and/or maintained as a result of projects funded through SPG-P	• Survey of researchers and partners
		• Key informant interviews
		• Case studies
4. Efficiency and Economy: Resource utilization in relation to the production of outputs and progress toward expected outcome		
4.1 To what extent are SPG Projects being administered (including promoting, awarding, managing, reporting) in the most efficient and economical manner?	4.1a Operating Ratio (¢:$1) (Operating Expenditures to Grant Funds Awarded)	• Financial administrative data review
	4.1b Operating Expenditure as a Percentage of Total Program Expenditures	

Appendix 4: Lines of Evidence

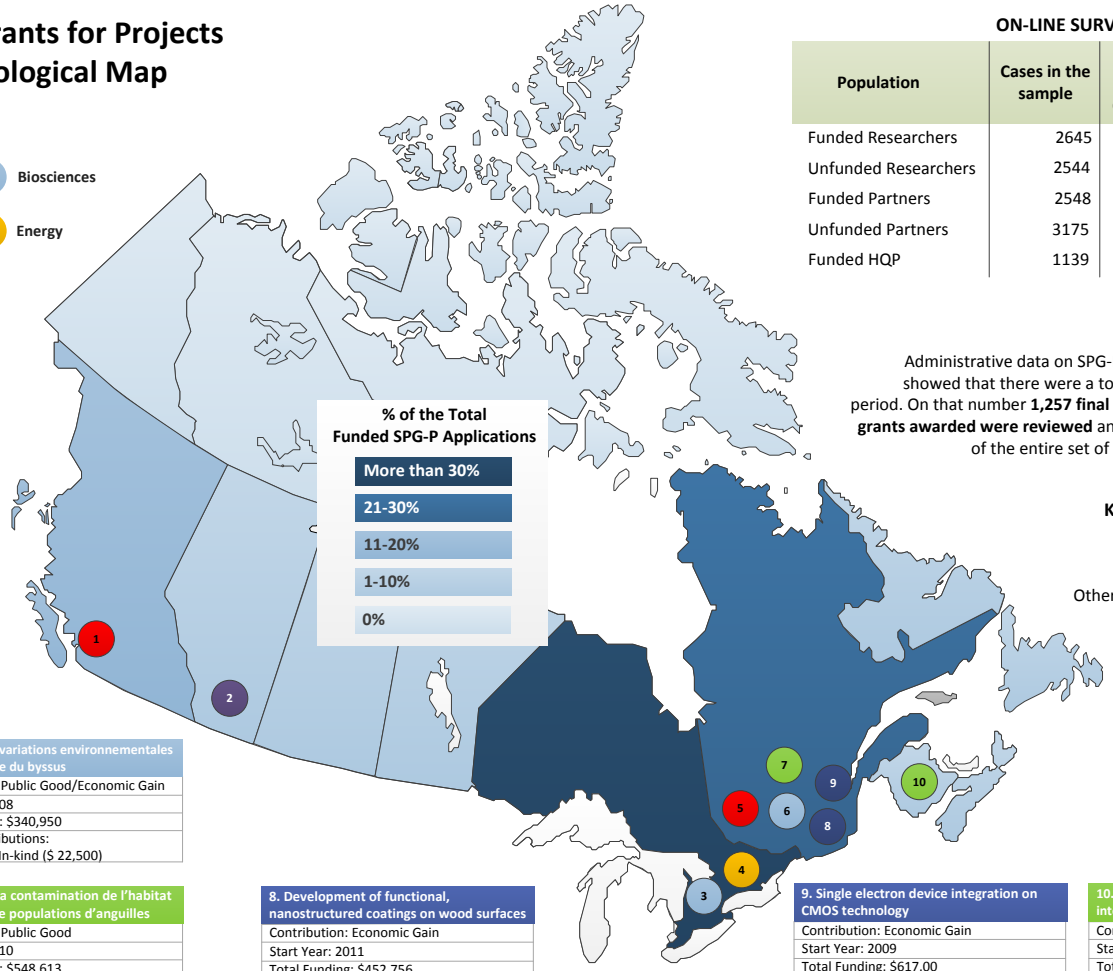
Lines of Evidence
Secondary data analysis
All 4,959 applications between 2000 and 2011, of which 1,540 (31%) were funded and 3,419 (69%) were non-funded. The NSERC Evaluation Division had to work with two SPSS data files: one used for the 2012 evaluation (containing data from 509 reports) and one for on-line reports available from the competition years covered in the evaluation available up to December 2016 (containing data from 748 reports). After creating consistent variables names, labels, and formats, these files were merged, retaining the original variables if their measurements (question or response format) had changed or otherwise retaining the original formats. Electronic and paper Final Reports submitted by researchers by 6 months post-grant. Analysis included all reports from 1,257 projects, funded between 2000 and 2011 and completed between 2003 and 2013, for which Final Reports were available (86% of grants awarded during this period).
Survey of researchers (funded and unfunded)
720 researchers who received an SPG-P grant completed between 2003 and 2013. The respondents were offered to respond about their earliest grant with which they were still familiar. Response rate: 27%. Margin of error: +/- 3%. 316 researchers who applied unsuccessfully for an SPG-P between 2000 and 2011 and never received a Strategic grant. The respondents were offered to respond about their earliest application with which they were still familiar. Response rate: 12%. Margin of error: +/- 5%.
Survey of partners (funded and unfunded)
260 partners (company, as well as government and not-for-profit organization representatives) in SPG projects completed between 2003 and 2013. Respondents were offered to respond about their earliest grant with which they were still familiar. Response rate: 10%. Margin of error: +/- 6%. 193 partners listed in applications for SPG-Ps submitted between 2000 and 2011, who were never part of a successful application. Respondents were offered to respond about their earliest application with which they were still familiar. Response rate: 6%. Margin of error: +/-7%.
Survey of HQP
130 undergraduate students, graduate students, and postdocs trained as part of successful Strategic projects completed between 2003 and 2013. The survey sample was developed based on a snowball sampling approach: survey invitations were sent to HQP who were identified by researchers included in the sample of funded applicants. Response rate: 11%. Margin of error: +/- 9% (the response rate was calculated on the basis of the number of HQP each researcher said they would forward the survey to).
Key informant interviews
20 telephone or in-person qualitative interviews with 23 individuals (initial target n= 30): Intended SPG beneficiaries in public policy and the private sector. Other funders in the SPG environment. Observers of research communities engaged in SPG. Host institutions (Universities and college eligible to receive SPG-P grants) NSERC staff and management.
Case studies
10 case studies of Strategic projects funded between 2006 and 2011. The cases were selected on the basis of several criteria expected to have been critical to the impact of the SPG on partners: previous successful collaboration history between partners and the PI and/or co-applicants; intention to pursue a collaboration after the end of the Strategic grant; and enabling a training environment for HQP in the partners' facilities. The case studies included document review and interviews with PI, researchers, partners and HQP. A total of 61 interviews were conducted (29 with researchers, 14 with partners, and 18 with HQP).

