

Table of Contents

Executive Summary.....	i
1. Introduction	1
1.1. NSERC’s Prizes: An Overview.....	1
1.2. Evaluation Questions.....	4
1.3. Methodology.....	5
1.4. Limitations.....	7
2. NSERC’s Prizes: Recognizing Canadian Achievements in the NSE ..	8
2.1. Why Prizes are Important	8
2.2. An Appropriate Role for the Federal Government	9
2.3. Scientific Prizes from Other Canadian Jurisdictions and Sectors	9
3. Design and Delivery of NSERC’s Prizes	10
3.1. The Value of NSERC’s Prizes	10
3.2. Selecting Prize Recipients and Increasing Diversity.....	11
3.3. Announcing Prize Recipients	12
3.4. Increasing the Scope of NSERC’s Prizes	13
3.5. Performance Monitoring and Reporting.....	14
4. Impacts of NSERC’s Prizes	15
4.1. Recognition of high performers and their achievements.....	15
4.2. Increased capacity: support for research and science promotion activities.....	17
4.3. Creating awareness of the value of research partnerships and collaborations.....	19
4.4. Career development of researchers & highly qualified personnel	20
5. Operational Efficiency of NSERC’s Prizes	22
6. Conclusion	23
7. Recommendations	25
Appendix A: Prizes Evaluation Matrix.....	27
Appendix B: Prizes Offered by Other Countries for Achievements in the NSE ..	29
Appendix C: References	31

Executive Summary

The Natural Sciences and Engineering Research Council's (NSERC) Prizes are designed to celebrate exceptional examples of research excellence, partnerships and/or science promotion within the Canadian natural sciences and engineering (NSE) community. In particular, they recognize a wide range of accomplishments from researchers at different stages of their careers, and highlight Canadian achievements in training, research, and innovation. This evaluation includes six of NSERC's prizes, which may be classified into the following categories:

- NSERC academic Prizes, in recognition of research excellence. This category of Prizes includes: the Gerhard Herzberg Canada Gold Medal for Science and Engineering; the E.W.R. Steacie Memorial Fellowships; the NSERC John. C. Polanyi Award; and, the Brockhouse Canada Prize for Interdisciplinary Research in Science and Engineering.
- NSERC Awards for Science Promotion, in recognition of individuals and groups who make an outstanding contribution to the promotion of science in Canada through activities encouraging popular interest in science or developing scientific abilities. Two recipients (one individual and one group) may be selected for the awards each year.
- Synergy Awards for Innovation, in recognition of collaborations that stand as a model of effective partnership between academia and industry, resulting in significant achievements in research and development.¹

NSERC's Prizes: Recognizing Canadian Achievements in the NSE

The evaluation confirms a continued need for NSERC's Prizes to celebrate Canadian research and innovation in the NSE. Scientific prizes are given to support the generation of new knowledge and innovations, and for solving problems. They are an "incentive system to produce the public good of knowledge" (Chan, Gleeson, & Torgler, 2013, p. 211) and are therefore expected to support long term economic growth. They are also recognized for raising the scientific profile of a country, its institutions and individual scientists resulting in increased productivity, opportunities for collaboration and greater attraction and/or retention of scientists.

NSERC is the main source of funding for NSE research in Canada and is therefore well placed to recognize Canadian achievements in the NSE through the provision of scientific Prizes. Such recognition places the NSE in the academic, political and public spotlight; thereby placing the NSE at the forefront of government policy and fostering a culture of science and innovation through the encouragement of more positive attitudes towards NSE. Additionally, NSERC's Prizes contribute to the development of Canada's workforce by generating opportunities for the

¹ In 2014, a category for colleges was added

career development of recipients and the student's they may hire using the funds from their Prize.

While other sources of scientific prizes recognizing research excellence, partnerships and/or science promotion in the NSE exist within Canada, NSERC's Prizes are often perceived to provide a higher level of prestige. Additionally, they are further distinguished as a result of their national scope, their consideration of all NSE disciplines, and/or by the rigorous peer-review process for selecting prize recipients. These distinguishing properties are considered to be important contributing factors to NSERC's realization of its objective of recognizing Canadian research and achievements in the NSE.

Design and Delivery of NSERC's Prizes

Overall, recipients are satisfied with the monetary value of NSERC's Prizes, which are considered sufficient to: entice credible and serious nominations; convey the prestige of the award; and, make a difference in terms of supporting researchers. The monetary values of NSERC's Prizes are also comparable to scientific prizes in other countries recognizing research excellence in the NSE². Additionally, the majority of recipients are also satisfied with the: length and scope of NSERC's Prizes; the guidelines on the use of funds; the timeliness of the decisions from the selection committees; the nomination process; and, the appropriateness of the selection criteria. Potential opportunities for improving the delivery of NSERC's Prizes include increasing the number of reports highlighting the impacts of specific Prizes submitted to NSERC by Prize recipients. This may be achieved by monitoring recipients at the end of their funding period to request the completion of the impact report and that this report is received, and/or by increasing the expectations around the reporting requirements for various Prizes.

Impacts of NSERC's Prizes

There is a strong indication that receiving an NSERC Prize increases the academic and/or organizational profile of recipients, at a national and/or international level, as well as the profile of their institution/organization. The profile of the industry partner(s) also tended to increase within the NSE community. Some recipients and key informants indicated that they would like to see more exposure of NSERC's Prizes and Prize recipients in the mass media. In the last few years NSERC's Communications Division has been actively engaged in the promotion of NSERC's Prizes, which has resulted in a significant increase in the number of media activities each year from 84 activities in 2011 to 181 activities in 2013.

Overall, it appears that receiving an NSERC Prize increased the capacity of recipients to engage in further research and/or science promotion activities. In particular, NSERC's Prizes were noted as contributing to research productivity, the pursuit of new directions or areas of inquiry,

² Examples of international scientific prizes are listed in Appendix B. A more comprehensive inventory of international prizes can be found on the Science.gc.ca website <http://science.gc.ca/default.asp?lang=En&n=9B434E5F-1>

research autonomy and the ability to access additional funding. The extent to which NSERC's Prizes contributed to opportunities for collaboration was moderate. The Synergy Award for Innovation however, was credited with increasing the recognition of academic-industry research and development (R&D) collaborations and the perceived benefits of successful collaborations within the NSE community. Industry partners also credit their collaborations with their academic partners with any increases in their organization's capacity, such as the development of new processes, tools and/or technologies.

NSERC's Prizes contributed to the career development of recipients, including greater opportunities to produce/engage in research outputs. They also contributed to the career development of highly qualified personnel (HQP), as the majority of recipients used their Prize funds to hire and train HQP. Additionally, HQP hired by researcher(s) who received a Synergy Award for Innovation often worked with industry partners, which provided opportunities to develop additional skills and in some cases employment by those partners.

Operational Efficiency of NSERC's Prizes

The operating ratio for NSERC's Prizes from fiscal year 2010-11 to 2013-14 is 15.21 cents for every \$1 of prizes awarded. While this is higher than the ratios for the two directorates which house NSERC's prizes: Research Grants and Scholarships (RGS) Directorate (4.24 cents) and Research Partnerships (RP) Directorate (6.56 cents); it is not entirely unexpected. Due to the limited number of Prizes awarded each year and the relatively smaller amounts of funding distributed through Prizes, in comparison with NSERC's other granting programs, as well as the additional cost of hosting the annual awards ceremony for Prize recipients the operating ratio for prizes is anticipated to be higher. In the last few years however, NSERC's Research Grants and Scholarships Directorate, Research Partnerships Directorate and Communications Division have made efforts to reduce the administrative expenditures of NSERC's Prizes, such as hosting selection committee meetings by videoconference and finding cost-saving measures for the awards ceremony. The impact of these efforts on the operating ratio for NSERC's Prizes will need to be examined further in future evaluations.

Recommendations

- 1. The findings from the evaluation illustrate the need for an explicit and cohesive set of intended outcomes for NSERC's Prizes.** While NSERC's Prizes are highly differentiated in terms of their eligibility criteria, value and objectives, the establishment of an organized set of intended outcomes for Prizes would support greater understanding of how they contribute to the priorities of the federal government and NSERC's strategic goals. This set of intended outcomes should reflect the common impacts across the six Prizes, such as recognition of high performers, increased capacity and career development (including HQP). It should also include the unique outcomes of individual Prizes, and/or of each category of Prizes, i.e. academic, science promotion and/or academic-industry collaborations.

2. **It is recommended that the current reporting requirements for NSERC's Prizes are examined to determine whether they are sufficient to meet the needs of the Council, and if not, how these requirements may be improved.** Reporting requirements exist for NSERC's academic Prizes and the NSERC Awards for Science Promotion for organizations; however, fewer than half of these Prize recipients submit the impact reports requested by the Council. Unlike other NSERC funding opportunities, Prizes are awarded for past achievements and recipients are not required to submit their impact report to be eligible for future grants and/or prizes. As a result, there may be fewer incentives for recipients to submit these reports. Without these reports however, Prizes' staff are limited in the extent to which they can assess and understand the impact of Prizes within the NSE research community.
3. **It is recommended that NSERC continue to work towards increasing the profile of its Prizes, and their respective recipients, using various communication tools including traditional mass media and social media.** Raising the profile of Prizes and recipients is important as Prizes are known to contribute to positive impacts on NSE research, including more opportunities for collaborations and career advancement, as well as increased capacity, such as receiving additional funds for future research. It was also noted by some Prize recipients and key informants that they would like to see more exposure of NSERC's Prizes and/or Prize recipients in the media, and that Prizes should be promoted more actively.

1. Introduction

This report presents the key findings, conclusions and recommendations from the evaluation of the Natural Sciences and Engineering Research Council's (NSERC) suite of Prizes. This evaluation includes six of NSERC's Prizes³ and covers the period from fiscal year 2003-2004 until 2013-2014. Goss Gilroy Inc. (GGI) conducted the evaluation in collaboration with NSERC's Evaluation Division. The purpose of the evaluation is to provide NSERC senior management with an assessment of the relevance, delivery and performance of Prizes. The evaluation is also designed to ensure that NSERC adheres to the requirements of section 42.1(1) of the *Financial Administration Act* and the Treasury Board *Policy on Evaluation* (2009)⁴.

