Science-Metrix

Evaluation of the Business Innovation Access Program

Evaluation Report

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Table of Contents

Tables

Figures

Acronyms

BERD	Business enterprise expenditures on research and development
BIAP	Business Innovation Access Program
CAIP	Canada Accelerator and Incubator Program
CATA	Canadian Advanced Technology Alliance
CCTT	Centres collégiaux de transfert de technologie
CMC	Canadian Management Consultants
GDP	Gross domestic product
IRAP	Industrial Research Assistance Program
ITA	Industrial Technology Advisor
NRC	National Research Council Canada
NSERC	Natural Sciences and Engineering Research Council of Canada
O&M	Operations and Maintenance
R&D	Research and Development
RCAO	Regional Contribution Agreement Officer
ST&I	Science, Technology and Innovation
SME	Small and medium-sized enterprise
US	United States

Executive Summary

This report presents the results of the 2014/15 evaluation of the Business Innovation Access Program (BIAP) delivered by the National Research Council Canada (NRC). BIAP provides contributions to small and medium-sized enterprises (SMEs) to collaborate with learning institutions and publicly funded research organizations on research and development (R&D) projects focused on commercialization. This pilot program was launched in April 2014 and was allocated $20 million.

This evaluation, conducted in 2015, focused on Program implementation modalities and outputs, and on any evidence that could be collected regarding the achievement of outcomes. The objective was to identify program design and delivery improvements that could be readily implemented, based on stakeholder engagement and feedback. The evaluation also sought to identify the specific needs being addressed by BIAP as compared to the Industrial Research Assistance Program (IRAP) and the type of program delivery mechanisms associated with them. Science-Metrix was responsible for carrying out an external and independent evaluation, while the NRC Office of Audit and Evaluation (OAE) provided advice and oversight. A mix of quantitative and qualitative data were collected through four evaluation methods, including a literature and document review, an administrative and performance data review, a survey of client SMEs and semi-structured interviews. The key evaluation findings, conclusions and recommendations are summarized below.

Key findings – Relevance

The evaluation findings revealed that Canada suffers from a commercialization gap induced by a lack of funding for and SME capacity in commercialization. Evidence was found that this gap can be reduced by increasing federal support to SMEs via demand-driven (as opposed to supply-driven) programs and by increasing SME awareness of the expertise and resources available within learning institutions and publicly funded research organizations. This is precisely what BIAP was intended to do by providing SMEs with contributions so that they can engage specifically with these organizations to solve commercialization-related technical and/or business hurdles. BIAP was found to be uniquely positioned at the federal level to address this need, given IRAP's pan-Canadian networking capabilities, solid R&D expertise and long-term experience in the field.

BIAP and IRAP were found to overlap slightly, as approximately half of BIAP supported projects were early stage R&D, and seemingly more aligned with IRAP's broader innovation support mandate than BIAP's commercialization-focus. A niche opportunity exists for BIAP to further address the commercialization gap by targeting projects later in the R&D continuum.

Recommendation 1: IRAP, as the delivery agent of BIAP, should consider strategies to support a greater proportion of projects that are positioned in the pre-commercialization phase of innovation development.

Management response and proposed actions: As stated in its Terms and Conditions, BIAP helps firms at an early development stage of an innovation project and also at later stages, closer to commercialization. IRAP recognizes the need for support at later stages. Should

BIAP be renewed, IRAP will continue to ensure that, where appropriate, BIAP resources are used to support projects in the pre-commercialization phase.

BIAP objectives were found to be consistent with current government commercialization priorities, as set out in recent federal budget plans, studies and the Science, Technology and Innovation (ST&I) Strategy. BIAP objectives are also aligned with IRAP's mission, which in turn is consistent with NRC's mandate as set out in the NRC Act.

Provincial governments also have a legitimate role in delivering programs similar to BIAP, as part of their economic development mandate. The evaluation found that there was some degree of co-ordination between BIAP and the provinces to reduce areas of overlap with similar provincial voucher programs. IRAP Industrial Technology Advisor (ITAs) and the IRAP Concierge Program actively assist SMEs in identifying and accessing the programs the most relevant to their needs, whether at the federal or provincial level.

Key findings - Performance

BIAP has made progress toward achieving its immediate outcome to facilitate access by SMEs to technical and business innovation support from learning institutions and publicly funded research organizations. There are stronger linkages between SMEs and learning institutions and publicly funded organizations as a result of BIAP, most notably in Quebec perhaps due to the province's well-organized Centres collégiaux de transfert de technologie (CCCT) network with a large number of "supply-ready" service providers.

Client SMEs are generally well positioned to meet their project objectives and a large proportion of projects are on track to meet their Contribution Agreement objectives and are moving incrementally closer to commercialization. However, the number of projects that are close to or have entered the commercialization phase is relatively low. This is not surprising given that it is still early in the Program's lifecycle, and that projects in the nascent stages of research and development are being funded.

The evaluation found that the Program would benefit from an emphasis on the business-related services that would assist SMEs to overcome the most important barriers to commercialization, including: securing anchor clients, distribution channels investigations, guidance on accessing venture capital, supply chain optimization and overcoming barriers to market access (e.g., tariffs, export quotas).

Recommendation 2: IRAP, as the delivery agent of BIAP, should identify and recommend a broader range of service providers across Canada, including university business schools, accelerators and incubators with expertise in business services that addresses the most important barriers to the commercialization of their innovations.

Management response and proposed actions: The main goal of BIAP is to encourage engagement between Canadian SMEs and universities, colleges, and publicly funded research organisations. The strength of these organizations is on the technical and scientific side. For this reason, IRAP also has engaged with incubators, accelerators and other such organizations that have access to business experts. IRAP recognizes the

importance of business support for SMEs. Should BIAP be renewed, and with appropriate resources, IRAP will identify an even broader range of service providers with business expertise and will facilitate BIAP clients' awareness and access to their services.

The BIAP design and delivery approach was considered appropriate and no alternative delivery mechanism was found that would be more efficient or as effective as BIAP. The absence of associated Operations and Maintenance (O&M) costs, the use of existing NRC-IRAP management and monitoring tools, and the optimization of the ITA network with no perceptible additional workload burden for the benefit of the Program suggest an economical and efficiently managed program. The shortfall in commitments and disbursements in the first year can be attributed to the initial lag in Program uptake by SMEs (part of the normal program cycle), although the Program was gaining traction by the end of 2014/15 and in 2015/16.

1 Introduction

This report presents the results of the 2014/15 evaluation of the Business Innovation Access Program (BIAP) delivered by the National Research Council Canada (NRC). In compliance with the Treasury Board *Policy on Evaluation*, the evaluation assessed the value-for-money of BIAP, including core issues related to relevance, performance and resource utilization.

BIAP is administered by NRC's Industrial Research Assistance Program (IRAP), whose main objective is to stimulate innovation in small and medium-sized enterprises (SMEs) by: 1) providing financial and advisory support to SMEs in Canada in the development and commercialization of technologies; and 2) collaborating in initiatives within regional and national organizations that support the development and commercialization of technologies by SMEs.

Under IRAP's governance and building on its extensive network of technical experts and experience with SMEs, BIAP provides contributions to SMEs to collaborate with learning institutions and publicly funded research organizations on research and development (R&D) projects focused on commercialization. The Program's expected results (see BIAP Logic Model in Appendix A) are that the technical and business services provided by universities, colleges and publicly funded research organizations in the context of these projects will enable SMEs to commercialize their products and services more quickly and effectively, allowing them to grow and become more productive and profitable. Over an extended period, it is expected that the Program will contribute to the establishment of long-term partnerships between SMEs and the abovementioned organizations, hence enabling SMEs to take better advantage of public sector investment.

The following sections provide an overview of the evaluation approach, including the evaluation context, objectives and scope (Section 1.1), a brief description of the methods used (Section 1.2) and their limitations and challenges (Section 1.3). Sections 2 and 3 present the key findings of the evaluation across the lines of evidence, organized by evaluation issue and evaluation question. Section 4 presents the conclusions drawn from the evaluation, as well as associated recommendations, organized by broad evaluation issue (i.e., relevance and performance). The Management Response and Action Plan is included in Section 5.

1.1 Evaluation context, objectives and scope

BIAP was officially launched in April 2014. Eight months into the Program's implementation, this evaluation of BIAP covering the period 2014/15 to 2015/16 was carried out to fulfill NRC's commitment that an evaluation focusing on program implementation be completed by June 2015. The evaluation was executed by external independent consultants, under the supervision of the NRC Office of Audit and Evaluation (OAE). Considering the early stage of the Program, the focus of the evaluation was on implementation modalities and outputs, and on any evidence that could be collected at this stage regarding the achievement of immediate outcomes. The objective was to identify program design and delivery improvements that could be readily implemented, based on stakeholder engagement and feedback. The evaluation also sought to identify the specific needs

being addressed by BIAP as compared to IRAP and the type of program delivery mechanisms associated with them.

1.2 Methodology

NRC's Office of Audit and Evaluation identified eight specific evaluation questions that are aligned with the five core issues of the Treasury Board *Policy on Evaluation* (i.e., continued need for the program, alignment with government priorities, alignment with federal roles and responsibilities, achievement of expected outcomes, and demonstration of efficiency and economy). These questions are listed in the evaluation matrix provided in Appendix B, which also identifies the methods that were used to address each of these questions.

Multiple lines of evidence were used as a means to enhance the reliability and validity of the information and data to be collected. The specific methods used in the study, which are discussed in greater detail in Appendix D, include:

- Literature and document review
- Administrative and performance data review
- Survey of client SMEs
    - Response rate: 59.3%
- Semi-structured interviews
    - Internal interviews with IRAP management, Industrial Technology Advisors (ITAs) and Regional Contribution Agreement Officers (n=13)
    - External interviews with SMEs and service providers (n=17)

2 Key findings – Relevance

2.1 Continued need for program

This section examines the rationale behind the creation of BIAP. It first demonstrates that innovative SMEs play a key role in a competitive economy but that Canada is affected by what has been referred to as a commercialization gap induced by a lack of funding for and SME capacity in commercialization. It is then argued that this commercialization gap can be reduced by increasing federal support to SMEs via demand-driven (as opposed to supply-driven) programs such as BIAP and by increasing SME awareness of the expertise and resources available within learning institutions and publicly funded research organizations. The relevance of BIAP is then discussed in the context of other similar programs available at the federal and provincial level.

2.1.1 Financial support is needed by SMEs to engage service providers

Finding 1: The evaluation confirms that there is a need to increase public funding support to SMEs to enhance collaborations with learning institutions and publicly funded research organizations to help them bridge the commercialization gap. Voucher programs with similar commercialization objectives were found in five provinces, three of these voucher programs were specifically designed to create linkages between SMEs and learning institutions as well as other service providers. While BIAP was found to be rather unique in addressing the commercialization needs of SMEs at the federal level, an assessment of the projects supported to date by BIAP suggests that there may be some overlap with IRAP.

