Public Interest Determinations in Impact Assessment: A Multiple Account Evaluation Framework

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List of Abbreviations

Abbreviation	Definition
Avg	Average
BCA	Benefit-cost analysis
CAD	Canadian dollars
CIT	Corporate income tax
CO_2e	Carbon dioxide equivalent
DCFA	Discounted cash flow analysis
EconIA	Economic impact analysis
ERP	Early revenue phase (Mary River Mine)
FPIC	Free, prior, and informed consent
GBA Plus	Gender-based analysis plus
GDP	Gross domestic product
GHG	Greenhouse gas
IA	Impact assessment
IAAC	Impact Assessment Agency of Canada
IBA	Impact and benefit agreement
IIBA	Inuit Impact and Benefit Agreement (Mary River Mine)
MAE	Multiple account evaluation
Mt	Million tonnes
MTA	Million tonnes per annum
NIRB	Nunavut Impact Review Board
NPV	Net present value
NTI	Nunavut Tunngavik Incorporated
PIT	Personal income tax
PY	Person years of employment
QIA	Qikiqtani Inuit Association

Executive Summary

i. The objective of this study is to outline a comprehensive multiple account evaluation (MAE) framework to improve the public interest determination process in impact assessment (IA).

ii. This report includes the following:
   1. A summary of methods used to inform public interest determinations in IA and their respective strengths and limitations;
   2. A description of an MAE framework for informing public interest determinations;
   3. A case study illustration of how the MAE framework functions in practice; and
   4. A summary of strengths and weaknesses of the MAE framework and recommended next steps for improving public interest determinations in IA.

iii. The IA process is designed to estimate the positive and adverse consequences of a proposed project, mitigate adverse impacts, and determine whether a project should be approved. A principal factor that decision makers must consider when deciding whether to approve or reject a proposed project is whether the project is in the public interest. According to Section 63 of the *Impact Assessment Act*, the factors that are taken into consideration when making a public interest determination include the project's contribution to sustainability, the extent to which the adverse effects of the project are significant, mitigation measures that decision makers consider appropriate, the impact on Indigenous groups and the rights of Indigenous peoples of Canada, and the effects of the project on Canada's environmental obligations and climate change commitments.

iv. Methods currently used to estimate impacts in the IA process and inform public interest determinations include qualitative impact categorization, economic impact analysis, benefit-cost analysis, and sustainability assessment. These methods have limitations that hinder their ability to provide comprehensive, transparent, and accurate information to decision makers.

v. MAE is a method that can overcome many of the limitations of the impact estimation methods currently used in IA. MAE methodology involves estimating the net impacts of a project and categorizing the impacts into various accounts that cover the entire range of project impacts. The strengths of MAE relative to other methodologies are that it helps overcome the limitations of individual methods by integrating multiple methods including qualitative impact categorization, economic impact analysis, benefit-cost analysis, and sustainability assessment into a single, comprehensive framework; it covers revenue, environmental, social, economic, and health impacts; it provides a more accurate assessment of project impacts by estimating net rather than gross impacts; it ensures consideration of impacts that cannot be quantified; it disaggregates impacts by key groups and regions; it helps assess the relative significance of impacts; it helps facilitate transparent comparisons of trade-offs; and it helps decrease subjective bias in decision making.

vi. The methodology used to develop the proposed MAE framework consisted of a review of the requirements for IA under the *Impact Assessment Act*, a literature review focused on alternative methods for IA, identification of strengths and weaknesses of alternative impact estimation methods, development of a proposed MAE framework based on an integration of existing impact estimation methods, testing of the proposed framework using a case study approach, review of the framework by experts through surveys and workshops, refinement of the framework based on the expert review, and dissemination of results.

vii. Two interconnected MAE frameworks are proposed: the Public Interest MAE Framework and the Indigenous Community MAE Framework. The Public Interest MAE Framework is intended to directly inform the public interest determination and includes all relevant parties that are likely to be impacted by a proposed project. The structure of the Public Interest MAE framework is based on MAE literature, IA

literature, Impact Assessment Agency of Canada guidance documents, and Indigenous-led IA documents. The proposed Public Interest MAE Framework includes project developer, government revenue, economic activity, environmental, social, health, Indigenous community, and summary accounts. The contents of these accounts are intended to be flexible to different project types and in practice are likely to be developed collaboratively by the Impact Assessment Agency of Canada, various government organizations, Indigenous groups, and stakeholders.

viii. The Indigenous Community MAE Framework is a companion framework that focuses on the impacts relevant to local Indigenous communities. All information contained within the Indigenous Community MAE Framework is also summarized in the Public Interest MAE Framework. The proposed Indigenous Community MAE Framework includes Indigenous government revenue, economic activity, environmental, social, health, governance, and summary accounts. The accounts and sub-accounts in the Indigenous Community MAE Framework are intended to be flexible and be developed by impacted Indigenous communities. An added purpose of the Indigenous Community MAE Framework is that it is intended to support the design and negotiation of impact and benefit agreements that Indigenous groups negotiate with project developers and/ or senior levels of government.

ix. The two MAE frameworks were applied to a case study, the Mary River mine located on Baffin Island, Nunavut, to illustrate how they work in practice. Information on project impacts was obtained from publicly available documents found on the Nunavut Impact Review Board website. The case study illustrates that the MAE framework provides a comprehensive and transparent assessment of the project's revenue, environmental, social, economic, and health impacts; provides a focused analysis of impacts on Indigenous communities; indicates the distribution of the impacts among regions and groups; and helps indicate the relative significance of the impacts.

x. A survey of IA experts, practitioners, and participants was conducted to evaluate the proposed Public Interest MAE framework. Various organizations and groups were represented in the survey including the Impact Assessment Agency of Canada, Natural Resources Canada, Environment and Climate Change Canada, Indigenous groups, universities/ colleges, the private sector, and the Mackenzie Valley Review Board. Respondents were asked to evaluate the impact estimation methods currently used in IA, provide their opinions on public interest and its role in IA, and evaluate the proposed Public Interest MAE Framework. The survey results indicate that the impact estimation methods currently used in IA have various limitations and the majority of respondents indicated that the Public Interest MAE Framework meets best practice criteria and possesses the characteristics of an effective impact estimation method for IA. Survey respondents indicated that while public interest is a key factor in IA and project approval, they believe that the term itself and the extent to which it informs project decisions is unclear in the context of IA. Respondents also indicated that the proposed Framework has the potential to improve public interest determinations in IA. Finally, respondents identified the strengths and weaknesses of the Public Interest MAE Framework, identified potential challenges around implementation, and made suggestions regarding how the framework could be improved. The survey results are summarized in the main body of the report and in Appendix B.

xi. The primary conclusion of this study is that the Public Interest MAE Framework has the potential to improve public interest determinations and overcome many of the limitations associated with other impact estimation methods. Therefore, the following recommendations are proposed:

1. Refine the Public Interest MAE Framework and explore how the framework can be integrated into federal IA policy; and
2. Identify components of the Public Interest MAE Framework that can be adopted on an interim basis to improve IA including the following:

a. Developing consistent definitions of indicators such as employment by using standardized terms such as average annual person years instead of total person years to avoid misinterpretation of project benefits;
b. Estimating net as opposed to gross impacts for economic indicators to avoid overestimating project benefits; and
c. Conducting benefit-cost analysis based on current Treasury Board of Canada guidelines to estimate project costs and benefits as part of the IA review process including disaggregating costs and benefits by major stakeholder group and for Indigenous communities.

Acknowledgements

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1. Introduction

Determining whether a proposed project is in the public interest is an essential step in the impact assessment (IA) process. Due to methodological and informational limitations, however, the information used to support public interest determinations in IA is often inadequate.

This study seeks to improve the public interest determination process in IA by developing a comprehensive multiple account evaluation (MAE) framework that is designed to transparently assess project impacts and inform decision makers of the trade-offs associated with a proposed project. This report begins with a summary of the Impact Assessment Agency of Canada's (IAAC) IA and public interest determination processes followed by a summary of alternative methods used to assess impacts and inform public interest determinations. Next, we outline the objectives of this study. Following this, we present the methodology used to develop the Public Interest MAE Framework, which includes a literature review, expert review, and a survey. Additionally, a case study approach is used to demonstrate how the Public Interest MAE Framework functions in practice. Subsequently, based on the results of the survey and case study, we assess the Public Interest MAE Framework's capacity to assess project impacts and inform public interest determinations compared to the current process. Finally, we present conclusions and identify next steps and future research needs.