1.1. NSERC's Prizes: An Overview

NSERC's Prizes are designed to recognize and celebrate exceptional examples of research excellence, partnerships and/or science promotion within the Canadian natural sciences and engineering (NSE) community. In particular, they recognize a wide range of accomplishments from researchers at different stages of their career, and highlight Canadian achievements in training, research, and innovation. Consequently, NSERC's Prizes differ from the Council's other funding opportunities as they recognize past achievements without stipulations for future practice. This evaluation includes six of NSERC's prizes, which may be classified into the following categories:

- NSERC academic Prizes, in recognition of research excellence. This category of Prizes includes: the Gerhard Herzberg Canada Gold Medal for Science and Engineering; the E.W.R. Steacie Memorial Fellowships; the NSERC John. C. Polanyi Award; and, the Brockhouse Canada Prize for Interdisciplinary Research in Science and Engineering.
- NSERC Awards for Science Promotion, in recognition of individuals and groups who make an outstanding contribution to the promotion of science in Canada through activities encouraging popular interest in science or developing scientific abilities. Two recipients (one individual and one group) may be selected for the awards each year.
- Synergy Awards for Innovation, in recognition of collaborations that stand as a model of effective partnership between academia and industry, resulting in significant achievements in research and development.

³ Only NSERC Prizes that continue to be awarded and that have been awarded for more than five years were included in this evaluation.

⁴ TBS (2009). *Policy on Evaluation*. Retrieved from: <http://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=15024>

The first two categories of Prizes are managed by NSERC’s Research Grants and Scholarships Directorate, while the Synergy Awards for Innovation are managed by the Research Partnerships Directorate. A detailed account of each prize, including their eligibility criteria, value, frequency and the number of awards given since fiscal year 2003-2004 is found in Table 1 below.

Table 1: Overview of NSERC’s Prizes, by category⁵

ACADEMIC/GERHARD HERZBERG CANADA GOLD MEDAL FOR SCIENCE AND ENGINEERING (hereafter referred to as the Herzberg Canada Gold Medal)

Eligibility: A scientist or engineer who is working at a Canadian university, government lab or private firm, whose research is primarily based in the fields of the NSE.

Recognizes: Someone who has demonstrated sustained excellence and influence in research for a body of work conducted in Canada that has substantially advanced the fields of the NSE.

Value: A gold medal and a grant of up to \$1 million distributed over five years. If the winner has an NSERC Discovery Grant, that grant is increased up to a maximum of \$200,000 for each of the five years.

Grant funds may be used for: Personal university-based research or to fund the research endeavors of others, e.g.: establishment of awards in his/her name.

Frequency: Awarded to one individual annually

Awarded since: 1991

Number awarded between 2003-2004 until 2013-2014: 11

ACADEMIC/E.W.R STEACIE MEMORIAL FELLOWSHIPS (hereafter referred to as the Steacie Fellowships)

Eligibility: Canadian scientists or engineers who are faculty members at Canadian universities, who graduated from a PhD less than 12 years prior and who hold an NSERC grant.

Recognizes: Early career scientists or engineers who have completed NSE research of international significance.

Value: A grant of up to \$250 000 (for the recipient) and \$90 000 (for the recipient’s university), over two years.

Grant funds may be used for: Release of teaching/administrative responsibilities (university), and direct costs of university-based research and/or enhancement of facilities (recipient).

Frequency: Awarded to six individuals annually

Awarded since: 1965

Number awarded between 2003-2004 until 2013-2014: 66

ACADEMIC/NSERC JOHN C. POLANYI AWARD (hereafter referred to as the Polanyi Award)

Eligibility: A Canadian scientist or engineer, or a team of predominantly Canadian researchers from government, industry, or academia, at least one of whom holds an NSERC grant.

Recognizes: Canadian-based, NSERC funded research that led to a recent outstanding advance within the NSE.

Value: A grant of up to \$250 000

Grant funds may be used for: Direct costs of university-based research and/or enhancement of facilities.

Frequency: Awarded to an individual or a team annually

Awarded since: 2006

Number awarded between 2003-2004 until 2013-2014: 8

ACADEMIC/BROCKHOUSE CANADA PRIZE FOR INTERDISCIPLINARY RESEARCH IN SCIENCE AND

⁵ The information included in this table reflects the criteria of the Prizes as they existed between fiscal years 2003-2004 and 2013-2014. It is possible that some criteria changed since 2013-2014, including the value of the Prize. Additionally, during this evaluation period not every Prize was awarded on an annual basis. For instance, the Polanyi Award was only founded in 2006.

ENGINEERING (hereafter referred to as the Brockhouse Canada Prize)

Eligibility: Canadian teams of researchers from different disciplines with at least two members who are independent and one of whom holds an NSERC grant. The majority of the team members must be employed at a Canadian university, public organization or private organization.

Recognizes: Outstanding Canadian teams of researchers from different disciplines who have combined their expertise to produce achievements of outstanding international significance in the NSE in the last six years.

Value: A grant of up to \$250 000

Grant funds may be used for: Direct costs of university-based research and/or enhancement of facilities

Frequency: Awarded to a team annually

Awarded since: 2004

Number awarded between 2003-2004 until 2013-2014: 9

NSERC AWARDS FOR SCIENCE PROMOTION

Eligibility: Individual and a group/organization who offer(s) informal science programs or science promotion activities for the general public.

Recognizes: Individuals and groups/organizations that make an outstanding contribution to the promotion of science in Canada through activities encouraging popular interest in science or developing scientific abilities.

Value: Awards of \$10,000 (for the individual) and \$25,000 (for the group/organization)

Award funds may be used for: Individuals may use their funds at their own discretion. Groups/Organizations must use their funds for future science promotion activities.

Frequency: Awarded to an individual and a group/organization annually since 2005. Prior to 2005, approximately five Prizes were awarded each year.

Awarded Since: 2001

Number awarded since between 2003-2004 until 2013-2014: 28⁶

SYNERGY AWARDS FOR INNOVATION (hereafter referred to as the Synergy Awards)

Eligibility: A team that includes partnerships between faculty member(s) from a Canadian university and a Canadian-based company with commercial activities in Canada.

Recognizes: Research collaborations between universities and industry, where NSE outputs lead to commercial benefits. In 2014, a category for colleges was added

Value: Prior to 2008-2009 a \$25,000 research grant for the principal nominee. Beginning in 2008-2009 the principal nominee received a \$200,000 research grant, and industry partners received the opportunity to hire a postdoctoral fellow through NSERC's Industrial R&D Fellowships, with NSERC paying for the partner's contribution (\$10,000 a year).

Grant funds may be used for Direct costs of research

Frequency: Three or more awards presented annually

Awarded since: 1998

Number awarded between 2003-2004 until 2013-2014: 57

Selecting Prize Recipients

A total of 179 NSERC Prizes were awarded between competition years 2003 and 2013, inclusive. The call for nominations for each Prize occurs annually between March and September, depending on the Prize. During the period examined for this evaluation, NSERC

⁶ NB: Prior to 2009 these awards were called the Michael Smith Awards for Science Promotion.

administrative data indicates that 1,549 nominations were received for all six Prizes and that 1,515 of these nominations were eligible. Almost half of the eligible nominations (46%) were for the Steacie Fellowships, which offers multiple awards each year. The other Prizes that received the most nominations were the Synergy Awards (19%), which also offer multiple awards per year and NSERC’s most prestigious award, the Herzberg Canada Gold Medal (15%).

The selection criteria vary for each Prize, and recipients are selected by committees of peers. Members of these committees are chosen based on their demonstrated prominence, leadership, impact and/or achievements in their discipline⁷. Selected recipients are informed of their success and asked to confirm their acceptance of the Prize. Recipients of each Prize are announced on the NSERC website, as well as in traditional and social media. The recipients of NSERC’s academic Prizes and Synergy Awards are also announced at an annual awards ceremony in Canada’s National Capital region, while the recipients of the NSERC Prizes for Science Promotion are announced and awarded in the region where the recipient is located.

1.2. Evaluation Questions

To measure the impacts of NSERC’s Prizes on the NSE community an “impact model” was developed in consultation with NSERC staff and management during the design phase of the evaluation. This model proposed four potential impact areas for NSERC’s Prizes based on their objectives, selection criteria and other documentation. The four potential impact areas are:

- Recognition of high performers and their achievements.
- Increased capacity: support for research and science promotion activities.
- Creating awareness of the value of research, partnerships and collaborations.
- Supporting the career development of researchers and highly qualified personnel (HQP).

Once finalized, the impact model informed the development of the evaluation questions, found in Table 2, and in particular questions pertaining to performance. The evaluation questions were also developed in consultation with NSERC staff and management, and address the core evaluation issues outlined in the Treasury Board *Directive on the Evaluation Function*.

Table 2: Evaluation Questions

Relevance: The extent to which NSERC’s Prizes address a demonstrable need, are aligned with federal government priorities and reflect an appropriate role for the government.

1. Is there a continued need for each NSERC Prize currently awarded?
2. Are NSERC’s Prizes aligned with the federal government’s priorities and NSERC’s strategic outcomes?
3. Is there a role for the federal government to fund and award Prizes in recognition of research excellence and to promote the NSE?

Design & Delivery: The extent to which NSERC’s Prizes are administered and delivered in their intended

⁷ Further details regarding the eligibility criteria, as well as the nomination and selection processes for each Prize are available on the NSERC website, http://www.nserc-crsng.gc.ca/Prizes-Prix/Index_eng.asp

manner and reflect best practices.

4. Is the design and delivery of NSERC's Prizes appropriate?

Performance: The extent to which NSERC's Prizes support progress towards expected impacts.

5. To what extent do NSERC's Prizes contribute to the recognition of high performers and their achievements?
6. To what extent do NSERC's Prizes contribute to the support of research and science promotion activities?
7. To what extent do NSERC's Prizes contribute to creating awareness of the value of research, partnerships and collaborations?
8. To what extent do NSERC's Prizes support career development?
9. What unintended outcomes, if any, resulted from NSERC's Prizes?

Efficiency and Economy: Resource utilization in relation to the production of outputs and progress towards expected impacts.