Contribution of innovative SMEs to a competitive economy

The evaluation found that innovative SMEs are key drivers of change in the economic landscape and economic wealth of a country. More specifically, there was a strong consensus in the literature produced on the subject over the last decade that innovation, particularly by SMEs, contributes to increased productivity, which in turn boosts economic competitiveness.[1] Moreover, literature and interview data indicate that SMEs tend to grow faster and to hire more[2]—and thus generate more employment—than larger organizations. This is especially true for SMEs that operate in the high-technology sector. Indeed, in the Canadian context, SMEs account for 99.8% of Canadian companies and employ 89.7% of private sector employees, the remainder working in large companies.[3] Innovation was also found to be linked to broader economic and social outcomes, such as increased income per capita, higher-quality social programs and a high-performing education system and health system.[4]

Need for increased business R&D investments to maintain Canada's competitiveness

Canada has maintained a relatively high level of competitiveness compared to other countries (ranking 14th on the World Economic Forum Global Competitiveness Index) due to factors such as an educated and skilled workforce, efficient markets, solid infrastructure and world-class higher education institutions.[5] However, the ongoing lack of business R&D investments, primarily by

SMEs, jeopardizes Canada's position as an "innovation driven" economy.[6] In 2012, Canadian business enterprise expenditures on research and development (BERD) as a percentage of the gross domestic product (GDP) were among the lowest in the world, ranking 15th out of 16 peer countries as determined by the Conference Board of Canada.[7] Among the factors that may have made Canadian companies disinclined to invest in R&D and generate innovation, the literature points to the historically strong reliance of the Canadian economy on natural resources, the privileged trading relationship with the US, a favourable exchange rate and an abundant labour supply.[8,9]

Canada's commercialization gap

In response to the above challenges, the federal government has made substantial investments in science, technology and innovation over the past decade, but these efforts have not translated into significant results. This is exemplified by Canada's performance on the Global Competitiveness Index, where the country's greatest weaknesses were found to be innovation and SMEs' limited access to financing and insufficient capacity to innovate.[10] In particular, the literature shows that Canadian businesses lack such funding and capacity at the later stages of the innovation process. These weaknesses are linked to what has been widely referred to as the "commercialization gap" that is affecting Canadian industry and SMEs in particular. A 2012 study undertaken by The Canadian Advanced Technology Alliance (CATA), entitled "Effective Commercialization of Innovations,"[11] identified the following four main commercialization challenges faced by SMEs:

1) A lack of commercialization expertise and business management perspicacity affecting Canadian companies that need to be highly performing at the global level to remain competitive, as Canada is too small a market.
2) A weak culture of collaboration.
3) Insufficient capitalization and funding for commercialization from the private and public sector, which prevents companies from reaching their full potential and paves the way for foreign companies to acquire them.
4) A lack of "competitive drive and strengths" needed in a context of fierce competition at the global level.

Evaluation survey data corroborates the above findings related to SMEs' innovation and commercialization capacity, as 47% of SME respondents indicated that they applied for BIAP funding because they lacked in-house expertise in R&D and 35% of respondents reported that they did so because they required assistance with the commercialization of new products and services. The CATA study further noted that Canadian SMEs "need to target marketing and sales in advance, collaborate to conquer a leading place in the market, and go for 'smart money' from investors who bring both financial and strategic business development support."[12] Moreover, the Canada Council of Academies suggested that Canadian companies need to be less risk averse than they have tended to be in comparison to their US counterparts when it comes to knowledge translation into commercial outcomes.[13]

Need for demand-driven federal R&D support programs to bridge the commercialization gap

With regard to the availability—or lack thereof—of public funding for commercialization, the literature review and interviews found that most federal government R&D support programs are supply-driven and take the form of funding directed toward learning institutions and publicly funded research organizations to undertake R&D projects in collaboration with SMEs (e.g., NSERC programs, Mitacs).[14] While such collaborations are a critical part of the Canadian innovation ecosystem, they have not generated substantial improvements in the patenting, sale, transfer or licensing of intellectual property to businesses, compared to the performance of the US institutions in these areas.[15] Internal and external interviewees stated that the approach centred on the service providers is more research-oriented than industry-oriented, and thus generally less effective at generating immediate and widespread benefits to SMEs.

Recent studies suggest that integrating a "demand-pull perspective centred on the firm, the ecosystem, and the factors that determine the choice of business strategy" into the conceptual framework governing innovation policy yields better results in terms of effective translation of knowledge and research into commercial outcomes.[16] The rationale for demand-pull driven programs is based on the premise that they come closer to meeting the commercialization needs of SMEs. In the words of Tom Jenkins:

> Effective collaboration between the business and higher education sectors depend on linking the "supply-push" of research and discoveries with the "demand-pull" of firms seeking to exploit the commercial potential of new ideas.[17]

Under the demand-pull model, the onus is on the SMEs to identify the specific innovation and commercialization challenges for which they need external support in the form of funding, advice and/or infrastructure. In this regard, BIAP addresses the need for demand-driven programs.

Need to increase SME awareness of the expertise and resources available within learning institutions and publicly funded research organizations

Furthermore, evidence was found in interviews and the Jenkins Expert Panel report[18] of a need to increase awareness among SMEs of the wealth of knowledge, skilled people, equipment, facilities and other resources that postsecondary education, government and non-profit research organizations constitute. These are underexploited resources that SMEs could tap into to expand the range of capacity-building tools at their disposal. This may be partly explained by the fact that learning institutions have traditionally not positioned themselves well to deliver timely and effective services for industry, according to internal and external interviewees. They usually don't have the proper mechanisms in place to accommodate the needs of SMEs (e.g., timeliness, industry-focused projects) while fulfilling their educational mandate.

In this context, the evaluation found that BIAP is contributing to meeting the need for enhanced linkages with learning institutions by providing funding to SMEs so that they can engage

specifically with these organizations to solve commercialization-related technical and/or business hurdles. External interviewees highlighted this design characteristic as a highly valuable and unique feature in the federal R&D program landscape. The SME interview data indicated that the funding provided through BIAP was critical in the decision to contract out R&D services. However, the fact that 75% of surveyed funded SMEs identified their own service provider without the support of the ITA suggests that there may not be such a high need for SME support when it comes to identifying and linking with learning institutions or publicly funded research organizations.

Similarities between BIAP and provincial voucher programs

BIAP shares common characteristics with R&D voucher programs delivered in Alberta, New Brunswick, Newfoundland and Labrador, Nova Scotia and Ontario (see Table 4 in Appendix C). All of these programs provide funding to SMEs to link with learning institutions (and other service providers) to carry out R&D and commercialization activities. The Ontario Vouchers for Commercialization Program has the additional purpose of supporting the establishment of new businesses on the basis of academic intellectual property. Eligible activities include both early and mid-stage R&D projects (e.g., proof of concepts, market assessment and strategy, product and prototype design), and commercialization activities (e.g., prototype field testing, product evaluations and certifications). The New Brunswick program is the only program that covers commercialization more so than earlier stage activities. As in BIAP, the maximum funding amounts provided to SMEs by provincial programs are relatively small, ranging from $15,000 (Newfoundland and Labrador Productivity and Innovation Voucher Program) to $80,000 (New Brunswick Innovation Voucher Program), and can generally cover up to 75% of project costs, with the exception of the New Brunswick program (80%) and the Nova Scotia program (100%).

BIAP differs slightly from its provincial counterparts when it comes to the type of eligible service providers and the generation of intellectual property. Indeed, the Alberta, New Brunswick, and Newfoundland and Labrador programs all allow SMEs to establish linkages with private sector research organizations, such as labs, consultants or research institutes. Only Nova Scotia and Ontario restrict eligibility to learning institutions and not-for-profit organizations. In terms of intellectual property, if a BIAP project is expected to give rise to intellectual property it will be redirected to IRAP. This is due to the fact that intellectual property negotiation processes are generally lengthy and do not facilitate quick projects, for which BIAP was designed to support.

Similarities between BIAP and other federal R&D programs

At the federal level, internal and external interviewees discussed the specific role of BIAP with respect to the main IRAP program. Where BIAP's objective is to enable SMEs to commercialize their products or services more effectively, IRAP's mission is to support SMEs growth through innovation. Internal and external interviewees often referred to IRAP projects as true innovation projects compared to BIAP. Likewise, they noted that in contrast to BIAP, it is not typically part of IRAP's mandate to assist SMEs beyond the development of their product. As an example of the complimentary nature of IRAP and BIAP, one IRAP management representative explained that an SME could carry out a technical IRAP project and want to tap into a new market with their new

technology innovation. At that point, they could draw on BIAP to support the commercialization of the output of that project.

However, an assessment of the projects supported by BIAP revealed that close to half of BIAP projects were early stage R&D, and seemingly more aligned with the IRAP's broader innovation mandate than BIAP's commercialization-focus. Specifically, approximately 45 percent of surveyed SMEs reported that their BIAP-funded project was only at the proof-of-concept level or earlier on the technology readiness level scale at the time of application (see Figure 7 in Appendix C for the technology readiness level scale). This was confirmed by the content analysis conducted on the BIAP project objectives and activities as stated in the Contribution Agreements that indicated that 53% of projects were at the proof-of-concept stage (level 3) or earlier at the time of application (see Table 6 and Table 7 in Appendix C). While BIAP's foundational documents indicate that, by design, the Program can support projects both in the early development stage and later stages (closer to commercialization), this finding suggests possible overlap between IRAP and BIAP. Given that IRAP is addressing the broader innovation gap, there is a niche opportunity for BIAP to address the previously discussed commercialization gap by targeting more of its funding toward projects situated at later stages of the R&D spectrum.

In terms of program design, the evaluation found that BIAP and IRAP differed predominantly in the requirements around the use of funding. Different than IRAP, BIAP requires SME to use the financial contribution for contractor fees and to establish linkages with universities, colleges and publicly funded research organizations.[19] While some internal interviewees highlighted that BIAP was designed to allow SMEs to rapidly access punctual services to solve a technical or business hurdle (as compared to IRAP, where projects require more scrutiny at the application stage given their scale and materiality), it is worthwhile to note that IRAP has an internal process intended to accelerate the approval of smaller projects and ensure that the monitoring of projects is commensurate with their size and complexity process (i.e., the Accelerated Review Process; see Table 5 in Appendix C for a comparison of Accelerated Review Process and BIAP).

A number of other federal programs sharing similar objectives and design features with BIAP were identified in the literature review and interviews, such as NSERC and Mitacs programming. However, NSERC and Mitacs both target their funding toward service providers (primarily universities and colleges) and not to SMEs. For instance, NSERC's Engage Program provides up to $25,000 to an academic researcher to collaborate with a company on a project aimed at solving a specific problem within the natural sciences and engineering fields.[20] As discussed previously, findings from the literature review indicate that an approach centred on service providers is generally less effective at generating significant and widespread commercial benefits. IRAP management representatives and ITAs also stated that Mitacs and NSERC have fewer people "on the ground" to work with service providers and these people tend to have a more limited network than ITAs.

2.2 Alignment with government priorities

This section examines the extent to which BIAP objectives align with government priorities.

2.2.1 Broad commercialization priorities were addressed

Finding 2: BIAP's objective is consistent with current government priorities related to the need to support SMEs in the commercialization of their innovations through increased linkages between businesses and learning institutions.