2. Impact Assessment and Public Interest Determinations under the *Impact Assessment Act*

The IA process is designed to estimate the positive and adverse consequences of a proposed project, mitigate adverse impacts, and decide whether a project is in the public interest and whether it should be approved. Section 63 of Canada's *Impact Assessment Act 2019*[1] outlines the following factors that the Minister or Governor in Council (i.e., Cabinet) must consider when making a public interest determination:

- The extent to which the designated project contributes to sustainability;
- The extent to which the adverse effects within federal jurisdiction and the adverse direct or incidental effects that are indicated in the impact assessment report in respect of the designated project are significant;

- The implementation of the mitigation measures that the Minister or the Governor in Council, as the case may be, considers appropriate;
- The impact that the designated project may have on any Indigenous group and any adverse impact that the designated project may have on the rights of the Indigenous peoples of Canada recognized and affirmed by section 35 of the *Constitution Act, 1982*; and
- The extent to which the effects of the designated project hinder or contribute to the Government of Canada's ability to meet its environmental obligations and its commitments in respect of climate change.

3. Methods for informing public interest determinations

Methods for assessing project impacts and informing public interest determinations in IA should be comprehensive, transparent, and accurate and should allow for consideration of all relevant trade-offs associated with the project. Unfortunately, current methods used in IA to inform public interest determinations do not fully meet these criteria. Alternative methods for estimating project impacts and informing public interest determinations are discussed below and their relative strengths and limitations are summarized in Table 1.

Table 1. Strengths and limitations of alternative methods for informing public interest determinations

Methods	Strengths	Limitations and challenges
Qualitative impact categorization	• Ensures consideration of impacts that cannot be quantified • Currently used in IA (familiar method for IA practitioners and decision makers)	• Potential for ambiguous and/ or inconsistent definitions of impact categorization • Challenging to compare between trade-offs
Economic impact analysis	• Provides useful information on gross, regional, and intersectoral economic impacts	• Significantly overestimates the benefits of projects
Benefit-cost analysis	• Estimates net impacts • Facilitates transparent comparison of trade-offs • Canadian federal government has developed guidelines for conducting benefit-cost analysis	• May omit impacts that cannot be quantified • May omit certain types of information that decision makers seek (e.g., gross domestic product impacts) • Sensitivity analyses can result in divergent, imprecise results
Sustainability assessment	• Assesses the impact of a project on short and long-term sustainability targets • Covers economic, environmental, social, heritage, and cultural impacts and focuses on interactions between different types of impacts • Incorporates qualitative and non-monetary data	• Requires sustainability targets, which can be challenging to develop • Requires information on cumulative impacts to assess the impacts of a project on sustainability targets, which are challenging to estimate • Lack of consensus regarding what sustainability assessment is and how to define it

Multiple account evaluation	• Integrates multiple methods, including qualitative impact categorization, economic impact analysis, benefit-cost analysis, and sustainability assessment, into a single comprehensive method • Estimates net impacts • Covers environmental, social, economic, cultural, and health impacts • Ensures consideration of impacts that cannot be quantified • Disaggregates impacts by key groups and regions • Facilitates transparent comparison of trade-offs	• Defining accounts can be subjective • Sensitivity analyses can result in divergent, imprecise results • Incorporates qualitative impact categorization, economic impact analysis, benefit-cost analysis, and sustainability assessment and therefore possesses the limitations of these methods

Note. Information in Table 1 adapted from Gunton et al. (2020)[2].

Qualitative impact characterization

Assessment of project impacts and public interest determinations in IA normally involves a qualitative summary of project benefits and adverse impacts. While qualitative descriptions can be useful for summarizing impacts that are challenging to quantify, exclusively relying on qualitative impact characterizations makes it particularly challenging to compare the costs and benefits of a project and consequently makes it challenging to transparently and defensibly determine whether the project is in the public interest and how to maximize net project benefits. This challenge can be exacerbated by the potential for IA processes to utilize ambiguous and/ or inconsistent definitions of impact categorizations and indicators. The limitations of qualitative impact categorizations are illustrated in Table 2 in which impacts of the Trans Mountain Expansion Project are summarized in the National Energy Board[i] report[3] using qualitative descriptions based on the magnitude and spatial scale of the impact. Based on this summary, the National Energy Board concluded that the project was in the public interest because the benefits exceeded the burdens but did not provide any transparent method for comparing benefits and burdens to make this determination. For example, how is a considerable **burden** on killer whales compared to a considerable **benefit** of market diversification? How is the sum of all the burdens compared to the sum of the benefits to determine if the project is in the public interest? And how can burdens and benefits be managed to maximize net project benefits?

Table 2. Example of qualitative impact summary: National Energy Board's Assessment of the Benefits and Burdens of the Trans Mountain Expansion Project.

Benefits	**Rating**		**Burdens**	**Rating**
Market Diversification	Considerable Regional and National		**Adverse Effect on Southern Killer Whales**	Considerable Local, Regional and National

[i] The National Energy Board is now known as the Canadian Energy Regulator

Jobs	Considerable Local, Regional and National		**Adverse Effect on Aboriginal Culture**	Considerable Local and Regional
Competition among Pipelines	Considerable Regional and National		**Marine GHG Emissions**	Considerable Regional and National
Spending on Pipeline Materials	Considerable Local and Regional		**Municipal Development Plans**	Modest Local
Community Benefit Program	Modest Local and Regional		**Impairment of Aboriginal Use of Land and Water**	Modest Local
Enhanced Marine Spill Response	Modest Local and Regional		**Impairment of Stakeholders Use of Land and Water**	Modest Local and Regional
Capacity Development (Humans resources)	Modest Local and Regional		**Pipeline Oil Spill**	Acceptable Risk Local and Regional
Government Revenue	Considerable Local, Regional and National		**Marine Tanker Spill**	Acceptable Risk Local and Regional

Note: Table 2 obtained from Gunton et al.[4] Information in Table 2 has been adapted from National Energy Board.[3]

Economic impact analysis

As the Trans Mountain Expansion Project IA illustrates, assessing economic impacts such as jobs, market diversification, and government revenue are critical components of public interest determinations in IA. Currently, economic impacts for proposed projects are primarily estimated in IA using economic impact analysis (EconIA) methodology and input-output models. EconIA can provide useful information on the regional and intersectoral impacts of a proposed project. EconIA, however, can significantly overestimate the benefits of a project by assuming no opportunity costs or supply constraints on resources required to build and operate the project and estimating gross as opposed to net project impacts. In the Trans Mountain case, for example, the employment gain estimate erroneously assumes that all of the workers employed on the project (gross employment) would be unemployed if the project did not proceed. EconIA also uses terms such as total person years of employment that can result in misinterpretation of the number of jobs created.[ii] Consequently, EconIA should not be relied upon as the sole method for estimating economic consequences, and in particular economic benefits for informing public interest determinations.

[ii] E.g., a single employee holding a job for 25 years of operations is often presented as 25 person years of employment in EconIA even though it is only one job or one average annual person year of employment.

Benefit-cost analysis

Benefit-cost analysis (BCA) is a well accepted and comprehensive tool based on a solid theoretical foundation that involves estimating the positive and adverse consequences of a proposed project to calculate its net impact from the perspective of society as a whole. The Government of Canada has developed guidelines for conducting BCA and requires BCA to determine whether proposed government regulations are in the public interest.[5] BCA overcomes some of the methodological limitations of the current public interest determination process in IA by quantifying project impacts, where feasible, to allow for a comparison of benefits and burdens and by estimating **net** rather than **gross** project impacts. By quantifying the magnitude of project costs and benefits, BCA can also be used to assess how alternative project designs and mitigation measures can be used to increase net project benefits.