10. Are Prizes awarded in the most efficient and economical manner?

1.3. Methodology

Evaluating NSERC's Prizes required multiple lines of inquiry including: a literature review; a document and administrative data review; a web-based survey with recipients of one or more NSERC Prize; key informant interviews; interviews with industry partners; and, a cost-efficiency analysis. The six lines of inquiry used to conduct this evaluation are described in Table 3 below. To guide the data collection, a detailed evaluation matrix, including the evaluation questions, indicators and the sources of data was developed with NSERC staff and management. This matrix is found in Appendix A.

Table 3: Lines of inquiry used for the evaluation of NSERC's Prizes

Line of Inquiry	Team Members
<i>Literature Review (62 documents)</i>	
The findings contributed to answering evaluation questions pertaining to the relevance of NSERC's Prizes, as well as design and delivery. The review included 4 internal government documents and 58 external documents, such as literature regarding the value of prizes.	Evaluation Division
<i>Document and Administrative Data Review</i>	
Documentation from the federal government, NSERC and Prizes was reviewed including written impact reports submitted to NSERC by recipients of certain Prizes (n=44), which provided information regarding the outcomes and design and delivery of those Prizes. ⁸ Also, administrative data were examined, to provide evidence regarding program delivery including nominations, awards, and recipient profiles. Data from the media scans conducted by NSERC's Communications Division between 2010 and 2013 were also included in this evaluation.	Evaluation Division / GGI

NSERC Prizes Recipients Survey (n = 91; response rate 61%)

⁸ Since 2008, recipients of the NSERC academic Prizes and the NSERC Awards for Science Promotion given to organizations (known as the Michael Smith Awards for Science Promotion until 2009) were requested to provide NSERC with a 2 to 4 page impact report informing the Council of any accomplishments or breakthroughs resulting from the receipt of the Prize, which could be communicated on the NSERC website and in other promotional materials. Recipients are also asked to provide feedback and recommendations on the award program. Guidelines for the content of the impact reports are provided by the Council.

Results from the survey were used to inform arguments regarding the design and delivery, as well as the impact of NSERC's Prizes. The sample initially included 160 prize recipients ⁹ from 2003-2004 and 2013-2014, which was reduced to 149 recipients as contact information was missing for 11 recipients. A total of 91 recipients completed the survey, yielding a 61% response rate with a margin of error of +/- 6.4%. Table 4 below illustrates the distribution of survey respondents across NSERC's Prizes.	GGI
Key Informant Interviews (n = 11)	
The purpose of the key informant interviews was to acquire a strategic perspective regarding the relevance of NSERC's Prizes in Canada, the design and delivery of Prizes, as well as their impact(s). Nine interviews were conducted with 11 key informants from two stakeholder groups including: NSERC management and staff (n=6) and selection committee members (n=5).	GGI
Interviews with Industry Partners (n = 10)	
Interviews with industry partners that received a Synergy Award between 2008 and 2013 were conducted to acquire a better understanding of the impact(s) of receiving a Synergy Award within industry. Ten interviews were conducted with industry partners.	Evaluation Division / GGI
Cost-Efficiency Analysis	
This line of inquiry determined if NSERC's Prizes were delivered efficiently and whether economy was achieved. The most recent complete set of financial data available for this analysis includes the fiscal years 2010-2011 until 2013-2014. This set of data was provided by NSERC's Finance and Awards Administration Division. The analysis examined total administrative expenditures relative to grant expenditures for NSERC's Prizes.	Evaluation Division

Table 4: Profile of the Survey Sample

Prize	Initial Sample	Final Sample	Number of Responses	Response Rate
	160	149 ¹⁰	91	61%
Brockhouse Canada Prize ¹¹	9	7	5	71%
Steacie Fellowships	62	60	38	63%
Herzberg Canada Gold Medal	11	11	6	55%
Polanyi Award	7	6	5	83%
NSERC Awards for Science Promotion	10	10	6	60%
Synergy Awards ¹²	61	55	31	56%

⁹ In this case, recipient is defined as the individual or the member of a team designated to receive the NSERC Prize.

¹⁰ 162 recipients were originally identified, but there were two duplicate Prize recipients (i.e., individuals who were awarded more than one Prize). These recipients were asked to frame their responses in terms of the most recent Prize they received; thereby resulting in the initial survey sample of 160 recipients. Additionally, recipients whose contact information was unavailable were excluded from the sample.

¹¹ Note that while the Brockhouse Canada Prize is awarded to an interdisciplinary team, only the principal investigator of the team was included in the sample.

¹² Note that the Synergy Award recognizes academic-industry partnership. For this survey however, only academic partners were included in the sample.

1.4. Limitations¹³

While the evaluation benefitted from multiple lines of inquiry, there are several limitations to the evaluation data. These limitations were identified throughout the evaluation, and when possible associated mitigation strategies were employed to facilitate data collection and/or analysis.

Measuring the impacts of Prizes – NSERC’s Prizes do not have a logic model. Consequently, during the design phase of this evaluation, an “impact model” was developed to help articulate the potential impacts of NSERC’s Prizes. This model consisted of a high level analysis of impacts that could be generalized to most Prizes, but may not reflect the unique objectives of individual Prizes. The impact model was then used to guide the development of the evaluation questions. Evidence regarding the extent of these potential impacts on recipients, the NSE community and/or Canada are limited however, as most of the information collected throughout this evaluation is based on the self-declaration of a sample of Prize recipients and the perceptions of selection committee members, as well as NSERC staff and management. Awareness of NSERC’s Prizes by the general public was not documented due to the financial and time constraints of the evaluation.

The information available regarding media coverage of NSERC Prizes and recipients is largely unavailable prior to 2010 as data regarding media coverage was not archived until 2011. Additionally, there is little information within the academic literature regarding the impacts of scientific prizes on recipients and/or within the research community. Only a small number of studies investigated such impacts and the prizes included in these studies are often international awards, such as the Nobel Prize and the Fields Medal for Mathematics.

Survey sample size - Despite the 10 year scope of this evaluation, there is only a small number of NSERC Prize recipients. As a result, the sample for the survey of Prize recipients was quite small. To address the small sample size and facilitate analysis, survey results were grouped into three categories of Prizes: 1) NSERC academic Prizes; 2) the NSERC Awards for Science Promotion; and, 3) Synergy Awards. In addition to the limited sample size, it is possible that certain Prize recipients are unfamiliar with some of the changes to NSERC’s suite of Prizes that occurred in the last decade. Such changes include, but are not limited to: a significant increase to the monetary value of the Synergy Awards, as well as changes to the media coverage and awards ceremony for NSERC Prize recipients. Consequently, their responses may not reflect the current state of the NSERC Prizes included in this evaluation.

¹³ Limitations pertaining to the individual lines of inquiry are noted in the respective technical reports.

2. NSERC's Prizes: Recognizing Canadian Achievements in the NSE

The findings in this section of the report present evidence for the evaluation questions regarding the relevance of NSERC's Prizes. In particular, the findings highlight: the importance celebrating Canadian research in the NSE; that scientific prizes are likely to increase the quality and quantity of research within a country; that prizes create opportunities for collaboration; that NSERC's Prizes align with the priorities of the federal government and NSERC's strategic outcomes; and, that there is a niche for the federal government in recognizing research excellence and innovation within Canada's NSE community.

2.1. Why Prizes are Important

All respondents of the NSERC Prizes recipient survey and key informants agree that there is a continued need for NSERC's Prizes to celebrate Canadian research and innovation in the NSE. Scientific prizes are awarded to support the generation of new knowledge and innovations, and for solving problems (Kalil, 2006). They are an “incentive system to produce the public good of knowledge” (Chan, Gleeson, & Torgler, 2013, p. 211), and are therefore expected to support long term economic growth (Borjas & Doran, 2013). Scientific prizes are also recognized for raising the scientific profile of a country, its institutions and individual scientists (Blandin & Renar, 2003; Industry Canada, 2007; Commonwealth of Australia, 2010). Such recognition may in turn contribute to increased productivity (Stephan, 2012), the exploration of new areas of research (Borjas, & Doran, 2013), greater attraction and/or retention of scientists (Organisation for Economic Co-operation and Development, 2008), the receipt of additional prizes in the future (Merton, 1968; Zuckerman, 1996), and reducing barriers to publishing (Merton, 1988).

Prizes are also considered important for researchers trying to attract national and international opportunities for collaboration, as the number and prestige of prizes received may result in researchers being evaluated more favourably by their colleagues (Zuckerman 1996). By raising a researcher's profile and causing fellow researchers to view their work with greater esteem (Beals, Lalonde & Associates, 2012), prizes have been found to foster an increased number of opportunities for collaboration (Zuckerman, 1967). When coupled with media attention, such opportunities are further increased. Consequently, media attention is sometimes considered a contributing factor for future collaborations. As noted by an NSE researcher during a 2015 presentation to NSERC and the Social Sciences and Humanities Research Council (SSHRC) staff, winning a scientific prize and the accompanying media attention helped attract partners for future research.

2.2. An Appropriate Role for the Federal Government

NSERC is the main source of funding for NSE research in Canada and is therefore well placed to recognize Canadian achievements in the NSE through the provision of Prizes. Such recognition places the NSE in the academic, political and public spotlight; thereby supporting the federal government's commitment to "keep science, technology and innovation at the forefront of government policy" (Industry Canada, 2014). Additionally, NSERC's Prizes are believed to contribute to the career development of recipients and the HQP they may hire using the funds from these Prizes. Consequently, Prizes align and support the expected result of NSERC's People program, which is to ensure that "Canada's workforce has the required talented and skilled researchers in the NSE" (NSERC, 2015). Key informants therefore, perceive that NSERC's Prizes are appropriately situated within NSERC's Science and Engineering Promotion Sub-Program.

NSERC's academic Prizes recognize research excellence, the acknowledgement of which through public celebration is considered an essential contributing factor "to foster science interest and engagement, as well as positive attitude towards science" (Council of Canadian Academies, 2014, pg. 168). As such, NSERC's academic Prizes, and more specifically their role in increasing the visibility and profile of Canadian NSE research excellence are important contributors to the NSERC 2020¹⁴ strategic goal of fostering a science culture in Canada. This strategic goal is further strengthened by the NSERC Awards for Science Promotion which recognize efforts to encourage interest in and understanding of the NSE among the general public. Moreover, the collaborations encouraged through the Synergy Awards support the NSERC 2020 strategic goal of strengthening the dynamic between discovery and innovation. Prizes also support NSERC's organizational priority to build "a stronger culture of science, technology and innovation in Canada" (NSERC, 2015).