As discussed in the previous section, the literature review found that Canada suffers from a commercialization gap, whereby SMEs lack the internal capacity and funding to take their innovations to the domestic and international markets.[21] The need for the federal government to shift from a supply-push to a demand-pull paradigm of R&D was also identified as one of the key mechanisms to address this issue. Commitments made in recent policies and budget plans demonstrate that the federal government has clearly been taking steps in that direction. In 2007, the *Science and Technology Strategy: Mobilizing Science and Technology to Canada's Advantage* was already setting the tone for the years to come by affirming the government's willingness to "strengthen public–private research and commercialization partnerships" through the creation of various flagship initiatives, and by increasing alignment between existing programs and activities of the NRC, NSERC and the Business Development Bank "to increase commercialization outcomes." The government also committed to work on developing "new approaches to transfer knowledge and technologies from universities, research hospitals, and government laboratories to the private sector."[22]

As part of the 2012 Economic Action Plan, the federal government further committed to a "new approach to supporting innovation in Canada, by pursuing active business-led initiatives that focus resources on better meeting private sector needs."[23] This change in approach was informed by the findings and recommendations of the 2012 Expert Panel, led by Thomas Jenkins, on how to improve support for business innovations and foster business competitiveness.[24] The Jenkins Report precisely advocated for the creation of an IRAP commercialization vouchers pilot program that would contribute to addressing the "ensuing need to provide complementary assistance for non-R&D activities along the path from idea to market success, particularly those related to commercialization," and increase SMEs' "awareness of the range of postsecondary education, government, non-profit and other commercialization facilities, assets and skilled personnel available across the country."[25] The 2013 Economic Action Plan thereafter allocated $20 million over three years to the creation of BIAP to provide SMEs with credit notes to access technology and business development services at universities, colleges and other non-profit research institutions to accelerate the commercialization of their products and services. The Budget Plan stated that SMEs would be better positioned to "by forging stronger linkages with post-secondary institutions to access new knowledge and skills, and transform them into a competitive advantage."[26] BIAP foundational documents clearly reiterated the commercialization-oriented, SME-centred objective, and the objective to foster linkages with learning institutions, thus confirming that the Program is well aligned with current government priorities.

2.3 Alignment with federal roles and responsibilities

This section first examines the role of the federal government in delivering BIAP based on IRAP's mission and NRC's mandate. It then discusses the federal and provincial roles in supporting SMEs through innovation voucher programs and discusses efforts made by BIAP to minimize overlap.

2.3.1 BIAP is an extension of the IRAP mandate

Finding 3: BIAP objectives are aligned with IRAP's mission, which in turn is consistent with NRC's mandate as set out in the *NRC Act*. Not only is BIAP an appropriate federal program but it was perceived by stakeholders as being uniquely positioned to establish linkages between SMEs and learning institutions and not-for-profit service providers, given the IRAP's pan-Canadian networking capabilities, solid R&D expertise and long-term experience in the field. Provincial governments also have a legitimate role in delivering programs similar to BIAP, as part of their economic development mandate. The evaluation found that there was some degree of co-ordination between BIAP and the provinces as ITAs and the IRAP Concierge Program assist SMEs in identifying and accessing the programs the most relevant to their needs, whether at the federal or provincial level.

Evidence was found in the literature review and internal interviews that the federal government, through the NRC and IRAP, has a legitimate role to play in delivering BIAP. BIAP's focus on enhancing R&D linkages between SMEs and learning institutions and publicly funded research organizations, and on helping them becoming more productive and profitable, is aligned with IRAP's mission to "stimulate innovation in small and medium-sized enterprises in Canada."[27] In turn, IRAP's mission is consistent with the NRC's duty to "undertake, assist or promote scientific and industrial research, including […] researches with the object of improving the technical processes and methods used in the industries of Canada, and of discovering processes and methods that may promote the expansion of existing or the development of new industries."[28]

Not only is BIAP a legitimate federal program, it was also perceived by interviewees as being uniquely positioned to establish linkages between SMEs and learning institutions and not-for-profit service providers, given its pan-Canadian networking capabilities, solid R&D expertise and long-term experience in the field. IRAP management representatives noted that economic development is also a prerogative of the provincial governments and, as discussed previously, the evaluation found documentation on provincial programs similar to BIAP. The latter's foundational documents indicate that the Program was expected to play a co-ordination role in order to ensure minimal overlap between BIAP and similar activities undertaken in other provincial and municipal jurisdictions. Documentary and internal interview evidence suggests that IRAP has indeed made efforts to fulfil this commitment. Notably, ITAs liaised with counterparts in other provincial departments to identify similarities and differences across programs to be able to direct SMEs to programs that are the most relevant to their specific R&D needs at the federal or other jurisdictional level. SME interviewees were appreciative of ITAs' guidance to help them navigate through the plethora of R&D programs that exist at the provincial and federal level. SMEs can also

contact the IRAP Concierge Service, a single point of access where advisors are expected to provide them with personalized and timely guidance on "the most appropriate innovation programs and services available."[29]

3 Key findings – Performance

3.1 Achievement of expected outcomes

This section highlights evidence related to the level of achievement of BIAP's short-term expected outcomes. It first assesses the extent to which BIAP has contributed to strengthening linkages between SMEs and service providers, by interpreting the statistics and qualitative data relative to the distribution and type of funded projects, SMEs and service providers, and the SME level of satisfaction with regard to the services received. It then looks into progress made by funded projects toward reaching their specific objectives and their evolution along the R&D spectrum.

3.1.1 Initial success in linking SMEs with service providers

Finding 4: BIAP has contributed to enhanced linkages between SMEs and learning institutions and publicly funded organizations, although some regions appear to have been quicker than others in committing their funding over the first year of the Program. BIAP has been notably successful in Quebec, perhaps due in part to the province's well-organized Centres collégiaux de transfert de technologie (CCTT) network with a large number of "supply-ready" service providers.

A total of 392 projects were approved in fiscal year 2014/15. Note that when the evaluation began in 31 October 2014, 85 projects had been approved, which the evaluation used as its project sample. Based on the Canadian Business Patterns database,[30] more than half of firms supported by BIAP are considered small (53%) and close to one third are considered micro (29%); only 11% of the SMEs were medium-size businesses. Using Statistics Canada classification,[31] a total of 26 out of the 85 funded SMEs are located in rural areas (30%), the remainder being located in areas where the population exceeds 30,000.

As per the program foundational documents, 500 SMEs were expected to benefit from BIAP funding between 2013/14 and 2015/16. However, BIAP was initially intended as a three-year program starting in 2013/14, but was only announced in February 2014 and did not officially start until 1 April 2014. The same resources were allocated to the Program, but had to be used over two years instead of three. Despite this, BIAP is gaining traction at a rapid rate, having achieved approximately 75% of its target within its first year.

Based on the evaluation sample, between March and October 2014, 45% of BIAP projects were carried out in Quebec, 20% in Ontario, 18% in British Columbia and the remainder in the Maritimes. Internal interview data suggests that some regions may have experienced delays because of the lack of a well-organized group of service providers that have a history of engaging with firms directly.

In terms of service providers, 44% of the pre-approved service providers were located in Quebec, 36% in the region spanning from British Columbia to Manitoba, 14% in Ontario and 6% in the Maritimes. A third (33%) of the 85 service providers were universities, 27% were non-profit research institutions, 21% were colleges and 15% were publicly funded research facilities.

The establishment of linkages between SMEs and learning institutions in the province of Quebec is greatly facilitated by the "supplier readiness" of its learning institutions, which are already very well connected to industry. This may explain why BIAP uptake is so high in the province. In particular, Quebec has a well-established network of Centres collégiaux de transfert de technologie (CCTT), whose mandate is to carry out applied research and technical assistance activities in partnership with companies in order to contribute to the development and commercialization of technological and social innovations. They are therefore better positioned to carry out projects under BIAP than more traditional colleges in other provinces.

Three quarters of funded SMEs received technical services (76%), while the remainder received business services. The evidence from interviews with ITAs indicates that there is a demand or at least a need for SMEs to access business services and that there are fewer business service providers among learning institutions and not-for-profit organizations with which SMEs can work under BIAP. Universities and colleges were also said by ITAs to have more resources that could provide technical services rather than business services.

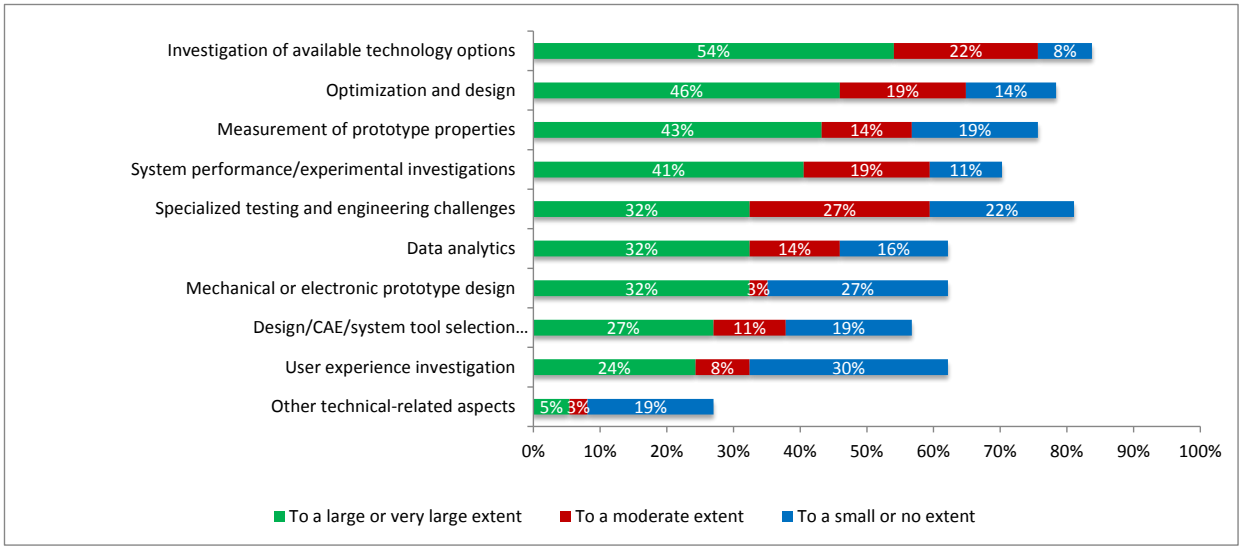
The evaluation found that close to 90% of the SMEs were satisfied with the business or technical services they received and the same proportion reported that they would use the same service providers again for any follow-up support or for a new R&D project. This provides early indication that long-term relationships are likely to be formed between SMEs and service providers, one of BIAP's intended outcomes.

3.1.2 BIAP project objectives are being achieved

Finding 5: While it is still too early in the program lifecycle to observe benefits resulting from BIAP, the evaluation found that a large proportion of projects are on track to meet their contribution agreement's objectives and are moving incrementally closer to commercialization.

Two thirds of surveyed SMEs (66%) reported that their project has already reached or is likely to reach its objectives, and only 6% reported that their project was not likely to do so. As shown in Figure 1, most improvements were observed for technical projects, which represent 80% of the total funded projects: the technical aspects that were the most improved as a result of BIAP were optimization and design (46%), measurement of prototype properties (43%), and system performance/experimental investigations (41%).