The merits of using BCA in IA are acknowledged in a recent IA Panel Report on the Grassy Mountain Coal Project. In its report, the Panel recommends that BCA should be used in combination with EconIA to provide decision makers with the information they need to evaluate projects. As the Panel recommends:

> "…the federal and provincial governments clarify the requirements for economic analysis for future provincial EIAs or federal impact assessments. Proponents should be required by the terms of reference to provide both an economic impact analysis and a cost-benefit analysis that allows decision makers to make informed decisions based on both types of economic information. The Panel also suggest that governments develop guidelines on the methodologies and assumptions that should be followed by proponents in producing these future analyses. Governments may wish to review the Canadian Cost-Benefit Analysis Guide produced by the Treasury Board of Canada. Different economists expressed varied views about what type of economic analysis should be conducted in a review. The Panel agreed that different types of economic analyses yield different kinds of information. The Panel believes that decision makers in future impact assessments would benefit from access to these different kinds of information."[6]

Some limitations of BCA are that some important impacts that cannot be easily quantified in dollar values (e.g., environmental values, cumulative impacts, and sustainability impacts) may be omitted from the analysis, sensitivity analyses used to assess the range of possible project parameters (e.g., construction costs, value of outputs, environmental risks, discount rates, etc.) can result in a wide variability in estimates, and certain types of information that decision makers are likely to seek, such as the total number of jobs created by a project and impacts of the project on gross domestic product (GDP), are not normally included in BCA.[7,8]

Sustainability assessment

Sustainability assessment is a complex method that involves assessing the impacts of a project from a multidisciplinary, long-term, and integrated perspective, that often follows a goals-oriented approach in which the estimated impacts of a project are assessed based on sustainability targets.[9,10,11,12] It should be noted that this method is not necessarily well-defined in the literature as there appears to be a lack of consensus regarding what sustainability assessment is and how to define it.[9] Narrower interpretations of sustainability assessment include any process that supports and guides decision-making towards sustainability in a general sense[9] or processes that focus on what are referred to as the three pillars of sustainability, which include environmental, economic, and social impacts.[11] Broader interpretations of sustainability assessment, however, adopt a more comprehensive version of sustainability and focus on a systems-based approach that covers economic, environmental, social, heritage, and cultural impacts and focuses on the interactions between all of these types of impacts.[10,12] The strengths of sustainability assessment are that it uses short and long-term sustainability targets to assess projects, can be comprehensive and cover all types of impacts, and can incorporate qualitative

and quantitative data. The limitations of sustainability assessment are that it requires predefined sustainability targets, which can be challenging to develop, it requires information on cumulative impacts to assess the impacts of a project on sustainability targets, which are challenging to estimate, and, as discussed, there is a lack of consensus regarding what sustainability impact assessment is and how to define it, which raises challenges around being able to apply the method consistently.

Multiple account evaluation

Multiple account evaluation (MAE), also referred to as multiple account benefit-cost analysis, is a method that addresses many of the limitations of the methods outlined above by providing more accurate and transparent information for public interest determinations. MAE is a comprehensive method that integrates several methods including qualitative impact categorization, BCA, EconIA, sustainability assessment, and other methods applicable to IA to assess projects and communicates results in a matrix summary based on a number of indicators.[2,13,14] The strengths of MAE relative to other IA methods are that MAE attempts to estimate the net impacts of a project rather than gross impacts; provides a comparison of revenue, environmental, social, economic, and health dimensions in a comprehensive evaluative framework; disaggregates benefit and cost distributions between impacted parties; provides results in a matrix summary allowing for a more transparent comparison of trade-offs and consequently decreasing subjective bias; and allows for the inclusion of qualitative data for impacts that cannot be easily quantified.[2,14] The limitations of MAE include the following: defining the accounts can be subjective, sensitivity analyses used to assess the range of possible project parameters can result in wide variability in estimates, and since it integrates several methods into a single method, it therefore possesses some of the limitations associated with these methods.[2,14]

MAE's ability to assess distributional impacts between impacted parties is especially important for analyzing impacts to Indigenous communities. The United Nations Declaration on the Rights of Indigenous Peoples along with major court rulings relating to Indigenous rights and title[15] have helped initiate a shift in priority towards assessing how projects impact Indigenous populations. Consequently, updated provincial and federal legislation, such as the *Impact Assessment Act*, prioritize assessing impacts to Indigenous peoples and communities. In addition to being a comprehensive method, MAE is a flexible assessment tool that can be adapted to facilitate the identification of project-related measures that would reduce externalities and ensure that decision makers have the necessary information to make a public interest determination. Given these strengths, MAE can provide an effective framework for assessing project impacts and how alternative project designs and mitigation measures can be used to maximize net project benefits.

4. Developing an MAE Framework

This study addresses the requirements and priorities of the *Impact Assessment Act* and the intent of the recommendations in the Joint Review Panel report on the Grassy Mountain Coal Project[6] by developing guidelines for an MAE methodology to support IA and the public interest determination process. This study presents two interconnected MAE frameworks that can be used to compare and assess project impacts under the *Impact Assessment Act*: one comprehensive MAE framework that directly informs the public interest determination, hereafter referred to as the **Public Interest MAE Framework**, and a second, companion MAE framework that specifically informs impacts to Indigenous communities, hereafter referred to as the **Indigenous Community MAE Framework**. The Indigenous Community MAE Framework provides a stand-alone assessment of the impacts of projects on Indigenous communities that can be used by communities to evaluate proposed projects and manage them in a manner to meet community objectives. The Indigenous Community MAE Framework can also be integrated into the Public Interest MAE Framework to help in the determination of whether the project is in the public interest. The sub-objectives of the study are as follows:

- Identify ways in which public interest determinations are currently informed and assessed in the IA process;
- Assess the strengths and weaknesses of MAE for identifying positive and adverse project impacts, informing public interest determinations, and assessing how alternative project designs and mitigation measures can be used to increase the net benefits of a project;
- Identify best practices for conducting MAE;
- Identify areas in which MAE can support Canada's new approach to assessing projects;
- Develop an MAE framework specific to IA that can be used to inform public interest determinations and can be integrated into Canadian IA methodology/ requirements; and
- Develop a companion MAE framework specific to impacts to Indigenous communities that can be used as a tool by Indigenous communities participating in IA.

The focus of this report is to describe the Public Interest MAE Framework and the Indigenous Community MAE Framework. This report is meant to serve as a guidance document, introducing the two MAE frameworks and their components and demonstrating how the frameworks can be used to add clarity and transparency to the public interest determination process as well as increase the level of information on impacts to Indigenous communities. In practice, the specific application of the Public Interest MAE Framework and Indigenous Community MAE Framework may vary as they are likely to be tailored to unique characteristics of the project being assessed and the objectives of the impacted parties.

5. Methodology

This study's methodology followed seven steps, which are outlined in Figure 1. The methodology used to develop the proposed Public Interest MAE framework consisted of a review of the requirements for IA under the *Impact Assessment Act*, a literature review focused on alternative methods for IA and identification of strengths and weaknesses of alternative impact estimation methods, development of a proposed MAE framework based on an integration of existing impact estimation methods, testing of the proposed framework using a case study approach, review of the framework by experts through a survey and workshop, refinement of the framework based on the expert review, and dissemination of results.

The structure of the Public Interest MAE Framework is based on MAE methodologies outlined in the literature[13,14,16,17,18,19,20,21,22,23] as well as new IAAC guidance under the *Impact Assessment Act*.[24] A comparison of the accounts that appear in the MAE literature can be found in Table 3. In the MAE literature there is significant overlap among the recommended accounts. The majority of MAE frameworks include a government revenue or taxpayer account, an economic activity account, an environmental account, and a social/community account, all of which have been included in this study's proposed Public Interest MAE Framework. While many of the MAE frameworks include a market valuation account for the project, this type of account has not been included in the Public Interest MAE Framework. Instead, the Public Interest MAE Framework includes a project developer account, which can accommodate assessments for both private and public projects and allow for a comparison of benefit and cost distributions. In cases where a public entity is developing the project, the project developer and government revenue accounts can be combined into a single account. An Indigenous community account was also added to the Public Interest MAE Framework, adapted from the BC Ministry of Agriculture and Lands[25] MAE framework and in accordance with the requirements and priorities of the *Impact Assessment Act*[26] to increase the comprehensiveness of assessments and ensure proper consideration is given to the benefits and costs of the project to Indigenous peoples, communities, and governments. The Indigenous communities account is directly linked to the Indigenous Community MAE Framework, which is the companion framework to the Public Interest MAE Framework, which will be discussed further below. Finally, a health account was added to the Public Interest MAE Framework. While this account only appears in one of the

MAE frameworks found in the literature, health has been identified as a priority area of the *Impact Assessment Act* and is an important topic to address when making a public interest determination. It should be noted that the accounts are intended to be flexible and in practice are intended to be selected by IAAC, other government agencies, Indigenous communities, and stakeholders.