2.3. Scientific Prizes from Other Canadian Jurisdictions and Sectors

NSERC is not the only source of prizes recognizing research excellence, partnerships and/or science promotion in the NSE within Canada. Other national prizes recognizing research excellence include, but are not limited to: the annual Killam Prize for natural sciences; and, the Ernest C. Manning Innovation Awards for commercially viable innovations¹⁵. There are also various provincial prizes, such as fellowships and awards offered through the Ontario Centres of Excellence (OCE) and the ASTech Foundation in Alberta, as well as prizes offered through non-profit associations, such as the Canadian Society for Chemistry and the Council of Ontario

¹⁴ NSERC 2020 Strategic Plan Draft Discussion Document, http://www.nserc-crsng.gc.ca/doc/NSERC2020-CRSNG2020/NSERC_2020_ENG.pdf

¹⁵ A more comprehensive inventory of Canadian prizes can be found on the Science.gc.ca website <http://science.gc.ca/default.asp?lang=En&n=9B434E5F-1>

Universities. Given the number of prizes celebrating NSE in Canada, efforts are made to ensure that NSERC's Prizes do not duplicate other prizes. Additionally, efforts are made to ensure that NSERC's Prizes do not duplicate other Council funding opportunities and if they do those Prizes are discontinued. Prizes may also be discontinued when they no longer align with NSERC's priorities and/or receive insufficient nominations.¹⁶

Key informants indicated that NSERC's Prizes are often distinguished from other Canadian scientific prizes as they are perceived to provide a higher level of prestige. Similar sentiments were also noted by Prize recipients, the majority of whom indicated that NSERC's Prizes confer prestige (82%), are highly regarded (81%) and are well-known (71%) in the NSE community. Key informants further distinguish NSERC's Prizes as a result of their national scope, their consideration of all NSE disciplines, and/or by the rigorous peer-review process for selecting prize recipients. These distinguishing properties are considered to be important contributing factors to NSERC's realization of its objective of recognizing Canadian research and achievements in the NSE.

3. Design and Delivery of NSERC's Prizes

Overall, recipients are satisfied with the monetary value of NSERC's Prizes, which are comparable to prizes in other countries recognizing research excellence in the NSE. The majority of recipients are also satisfied with the: length and scope of NSERC's Prizes; the guidelines on the use of funds; the timeliness of the decisions from the selection committees; the nomination process; and, the appropriateness of the selection criteria. Potential opportunities for improving the delivery of NSERC's Prizes include addressing some of the challenges associated with the peer-review process and the reporting requirements for various Prizes.

3.1. The Value of NSERC's Prizes

Overall, the monetary value of NSERC's Prizes are appropriate with the majority of Prize recipients (85%) noting they were satisfied¹⁷ with the value of the prize they received. Prize recipients also appear satisfied with the guidelines on the use of the funds associated with NSERC's Prizes (88%), and the length of their Prize (83%). Additionally, key informants noted that the monetary values of NSERC's academic Prizes¹⁸ are sufficient to entice credible and serious nominations, to convey the prestige of the award and make a difference in terms of supporting researchers. In particular, the value of the Herzberg Canada Gold Medal was

¹⁶ The findings from this evaluation indicate that there is no evidence of overlap or duplication between the NSERC Prizes included in this evaluation and other NSERC funding opportunities or prizes, with the exception of the new scholarships for students and fellows. NSERC is however, currently modifying its suite of Prizes to reduce this overlap.

¹⁷ Using a 7 point Likert-type scale satisfaction includes scores from 6 to 7.

¹⁸ Brockhouse Canada Prize, Herzberg Canada Gold Medal, Steacie Fellowships and the Polanyi Award

considered very attractive and significant at up to \$1 million dollars over five years. While the monetary amount of NSERC's Prizes is an important contributor to determine the value of a prize, key informants further indicated that the prestige and recognition associated with Prizes are often more important.

Findings from the key informant interviews note that the monetary value of NSERC's Prizes is comparable to prizes in other countries recognizing research excellence in the NSE. An internet search confirmed that the monetary value of NSERC's Prizes is highly competitive with similar scientific prizes¹⁹. Examples of such scientific prizes are documented in Appendix B. Notably; most other countries with knowledge-based economies offer a suite of scientific prizes that are similar in many ways to NSERC's Prizes. Australia however, appears most closely aligned as the majority of the country's prizes are funded by the government and focus on recognizing excellence (Australian Research Council, 2015; Australian Government, 2015).

3.2. Selecting Prize Recipients and Increasing Diversity

In general, Prize recipients are satisfied with the selection process for NSERC's Prizes with 86% indicating they are satisfied with the timeliness of the decisions from the selection committees, 85% with the nomination process and 84% with the appropriateness of the selection criteria. While none of the Prize recipients indicated they were dissatisfied with the selection process, there were some suggested areas for improvement. For instance, it was noted that the limitation on the number of nominations per institution for the Steacie Fellowships makes it difficult for larger institutions to nominate all of their eligible researchers.

Overall, evidence from key informant interviews suggest that the peer-review process for selecting NSERC Prize recipients is effective with clearly defined evaluation criteria provided to the committee members, a relatively diverse committee membership and a consensus-based decision making process. There are however, some perceived concerns with the peer-review process noted by key informants including, but are not limited to: difficulties assessing applications from all specialty areas; not enough committee members to share the workload; difficulties communicating through videoconference; and, tight timelines, especially for the Synergy Awards. Additionally, while it was noted that the selection committees are relatively diverse some key informants have a perceived concern that engineers represent a much smaller proportion of peer-review committee members and believe such an imbalance places members of the engineering community at a disadvantage during the selection process and as a result they are discouraged from seeking nomination²⁰. A small number of key informants also voiced concerns regarding the challenges of recruiting female committee members, particularly for the Herzberg

¹⁹ Examples of international scientific prizes are listed in Appendix B. A more comprehensive inventory of international prizes can be found on the Science.gc.ca website <http://science.gc.ca/default.asp?lang=En&n=9B434E5F-1>

²⁰ For the last five years engineers represented 50% of the selection committee. Consequently, it is possible that this perception is based on the composition of the selection committee during the earlier years covered by this evaluation.

Canada Gold Medal. NSERC has policies related to diversity in its selection committees²¹ and takes steps to ensure diversity among committee members.

In addition, to the challenge of recruiting female committee members, key informants indicated that female researchers continue to be under-represented among nominees for NSERC's Prizes. During the period under study (2003-2004 until 2013-2014) the proportion of female nominees varies by NSERC Prize, from approximately 2% of nominees for the Herzberg Canada Gold Medal to 16% of nominees for the Steacie Fellowships. During the same time period, women received a total 12% of all NSERC Prizes including: 15% of the Steacie Fellowships; 13% of the Polanyi Awards; 11% of the Synergy Awards; 11% of the Brockhouse Canada Prizes; and 7% of the NSERC Awards for Science Promotion for individuals. There were no female recipients of the Herzberg Canada Gold Medal during this time period. While the proportion of female nominees and recipients are similar, they are significantly fewer women nominated for NSERC's Prizes as compared to their male counterparts.

When asked why women are under-represented among nominees for NSERC Prizes, the main reason provided by key informants was the general under-representation of women in NSE disciplines. In other words, because women represent a small proportion of researchers in the NSE, they will in turn represent a small proportion of nominees for scientific prizes. The literature available on this issue however, suggests that the under-representation of women among prize recipients may be attributed to structural barriers experienced by female researchers in relation to circumstances that greatly affect a researcher's ability to compete for prizes including: publishing; promotions; funding; and, access to research resources (Lincoln, Pincus, Koster & Leboy, 2012). Studies further indicated, that when these barriers are removed women and men show no difference in production and career mobilization (Ceci & Williams, 2011); yet such barriers continue to remain prominent in academia. Consequently, fewer women are awarded prizes in each tier of the scientific track (Bornman, Mutz, & Daniel, 2007). During the key informant interviews, it was speculated that women receive fewer nominations for NSE prizes because members of the NSE university faculties are not as familiar with nominating women and/or because women do not self-promote as much as men. This latter speculation is well supported in the literature examining why there are fewer female researchers nominated for scientific prizes (Rudman, 1998).

3.3. Announcing Prize Recipients

Once the recipients of NSERC's Prizes for a specific competition year are identified by the various selection committees and confirmed by Prizes' staff their names are submitted to NSERC's Communications Division. Staff within the Communications Division then contact

²¹ NSERC Guidelines Governing Membership of Selection Committees, http://www.nserc-crsng.gc.ca/NSERC-CRSNG/Policies-Politiques/committeemembers-membrescomite_eng.asp

Prize recipients and work closely with them to develop media products, such as videos, photographs and written profiles that will accompany the public announcement of the Prize recipients. This announcement occurs through a national news release the morning of the annual awards ceremony for Prize recipients. The Communications Division is also responsible for organizing this ceremony, including all of the travel arrangements for Prize recipients. In 2013, the awards ceremony was hosted at Rideau Hall where the Governor General of Canada, His Excellency the Right Honourable David Johnston, presented the Prizes.

The Communications Division contacts the academic institutions of the Prize recipients approximately one month prior to the awards ceremony to advise them of the success of one of their faculty members. This is done to facilitate public announcements and recognition of Prize recipients by providing sufficient time to the communications teams within those institutions to prepare their own media campaigns and outreach plans. Additionally, the Communications Division employs a centrally coordinated communications strategy just prior to the awards ceremony through which it provides these institutions with the various media products developed in collaboration with Prize recipients.

The NSERC Communications Division engages in a targeted monitoring of the media activities relating to NSERC's Prizes and their recipients for a period of seven to 14 days following the annual awards ceremony. Such media activities include: newspaper articles, online publications, news releases, institutional websites, as well as radio and television coverage. The Communications Division relies on four different sources²² to collect this data to ensure comprehensive coverage of the presence of NSERC's Prizes in the media. This is not however, an exhaustive accounting of all the media activities related to NSERC's Prizes and recipients for each competition year. It is possible that additional media activities occur after the 14 day window of the Communications Division targeted media scan and would be captured by the Communications Division daily monitoring of media activities related to NSERC and its funding opportunities.