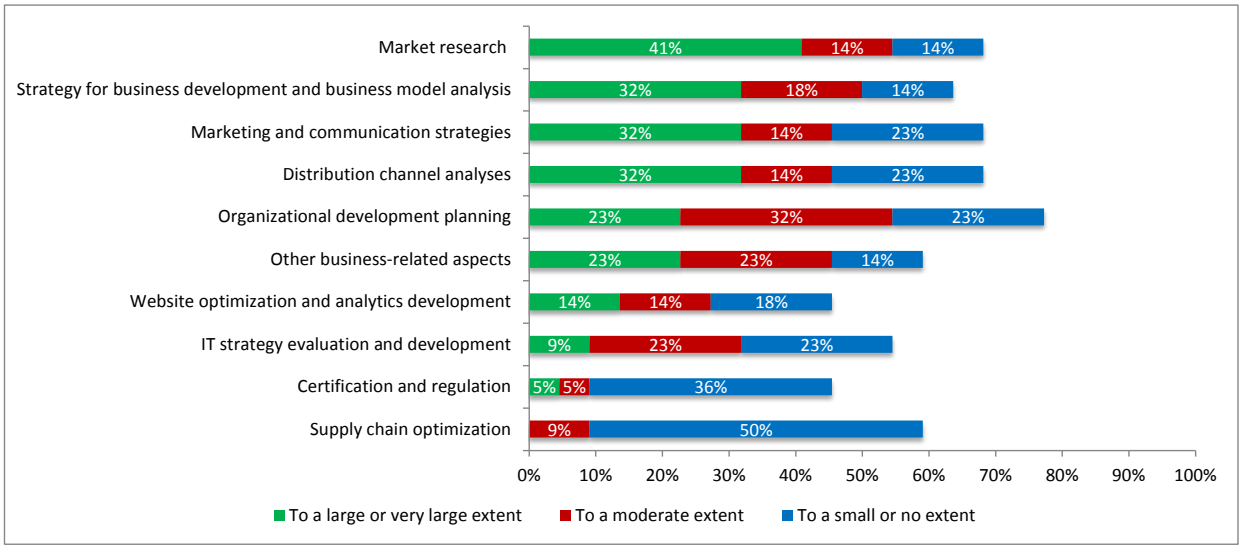
Figure 1 Technical improvements resulting from funded projects



Source: BIAP evaluation survey data

Business aspects with the most noticeable improvements attributed to BIAP (Figure 2) were market research (41%), strategy for business development and business model analysis (32%), marketing and communication strategies (32%), and distribution channel analyses (32%).

Figure 2 Business improvements resulting from funded projects



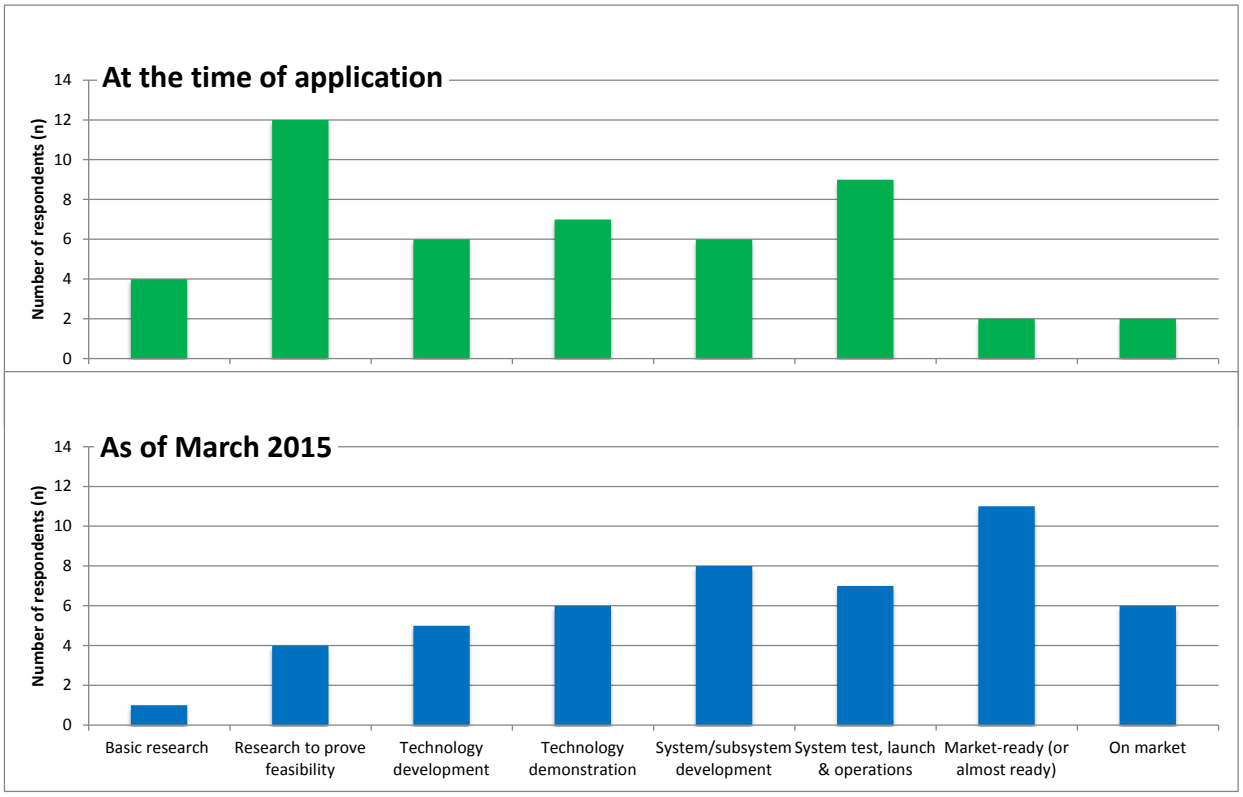
Source: BIAP evaluation survey data

The evaluation compared the positioning of the projects on the technology readiness scale at the start of their project and at the time of the evaluation (March 2015). On average, since the time of application, BIAP projects moved up at least one level on the technology readiness level scale used by the evaluation (Figure 3). More than one quarter of them remained at the same level (27%), and one quarter progressed three or four levels (25%). At the time of application, a sizeable portion of funded projects were at the early stages of the R&D process (Figure 3), which explains why, despite

a notable progression of all projects, a third (36%) of surveyed SMEs reported that their project was market-ready or on the market as of March 2015. This is further explained by the fact that several projects are still ongoing or have just started and that BIAP support is not expected to be sufficient to put a product on the market (i.e., further steps and additional funding are needed to commercialize a new product).

Furthermore, of the surveyed respondents who had not yet put their product on the market (88% of the total sample), 60% indicated it would be commercialized within the next year and a further 19% indicated they would commercialize within the next two years. A smaller portion of SMEs that had not yet put their product on the market (12%) reported that their BIAP project would not be commercialized within the next five years. This is not unusual as it is part of the normal innovation path to have some projects at the earlier stages of the R&D process that have to change direction or abort.

Figure 3 Level of commercialization readiness of BIAP funded projects at time of application and as of March 2015



Source: BIAP evaluation survey data

3.2 Demonstration of efficiency and economy

This section discusses the appropriateness of BIAP's design and delivery and demonstrates how the Program is being administered efficiently and economically—that is, so as to minimize the level of resources needed to achieve its intended outcomes. The section first highlights the high level of satisfaction of SMEs with key program design and delivery features and administrative procedures

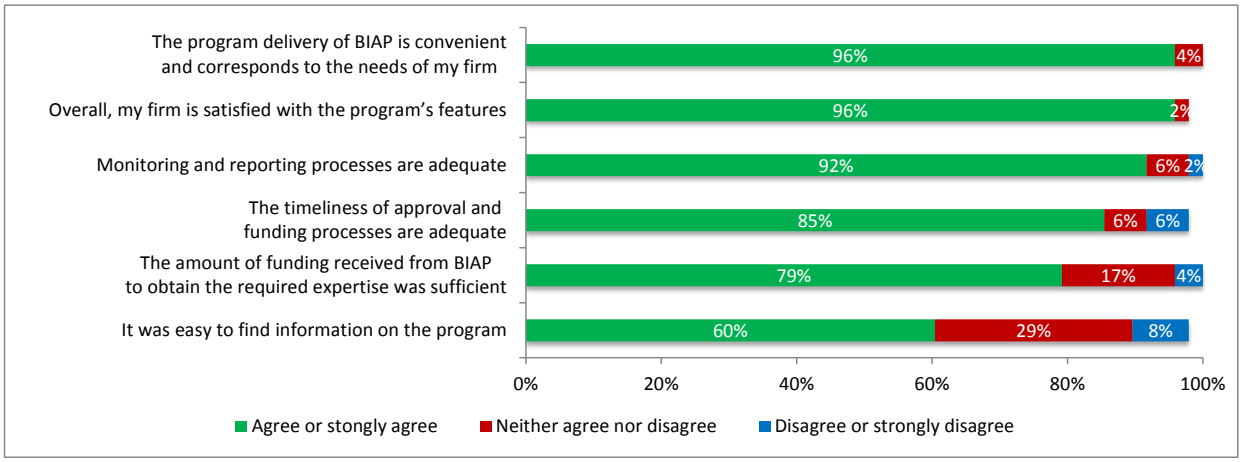
(i.e., application, claim monitoring and reporting processes), while acknowledging program delivery issues and potential areas of improvement raised by survey respondents and interviewees. It then shows how program funds have been used by the regions, and illustrates how the high efficiency level of BIAP is largely attributable to the fact that it is administered by IRAP.

3.2.1 Appropriate program design and delivery

Finding 7: Overall, BIAP design and delivery was deemed appropriate and no alternative delivery mechanism was found that would be more efficient than and as effective. Areas of improvement to the Program were primarily related to facilitating access to business service providers.

Based on the survey and interview data, the evaluation found that key implementation design characteristics were viewed quite positively by the SMEs and service providers (Figure 4). Indeed, 96% of surveyed SMEs reported that, overall, their firm was satisfied with the Program's features and 79% felt that the funding received was sufficient to meet their objectives. The interview and survey data also indicates that the 15 business day project approval time from submission of proposal to final approval of the project was deemed very efficient. More precisely, it usually takes about a calendar week for the ITA to submit a recommendation to the executive director once the proposal has been received, and then two weeks for the executive director to provide an answer and/or issue the contract.

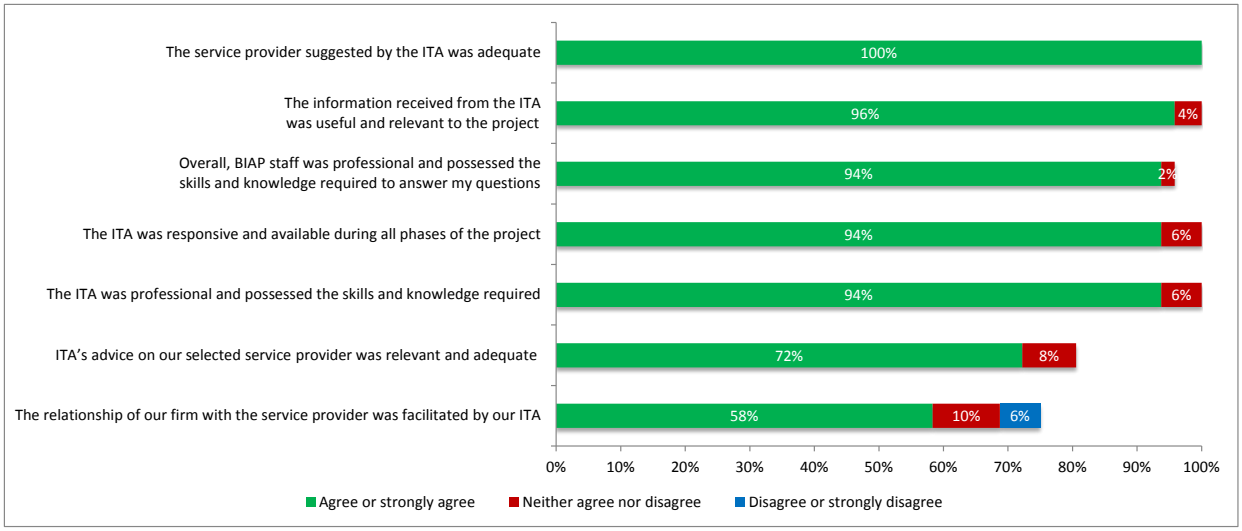
Figure 4 Level of satisfaction of surveyed SMEs with BIAP design features



Source: BIAP evaluation survey data

Furthermore, SMEs and service providers considered the advice and support of the ITAs as a key success factor in their projects (Figure 5). Interviewees particularly praised ITAs' extensive networks of service providers, involvement in the field and close relationship with SMEs. ITAs were often reported as being highly responsive and effective throughout the application process. ITAs themselves noted that the process is straightforward and similar to—although less complex and shorter than—the IRAP process, which is well established and has proven effective over the years.