The Indigenous Community MAE Framework provides a deeper focus on the impacts on Indigenous communities involved in proposed projects. While this companion framework can be used as a separate tool, the Indigenous Community MAE Framework will directly inform the Public Interest MAE Framework's Indigenous communities account. As discussed, understanding the impacts of a project on Indigenous communities is a priority of the *Impact Assessment Act* and is essential to the public interest determination. In addition to this companion framework allowing for a stronger focus on Indigenous impacts, a purpose of the Indigenous Community MAE Framework is to serve as a tool that Indigenous communities can use to assess community impacts and inform the design of any impact and benefit agreements (IBAs) they may negotiate.

Like the proposed Public Interest MAE Framework, the general structure of the proposed Indigenous Community MAE Framework is based on MAE literature, but the accounts have been adapted due to the specific scope of the Framework. The Indigenous Community MAE Framework only includes accounts that relate directly to Indigenous communities, and the selected accounts were informed by IA guidance literature[26,27] as well as some recent publicly available Indigenous-led IA reports[28,29,30] and literature on Indigenous-led IAs[31,32] that provide examples of the types of impacts that are important to consider from the perspective of Indigenous communities. As with the Public Interest MAE Framework, the accounts included in the Indigenous Community MAE Framework are flexible and in practice are intended to be selected by the Indigenous communities participating in an IA.

The sub-accounts in the two MAE frameworks outlined below were also informed by MAE literature, IAAC guidance,[26] publicly available Indigenous-led IAs, and literature on Indigenous-led IAs. Estimation methods and indicators were informed by methodology literature[2,9,10,14,17,19,23,32,33,34,35,36,37,38,39] and IAAC guidance.[24,26,40]

Figure 1. Study methodology

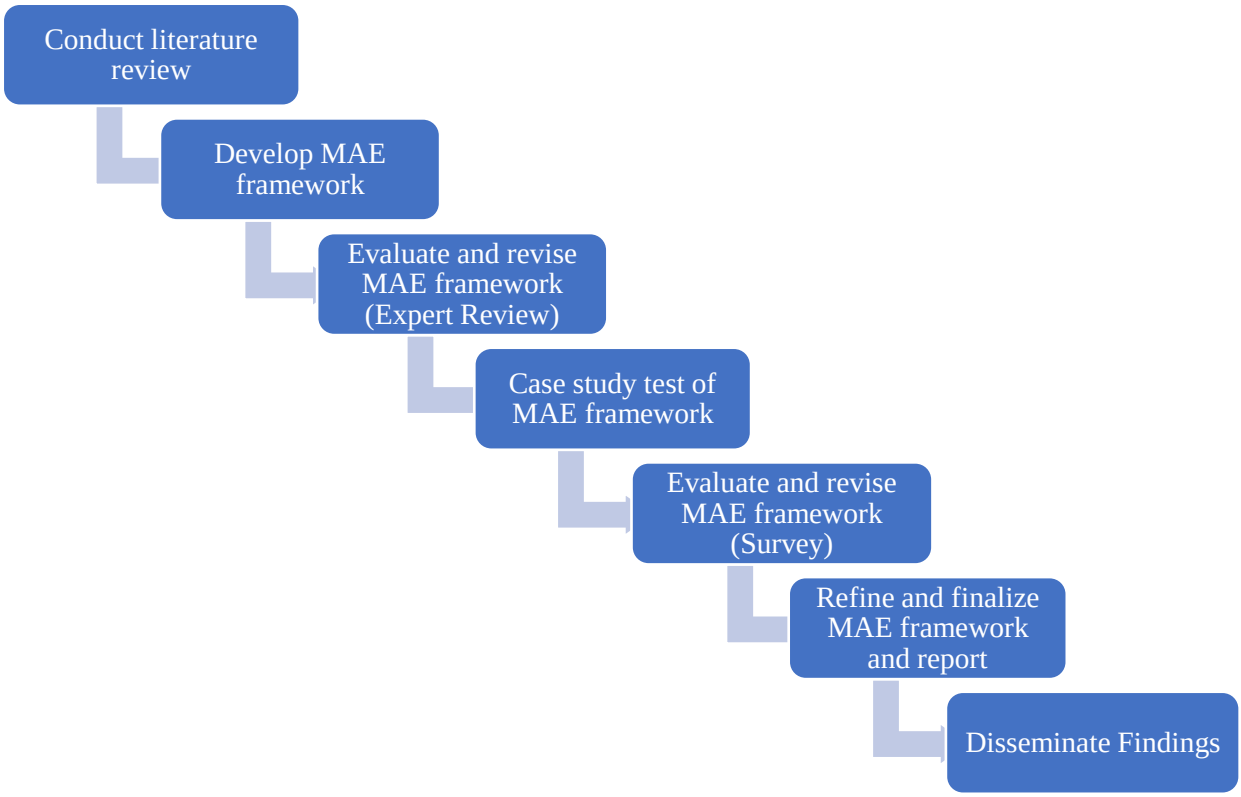


Table 3. Comparison of MAE Accounts from Literature

	MAE References									
Account	Shaffer[14]	Winter et al.[13]	BC Ministry of FLNRORD[41]	US Water Resources Council[23]	Campbell & Brown[19]	City of Saskatoon[20]	Crown Corps Secretariat[21]	BC Ministry of Agriculture and Lands[17]	BC Ministry of Transportation[18]	Alberta Transportation[16]
Project/ Market Valuation	✓	✓	✗	✗	✓	✓	✓	✗	✓	✓
Government/ Taxpayer (Revenue)	✓	✓	✓	✓	✗	✓	✓	✓	✗	✗
User/ Target Beneficiary	✓	✓	✗	✗	✓	✓	✓	✗	✓	✓
Project Developer	✓	✓	✗	✗	✓	✗	✓	✗	✓	✓
Economic Activity[42]	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓
Environmental	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓
Social/ Community	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓
Indigenous Peoples	✗	✓	✓	✗	✗	✗	✗	✓	✗	✗
Health	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗
Archaeological and Heritage resources	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗

6. Public Interest MAE Framework

The proposed Public Interest MAE Framework builds on a number of existing MAE models to create eight accounts summarized in Table 4. The accounts and sub-accounts are not necessarily prescriptive and can be modified to accommodate for context and project-dependent characteristics. The proposed accounts and sub-accounts were developed with an extractive natural resource project in mind but could be adapted for non-resource projects. The accounts and sub-accounts selected for a particular assessment are intended to capture the range of impacts as well as organize the impacts into relevant categories. The indicators for each account are intended to measure or summarize the magnitude of the impacts (i.e., dollar value for quantifiable impacts and/ or descriptions for qualitative impact categorizations and impacts on sustainability objectives) and to provide decision makers with comprehensive information on all consequences to help inform public interest determinations. Some impacts may appear in more than one account to indicate a compounding effect and interaction between different accounts (e.g., an impact in the environmental account may also impact social, physical, and/ or mental wellbeing). In these circumstances, a monetary estimate of the impact will only appear in a single account to avoid double counting, and qualitative categorizations will be used for any other accounts in which the impact appears. Additionally, the Public Interest MAE Framework addresses uncertainty and risk through including the results of sensitivity analyses, such as estimating how alternative resource commodity prices, capital costs, operating costs, production levels, fiscal regimes, or discount rates affect project feasibility and the distribution of benefits. Indicators in the Public Interest MAE Framework primarily summarize the net impacts of the project, estimating the difference between development and non-development scenarios.