3.4. Increasing the Scope of NSERC's Prizes

There is a high degree of satisfaction among Prize recipients regarding the scope of NSERC's Prizes. For instance, most NSERC academic Prize recipients and Synergy Award recipients (73%) agree that the Council's current suite of Prizes provide adequate coverage of key aspects of research excellence, such as multidisciplinary research, innovation, and academic-industry partnerships. The majority of Prize recipients (65%) also agree that NSERC's Prizes offer satisfactory recognition of researchers across the career spectrum.

²² These sources include: NewsDesk, a Government of Canada electronic media monitoring system; Cision Media Monitoring, which examines radio and television media; Google Search and Google News; and, Feedly, which is an aggregator application that compiles news feeds from a variety of online sources.

Despite this satisfaction, approximately a quarter of all Prize recipients (25%) believe that NSERC should create additional prizes. When asked to elaborate what kind of additional prizes, several recipients indicated that they would like to see more prizes for researchers that are mid-career, while a few others stated that they would like more prizes focused on promoting the NSE to the general public. Other suggested prizes include: prizes for doctoral students²³ or researchers in the early stages of their career; prizes directed towards entrepreneurial or commercialization achievements; prizes for specific NSE fields²⁴; and/or prizes that promote the recruitment of women in the NSE. Key informants were less inclined to support the creation of additional prizes as there were concerns that increasing the number of prizes may dilute the prestige of the current suite of Prizes.

3.5. Performance Monitoring and Reporting

Of the 60 Prize recipients²⁵ that participated in the survey and who received an NSERC Prize with a reporting requirement, almost all of them indicated they were satisfied with this requirement (92%). Currently only recipients of an NSERC academic Prize or an NSERC Award for Science Promotion given to organizations are asked to complete an impact report once the funding period for their Prize is complete. Each Prize has its own, unique impact report comprised of a series of open-ended questions aimed at understanding how the money associated with the Prize was used and the impact of the Prize on the research and/or the research community. While some questions may be similar across one or more reports, there is no common set of questions asked to all Prize recipients.

During the period of this evaluation 95 Prize recipients were asked to complete an impact report and 44 of these reports were received by NSERC. The majority (77%) of reports received were from recipients of a Steacie Fellowship, which provides the highest number of Prizes annually. The relatively low submission rates of these impact reports may be attributed to the fact that Prizes are awarded for past achievements and funds are not tied to the accomplishment of specific objectives. Consequently, there is no requirement for recipients to complete these reports, which are requested by the Council on a voluntary basis. Without these reports however, NSERC is limited in the extent to which it can understand the impact of its Prizes within the NSE research community.

Several key informants perceive the monitoring and reporting of the impacts of NSERC's Prizes as an area for improvement within the Council. In particular, it was suggested that NSERC monitor recipients more closely and have higher expectations for the reporting of products resulting from the receipt of a Prize. It is believed that such efforts will provide a better

²³ From 2002 until 2010 NSERC offered Doctoral Prizes for up to four students annually.

²⁴ The survey did not provide respondents with the opportunity to elaborate as to which specific fields.

²⁵ Synergy Awards do not have a reporting requirement; therefore, the 31 survey respondents that received a Synergy Award were not asked to provide a response regarding NSERC's reporting requirements.

understanding of the impact(s) of Prizes on future research, career development, as well as the design and delivery of NSERC's Prizes.

4. Impacts of NSERC's Prizes

There is a strong indication that receiving an NSERC Prize increases the academic and/or organizational profile of recipients, at a national and/or international level, as well as the profile of their institution/organization. The profile of the industry partner(s) also tended to increase within the NSE community. Overall, it appears that receiving an NSERC Prize increased the capacity of recipients to engage in further research and/or science promotion activities. The extent to which NSERC's Prizes contributed to opportunities for collaboration was moderate. The Synergy Awards however, are credited with increasing the recognition of academic-industry research and development (R&D) collaborations and the perceived benefits of successful collaborations within the NSE community. Additionally, NSERC's Prizes contributed to the career development of a little more than half of recipients. They also contributed to the career development of HQP, as the majority of recipients used the funds associated with their Prize to hire and train HQP.

4.1. Recognition of high performers and their achievements

NSE Researchers

Almost all recipients of an NSERC academic Prize and/or Synergy Award (88%) believe that receiving a Prize increased their academic profile and reputation in Canada. A majority of these Prize recipients also believe that receiving a Prize increased the profile of their academic institution (74%), as well as their international reputation as a researcher (59%). Only a third of all Prize recipients, however, perceive winning an NSERC Prize as contributing to increased opportunities of receiving another Canadian prize for their work/research (36%), with even fewer perceiving it as contributing to the receipt of an international prize (25%). The impact reports submitted by recipients of an NSERC academic Prize further highlight how recipients perceived the receipt of their Prize as increasing their visibility within the NSE community and in some cases contributed to the receipt of another scientific prize.

While Prize recipients are generally of the opinion that Prizes increase the profile of NSE researchers, key informants believe that more needs to be done to raise the profile of NSERC Prize recipients and/or, the NSE in general. When asked whether they received public recognition as a result of their Prize, almost all (95%) Prize recipients indicated that they participated in the annual awards ceremony hosted by NSERC. Three-quarters of all Prize recipients (75%) indicated that they received recognition from their institution or department. Findings from the key informant interviews indicate that such recognition includes, but is not

limited to: media releases, and/or publishing articles institutional and/or local newspapers; posting information on the institution's website and social media channels; and/or hosting an event celebrating the Prize recipient(s) and their research. Additionally, 16% of all Prize recipients received recognition by industry, while 8% received recognition from science educators and/or a science promotion organization.

Just over a third of Prize recipients (37%) indicated receiving recognition for their Prize in the mass media following the receipt of their Prize. It was also noted by some Prize recipients and key informants that they would like to see more exposure of NSERC's Prizes and/or Prize recipients in the media, and that Prizes should be promoted more actively. Data provided from the Communications Division regarding the number of media activities occurring within the 14 day window following the annual awards ceremony indicates that in 2010 the number of media activities was quite low at only 24 activities. However, the number of activities increased significantly in the following years with 84 activities in 2011, 107 activities in 2012 and 181 activities in 2013. This increase is attributed to some of the changes that occurred within the Division to increase the profile of NSERC's Prizes in the mass media.

For instance, during fiscal year 2009-2010 it was determined that it would be more efficient to have one, large awards ceremony for NSERC's Academic Prizes as it would allow the Communications Division more time and resources to develop a comprehensive communications strategy to accompany the ceremony. The Synergy Awards were included in this larger ceremony the following fiscal year, 2010-2011²⁶. Additionally, in 2013 the Communications Division began working closely with key media outlets in the weeks leading up to the awards ceremony to facilitate media interviews with the recipients and provide media products to help these media outlets prepare stories on the NSERC Prizes and their recipients. However, the extent to which these changes had an impact on the recognition of NSERC Prizes and their recipients is difficult know as they occurred at the end of the evaluation period, 2003-2013. Consequently, the next evaluation of NSERC's Prizes should include a more thorough examination of the differences in media activities prior to and following the changes implemented by the Communications Division in 2011 and 2013, as well as the perspectives of newer Prize recipients regarding media coverage following the receipt of their Prize.

Industry Partners

A little less than half of the industry partners who were interviewed indicated that their organization's receipt of a Synergy Award was recognized within the media. Recognition included, but was not limited to: newspaper articles and/or press releases; radio announcements and/or interviews; and a magazine article. All industry partners were however, recognized at the annual ceremony for recipients of NSERC's Prizes and several partners noted enjoying the

²⁶ The NSERC Award for Science Promotion is not awarded at the annual ceremony for NSERC Prize recipient, but is awarded in the region where the recipient is located through a regional announcement.

opportunity to meet with the Governor General. In some cases industry partners also received recognition from their organization as their receipt of the Synergy Award was announced through various forms of internal communications, such as the company's website, newsletters, board of directors meeting, etc.

Science Promotion

The majority (83%) of recipients of an NSERC award for Science Promotion who participated in the recipients survey believe that receiving this Prize increased their and/or their organization's profile in Canada. None of the recipients however, indicated that this Prize had a meaningful impact on their and/or their organization's international profile. In terms of raising the profile of NSE among the general public, half (50%) of the recipients of an NSERC Award for Science Promotion completely agreed that their Prize contributed to increasing the audience for their science promotion activities/events. In particular, they had access to more classrooms and/or larger venues, as well as greater attendance by groups traditionally under-represented in the NSE, such as girls and Aboriginal youth. The perceived contribution of the NSERC Award for Science Promotion towards increasing the audience of science promotion activities was echoed within the impact reports submitted by Prize recipients. The NSERC Award for Science Promotion however, did not appear to have a significant impact on broadening the audience to include residents from rural and/or remote areas.

4.2. Increased capacity: support for research and science promotion activities

Within the NSE community

Overall, it appears that receiving an NSERC academic Prize or Synergy Award helped increase the research capacity of recipients, as well as their outputs within the NSE community and/or industry. In particular, the majority of these Prize recipients agree that their NSERC Prize increased their productivity as a researcher (78%) and enabled them to pursue new directions or areas of inquiry in their research (66%). Additionally, receiving an NSERC Prize increased the research autonomy and independence of approximately half of these recipients (53%), while just over a third (36%) felt it increased their access to leading edge or custom instruments, tools, equipment, or technology. Only a very small proportion (11%) indicated that receiving their Prize enhanced their capacity to obtain patents or other commercial outcomes.

About half of all Prize recipients²⁷ (48%) indicated that receiving their Prize increased their ability to access additional funding to conduct their research or engage in outreach and/or science promotion activities. Additionally, recipients indicated that their Prize funds may have been used to enhance capacity in one or more of the following ways:

²⁷ Including recipients an NSERC academic Prize, NSERC Award for Science Promotion and/or Synergy Award.