Figure 5 Level of satisfaction of surveyed SMEs with ITAs and BIAP staff



Source: BIAP evaluation survey data

There was also a high level of SME satisfaction (Figure 4) with the program monitoring and reporting requirements (92%) and funding (claim) processes (85%). Internal and external interviewees stated that the frequency and type of reporting requirements were adequate overall. The frequency with which status reports and claims are submitted appears to vary from one service provider to another though, while the program guidelines highly recommended that these be submitted on a monthly basis to allow for close monitoring of the progress of the projects (except for smaller projects that can claim a single payment at the end of the project). While insufficient evidence was collected to draw any robust conclusion on this topic, anecdotal evidence was found in external interviews that service providers appreciate having some flexibility in the frequency at which they submit claims and reports depending on the size and time frame of the project. Internal interview evidence suggests that reducing the frequency of claims and reports should be allowed to the extent that it does not prevent BIAP from adequately tracking progress made by funded projects.

As noted earlier, interviewees raised program delivery issues related to business services, possibly explaining the relatively small number of business projects (i.e., 20 out of 85 projects), especially projects that are at the later stages of the R&D spectrum. Most notably, SMEs and ITAs face difficulties in identifying business service providers because universities and colleges typically have more technical rather than business-related resources and expertise, and some ITAs were perceived as being less familiar with business than technical service providers. Internal interviewees also noted that SMEs tend to prioritize technical service needs over business service needs.

The evaluation found that the BIAP operational context embedded within IRAP using many of the same management tools may also have had an influence on the orientation of the Program toward addressing technical/technology development-related issues rather than business-related issues, such as marketing plans, supply chain development, identification of distribution channels or regulatory requirements of key export markets. Interviews with IRAP management revealed that

IRAP has made an effort over the past five years to ensure that new ITAs have the requisite and recent business experience and/or receive training in this area.

Interviews with internal and external stakeholders highlighted potential improvements that could be made to the design and delivery of BIAP, including:

- Improving the flexibility of the Program with regard to the number of projects and the combination of technical and business projects. For example, the possibility of carrying out several technical and/or business BIAP projects annually, instead of only one business and one technical project per year.
- Extending the Program beyond two years, considering that it took almost a year before the Program reached its cruising speed, including the time to make the official announcements and the time for program staff to become familiar with the Program's rules and to engage with SMEs and service providers.
- Working with service providers that are not used to collaborating with industry, such as universities, and possibly having program resources on site to facilitate and accelerate the application process and ensure that projects carried out with these service providers are run more smoothly. Indeed, internal and external interviewees felt that universities and colleges need support to adapt their research (e.g., have resources available outside of the academic calendar) and administrative processes (e.g., have mechanisms in place to prepare quotations) to be able to respond to SMEs' needs more quickly and effectively. Some SMEs experienced unexpected delays due to lengthy administrative processes on the service provider's side (e.g., submission of proposals, quotations and claims) and the misalignment between the academic calendar and the time frames of the projects, which required that students and faculty be available even during the summer.
- Using a grant model rather than a contribution model, whereby the funding would be provided to SMEs upfront instead of as a reimbursement. In addition to providing more flexibility to the SMEs, it would better suit the financial mechanisms in place in learning institutions (i.e., they are reportedly more used to processing grants than contributions).

3.2.2 An economical and efficient program

Finding 8: The evaluation found that BIAP has been delivered economically and efficiently, as evidenced by the absence of associated operations and maintenance (O&M) costs, the use of existing IRAP management and monitoring tools, and the optimization of the ITA network with no perceptible additional workload burden for the benefit of the Program. The evaluation found that all regions except for Quebec spent less than their total available funds over the first year of the Program, although the gap progressively decreased toward the end of 2014/15 and the beginning of 2015/16.

As shown in Table 1, a total of $10 million in new funding was allocated to the Program for fiscal year 2013/14 and fiscal year 2014/15 combined, and an additional $0.7 million were provided by other sources (e.g., IRAP) for personnel and O&M. Due to the late program launch discussed

earlier, the funding of $2.5 million originally allocated for 2013/14 was transferred to 2014/15. As illustrated in Table 2, approximately $8.2 million were disbursed by the regions in fiscal year 2014/15. All provinces except Quebec were behind in their funding assignment schedule. These data indicate that BIAP is progressively ramping up. A possible explanation for the difference between planned and actual spending comes from BIAP foundational documents, which indicates that the expected average value of BIAP's contribution to a SME was to be $40,000. However, to date the average BIAP project funding allocation is 25% less, at approximately $30,000. This could indicate that the funds are allocated in an economical manner, or that the funding requirements for the types of projects submitted are more modest than expected.

Table 1 Funding allocated to BIAP for fiscal years 2014/15 to 2015/16

	2014/2015	2015/2016	Total
New funding			
Contributions and evaluation costs*	$10,000,000	$10,000,000	$20,000,000
Estimated funding leveraged from IRAP to deliver BIAP			
Personnel and O&M	$387,250	$281,250	$668,500

Source: BIAP and IRAP financial data
* $200,000 was originally allocated for evaluation costs

Table 2 Funding allocated and disbursed for BIAP projects for fiscal year 2014/15, by region

Region	Planned budget	Actual (funds disbursed)	Variance between actual funds and planned budget	% funds assigned out of planned budget
Pacific	$1,700,000	$1,646,903.70	$53,096.30	96.9%
West	$1,800,000	$1,237,361.23	$562,638.77	68.7%
Ontario	$2,755,000	$1,763,907.13	$991,092.87	64.0%
Quebec	$2,995,000	$2,894,856.42	$100,143.58	96.7%
Atlantic	$750,000	$626,128.07	$123,871.93	83.5%
Total	$10,000,000	$ 8,169,156.55	$1,830,843.45	81.7%

Source: BIAP and IRAP financial data
Note: $1.7 million of uncommitted BIAP funding was cash managed internally and provided to IRAP in 2014/15, which explains the majority of the variance in actual and planned funds. IRAP will return the funds to BIAP in 2015/16.

The absence of additional associated O&M costs,[32] the use of existing NRC-IRAP management and monitoring tools, and the optimization of the ITA network with no perceptible additional workload burden for the benefit of the Program suggest that BIAP is managed economically and efficiently. Moreover, internal interviewees stated that ITAs and administration staff did not face any major challenge in coordinating their work on IRAP and BIAP, given the small number of BIAP projects compared to the number of IRAP projects. As an example, in one region the additional workload was approximately one BIAP project per ITA, whereas in another region the additional workload represented no more than 15 projects a year, compared to 200 IRAP projects. In both cases, this was deemed to be very reasonable. In another region, where program uptake was quite high, an IRAP management representative mentioned that the additional workload

required ITAs to spend slightly less time on providing advice and more time on the provision of funds, but without affecting the quality of the services provided overall. To prevent this issue, an IRAP management representative from another region explained that efforts were made to reduce ITAs' administrative duties to allow them to spend more time in the field.

4 Conclusion and recommendations

BIAP was found to address an important need and government priority to provide financial support to SMEs in order to support the commercialization of their innovations through enhanced linkages with academic and publicly funded research organizations. BIAP is uniquely positioned to address this need given that it is delivered by IRAP, which has pan-Canadian networking capabilities, solid R&D expertise and long-term experience in the field. BIAP was found to be rather unique at the federal level given that it was designed to address the commercialization needs of SMEs. The finding that approximately half of BIAP supported projects were early stage R&D, and seemingly more aligned with IRAP's broader innovation support mandate than BIAP's commercialization-focus suggest that there may be some overlap between BIAP and IRAP. Where IRAP is addressing the broader innovation gap, there is a niche opportunity for BIAP to address the commercialization gap by targeting projects later in the R&D continuum.

Recommendation 1: IRAP, as the delivery agent of BIAP, should consider strategies to support a greater proportion of projects that are positioned in the pre-commercialization phase of innovation development.

BIAP has made progress toward achieving its immediate outcome to facilitate access by SMEs to technical services to support innovation from learning institutions and publicly funded research organizations, but less so for business services to support commercialization. Based on a review of the literature, the most important barriers to commercialization are: the lack of SME business management, marketing and sales expertise; inappropriate customer targeting; poor utilization of "anchor companies"; and the low level of capitalization for commercialization. The Program would benefit from an emphasis on the business-related services that would assist SMEs to overcome these barriers, including: securing anchor clients, distribution channels investigations, guidance on accessing venture capital, supply chain optimization and overcoming barriers to market access (e.g., tariffs, export quotas).

Recommendation 2: IRAP, as the delivery agent of BIAP, should identify and recommend a broader range of service providers across Canada, including university business schools, accelerators and incubators with expertise in business services that addresses the most important barriers to the commercialization of their innovations.

Client SMEs are generally well positioned to meet their project objectives and some have made progress toward commercialization. However, the number of projects that are close to or have entered the commercialization phase is relatively low. This is not surprising given that it is still early in the Program's lifecycle, and that projects in the nascent stages of research and development are being funded. The evaluation found that BIAP is managed efficiently and economically, essentially because it uses resources, structures and processes already in place within IRAP and IRAP-related programs. The shortfall in commitments and disbursements in the first year can be attributed to the initial lag in Program uptake by SMEs (part of the normal program cycle), although the Program was gaining traction by the end of 2014/15 and in 2015/16.

5 Management Response and Action Plan

Management Foreword: In delivering BIAP, ITAs have been responsive to clients' needs, whether they were of a technical or business nature, in an earlier or a later stage of the innovation process, and the current mix of services and suppliers is a reflection of those needs.