The *project developer* account in the proposed Public Interest MAE Framework indicates the impact of the project on the developer's finances. This account is comparable to a private sector financial analysis that indicates the sum of all project revenues and project-related costs incurred by the project developer and excludes external costs and benefits that are addressed in other accounts. Estimating this account requires estimation of the net present value (NPV) of the entire project which indicates the overall profitability of the project and the total economic rent or monetary value of the project that is distributed to the various parties involved including the project developer, senior levels of government, Indigenous communities, and the general public. Additionally, the NPV indicates the financial capacity to mitigate adverse project impacts.

The other proposed accounts (*government revenue, economic activity, environmental, social, health, and Indigenous community*) assess the broader public interest impacts of the project not included in the project developer's account. In practice, the contents of the accounts and methods for estimating impacts for a particular project would be prescribed in the Tailored Impact Statement provided to the project proponent in the planning stage of the IA process. Valued components, which are specific impact topic areas that are identified by participants from Indigenous communities, stakeholders, and/ or IA practitioners, will also be outlined in the Tailored Impact Statement in the early stages of an IA process. Since valued components are often specific to a certain project, they have not been explicitly listed in the Public Interest MAE Framework outlined below but in practice would be included in the relevant sub-accounts.

The *summary* account provides an overall summation of the project's costs and benefits to determine the net impact of the project. This account helps indicate whether the project is in the public interest by estimating its overall net impact and the other accounts help indicate the relative magnitude of the costs and benefits by type and by impacted party. This shows the distributional effects of the project and helps identify how the project can be modified through various mitigation measures to increase overall benefits and reduce costs to society to enhance the public interest. The summary account is not intended to prescribe the public interest determination but rather help inform it. Ultimately, making a public interest determination and deciding whether to approve or reject a proposed project is the responsibility of decision makers. The Public Interest MAE Framework, however, can potentially decrease the level of subjective bias in the public interest determination through increasing the transparency around the trade-offs associated with the project.

Table 4. Public Interest MAE Framework

Account	Description	Potential sub-accounts and components	Potential estimation methods	Indicators
Project Developer	**This account measures the impact of the proposed project on the project developer's finances.**	Net revenue	Discounted Cash Flow Analysis (DCFA)	1) The *net present value (NPV) of project developer revenue*, in current Canadian dollars (CAD), indicates the net benefit (or cost) of the proposed project to the project developer. 2) For resource projects, the *percentage of total resource rent (% of total rent) to the project developer* indicates the proportion of total resource rent that accrues to the project developer.
Government Revenue	**This account measures the fiscal impacts of the proposed project for federal, provincial/ territorial, municipal, and Indigenous governments.**	Federal government revenue Provincial/ territorial government revenue Municipal government revenue Indigenous government revenue	DCFA	1) *Fiscal NPV* indicates the net benefit (or cost) of the proposed project to governments. Net fiscal impact is defined as net revenue less net costs to government resulting from the project, which is different from most IAs that estimate only gross revenue to government. 2) For resource projects, the *% of total rent to government* indicates the proportion of total resource rent that accrues to government. This also indicates the effectiveness of certain types of taxes and royalties at collecting rent and generating government revenue.
Economic Activity	**This account measures the impacts of the proposed project on economic activity.** This includes the net direct, indirect, and induced economic impacts to Indigenous communities, a region, and/ or a nation; depending on the scope of the analysis, as a result of the development of the proposed project. The economic activity account is meant to	Economic activity • Upstream and downstream economic impacts • Consumer spending Employment	DCFA Economic Impact Analysis (EconIA)	The economic impacts of a project are normally measured in terms of impact on *economic output*, or *GDP*, and *employment*. GDP and employment impacts are measured in *monetary units.* Employment can also be measured in *total person years of employment (PY)*[iii], for the construction phase of a project and *average annual PY*, for the operations phase. The impacts of a project on GDP and employment can be classified as a project's *net contribution to GDP* and *employment*.

[iii] One person year of employment is equivalent to 2,080 hours of work and is based on a 40-hour work week. Person year of employment is also sometimes referred to as full-time equivalent.

	capture impacts to upstream, downstream, and competing sectors.	Training and education		Further, these impacts can be classified based on scope including local/ regional (including Indigenous communities), provincial/ territorial, and national level impacts. Economic activity indicators are summarized as follows: *Net…*[43] a) *Contribution to national GDP* b) *Contribution to provincial/ territorial GDP* c) *Contribution to regional/ local GDP* d) *Contribution to national employment* e) *Contribution to provincial/ territorial employment* f) *Contribution to regional/ local employment* g) *Contribution to Indigenous employment*
Environmental	**This account measures the impact of the proposed project on the natural environment.** This account aligns with the traditional interpretation of IA, covering impacts to land and resources, water/ marine, air/ atmosphere, and climate commitments. Any proposed mitigation measures that are intended to help offset adverse impacts will be included in the relevant sub-account. Additionally, this account incorporates the *Impact Assessment Act*'s new requirements of assessing the extent to which the proposed project contributes to Canada's climate targets and commitments.	Land and resources • Terrestrial/ arboreal species • Land/ topography • Private Property • Recreation • Archaeological and heritage sites Water/ marine • Aquatic species • Hydrology, surface water and groundwater • Recreation Air/ Atmosphere • Air quality • GHG emissions Climate Commitments • Paris Agreement	Environmental Assessment Sustainability Assessment Cumulative Impact Assessment Non-market Valuation • Revealed Preference • Stated Preference • Offset/ Replacement Cost	The environmental, social, and health accounts are likely to include monetary estimates, quantitative/ physical unit estimates, and/ or qualitative impact characterizations. Non-market valuation methods can be used to estimate environmental, social, and health impacts.[44] Specific indicators for the environmental account will vary from project to project depending on the potential impacts. Indicators of environmental impacts are likely to include: 1) M*onetary estimates* (NPV); 2) *Quantitative/ physical units*; and/ or 3) *Qualitative impact characterizations of impacts using a scale-based rating scheme* (e.g., magnitude, geographic extent, timing, frequency, and duration of the impacts) *or other level of measurement such as sustainability targets.*

		• Canada's 2030 GHG emissions targets • Net zero emissions goal		
Social	**This account measures the social impacts of the proposed project.** Social impacts include physical and/ or cognitive social impacts that the proposed project may impose on the public. These impacts are likely to be limited to nearby towns and communities, but there is also potential for some social impacts to extend to a region or nation. A priority of the *Impact Assessment Act* is the consideration of the distribution of impacts among genders and potentially marginalized groups, which can be estimated following Gender-based analysis plus methodology (GBA Plus). Additionally, a separate account could be added that focuses specifically on the distribution of impacts among genders and potentially marginalized groups, similar to the Indigenous communities account outlined below. Project-related social impacts may stem from the development of community infrastructure or the provision of new or expanded services in the community.	Community services and infrastructure Community well-being Equality • Gender • Marginalized groups	Social Impact Assessment GBA Plus Non-market Valuation • Revealed Preference • Stated Preference • Offset/ Replacement Cost	Specific indicators for the social account will vary from project to project depending on the potential impacts. Indicators of social impacts are likely to include: 1) M*onetary estimates* (NPV) (e.g., estimated cost of additional social service provision); 2) *Quantitative/ physical units*; and/ or 3) *Qualitative impact characterizations of impacts using a scale-based rating scheme* (e.g., magnitude, geographic extent, timing, frequency, and duration of the impacts) *or other level of measurement such as sustainability targets.*
Health	**This account measures the health impacts of the proposed project.** IAAC guidance adopts the World Health Organization's definition of health, describing it as "[a] state of complete	Mental wellbeing Physical wellbeing	Health Impact Assessment	Specific indicators for the health account will vary from project to project depending on the potential impacts. Indicators of health impacts are likely to include:

	physical, mental, and social well-being, and not merely the absence of disease or infirmity."[45] In addition to assessing health outcomes, IAAC guidance stresses the importance of assessing determinants of health, which cover a broad scope of factors that influence health outcomes. Additionally, upstream and downstream health impacts should be considered when assessing the health impacts of a proposed project.		Human Health Risk Assessment Non-market Valuation • Revealed Preference • Stated Preference • Replacement/ Offset Cost	1) M*onetary estimates* (NPV*)* (e.g., estimated cost of additional health service provision); 2) *Quantitative/ physical units*; and/ or 3) *Qualitative impact characterizations of impacts using a scale-based rating scheme* (e.g., magnitude, geographic extent, timing, frequency, and duration of the impacts) *or other level of measurement such as sustainability targets*.
Indigenous Communities[iv]	**This account measures the impacts of the proposed project on Indigenous communities.** It should be noted that the impacts summarized in this account are likely to also be included in other accounts. For example, government revenue impacts will include Indigenous government revenue and national employment impacts will include Indigenous community employment impacts. Monetary estimates for these impacts, however, will only be accounted for once in the bottom-line sum of the summary account. This account can be further disaggregated to accommodate multiple communities.	Indigenous government revenue Economic activity Environmental Social Health Governance	DCFA EconIA Environmental Assessment Sustainability Assessment Cumulative Impact Assessment Non-market Valuation • Revealed Preference • Stated Preference • Replacement/ Offset Cost	Specific indicators for the Indigenous communities account will vary from project to project depending on the potential impacts. Non-market valuation methods applied to Indigenous contexts should follow best practices.[46] Indicators of impacts to Indigenous communities are likely to include: 1) M*onetary estimates* (NPV); 2) *Quantitative/ physical units*; and/ or 3) *Qualitative impact characterizations of impacts using a scale-based rating scheme* (e.g., magnitude, geographic extent, timing, frequency, and duration of the impacts) *or other level of measurement such as sustainability targets.*

[iv] For more information regarding Indigenous community sub-accounts, estimation methods, and indicators, see Appendix B.

			Social Impact Assessment GBA Plus Health Impact Assessment	
Summary	**This final account measures the net impact of the proposed project to the public: the sum of all accounts above.**	Project developer Government revenue Economic activity Environmental Social Health Indigenous communities	-	Generally, a positive net impact indicates that the proposed project is in the public interest and a negative impact indicates that the proposed project is not in the public interest. In addition to calculating the net impact of the proposed project in monetary terms, it is important that the summary account also includes other key pieces of information, such as quantitative/ physical units and qualitative impact characterizations, to allow for a proper assessment of the trade-offs associated with the proposed project. **Ultimately, it is the responsibility of the decision maker(s) to determine whether the proposed project is in the public interest and the Public Interest MAE Framework and its outputs are intended to help inform the determination and provide guidance on how the project can be modified to increase the net benefits to the public.**

7. Indigenous Community MAE Framework

The proposed Indigenous Community MAE Framework (Table 5) is used to evaluate the net impacts of a proposed project on an Indigenous community. All the information and impact estimates included in the Indigenous Community MAE Framework are also included in the Public Interest MAE Framework in a summarized form. The proposed Indigenous Community MAE Framework presented below has a significant amount of overlap with the Public Interest MAE Framework in terms of accounts, sub-accounts, estimation methods, and indicators. In practice, the Indigenous Community MAE Framework's accounts, sub-accounts, and indicators will be developed by Indigenous communities to conduct an assessment on how they may be impacted by a project, either independently or in collaboration with IAAC and/ or provincial/ territorial IA agencies. Effort must be made to estimate and consider all impacts to the community based on the Indigenous community's values and interests, and using traditional knowledge, to ensure that the assessment of the impacts of the proposed project is comprehensive and accurate. Multiple Indigenous Community MAE Frameworks may be required in IAs for projects that impact multiple Indigenous communities. Additionally, the Indigenous Community MAE Framework is intended to serve as a standalone tool that a community can use to analyze how it may be impacted by a proposed project, which is important for informing the community's assessment of whether the proposed project is in its interest and for informing IBA design and negotiation.

Table 5. Indigenous Community MAE Framework

Account	Description	Potential sub-accounts and components	Potential Estimation Methods	Indicators
Indigenous Government Revenue	**This account measures the fiscal impacts of the proposed project to the Indigenous community's government or administrative body.** Revenue benefits can be generated by a community through negotiating an IBA with the project developer and/ or negotiating a benefit agreement with a senior level of government, such as an economic and community development agreement.[47] The proposed project may also result in revenue costs if community-based economic sectors are impacted (e.g., fisheries,	Net Revenue	DCFA	1) The *NPV* of *First Nation government revenue* indicates the net benefit (or cost) of economic impacts to the Indigenous community. 2) For resource projects, the *% of total rent* indicates the proportion of total resource rent that accrues to Indigenous communities. This also indicates the effectiveness of IBA fiscal instruments at collecting rent and generating revenue and can be used to assess the equality of the IBA in distributing benefits.

	forestry, or tourism) and/ or net expenditures (e.g., adverse impact mitigation measures or adverse impacts on other sectors).			
Economic Activity	**This account measures the impact of the proposed project on the community's economic activity.** Economic activity impacts include non-revenue benefits and costs to the Indigenous community's economy resulting from the proposed project. Non-revenue economic impacts may include employment, training and education, local business contracts, and local infrastructure.	Employment Training and education Local business Local infrastructure	DCFA EconIA	1) The *net contribution to Indigenous community employment*, measured in monetary terms as well as total PY during the construction phase and average annual PY during the operations phase, indicates the net employment impacts of a project taking into account employment gains from the project as well as employment losses in other sectors that may be adversely impacted by the project and comparing these gains and losses to the current or baseline state of community employment.[48] 2) The *Indigenous community's percentage share of total PY* (during construction) and *annual average PY* (during operations), helps indicate the employment equity of the project. 3) The *net monetary values* of non-market benefits such as training and education, local business contracts, and local infrastructure; which can be estimated based on predicted costs incurred by the project developer or senior level of government to provide the benefit, indicate the benefit of these provisions to the Indigenous community.
Environmental	**This account measures the impact of the proposed project on the community's natural environment.** The environmental account aligns with the traditional interpretation of IA, covering impacts to land and resources, water/ marine, and air/ atmosphere. Any proposed mitigation measures that are intended to help offset	Land and resources Terrestrial/ arboreal species Land/ topography Vegetation/ plants Private Property Recreation	Environmental Assessment Non-market Valuation • Revealed Preference • Stated Preference • Replacement / offset cost	The environmental, social, and health accounts are likely to include monetary estimates, quantitative/ physical unit estimates, and/ or qualitative impact characterizations. Non-market valuation methods can be used to estimate environmental, social, and health impacts.[49] Non-market valuation methods applied to Indigenous contexts should follow best practices.[46] Indicators for this account will vary from project to project depending on the potential impacts. Indicators of environmental, social, and health impacts will include:

	adverse impacts will be included in the relevant sub-account.	Archaeological and heritage sites Water/ marine Aquatic species Hydrology, surface water and groundwater Recreation Air/ atmosphere Air quality GHG emissions	Cumulative Impact Assessment Sustainability Assessment	1) M*onetary units* (presented as an *NPV)*; 2) *Quantitative/ physical units*; and/ or 3) *Qualitative impact characterizations of impacts using a scale-based rating scheme* (e.g., magnitude, geographic extent, timing, frequency, and duration of the impacts) *or other level of measurement such as sustainability targets.*
Social	**This account measures the impact of the proposed project to the community's social wellbeing.** *Social wellbeing* may be affected by impacts on social practices, systems, and networks that affect community social cohesion or affect community sub-groups. This may include unequal hiring practices or potential for increased violence against women or marginalized groups due to an influx of migrant project workers. Social impacts may instead be incorporated into the health account depending on how a community defines health and whether it includes social wellbeing.	Social wellbeing	Social Impact Assessment GBA Plus Non-market Valuation • Revealed Preference • Stated Preference • Replacement / offset cost	Specific indicators for this account will vary from project to project depending on the potential impacts. Indicators of social impacts are likely to include: 1) *Monetary estimate in current CAD* (*NPV)* (e.g., estimated cost of additional social service provision); 2) *Quantitative/ physical units*; and/ or 3) *Qualitative impact characterizations of impacts using a scale-based rating scheme* (e.g., magnitude, geographic extent, timing, frequency, and duration of the impacts) *or other level of measurement such as sustainability targets.*