- Other research operating costs (55%)
- Conference attendance (55%)
- Salary costs of research staff (45%)
- Purchase of research instruments and tools (44%)
- Establishing/maintaining collaborations (32%)
- Salaries of other staff within the department to provide the recipient with release time from teaching and/or administrative responsibilities (29%)
- Enhancement of research facilities (23%)
- Expansion of science promotion activities (10%)²⁸

The impact reports submitted by Prize recipients illustrate examples of the impacts of Prizes on research capacity including how Prizes led to advancements and new discoveries by providing recipients with the resources²⁹ to focus on their research, as well as opportunities to explore new research areas. At times these explorations resulted in breakthroughs having a significant impact on the direction of research in a specific area; which in turn, increased the NSE community's interest in the recipient's research. Several impact reports also highlight how receiving an NSERC Prize increased the recipient credibility within the NSE community, which subsequently increased their opportunities to secure additional and/or future funding.

Evidence from the key informant interviews also highlights the impact of Prizes on research capacity. In particular, it was noted that Steacie Fellowships support research capacity development by providing direct financial support, through the academic institutions, towards the recipient's salary for two years, which releases the recipient from administrative and teaching responsibilities so they may focus on their research. The value of having this administrative and teaching release is well documented by the recipients of a Steacie Fellowship who submitted their impact report. As noted by one recipient:

“The relief from teaching and administrative duties had an immense impact on my research (...) I was able to spend at least an extra 80 hours per month on my research (...) I was able to be more mobile throughout the year which is very important to conduct field work (...) I spent a significant amount of time travelling to field sites and visiting collaborators to further develop the research projects. I spent a great deal of time with my students working directly with them. I feel this was an excellent training ground for HQP”.

²⁸ 50% of recipients of an NSERC Award for Science Promotion indicated that they used the funds from their Prize towards the expansion of science promotion activities. However, this type of enhanced capacity is not generally applicable to the other Prizes and for this reason represents only a small proportion for NSERC's Prizes overall. A third of recipients (33%) of an NSERC Award for Science Promotion who participated in the recipients' survey were able to develop new materials, events and/or tools to enhance the accessibility and relevance of science to their audiences using the funds of their NSERC Prize.

²⁹ Resources included time to conduct the research through a reduction of teaching and administrative duties.

Within Industry

While the receipt of a Synergy Awards was noted by industry partners as generating positive feelings within the organization, such as pride and increased motivation, industry partners that received a Synergy Award were unable to directly attribute any increases in organizational capacity to the receipt of their Prize. They did however, link increases in their organizational capacity to their collaborations with university partners because these collaborations often resulted in the employment of new processes, tools and/or technologies, and/or engagement in new research activities.

4.3. Creating awareness of the value of research partnerships and collaborations

NSERC supports partnerships and collaborative efforts among the various members of the NSE community, including academia and industry, as well as across NSE disciplines.³⁰ In acknowledgment of such efforts, the Council offers two Prizes for outstanding accomplishments resulting from collaborations: (1) the Synergy Awards for academic-industry partnerships; and, (2) the Brockhouse Canada Prize for interdisciplinary teams of Canadian researchers. Recipients of other NSERC Prizes may also engage in collaborations throughout their research and/or science promotion efforts; however, such collaborations are not explicitly required.

As illustrated in Table 5 below, almost half of all Prize recipients (43%) agree that receiving an NSERC Prize created more opportunities for them to collaborate with other members of the NSE community, within and outside of Canada. A slightly smaller proportion (41%) indicated that their Prize contributed to collaborations with multidisciplinary teams, while a quarter of recipients indicated that receiving a Prize created more opportunities to collaborate with Canadian industry/ies. With regards to collaborations with Canadian industry/ies, half of the recipients of a Synergy Award indicated that their Prize contributed to more opportunities for such collaborations; thereby, suggesting that receiving this Prize provides opportunities for new collaborations and/or ongoing collaborations with industry partners. Opportunities for collaboration resulting from the receipt of an NSERC Prize were also well documented in the impact reports submitted by Prize recipients.

³⁰ NSERC 2020: A Strategic Plan. http://www.nserc-crsng.gc.ca/doc/NSERC2020-CRSNG2020/NSERC_2020_ENG.pdf

Table 5: The proportion of Prize recipients who experienced opportunities for collaboration(s) following the receipt of their NSERC Prize, disaggregated by category of Prize

Receiving an NSERC Prize contributed to...	Total Prize Recipients (n = 91)	Academic Prizes (n = 54)	Synergy Awards (n = 31)	NSERC Awards for Science Promotion (n = 6)
Creating more opportunities for me to collaborate in Canada	43%	52%	32%	17%
Creating more opportunities for me to collaborate outside of Canada	43%	59%	19%	17%
Creating more opportunities for me to collaborate with multidisciplinary teams	41%	44%	32%	17%
Creating more opportunities for me to collaborate with Canadian industry	25%	11%	52%	17%

Source: NSERC Prize recipients survey

Within Industry

As previously noted, NSERC’s Prizes are widely recognized for raising the profile of individual researchers and/or their institution. Additionally, the majority of Synergy Award recipients agree that receiving this Prize increased the recognition of academic-industry research and development collaborations within their institution (81%), as well as the profile and perceived benefits of successful academic-industry research and development collaborations within the NSE community (77%). When asked how receiving a Synergy Award had an impact on their organization’s collaboration with academia, several industry partners spoke about the benefits³¹ of collaborating with academia; however, they could not specifically attribute these benefits to the Synergy Award.

4.4. Career development of researchers & highly qualified personnel

Prize Recipients

NSERC’s Prizes appear to have a positive impact on career development, as 58% of Prize recipients agree that receiving a Prize resulted in a promotion or other forms of career advancement within their institution. Of this 58% of recipients, just over half (55%) were recipients of a Steacie Fellowship. This is not surprising given that this Prize is awarded to researchers in the earlier stages of their career so they may devote the majority of their time and energy to research.

In certain cases, receiving an NSERC Prize was noted as contributing to greater opportunities to produce/engage in research outputs, which in turn is likely to benefit the recipient’s career.

³¹ The benefits of working with academia included: improved operations and products; demonstrations of innovation; pride in their accomplishments; and, more opportunities for collaboration.

Examples of research outputs resulting from the receipt of an NSERC Prize, as noted by Prize recipients include invitations: to speak at a conference or a science-related event (48%); to speak at public events/venues (25%); for prestigious appointments to committees, academic organizations or scientific initiatives (18%); to speak at science-related events for youth (16%); and/or, to join (a) board(s) of directors (7%). Additionally, about half (48%) of NSERC academic Prize and Synergy Award recipients perceive winning an NSERC Prize as increasing their ability to publish in peer-reviewed journals. Findings from the key informant interviews and the impact reports support the assertion that the receipt of an NSERC Prize supports the career trajectory of recipients. In particular, the impact reports provide examples of how receiving an NSERC Prizes resulted in the publication of papers in international journals, invitations to speak at international and national conferences, and/or opportunities to (co-) organize a conference or workshop.

HQP

Of the 85 Prize recipients who received an NSERC academic Prize or Synergy Award, 80% indicated that they used the funds associated with their Prize to hire and train at least one highly qualified personnel (HQP); thereby, supporting HQP career development. In general, almost all NSERC academic Prize recipients hired at least one postdoctoral fellow (96%), PhD student (92%), and/or master’s student (90%), while 79% hired at least one undergraduate student. Synergy Award recipients were also more likely to hire a graduate student and/or a postdoctoral fellow. The average number of PhD students trained across both categories of Prize recipients was 2.3, while the average number of postdoctoral fellows was 2.9. The breakdown of the proportion and types of HQP hired and trained per category of Prize is illustrated in Table 6 below.

Table 6: The proportion of HQP hired by NSERC academic Prize and Synergy Award recipients, disaggregated by type of HQP and category of Prize

HQP	Academic Prizes (n = 48)	Synergy Awards (n = 20)
Postdoctoral Fellow	96%	60%
PhD	92%	70%
Master’s	90%	65%
Undergraduate	79%	40%

NB: It is possible that respondents hired more than one type of HQP; therefore the groups listed above are not mutually exclusive.
Source: NSERC Prize recipients survey

Many of the impact reports submitted by Prize recipients discussed the benefits of using Prize funds to employ HQP. These benefits were often two-fold as the HQP’s received opportunities to engage in research projects and develop their skills, while researchers were able secure resources to help further their research. Additionally, several recipients of a Steacie Fellowship noted their ability to provide HQP with more intensive training as the recipient is released from teaching and

administration responsibilities and therefore has more time to devote to HQP training. In the case of the Brockhouse Canada Prize, HQP were also given the opportunity to work within an interdisciplinary team of researchers.

The career development of HQP also featured prominently in several interviews with industry partners. In particular, partners indicated that HQP working with the researcher(s) with whom the industry partner collaborated were quite involved in the collaborative research project and were considered a valuable resource. It was further indicated that HQP were specifically involved in the development of tools, processes and/or technologies that resulted from this collaboration. Consequently, HQP also had an opportunity to learn and develop their skills. As noted by one partner, “One of the most important aspects of our partnership is our relationship with McMaster University and getting students to work with us. This is an important source of future advanced students and it helps them develop for their career”. In some cases, HQP were hired by industry partners following the end of the project and/or collaboration.

5. Operational Efficiency of NSERC’s Prizes

Demonstration of efficiency and economy is one of the core issues stipulated in the Treasury Board Secretariat’s Directive on the Evaluation Function. It is defined as “assessment of resource utilization in relation to the production of outputs and progress toward expected outcomes”.³² As such, the common measure of the operational efficiency for all NSERC funding opportunities is to assess the ratio of administrative expenditures³³ in relation to the total amount of grant expenditures, in this case Prizes awarded. This operating ratio represents the cost for NSERC of administering \$1 of a specific grant. A funding opportunity’s operational efficiency may also be presented as the percentage of administrative expenditures within the total program expenditures.

As presented in Table 7 the overall operating ratio for NSERC’s Prizes from fiscal year 2010-11 to 2013-14 is 15.21 cents for every \$1 of prizes awarded. While this is higher than the ratios for the two directorates which house NSERC’s prizes: Research Grants and Scholarships (RGS) Directorate (4.24 cents) and Research Partnerships (RP) Directorate (6.56 cents); it is not entirely unexpected. Due to the limited number of Prizes awarded each year and the relatively smaller amounts of funding distributed through Prizes, in comparison with NSERC’s other granting programs, as well as the additional cost of hosting the annual awards ceremony recognizing Prize recipients the operating ratio for prizes is anticipated to be higher.