Appendix 5: Evaluation Methodological Map

Strategic Partnership Grants for Projects Evaluation Methodological Map

CASE STUDIES - Strategic Target Area

- Information and Communication
- Safety and Security
- Biosciences
- Environment
- Manufacturing
- Energy



1. IDEAS2.0: Integrative Data-Enabled Approaches to Sustainability across Scales
Contribution: Public Good/Economic Gain
Start Year: 2011
Total Funding: $452,760
Partner contributions:
In-cash ($ 0); In-kind ($ 743,960)

2. Development of multidimensional vulnerability analysis and risk mngt.
Contribution: Public Good/Economic Gain
Start Year: 2006
Total Funding: $277,000
Partner contributions:
In-cash ($ 145,000); In-kind ($ 171,000)

3. Genomic selection & association mapping of Atlantic salmon populations
Contribution: Public Good/Economic Gain
Start Year: 2005
Total Funding: $517,126
Partner contributions:
In-cash ($ 0); In-kind ($ 180,000)

4. Biochard as a soil amendment in northern forests
Contribution: Public Good/Economic Gain
Start Year: 2011
Total Funding: $549,800
Partner contributions:
In-cash ($ 0); In-kind ($ 195,000)

6. Impact des variations environnementales sur la structure du byssus
Contribution: Public Good/Economic Gain
Start Year: 2008
Total Funding: $340,950
Partner contributions:
In-cash ($ 0); In-kind ($ 22,500)

5. Millimeter Wave MIMO for emerging Wireless Communication Systems
Contribution: Public Good/Economic Gain
Start Year: 2011
Total Funding: $387,500
Partner contributions:
In-cash ($ 0); In-kind ($ 45,000)

7. Impact de la contamination de l'habitat sur la santé de populations d'anguilles
Contribution: Public Good
Start Year: 2010
Total Funding: $548,613
Partner contributions:
In-cash ($ 18,000); In-kind ($ 120,600)

8. Development of functional, nanostructured coatings on wood surfaces
Contribution: Economic Gain
Start Year: 2011
Total Funding: $452,756
Partner contributions:
In-cash ($ 13,044); In-kind ($ 231,000)

9. Single electron device integration on CMOS technology
Contribution: Economic Gain
Start Year: 2009
Total Funding: $617,00
Partner contributions:
In-cash ($ 0); In-kind ($ 245,515)

10. Modeling the environmental interactions in the Bay of Fundy ecosystem
Contribution: Public Good
Start Year: 2008
Total Funding: $500,773
Partner contributions:
In-cash ($ 0); In-kind ($ 117,000)

ON-LINE SURVEYS

Population	Cases in the sample	Cases who completed a questionnaire	Raw Response Rate
Funded Researchers	2645	720	27.2%
Unfunded Researchers	2544	316	12.4%
Funded Partners	2548	260	10.2%
Unfunded Partners	3175	193	6.1%
Funded HQP	1139	130	11.4%

SECONDARY DATA ANALYSIS

Administrative data on SPG-P applications and funded grants showed that there were a total of 1,464 funded grants in this period. On that number **1,257 final reports representing 86% of the grants awarded were reviewed** and provide a good representation of the entire set of grants awarded over this period.

KEY INFORMANT INTERVIEWS

NSERC staff	3
Other funders in the SPG-P environment	4
Host Institutions	4
Observers of research communities	5
Intended SPG-P beneficiaries	7

Appendix 6: References

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