Health	**This account measures the impact of the proposed project to the community's health.** When measuring the impacts of a project on the health of a community and its members, a comprehensive and holistic view of health should be utilized.[24,32] It should be emphasized that each component of the health account is interconnected, and a single project-related impact may have a compounding effect on community health. The *mental* and *physical wellbeing* of community members may be impacted by changes in access to food sources, adequate housing, drinking water, recreational opportunities, etc. *Cultural* and *spiritual wellbeing* may be affected by impacts on cultural practices, systems, or beliefs that affect cultural cohesion and/ or continuity. This includes language and intergenerational transmission of culture and history.	Mental wellbeing Physical wellbeing Cultural and spiritual wellbeing	Health Impact Assessment (HIA) Human Health Risk Assessment (HHRA) Non-market Valuation • Revealed Preference • Stated Preference • Replacement / offset cost	Specific indicators for this account will vary from project to project depending on the potential impacts. Indicators of health impacts are likely to include: 1) M*onetary estimate in current CAD* (*NPV)* e.g., estimated cost of additional health service provision); 2) *Quantitative/ physical units*; and/ or 3) *Qualitative impact characterizations of impacts using a scale-based rating scheme* (e.g., magnitude, geographic extent, timing, frequency, and duration of the impacts) *or other level of measurement such as sustainability targets.*
Governance	**This account measures the impacts of the proposed project on the community's governance over its territory and resources.** These impacts are broadly categorized as *governance-related benefits* or *governance-related costs*.	Governance-related benefits Governance-related costs FPIC	Document Analysis	1) *Qualitative descriptions* of the impact indicate the governance impact to the community, including the *mechanism*, *categorization as a benefit or a cost*, *magnitude*, *geographic extent*, *timing*, *frequency*, and *duration*. The mechanism refers to the instrument or tool that is responsible for delivering the governance-related benefits or costs. These mechanisms are likely to derive from

	Governance-related benefits refer to any mechanisms associated with a proposed project that strengthen a community's rights and title. Potential sources of these governance-related benefits include the proponent's project application, an IBA negotiated with the project developer, an economic and community development agreement or memorandum of understanding negotiated with a senior level of government, and the IA certificate (and its conditions). *Governance-related costs* refer to any mechanisms associated with a proposed project that weaken a community's rights and title. Potential sources of these governance-related costs include sales or leases of land or water title, rights, or tenures to a project developer. Additionally, *free, prior, and informed consent (FPIC)* is addressed in this account. While not necessarily categorized as a project impact, community consent (or lack thereof) has the potential to significantly influence the public interest determination and therefore is an important consideration.			legislation, regulation, contracts, or agreements. Potential mechanisms may include (but are not necessarily limited to): • Dispute resolution mechanisms; • Shared decision-making arrangements; • Monitoring and enforcement provisions; • Renegotiation provisions; • Adaptive management provisions; and • Land or water rights, title, tenure sale or leases. 2) *Whether FPIC has been provided by a community/ obtained by a developer.*
Summary	**This final account measures the net impact of the project on the**	Indigenous government revenue	-	Generally, a positive net impact, or NPV, indicates that the project is in the community's interest and a negative

	Indigenous community: the sum of all accounts above	Economic activity Environmental Social Health Governance		impact, or NPV, indicates that the project is not in the community's interest. In addition to calculating the net impact of the project in monetary terms, it is important that the summary account also includes other key pieces of information, such as quantitative/ physical units and qualitative impact characterizations, to allow for a proper assessment of the trade-offs associated with a proposed project. **Ultimately, it is the responsibility of the community decision maker(s) to determine whether the project is in the community's interest and the Indigenous Community MAE Framework and its outputs are intended to help inform the determination.**

8. Case Study Analysis: Mary River Mine

A case study application of the proposed Public Interest MAE Framework is provided to illustrate how the Framework functions in practice. The Mary River Iron Mine project (the Project), located on Baffin Island in Nunavut, Canada, was selected as a case study due to the publicly available and comprehensive impact assessment documents containing detailed information on project impacts and the two publicly available IBAs that contain the information required to estimate economic impacts to the Inuit and show how IBAs, which are an increasingly common tool in project development, can affect the distribution of project costs and benefits. Monetary estimates of benefits and costs of the project were estimated using a discounted cash flow model developed using Microsoft Excel.

Baffinland Iron Mines Corp. (Baffinland) received approval for the Mary River mine from the Nunavut Impact Review Board (NIRB) for an initial "early revenue phase" (ERP) in 2012 and the mine became operational in 2015. An application for the "Phase 2" expansion which would allow for an increase in production from its current 4.6 million tons of iron ore per annum (MTA) to 12 MTA, was recently rejected by the NIRB. However, at the time this case study was initially conducted, the application was still under review and it is possible that the proponent may submit a revised Phase 2 expansion application in the future. Therefore, the case study reflects a development scenario that includes the ERP (from years 1 to 11 of operations) and the Phase 2 expansion (from year 12 to the final year of operations in year 24). The other assumptions and model inputs used for the case study can be found in Table 10 in Appendix A.

It should be noted that the purpose of this case study is not to conduct a thorough assessment of the project and attempt to determine whether the correct decision was made to approve the ERP and/ or reject the Phase 2 expansion. The purpose of the case study, rather, is to demonstrate how the Public Interest MAE Framework functions in practice and verify whether its outputs help inform public interest determinations in the IA process.

The results of the case study analysis are presented in table format (Table 6). Information on potential project impacts was obtained from impact assessment documents produced by the NIRB.[50] The financial and economic impacts of the project, including estimated revenues accruing to the Inuit, senior levels of government, and Baffinland, were estimated using a discounted cash flow model developed in Microsoft Excel, using inputs from publicly available documents on the NIRB website.[51] Greenhouse gas costs were estimated using the model and following Environment and Climate Change Canada methodology using its social cost of carbon estimates.[52] Additionally, two IBAs negotiated between Baffinland and the Qikiqtani Inuit Association[53] (QIA) were analyzed to assess the role of IBAs in affecting the distribution of project costs and benefits on local Inuit communities.

The case study is intended as a simplified illustration of MAE that does not go into detail on various methodological issues such as distinguishing between gross and net impacts and quantifying impacts in monetary terms. These issues are dealt with in more detail in previous reports.[2,4,14] Many of the impacts have not been estimated in monetary or quantitative terms for the case study, primarily in the environmental, social, health, and Indigenous accounts, due to data and, in some cases, methodological limitations. As discussed, it is possible to use non-market valuation techniques to estimate the monetary value of many of the positive and adverse consequences, but MAE methodology does allow for the inclusion of qualitative impact estimates when monetary impacts are difficult to measure.

The Public Interest MAE Framework includes an Indigenous account that summarizes the impacts of the project on the Indigenous communities (Inuit). The more detailed Indigenous Community MAE Framework for the case study is included in Appendix A for those wanting more detail on the estimated impacts on the Inuit.

Case Study Results

Table 6. Public Interest MAE Framework for the Mary River Mine

Account	Sub-account	Summary of impacts	Net Impact[v] (Reference price, Millions of CAD, black text indicates benefit and red text indicates cost)	Sensitivity (Low and high price scenarios, Millions of CAD)
Project Developer	Net Revenue	Project revenue is generated by selling the iron ore produced by the mine, less project capital costs, operating costs, taxes, and royalties.	**$1,246** Less unestimated fuel tax and payroll tax expenditures. **52% of total net benefit/ resource rent**	$252 - $1,844
Government Revenue	Federal Government Revenue	The federal government is expected to generate net revenues from the project based on the following taxes (other tax revenues are assumed to result in no net change in revenue because they would have been generated by alternative economic activity if the project did not proceed): **CIT- Project Developer** **CIT- Inuit Businesses** **Net change in personal income tax (PIT)- Inuit Employees**	**$431** **17% of total net benefit/ resource rent**	$208 - $574
	Government of Nunavut	The government of Nunavut is expected to generate net revenues based on the following taxes (other tax revenues such as personal income taxes are assumed to result in no net change in revenue because they would have been generated by alternative economic activity if the project did not proceed and/ or are offset by net costs to the Nunavut government resulting from the project): **CIT- Project Developer**	**$322** **13% of total net benefit/ resource rent**	$143 - $436

[v] Monetary values are presented as net present values in 2020 Canadian dollars.