³² TBS (2012). Directive on the Evaluation Function. Retrieved from: <https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=15681>

³³ Administrative expenditures include both 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 NSERC Directorates. In the case of NSERC’s Prizes, direct costs also include the costs associated with the annual awards ceremony recognizing Prize recipients, which is organized by the Communications Division. Indirect costs include common administrative services for NSERC, such as Human Resources, Finance and Awards, IT, etc.

Table 7: Operating expenditures for NSERC’s Prizes from 2010-11 until 2013-14

Fiscal Year	Administrative Expenditures	Grant Expenditures	Administrative Expenditures per \$1 of Grant Expenditures	Administrative Expenditures (% of Total Cost)
2010-11	\$401,817	\$2,657,653	¢15.12	13.1%
2011-12	\$410,516	\$2,746,953	¢14.94	13.0%
2012-13	\$380,800	\$2,515,500	¢15.14	13.1%
2013-14	\$388,526	\$2,482,000	¢15.65	13.5%
Overall	\$1,581,659	10,402,106	¢15.21	13.2%

Source: Finance and Awards Administration Division, NSERC

It should be noted that in the last few years, NSERC’s Research Grants and Scholarships Directorate, Research Partnerships Directorate and Communications Division have made efforts to reduce the administrative expenditures of NSERC’s Prizes. These efforts include, but are not limited to hosting selection committee meetings by videoconference instead of bringing committee members to Ottawa, and entering into a Memorandum of Understanding with Rideau Hall as the venue for the annual awards ceremony at a reduced cost. The impact of these efforts on the operating ratio for NSERC’s Prizes will need to be examined further in future evaluations.

6. Conclusion

NSERC’s Prizes: Recognizing Canadian Achievements in the NSE

The evaluation confirms a continued need for NSERC’s Prizes to celebrate Canadian research and innovation in the NSE. Scientific prizes are given to support the generation of new knowledge and innovations, and for solving problems. They are an “incentive system to produce the public good of knowledge” (Chan et al., 2013) and are therefore expected to support long term economic growth. They are also recognized for raising the scientific profile of a country, its institutions and individual scientists resulting in increased productivity, opportunities for collaboration and greater attraction and/or retention of scientists.

NSERC is the main source of funding for NSE research in Canada and is therefore well placed to recognize Canadian achievements in the NSE through the provision of scientific Prizes. Such recognition places the NSE in the academic, political and public spotlight; thereby placing the NSE at the forefront of government policy and fostering a culture of science and innovation through the encouragement of more positive attitudes towards NSE. Additionally, NSERC’s Prizes contribute to the development of Canada’s workforce by generating opportunities for the career development of recipients and the student’s they may hire using the funds from their Prize.

While other sources of prizes recognizing research excellence, partnerships and/or science promotion in the NSE exist within Canada, NSERC's Prizes are often perceived to provide a higher level of prestige. Additionally, they are further distinguished as a result of their national scope, their consideration of all NSE disciplines, and/or by the rigorous peer-review process for selecting prize recipients. These distinguishing properties are considered to be important contributing factors to NSERC's realization of its objective of recognizing Canadian research and achievements in the NSE.

Design and Delivery of NSERC's Prizes

Overall, recipients are satisfied with the monetary value of NSERC's Prizes, which are considered sufficient to: entice credible and serious nominations; convey the prestige of the award; and, make a difference in terms of supporting researchers. The monetary values of NSERC's Prizes are also comparable to those of prizes in other countries recognizing research excellence in the NSE. Additionally, the majority of recipients are also satisfied with the: length and scope of NSERC's Prizes; the guidelines on the use of funds; the timeliness of the decisions from the selection committees; the nomination process; and, the appropriateness of the selection criteria. Potential opportunities for improving the delivery of NSERC's Prizes include increasing the number of impact reports received by Prize recipients by monitoring recipients more closely, particularly towards the end of their funding period, and increasing the expectations around the reporting requirements for various Prizes.

Impacts of NSERC's Prizes

There is a strong indication that receiving an NSERC Prize increases the academic and/or organizational profile of recipients, at a national and/or international level, as well as the profile of their institution/organization. The profile of the industry partner(s) also tended to increase within the NSE community. Some recipients and key informants indicated that they would like to see more exposure of NSERC's Prizes and Prize recipients in the mass media. In the last few years NSERC's Communications Division has been actively engaged in the promotion of NSERC's Prizes, which has resulted in a significant increase in the number of media activities each year from 84 activities in 2011 to 181 activities in 2013.

Overall, it appears that receiving an NSERC Prize increased the capacity of recipients to engage in further research and/or science promotion activities. In particular, NSERC's Prizes were noted as contributing to research productivity, the pursuit of new directions or areas of inquiry, research autonomy and the ability to access additional funding. The extent to which NSERC's Prizes contributed to opportunities for collaboration was moderate. The Synergy Award for Innovation however, was credited with increasing the recognition of academic-industry research and development (R&D) collaborations and the perceived benefits of successful collaborations within the NSE community. Industry partners also credit their collaborations with their academic

partners with any increases in their organization's capacity, such as the development of new processes, tools and/or technologies.

NSERC's Prizes contributed to the career development of recipients, including greater opportunities to produce/engage in research outputs. They also contributed to the career development of highly qualified personnel (HQP), as the majority of recipients used their Prize funds to hire and train HQP. Additionally, HQP hired by researcher(s) who received a Synergy Award for Innovation often worked with industry partners, which provided opportunities to develop additional skills and in some cases employment by those partners.

Operational Efficiency of NSERC's Prizes

The operating ratio for NSERC's Prizes from fiscal year 2010-11 to 2013-14 is 15.21 cents for every \$1 of prizes awarded. While this is higher than the ratios for the two directorates which house NSERC's prizes: Research Grants and Scholarships (RGS) Directorate (4.24 cents) and Research Partnerships (RP) Directorate (6.56 cents); it is not entirely unexpected. Due to the limited number of Prizes awarded each year and the relatively smaller amounts of funding distributed through Prizes, in comparison with NSERC's other granting programs, as well as the additional cost of hosting the annual awards ceremony for Prize recipients the operating ratio for prizes is anticipated to be higher. In the last few years however, NSERC's Research Grants and Scholarships Directorate, Research Partnerships Directorate and Communications Division have made efforts to reduce the administrative expenditures of NSERC's Prizes, such as hosting selection committee meetings by videoconference and finding cost-saving measures for the awards ceremony. The impact of these efforts on the operating ratio for NSERC's Prizes will need to be examined further in future evaluations.

7. Recommendations

- 1. The findings from the evaluation illustrate the need for an explicit and cohesive set of intended outcomes for NSERC's Prizes.** While NSERC's Prizes are highly differentiated in terms of their eligibility criteria, value and objectives, the establishment of an organized set of intended outcomes for Prizes would support greater understanding of how they contribute to the priorities of the federal government and NSERC's strategic goals. This set of intended outcomes should reflect the common impacts across the six Prizes, such as recognition of high performers, increased capacity and career development (including HQP). It should also include the unique outcomes of individual Prizes, and/or of each category of Prizes, i.e. academic, science promotion and/or academic-industry collaborations.
- 2. It is recommended that the current reporting requirements for NSERC's Prizes are examined to determine whether they are sufficient to meet the needs of the Council, and if not, how these requirements may be improved.** Reporting requirements exist for NSERC's academic Prizes and the NSERC Awards for Science Promotion for organizations;

however, fewer than half of these Prize recipients submit the impact reports requested by the Council. Unlike other NSERC funding opportunities, Prizes are awarded for past achievements and recipients are not required to submit their impact report to be eligible for future grants and/or prizes. As a result, there may be fewer incentives for recipients to submit these reports. Without these reports however, Prizes' staff are limited in the extent to which they can assess and understand the impact of Prizes within the NSE research community.

- 3. It is recommended that NSERC continue to work towards increasing the profile of its Prizes, and their respective recipients, using various communication tools including traditional mass media and social media.** Raising the profile of Prizes and recipients is important as Prizes are known to contribute to positive impacts on NSE research, including more opportunities for collaborations and career advancement, as well as increased capacity, such as receiving additional funds for future research. It was also noted by some Prize recipients and key informants that they would like to see more exposure of NSERC's Prizes and/or Prize recipients in the media, and that Prizes should be promoted more actively.

Appendix A: Prizes Evaluation Matrix

Question	Indicators	Methods
Relevance		
1. Is there a continued need for each NSERC Prize currently awarded?	<ul style="list-style-type: none"> Evidence of need to recognize excellence in the natural sciences and engineering (NSE) Evidence of need to promote NSE Evidence of need for Prizes to support research in the NSE 	Key informant interviews Literature review
2. Are NSERC's Prizes aligned with the federal government's priorities and NSERC's strategic outcomes?	<ul style="list-style-type: none"> Evidence of alignment between Prizes and NSERC's program alignment architecture Evidence of alignment between Prizes and federal government outcome statements Evidence of alignment between the objectives of Prizes and NSERC's mandate 	Document review Key informant interviews
3. Is there a role for the federal government to fund and award Prizes in recognition of research excellence and to promote the NSE?	<ul style="list-style-type: none"> Existence or absence of similar funding mechanisms Evidence of a niche for the federal government versus other level of governments to be involved 	Document review Key informant interviews
Design and Delivery		
4. Is the design and delivery of NSERC's Prizes appropriate?	<ul style="list-style-type: none"> Satisfaction of recipients with the delivery of NSERC's Prizes Extent to which the Prizes promote NSE and recipients to the general public Extent to which the nomination process is effective at attracting nominations to ensure an appropriate range of disciplines and high performers Extent to which selection criteria ensure an appropriate range of disciplines and high performers Perceptions regarding the appropriateness of the value of NSERC's Prizes Evidence that the program is delivered in a timely manner (from nomination to decision and from decision to award) 	Key informant interviews File review Survey
Performance		
5. To what extent do NSERC's Prizes contribute to the recognition of high performers and their achievements?	<ul style="list-style-type: none"> # of Prize recipients (disaggregated by disciplines) Evidence that Prize recipients were high performers Recipients' perception that the NSERC Prize contributed to receiving other Prizes Recipients' perception that the NSERC Prize contributed to receiving research funding and opportunities for collaborations Perceptions regarding the prestige of NSERC's Prizes 	Document review Key informant interviews Survey