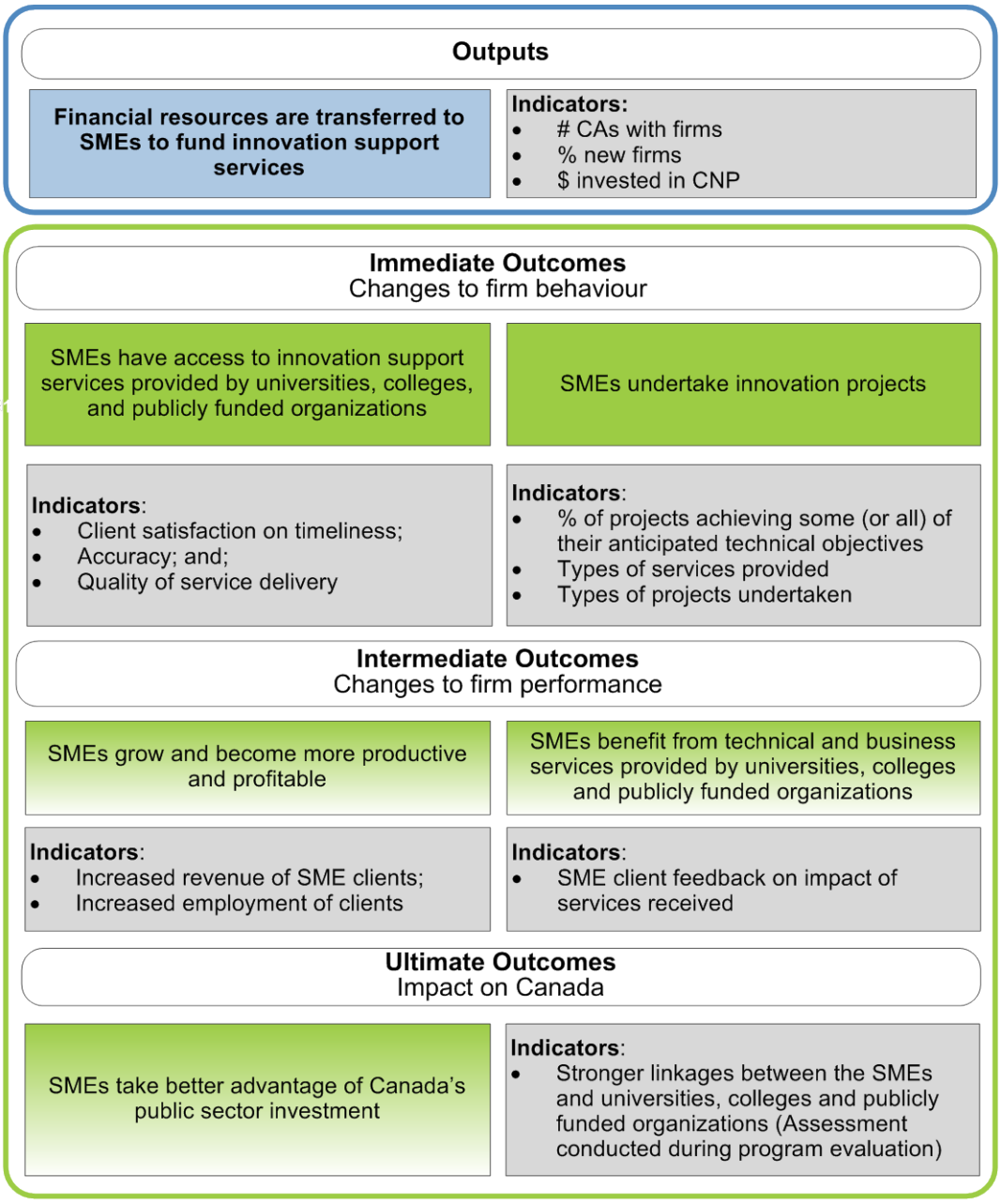
Given that BIAP is scheduled to end on March 31, 2016, and that 92% of this year's budget has already been committed, there is little opportunity to implement the proposed recommendations. While IRAP considers that the recommendations have value, they can only be implemented if the Government decides to renew the program and to include those recommendations in the design of the renewed program. The management response and action plan included is framed to reflect this.

Recommendation	Response and Planned Action (s)	Proposed Person (s) Responsible	Timelines	Measure (s) of Achievement
IRAP, as the delivery agent of BIAP, should consider strategies to support a greater proportion of projects that are positioned in the pre-commercialization phase of innovation development.	Accepted. As stated in its Terms and Conditions, BIAP helps firms at an early development stage of an innovation project and also at later stages, closer to commercialization. IRAP recognizes the need for support at later stages. Should BIAP be renewed, IRAP will continue to ensure that, where appropriate, BIAP resources are used to support projects in the pre-commercialization phase.	Executive Director Division Services, NRC-IRAP	March 31, 2016	If BIAP is renewed, evidence that this recommendation is considered in program design.
IRAP, as the delivery agent of BIAP, should identify and recommend a broader range of service providers across Canada, including university business schools, accelerators and incubators with expertise in business services that addresses	Accepted. The main goal of BIAP is to encourage engagement between Canadian SMEs and universities, colleges, and publicly funded research organisations. The strength of these organizations is on the technical and scientific side. For this reason, IRAP also	Executive Director Division Services, NRC-IRAP	March 31, 2016	If BIAP is renewed, evidence that this recommendation is considered in program design

Recommendation	Response and Planned Action (s)	Proposed Person (s) Responsible	Timelines	Measure (s) of Achievement
the most important barriers to the commercialization of their innovations	has engaged with incubators, accelerators and other such organizations that have access to business experts. IRAP recognizes the importance of business support for SMEs. Should BIAP be renewed, and with appropriate resources, IRAP will identify an even broader range of service providers with business expertise and will facilitate BIAP clients' awareness and access to their services.			

Appendix A – BIAP Logic model

Figure 6 BIAP Logic Model



Source: BIAP Program documents

Appendix B – Evaluation matrix

Table 3 BIAP evaluation matrix

Issues	Questions	Literature and document review	Review of Administrative and Performance data	Semi-structured interviews	Survey of client SMEs
Program Relevance					
Continued need for Program	R1. Is there a justifiable need to provide financial support to SMEs for the purchase of services from Canada's learning institutions and publicly-funded research organizations to develop or commercialize products, services and processes more quickly?	•		•	
		•		•	•
		•		•	•
		•		•	•
Alignment with government priorities	R2. To what extent is BIAP consistent with current government priorities?	•		•	
Alignment with federal roles and responsibilities	R3. Is BIAP consistent with federal roles and responsibilities?	•		•	
Program Performance					
Achievement of Program outcomes	P1. To what extent has BIAP been successful in connecting SMEs with Canada's learning institutions and publicly-funded research organizations?	•	•	•	
			•		
			•		•
			•	•	
			•	•	
					•

Issues	Questions	Literature and document review	Review of Administrative and Performance data	Semi-structured interviews	Survey of client SMEs
					●
				●	●
				●	●
	P2. To what extent has BIAP resulted in benefits to client SMEs?		●	●	●
				●	●
			●	(●)	●
			●	●	●
					●
			●	●	●
				●	●
	P3. What are the unintended impacts, if any, of BIAP?		●	●	●
Demonstration of efficiency and economy	P4. To what extent is the Program design and delivery appropriate? Are there alternative modes of Program delivery that would be more efficient and as effective?			●	●
				●	●
				●	●
				●	●
		●	●	●	
	P5. To what extent is the Program being delivered in an			●	

Issues	Questions	Literature and document review	Review of Administrative and Performance data	Semi-structured interviews	Survey of client SMEs
	economic and efficient manner?	•	•	•	
		•	•	•	

Source: BIAP evaluation planning documents

Appendix C – Additional data tables and figures

Table 4 Comparative analysis of BIAP and provincial voucher programs

Characteristics	NRC-IRAP – Business Innovation Access Program	Alberta – Innovation Voucher Program	New Brunswick – Innovation Voucher Program	Newfoundland & Labrador – Productivity & Innovation Voucher Program	Nova Scotia – Productivity & Innovation Voucher Program	Ontario – Vouchers for Commercialization Program
Program administration	NRC-IRAP	Alberta Innovates – Technology Futures	New Brunswick Innovation Foundation	Research & Development Corporation	Economic Rural Development and Tourism	Ontario Centres of Excellence
Description	Provides SMEs with credit notes to pay for services with eligible service providers in order to commercialize new products, services and processes more quickly.	Provides small technology and knowledge-driven businesses with resources to move ideas from concept to commercialization more quickly.	Provides SMEs with a unique opportunity to access the scientific talent and facilities they need to develop and commercialize new innovations.	Provides businesses with improved access to technical expertise and facilities required to support their R&D activities.	Provides SMEs with access to Nova Scotia universities and colleges to make their businesses more innovative and productive.	Provides a means of transferring research to existing Ontario-based companies or to use academic intellectual property as a basis to found new Ontario-based businesses.
Applicant eligibility	SMEs with < 500 employees	Small businesses located in province with < 51 employees and gross income up to $5M	SMEs located in province with < 500 employees, 24 months operating history	Businesses located in province with R&D needs and high growth potential	SMEs operating in province with < 100 employees who in part, or all, reside in province	Start-up companies < 3 years old with < $250,000 pre-recurring revenue with academic IP or in-licence IP
Eligible service providers	Universities, colleges, non-profit research institutions and publicly funded research facilities	Labs, consultants, designers, fabrication shops, prototyping centres, IP service providers	Collaborating researchers and research organizations	Research institutes, academic institutions and laboratories	Universities and colleges based in the province	Universities and colleges, teaching hospitals based in the province
Proposal submission	Ongoing	Quarterly competitions	Ongoing	Ongoing	Annual competition	Ongoing
Maximum duration	12 months	24 months	12 months	12 months	12 months	12 months
Maximum contribution	$50,000 max.	Small: $15,000 max. Large: $50,000 max.	$80,000 max.	$15,000 max.	Tier 1 $15,000 max. Tier 2 $25,000 max.	$50,000 max.
Eligible project costs	75% of project cost	75% of project cost	80% of project cost	75% of project cost	100%	75% of project cost

Characteristics	NRC-IRAP – Business Innovation Access Program	Alberta – Innovation Voucher Program	New Brunswick – Innovation Voucher Program	Newfoundland & Labrador – Productivity & Innovation Voucher Program	Nova Scotia – Productivity & Innovation Voucher Program	Ontario – Vouchers for Commercialization Program
Assessment notification	15 business days from proposal submission	6–8 weeks after competition deadline	2 weeks from proposal submission	2–3 weeks from proposal submission	4 weeks after competition closing	6–8 weeks from proposal submission
Voucher recipient	Applicant	Applicant	Service provider	Applicant	Applicant	Applicant
Intellectual Property	If the proposed project gives rise to IP issues, the ITA should not use the BIAP.	If IP expected, an agreement must be in place between the service provider(s) and the small business to govern its ownership.	IP is owned by the company that receives the voucher.	If IP expected, an agreement must be in place between the service provider(s) and the company to govern its ownership.	If IP expected, an agreement must be in place between the service provider(s) and the company to govern its ownership.	IP protection costs are the responsibility of the applicant; OCE may consider supporting a start-up with up to $5,000 for IP filing costs.
Eligible activities	Technology services: • Prototype design • Product optimization • Technology options • Algorithms or mathematical models • Specialized testing and investigation. Business services: • Business development plans • Market research, strategies and plans • Certification and regulation • Distribution channel analysis • Supply chain optimization • Regulatory requirements assessment	Small projects: • Opportunity assessments • Business mentoring • Small scale prototyping • IP services Large projects: • Product prototyping • Lab verification • Field testing	• Applied research • Proof of concept • Prototyping • Product testing • Product demonstration • Product evaluations and certifications • Industrial/process engineering services	• Applied R&D • Prototyping • Performance testing • Field trials • Small-scale demonstration projects	• Applied research • Industrial/process engineering services • Field testing • Product evaluation and certification • Prototyping • Product design • Market feasibility • Eco-efficiency audits	• Technology assessment • Market assessment and strategy • Prototype design and development • Material characterization • Proof of concept demonstration • Early customer engagement