Question	Indicators	Methods
6. To what extent do NSERC's Prizes contribute to the support of institutions and/or future research and science promotion activities?	<ul style="list-style-type: none"> • Extent to which receiving a Steacie Fellowship or Herzberg Canada Gold Medal contributed to supporting the salary costs of researchers and faculty positions • Extent to which receiving a Prizes increase recipients' capacity to conduct research • # of highly qualified personnel (students and postdocs) trained as a result of Prizes • % of recipients who leveraged funding from other sources to conduct research as a result of their Prize • Perception about how and extent to which the NSERC Award for Science Promotion supported activities that promote science to general population 	<p>Document review</p> <p>Key informant interviews</p>
7. To what extent do NSERC's Prizes contribute to creating awareness of the value of research and research collaborations?	<ul style="list-style-type: none"> • Extent to which receiving a Prize was accompanied by recognition/ceremony • Extent to which receiving a Prize award resulted in: <ul style="list-style-type: none"> ➢ research publications; ➢ Mass Media coverage; ➢ speaking engagements; and • % of recipients reporting research collaborations resulting from their Prize (Canadian and/or international; industry and academia; and multidisciplinary) 	<p>Document review</p> <p>Survey</p>
8. To what extent do NSERC's Prizes support career development?	<ul style="list-style-type: none"> • Perceptions of recipients of the impact of receiving a Prize on their career development 	<p>Survey</p> <p>Key informant interviews</p>
9. What unintended outcomes, if any, resulted from NSERC's Prizes?	<ul style="list-style-type: none"> • Extent to which Prizes contributed to attracting youth and underrepresented groups (women, aboriginals, etc.) to NSE • Other unintended outcomes identified 	<p>Survey</p> <p>Key informant interviews</p>
Efficiency and Economy		
10. Are Prizes awarded in the most efficient and economical manner?	<ul style="list-style-type: none"> • Operating Ratio (¢:\$1) (Operating Expenditures to Grant Funds Awarded) • Operating Expenditure as a Percentage of Total Program Expenditures 	<p>Key informant interviews</p> <p>Efficiency analysis</p>

Appendix B: Prizes Offered by Other Countries for Achievements in the NSE

Life Time Awards

The *Nobel Prizes* (Sweden) are renowned scientific prizes based on an international competition, where researchers are nominated by fellow academics including members of the Swedish Academy and previous laureates. Prize categories include Physics, Chemistry, and Physiology or Medicine. The number of laureates that receive a prize depends on the merit of nominees, but does not exceed three laureates per category. From 2003 until 2011 the prize included a Swedish kronor (SEK) \$10 million dollar award. In 2012 the amount of the award decreased to \$8 million SEK. The winners are expected to attend a ceremony and participate in an international lecture series. The prizes are funded by the Nobel Foundation, a private institution founded in 1900.

The *Queen Elizabeth Prize for Engineering* (United Kingdom) is an international engineering prize that rewards ground-breaking engineering innovations that lead to global benefit for humanity. The £1million prize is awarded annually in the name of Queen Elizabeth II, and may be shared between three scientists. The Prize was established in 2011 and is funded by the QEPrize charity through donations from several major corporations.

The *Milner Fundamental Physics Prize (Breakthrough Prize)* (United States of America) is one of the largest prizes with a monetary sum of \$3 million. The prize may be shared between two or more scientists and is awarded annually. It was established in 2012 and is funded by the Milner Foundation.

The *Life Sciences Breakthrough Prizes* (United States of America) were established in 2013. Up to six prizes are awarded annually, with one specifically related to understanding Parkinson's disease & Neurodegenerative Disorders. All prizes include a monetary sum of \$3 million. The prizes are funded by several foundations including the Sergey Brin and Anne Wojcicki's foundation, The Brin Wojcicki Foundation; the Silicon Valley Community Foundation; Jack Ma's Foundation; and the Milner Foundation.

Established Scientist Awards

The *Prime Minister's Prize for Science* (Australia) may each be awarded to up to four individuals, for their contributions to Australia and the global advancement of science. Each Prize includes an award certificate, a gold medallion and lapel pin, and a monetary award of \$250,000.

Early Career Prizes

The *Alan T. Waterman Award* (United States of America) was established in 1975 to mark the 25th Anniversary of the National Science Foundation. The annual award recognizes an outstanding young American completing research in any NSE field supported by the National Science Foundation. The researcher must be in the first seven years of practice following their PhD. The awardee receives a medal, as well as a five year grant of \$1,000,000 for scientific research or advanced study in the NSE at the institution of the recipient's choice.

The *Frank Fenner Prize for Life Scientist of the Year* and the *Malcolm McIntosh Prize for Physical Scientist of the Year* (Australia) are awarded to scientists in the early or mid-career stages of their careers, meaning the first ten years following completion of their PhD. Each prize is awarded for an outstanding achievement in science that advances, or has the potential to advance human welfare or benefit society. Each Prize includes an award certificate, a silver medallion and lapel pin, and a monetary award of \$50,000.

The *New Horizons in Physics Prize (Breakthrough Prizes)* (United States of America) is awarded annually to up to three promising junior researchers who already produced important work. The monetary value of the prize is \$100,000 and is funded by a grant from the Milner Foundation. The New Horizons in Physics Prize was established in 2012.

The Royal Society's *Mullard Award* (United Kingdom) is awarded to an individual with an outstanding academic record in the NSE and whose work is currently making or has the prospect to make a contribution to national prosperity. This prize is aimed at early career scientists, engineers and technologists up to 15 years following the completion of their PhD. The award consists of a silver gilt medal, a £2,000 gift and a £1,500 travel grant.

Interdisciplinary Teams

The *Eureka Prize for Excellence in Research by an Interdisciplinary Team* (Australia) encourages outstanding, innovative research that demonstrates the benefits of practical interdisciplinary cooperation. The \$10,000 prize rewards an Australian research partnership, group or team for a groundbreaking outcome involving collaboration and integration between researchers from two or more unrelated disciplines.

Commercial Applications of Research

The *Prime Minister's Prize for Science* and *Prime Minister's Prize for Innovation* (Australia) may each be awarded to an individual or jointly to up to four individuals for the translation of science knowledge into a substantial commercial impact. Each Prize comprises an award certificate, a gold medallion and lapel pin, and a monetary award of \$250,000. These Prizes were established in 2012.

Science Promotion

No prizes were found in other countries that are comparable to the NSERC Award for Science Promotion.

Appendix C: References

- Beals, Lalonde & Associates. (2012). *Evaluation of the SSHRC Prizes and Special Fellowships*. Ottawa (ON): Government of Canada.
- Blandin, M.-C. & Renar, I. (2003). *Rapport d'information fait au nom de la commission des Affaires culturelles par la mission d'information chargée d'étudier la diffusion de la culture scientifique*. Paris, France: Sénat.
- Borjas, G. J., & Doran, K. B. (2015). Prizes and productivity: How winning the fields medal affects scientific output. *Journal of Human Resources*, 50(3), 728-758.
- Bornmann L., Mutz R., & Daniel H.-D. (2007). Gender differences in grant peer review: A meta-analysis. *Journal of Informetrics*, 1, 226–238.
- Ceci, S.J., & Williams, W.M. (2011). Understanding current causes of women's underrepresentation in science. *Proceedings of the National Academy of Sciences of the United States of America*, 108(8), 3157-3162.
- Chan, H. F., Gleeson, L. & Torgler, B. (2014). Awards before and after the Nobel Prize: A Matthew effect and/or a ticket to one's own funeral? *Research Evaluation*, 23(3), 210-220.
- Commonwealth of Australia. (2010). *Inspiring Australia: A National Strategy for Engagement with the Sciences*. Canberra, Australia: Government of Australia.
- Council of Canadian Academies. (2014). *Science Culture: Where Canada Stands*. Ottawa (ON): The Expert Panel on the State of Canada's Science Culture. Retrieved from: http://www.scienceadvice.ca/uploads/eng/assessments%20and%20publications%20and%20news%20releases/science-culture/scienceculture_fullreporten.pdf
- Industry Canada. (2007). *Mobilizing Science and Technology to Canada's Advantage*. Ottawa (ON): Government of Canada.
- Industry Canada. (2014). *Seizing Canada's Moment: Moving Forward in Science, Technology and Innovation 2014*. Ottawa (ON): Government of Canada.
- Kalil, T. (2006). *Prizes for technological innovation*. Brookings Institution, 12 (Hamilton Project). Retrieved from: <http://www.brookings.edu/research/papers/2006/12/healthcare-kalil>
- Lincoln, A.E., Pincus, S., Koster, J.B., Leboy, P.S. (2012). The Matilda effect in science: awards and prizes in the US, 1990s and 2000s. *Social Studies of Science*. 42(2), 307–320
- Long, J.S. & Fox, M.F. (1995). Scientific Careers: Universalism and Particularism, *Annual Review of Sociology*, 21, 45-71.
- Merton, R. K. (1968). The Matthew effect in science. The reward and communication systems of science are considered, *Science* 159: 56-63.
- Merton, R.K. (1988). The Matthew Effect in science, II: Cumulative advantage and the symbolism of intellectual property. *ISIS*, 79, 606-623.

Natural Sciences and Engineering Research Council. (2015). Reports on Plans and Priorities 2015-16. Retrieved January 21, 2016 from: http://www.nserc-crsng.gc.ca/NSERC-CRSNG/Reports-Rapports/RPP-PPR/2015-2016/index_eng.asp

Organisation for Economic Co-operation and Development [OECD] (2008). *The Global Competition for Talent: Mobility of the Highly Skilled*. Paris, France: OECD.

Rudman, L.A. (1998) Self promotion as a risk factor for women: The costs and benefits of counterstereotypical impression management. *Journal of Personality and Social Psychology*, 74(3), 629–645.

Stephan, P. (2012) *How Economics Shapes Science*. Cambridge, Mass.: Harvard University Press

Zuckerman, H. (1967). Nobel Laureates in Science: Patterns of Productivity, Collaboration, and Authorship, *American Sociological Review*, 32(3), 391-403.

Zuckerman, H. (1996). *The Scientific Elite: Nobel laureates in the United States*. New Brunswick, NJ, Transaction Publishers.