Sources: Programs' websites

Table 5 Comparative analysis of BIAP and IRAP-Accelerated Review Process

Characteristics	IRAP Accelerated Review Process	BIAP
Total IRAP Contribution	Up to $50,000	Up to $50,000. Range from $10k to $40k with emphasis on well-defined problems.
Project duration	Shorter than IRAP projects (typically less than 1 year)	Up to 1 year. Targeting 3 to 6 months, year-long projects would be exceptional.
Qualifying work	Technical or business problem	Well-defined technical or business problem to accelerate commercialization efforts.
Support of SME internal costs	Normally up to 80% of salary costs	N/A
Support of SME external costs	Normally up to 50% of contractor costs	Up to 75% of contractor costs to encourage SMEs the use of BIAP.
Eligible firms	Standard IRAP eligibility and risk management	Standard IRAP eligibility and risk management.
Eligible contractors	SME can use any capable private or public contractor	Limited primarily to universities, colleges, and non-profit research institutions, and where appropriate, publicly funded research facilities with unique abilities or due to proximity challenges. Also includes not-for-profit incubators and accelerators with permanent staff. Publicly funded research facilities are government labs (i.e., NRC). The contractor must operate in Canada.
Number of contractors per project	No limit (total contribution must be under $50,000)	Only one contractor per project.
Number of projects per firm	One or more concurrent ARP project covering one or more fiscal year	One Business BIAP project (support up to $50,000) can be started in each government fiscal year of BIAP AND One Technical BIAP project (support up to $50,000) can be started in each government fiscal year of BIAP. Project splitting with another IRAP project is not allowed to include concurrent firm costs of the BIAP work.
Concurrent projects with other government programs	Possible	Possible. BIAP can run in parallel with other federal or provincial programs but other programs may have restrictions themselves. If BIAP support is set at 75% of project, no other support is allowed for the Activities of the project.
Contractor capacity	Contractor can subcontract if required	BIAP principles: - No flow-through - Contractor cannot sub-contract - No third party arrangements BIAP is to ensure knowledge and competencies are retained and remain available to SMEs. The intent is to increase the ability of the public service providers to engage and work with SMEs. Full-time employees, registered students of the institution under contract and professors are allowed.

Characteristics	IRAP Accelerated Review Process	BIAP
Intellectual Property	Possibility of IP creation. The IP belongs to the company.	No or minimal IP is expected. If IP becomes a critical path issue then another type of IRAP program should be used. BIAP projects are fee for service rather than collaborative research.
Service standard	Project to be approved by Director within 20 business days of receipt of complete client proposal.	Project to be approved by Director within 15 business days of receipt of complete client proposal. The objective is to address immediate SME needs.
Developing SME and contractor quote/proposal	The SME and the contractor develop the quote and work plan that are reviewed by the Lead ITA.	The SME and the contractor develop the quote and work plan that are reviewed by the Lead ITA. Proposal/quote should provide the ITA with enough assurance that the contractor meets eligibility criteria and that the service provided will enhance innovative capacity of firm to develop and commercialize new and improved products.
Assessment and recommendation	Streamlined from regular IRAP.	Very similar to ARP.
Contribution Agreement management	Status Reports required and contractor reports can be attached to Status Reports to confirm work completed.	Status Reports required and contractor reports can be attached to Status Reports to confirm work completed. BIAP will not provide advance payments when a deposit is required by contractor. Firms will only be able to claim costs incurred once the work has been performed by the contractor.
Reporting	Status Report, PPA, and Snapshot.	Status Report, PPA, and Snapshot. Snapshot is reduced to 3 years following project completion date.

Source: BIAP Program documents

Table 6 Distribution of projects by Technology Readiness Level and type of service

Technology Readiness Levels	Business Services	Technical Services	TOTALS
TRL 1	1	5	6
TRL 2	0	7	7
TRL 3	10	22	32
TRL 4	0	6	6
TRL 5	1	3	4
TRL 6	5	15	20
TRL 7	0	4	4
TRL 8	1	3	4
TRL 9	2	0	2
TOTALS	20	65	85

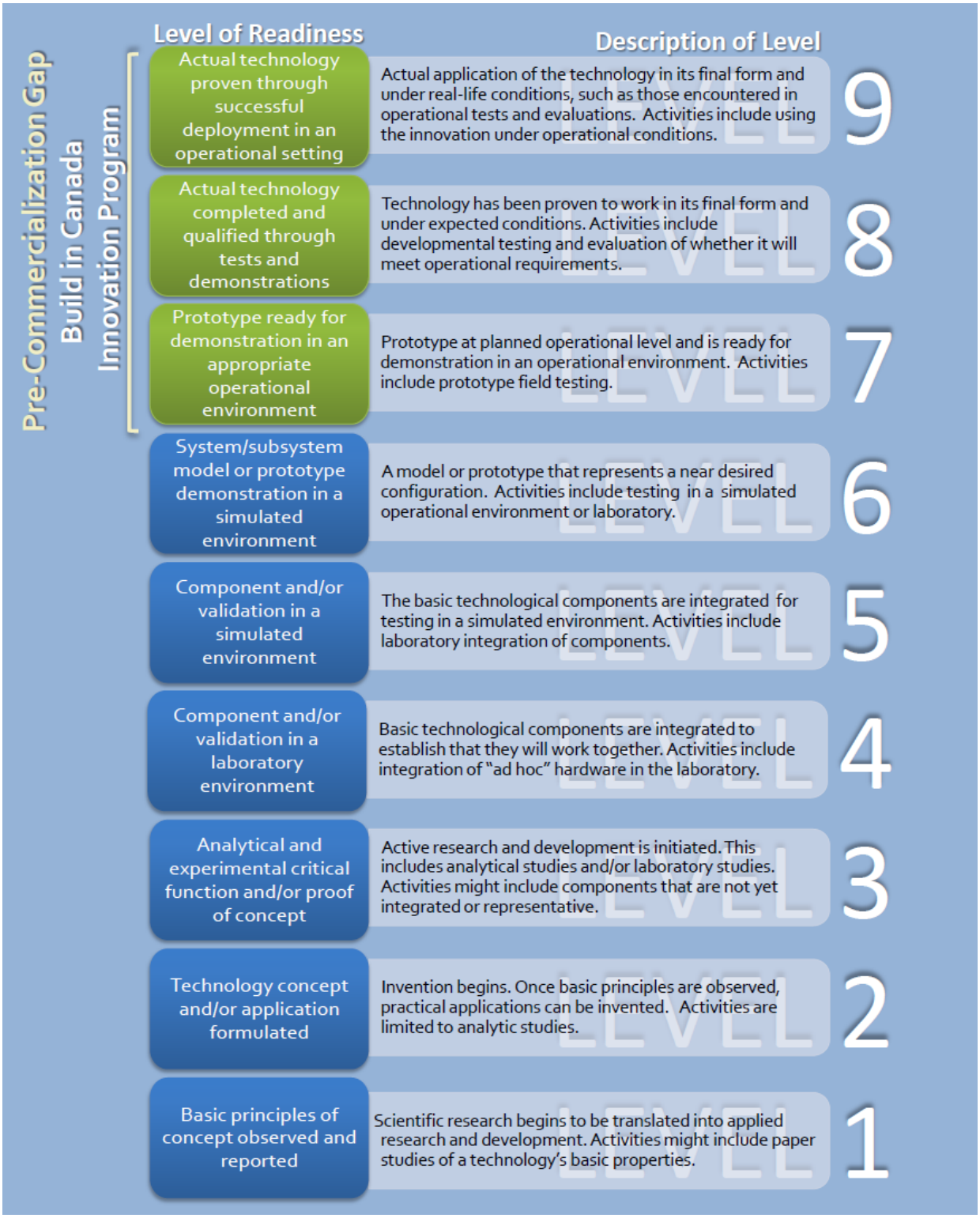
Source: BIAP administrative files; PWGSC 2011

Table 7 Co-occurrence coefficients by Technology Readiness Level type and type of service

Technology Readiness Levels	Business Services	Technical Services	TOTALS
TRL 1	0.04	0.08	0.12
TRL 2	0	0.11	0.11
TRL 3	0.24	0.29	0.53
TRL 4	0	0.09	0.09
TRL 5	0.04	0.05	0.09
TRL 6	0.14	0.21	0.36
TRL 7	0	0.06	0.06
TRL 8	0.04	0.05	0.09
TRL 9	0.1	0	0.1

Source: BIAP administrative files; PWGSC 2011

Figure 7 Technology readiness levels



Source: PWGSC 2011 [33]

Appendix D – Detailed methodology

An evaluation of the Business Innovation Access Program (BIAP), delivered by the National Research Council (NRC) Industrial Research Assistance Program (NRC-IRAP), was undertaken to cover the period 2014/15 to 2015/16. The evaluation was carried out to fulfill the conditions of the Program's approval by Treasury Board, and in accordance with the NRC's approved evaluation plan and Treasury Board policies.

Given that BIAP has been in operation for less than one year, the evaluation primarily sought to update NRC senior executives and NRC-IRAP management on program implementation. In alignment with the Treasury Board Secretariat (TBS) *Policy on Evaluation* (2009), the evaluation also explored questions related to relevance, achievement of early outcomes, and efficiency and economy.

The selection of methods was based upon the most efficient means of addressing the evaluation issues in a rigorous way, while taking into account the evaluation scope as well as cost, time and resource constraints. A mix of qualitative and quantitative methods were used for this evaluation, including a literature and document review, an administrative and performance data review, a survey of client SMEs and semi-structured interviews. This allowed for triangulation of findings from multiple lines of evidence, leading to useful, valid and relevant evaluation recommendations.

Details for each of the methods are included in the subsections below, as well as associated methodological challenges and limitations.

Literature and document review

A literature and document review was conducted to position the initiative within a broad frame of reference for the sector. In this case, the literature included documents produced by various government departments, peer-reviewed academic publications and grey literature. Such documentation was used not only to contextualize BIAP, but also to better understand other program models or efforts to support innovation, commercialization and SME development within Canada and internationally. Similarly, a review of internal documents such as strategic plans, performance reports, and other internal studies allowed the evaluation team to gain historical insights into how BIAP came about and allowed for relevance and performance issues to be addressed. Relevant text from the captured stock of documents was coded in ATLAS.ti, a qualitative data analysis software, using both the deductive and inductive approaches.

Administrative and performance data review

An in-depth analysis of BIAP project, performance and financial data was conducted to gain a better understanding of the Program's profile, implementation and delivery characteristics, client reach, as well as efficiency and economy. The administrative and performance data were extracted from SONAR, IRAP's Client Relationship Management system. This included available data on the approved BIAP projects such as funds received, region, size, service providers.

Survey of client SMEs

The web survey sought to collect information on all evaluation questions, and to assess program need, program delivery and early outcomes from the users' perspective. The e-survey also included questions to mitigate the limited Program Administrative and Performance data. The survey population consisted of all 85 SMEs that were supported by BIAP as of 31 October 2014. Four of these had invalid email addresses, leading to a survey population (N) of 81 client SMEs. All 81 SMEs were invited to participate in the survey, and with a response rate of 59% this resulted in 48 completed questionnaires.

Both Science-Metrix and NRC evaluation staff were involved in drafting the survey questionnaire in English and in French, as well as in pre-testing the web survey. The 28-question survey included both closed-ended (e.g., multiple choice or five-point scale) and open-ended questions (where relevant); some of these also included sub-questions.

Once the survey was programmed into the software (Fluid Surveys), it was pretested internally by representatives from Science-Metrix and NRC to ensure that the technical and logical aspects of the online survey were sound (i.e., the survey could be completed using various browsers and operating systems), and to examine the validity of the questionnaire in terms of sequencing and clarity of the questions (e.g., the routing of questions worked as intended). Minor adjustments were made to the questionnaire based on the comments received from those involved in pretesting.

NRC evaluation staff was responsible for drafting and sending out the pre-notification letter to all potential survey respondents, while Science-Metrix was charged with preparing and emailing the survey invitations and reminders. The survey invitation was sent by email in both official languages. Respondents accessed the web surveys through a personalized link to the questionnaire's URL. This enabled Science-Metrix to track, in real time, the respondents who had accessed and responded to the survey. It also prevented respondents from submitting a completed survey more than once.

Science-Metrix launched the web survey on 26 January 2015. It then remained open for more than five weeks, closing on 4 March 2015. Four reminders were emailed at regular intervals to respondents who had not yet completed and submitted the survey. SMEs were also contacted by phone once, after the fourth reminder, in order to encourage their participation.

Semi-structured interviews

The objective of the interviews was to collect perceptions from internal and external stakeholders on most evaluation questions related to program relevance (e.g., continued need, duplication or complementarity with other programs, alignment with the federal government and NRC priorities and roles and responsibilities), effectiveness (i.e., achievement of expected outcomes), and efficiency and economy (e.g., sufficiency of program resources, alternative delivery strategies).

A total of 30 interviews were conducted with five different interview groups (Table 8), including one in-person and 29 by telephone. The interview distribution focused heavily on external

stakeholders. Considering that the Program has been in operation for less than one year, a strong focus on gathering stakeholder feedback contributes to program design improvements and may help steer the future direction of the Program.

Following an initial email sent by a program representative at NRC-IRAP (for external stakeholders only), Science-Metrix contacted individuals to schedule an interview. Interviews were conducted by telephone using an interview guide tailored for each interview group that had been approved by NRC evaluation staff beforehand. Interviewees were sent a copy of the interview guide in advance of the interview.

All interview transcripts were systematically coded and analyzed by indicator using ATLAS.ti, qualitative data analysis software.

Table 8 Distribution of interviewees by interview group

Interviewee group	Targeted number of interviews	Number of interviews completed
NRC-IRAP Management and Government Officials	7	6
Industrial Technology Advisors (ITAs)	5	5
Regional Contribution Agreement Officers (RCAOs)	2	2
Small and medium enterprises (SMEs)	10	7
Service Providers	12	10
TOTAL	36	30

Challenges and limitations

The main limitation for this evaluation relates the fact that the Program has only been in place for a year, hence limiting the availability of data on the impact of the Program on SMEs, in terms of commercialization outcomes, increased profitability and establishment of long-term relationships with service providers.

Other key methodological challenges were faced during the evaluation and addressed with corresponding mitigation strategies, as per the following:

- **Survey population size issues:** The small size of the survey population (SMEs) combined with low response rate could have had an impact on the reliability of survey data. Extra efforts were made to encourage SMEs to participate through frequent reminders by email and by telephone. In addition, 17 SMEs were consulted via interviews, most of whom had not completed the survey questionnaire.
- **Survey respondents' familiarity with BIAP:** Some respondents indicated they were not aware they were supported by BIAP. Others could not remember precisely how BIAP funds were used. This indicates that some responses provided may have been uninformed. Survey

questionnaires were screened manually to identify respondents who did not seem to be familiar with BIAP (e.g., who answered "Don't know/Not applicable" to all questions or who answered similarly to all closed-ended questions). No such questionnaires were found, possibly indicating that respondents answered on a best-effort basis.

- **Interviewee participation:** There was a risk that interview candidates, especially SMEs, would not be available or not be willing to participate. The interview list included back-up interview candidates who were contacted to replace any primary candidates who declined to participate. A number of SMEs were also contacted for both the e-survey and the interviews, to increase the chances of capturing input from this group.

Appendix E – Reference list and notes

[1] Jenkins, Tom. (2011). *Innovation Canada: A Call to Action. Review of Federal Support to Research and Development – Expert Panel Report* [pdf]. Retrieved from http://rd-review.ca/eic/site/033.nsf/vwapj/R-D_InnovationCanada_Final-eng.pdf/$FILE/R-D_InnovationCanada_Final-eng.pdf

[2] OECD. (2011). *Science, Technology and Industry Scoreboard 201: Innovation and Growth in Knowledge Economies* [pdf]. Retrieved from http://www.oecd-ilibrary.org/docserver/download/9211041e.pdf?expires=1427816817&id=id&accname=guest&checksum=C2524B6719D70513BDB8FB15A9C355BF

[3] Industry Canada. (2015). SME Research and Statistics. [webpage]. Retrieved from http://www.ic.gc.ca/eic/site/061.nsf/eng/Home

[4] Conference Board of Canada. (2013). *How Canada Performs: A Report Card on Canada* [pdf]. Retrieved from http://www.conferenceboard.ca/Libraries/PUBLIC_PDFS/13-260_HCP2013_ExecSumm.sflb

[5] World Economic Forum. (2013). *The Global Competitiveness Report 2013–2014* [pdf]. Retrieved from http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2013-14.pdf

[6] *Ibid.*

[7] Conference Board of Canada. (2013). *How Canada Performs: A Report Card on Canada* [pdf]. Retrieved from http://www.conferenceboard.ca/Libraries/PUBLIC_PDFS/13-260_HCP2013_ExecSumm.sflb

[8] Council of Canadian Academies. (2013). *Paradox Lost: Explaining Canada's Research Strength and Innovation Weaknesses* [pdf]. Retrieved from http://www.scienceadvice.ca/uploads/eng/assessments%20and%20publications%20and%20news%20releases/synthesis/paradoxlost_en.pdf

[9] Council of Academies. (2013). *The State of Industrial R&D in Canada* [pdf]. Retrieved from http://www.scienceadvice.ca/uploads/eng/assessments%20and%20publications%20and%20news%20releases/research%20and%20develop/ird_fullreporten.pdf

[10] World Economic Forum. (2013). *The Global Competitiveness Report 2013–2014* [pdf]. Retrieved from http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2013-14.pdf

[11] CATA. (2012). *Beyond R&D: Gaining Economic Value through Effective Commercialization of Innovations* [pdf]. Retrieved from http://www.cata.ca/files/PDF/2012/Draft-ExecutiveSummary-of-Commercialization-Study-SCohn-24March2012.pdf

[12] *Ibid.*

[13] Council of Academies. (2013). *The State of Industrial R&D in Canada* [pdf]. Retrieved from http://www.scienceadvice.ca/uploads/eng/assessments%20and%20publications%20and%20news%20releases/research%20and%20develop/ird_fullreporten.pdf

[14] Council of Canadian Academies. (2013). *Paradox Lost: Explaining Canada's Research Strength and Innovation Weaknesses* [pdf]. Retrieved from http://www.scienceadvice.ca/uploads/eng/assessments%20and%20publications%20and%20news%20releases/synthesis/paradoxlost_en.pdf

[15] Science, Technology and Innovation Council. (2012). *State of the Nation: Canada's Science, Technology and Innovation System: Aspiring to Global Leadership* [pdf]. Retrieved from http://www.stic-csti.ca/eic/site/stic-csti.nsf/vwapj/StateOfTheNation2012-may16-eng.pdf/$file/StateOfTheNation2012-may16-eng.pdf

[16] Council of Canadian Academies. (2013). *Paradox Lost: Explaining Canada's Research Strength and Innovation Weaknesses* [pdf]. Retrieved from

http://www.scienceadvice.ca/uploads/eng/assessments%20and%20publications%20and%20news%20releases/synthesis/paradoxlost_en.pdf

17 Jenkins, Tom. (2011). *Innovation Canada: A Call to Action. Review of Federal Support to Research and Development – Expert Panel Report* [pdf]. Retrieved from http://rd-review.ca/eic/site/033.nsf/vwapj/R-D_InnovationCanada_Final-eng.pdf/$FILE/R-D_InnovationCanada_Final-eng.pdf

18 *Ibid.*

19 Funding provided to SMEs by IRAP can be used to for contractor fees; travel costs and living expenses; reports and studies; overhead; materials; consumed capital; and patenting costs (IRAP Terms and Conditions).

20 NSERC. (2015). Engage Grants. [webpage]. Retrieved from http://www.nserc-crsng.gc.ca/Professors-Professeurs/RPP-PP/Engage-Engagement_eng.asp

21 CATA. (2012). *Beyond R&D: Gaining Economic Value through Effective Commercialization of Innovations* [pdf]. Retrieved from http://www.cata.ca/files/PDF/2012/Draft-ExecutiveSummary-of-Commercialization-Study-SCohn-24March2012.pdf

22 Industry Canada. (2007). *Mobilizing Science and Technology to Canada's Advantage* [webpage]. Retrieved from http://www.ic.gc.ca/eic/site/icgc.nsf/eng/h_00856.html

23 Minister of Finance. (2012). *Jobs, Growth and Long-Term Prosperity: Economic Action Plan 2012* [pdf]. Retrieved from http://www.budget.gc.ca/2012/plan/pdf/Plan2012-eng.pdf

24 Jenkins, Tom. (2011). *Innovation Canada: A Call to Action. Review of Federal Support to Research and Development – Expert Panel Report* [pdf]. Retrieved from http://rd-review.ca/eic/site/033.nsf/vwapj/R-D_InnovationCanada_Final-eng.pdf/$FILE/R-D_InnovationCanada_Final-eng.pdf

25 Ibid, p. 5-13

26 *Minister of Finance. (2013). Jobs Growth And Long-Term Prosperity: Economic Action Plan 2013* [pdf]. Retrieved from http://www.budget.gc.ca/2013/doc/plan/budget2013-eng.pdf

27 NRC. (2012). Mandate and role. [webpage]. Retrieved from http://www.nrc-cnrc.gc.ca/eng/irap/about/mandate.html

28 Minister of Justice. (2013). *National Research Council Act* [pdf]. Retrieved from http://www.laws.justice.gc.ca/PDF/N-15.pdf

29 NRC. (2015). Concierge Service. [webpage]. Retrieved from http://www.nrc-cnrc.gc.ca/eng/irap/concierge/

30 Industry Canada 2015. Retrieved from http://www.ic.gc.ca/eic/site/cis-sic.nsf/eng/h_00005.html

31 The population centres (1 through 4) are linked to each Canadian postal code based on the definitions above and are available in the "Postal Code Conversion File (PCCF)" and in the "Postal Codes by Federal Ridings File (PCFRF)," both of which have been purchased by IRAP.

32 As illustrated in Table 1, the costs related to BIAP personnel and O&M are covered by funds already allocated to other programs, including IRAP.

33 Public Works and Government Services Canada [web page]. Retrieved from https://buyandsell.gc.ca/initiatives-and-programs/build-in-canada-innovation-program-bcip/program-specifics/technology-readiness-levels