		CIT- Inuit Businesses		
	Inuit Governments/ Organizations Revenue	The Inuit; consisting of Nunavut Tunngavik Incorporated (NTI), Kitikmeot Inuit, Kivalliq Inuit, and the QIA; are expected to generate net revenues based on the following sources: **Mineral royalty** **Land lease** **IBAs (royalty and lump sum payments)**	**$445** **18% of total net benefit/ resource rent**	$273 - $562
Economic Activity	Training and Education	**Training and education fund** ($1 million in each of the first two years following IBA signing and $250,000 per year during production phase of mine). **Training and education center** built in Pond Inlet following approval of Phase 2.	**Net benefit to Inuit training and education** (see economic activity sub-account in Indigenous Community Account). **No net impacts to training and education for rest of Canada.**	-
	Employment	Net employment impacts are estimated in PY and the dollar net benefit of employment. **For Canada, the employment gains in both person years and dollar benefit are minimal** because it is assumed that the social opportunity cost of labour for fly-in/ fly-out in-migrant workers is approximately equal to the average wage of Project employees and most of the employees would be employed elsewhere in the Canadian economy if the project did not proceed. However, some proportion of the Inuit employees in the project may not otherwise be employed in the Canadian economy. For the case study it is assumed that 25% of the Inuit employment for the ERP and Phase 2 construction phases and first 5 years of ERP and Phase 2 operations phases are net in terms of PY and dollars of employment benefit. **For the regional economy it is assumed that all of the jobs from the Project are net in terms of PY and there are net employment benefits in dollar terms** resulting	**Net contribution to national employment:** ERP Construction phase- **19 PY** ERP Operations phase- **8 avg annual PY** Phase 2 Construction phase- **25 PY** Phase 2 Operations phase- **10 avg annual PY** **Net benefit to national employment:** **$23** (Inuit employment benefit) **Net contribution to Nunavut employment:** ERP Construction phase- **425 PY** ERP Operations phase- **178 avg annual PY**	-

		from employment of Inuit workers who otherwise would be unemployed (25% of the Inuit employment for the ERP and Phase 2 construction phases and first 5 years of ERP and Phase 2 operations phases to the region). Inuit workers are expected to make up **17% of the total workforce** over the lifetime of the mine. There is also a net benefit to Inuit workers that were previously employed as they are expected to earn higher average wages than they would have in alternative employment, resulting in an estimated annual salary increase of $49,000. Inuit employment benefits are accompanied by **personal income tax payments** due to the higher wages earned by Project employees compared to median Nunavut wages. **Potential adverse impacts to employment in food harvesting and tourism industries** due to impacts to terrestrial and aquatic species.	Phase 2 Construction phase- **575 PY** Phase 2 Operations phase- **232 avg annual PY** **Net benefit to Nunavut employment:** **$23** (Inuit employment benefit)	
	Other Economic Impacts	There are expected to be **net contracting revenue benefits** for Inuit-owned businesses. The contracting benefits are accompanied by **corporate income tax payments.** **Potential adverse impacts to food harvesting and tourism businesses** due to impacts to terrestrial and aquatic species. **Funding for five Daycare centers** following approval of Phase 2. **Funding for training and education center** built in Pond Inlet following approval of Phase 2. Local infrastructure benefits are accompanied by **infrastructure maintenance and operations expenses.** **Potential adverse impact on Nunavut's tourism industry** due to potential impacts to terrestrial, arboreal, and/ or aquatic species.	**Net impact to Nunavut's economic activity:** **$145** (Benefit to Inuit-owned businesses) Less net cost of impacts to food harvesting industry and tourism industry. (Non-market valuation methods could be used to estimate the monetary value of adverse impacts) **Net impact to Canada's economic activity:** **$0**	$145

		There are not expected to be net economic activity impacts for Canada as it is assumed that the economic activity impacts are just distributional impacts; most of the labour and capital employed in the project would have been employed in Canada in other activities if the project did not proceed. Therefore, economic activity benefits generated by the Project are approximately offset by the opportunity cost of the Project and/ or net costs to other sectors.	Net contribution to national GDP[vi]: **minimal to nil** Net contribution to Nunavut GDP: **$7,728**	
Environmental	Terrestrial/ Arboreal Species	Establishment of a **wildlife compensation fund** intended to contribute to impact mitigation efforts. Potential adverse impacts to caribou,[vii] wolf, fox, Arctic hare, ermine, and small mammal populations. Potential impacts include loss of habitat, disruption to movement corridors, mortality, and exposure to contaminants. Impacts expected to be short-term and not significant. Potential adverse impacts to peregrine falcon, snow goose, common and king eider, red-throated loon, thick-billed murres, and Lapland longspur populations. Impacts expected to be limited to displacement from Project footprint. Impacts expected to be long-term but minimal and not significant.	Net benefit to impact mitigation for wildlife/ terrestrial species (monetary value included in Inuit governments/ organizations revenue sub-account). Net cost associated with impacts to terrestrial and arboreal species. **Net monetary impact not estimated.** (Non-market valuation could be used to estimate net monetary impact and/or quantitative/qualitative indicators could be used to assess impacts)	-
	Land/ Topography	Potential adverse impacts to sensitive landforms including ice rich permafrost, saline permafrost, and thaw sensitive ground due to construction/ infrastructure footprint.	**Net cost associated with permafrost disturbance and associated GHG emissions** (monetary estimate included in GHG cost estimate).	-
	Vegetation	Potential adverse impacts to vegetation due to dust deposition from construction activities and trucks travelling on Milne Inlet tote road.	Net cost associated with impacts to vegetation. **Net monetary impact not estimated.**	-

[vi] Estimates of gross contribution of Project to GDP have been adjusted to reflect a production of 12 MTA.

[vii] Caribou were selected as the indicator species (for terrestrial species) in the impact assessment due to their significance in Inuit Culture.

			(Non-market valuation methods could be used to estimate net monetary impact and/or quantitative/qualitative indicators could be used to assess impacts)	
	Archaeological and Heritage Sites	Potential adverse impacts to archeological sites located around Milne Port and along sections of Milne Inlet tote road and proposed rail line.	Net cost associated with impacts to archaeological and heritage sites. **Net monetary impact not estimated.** (Non-market valuation methods could be used to estimate net monetary impact and/or quantitative/qualitative indicators could be used to assess impacts)	-
	Aquatic Species	Potential adverse impacts to marine mammals including polar bears, narwhals, ringed seals, bowhead whales, beluga whales, and walruses due to shipping related noise and disturbance, vessel strikes, blasting and dredging, and ballast water discharge. Potential impacts include loss and disturbance of habitat and mortality. Potential adverse impacts to fish including artic char, sculpin, and Greenland cod due to construction/ infrastructure footprint, shipping related noise and disturbance, ballast water discharge, and vessel prop wash. Potential impacts include loss and disturbance of habitat and mortality.	Net cost associated with impacts to aquatic species. **Net monetary impact not estimated.** (Non-market valuation methods could be used to estimate net monetary impact and/or quantitative/qualitative indicators could be used to assess impacts)	-
	Surface Water and Groundwater	Potential adverse impacts to hydrology/ water quantity due to water withdrawal at construction camp and construction of culverts. Potential adverse impacts to water quality due to effluent discharge into Mary River (from sewage treatment plants, ore stockpile areas, and mine pit), post-closure pit lake water contamination, and acid rock drainage and metal leaching from newly exposed rock.	Net cost associated with impacts to surface water and groundwater. **Net monetary impact not estimated.** (Non-market valuation methods could be used to estimate net monetary impact and/or quantitative/qualitative indicators could be used to assess impacts)	-

	Air Quality	Potential adverse impacts to air quality due to dust deposition and increase in concentrations of criteria air contaminants including total suspended particulates, SO_2, NO_x, metals, CO, PM_{10} and $PM_{2.5}$. Dust deposition impacts expected to be negative, exceed threshold levels, extend beyond the Project site, and be irreversible. Criteria air contaminants are expected to be negative, exceed magnitude thresholds, be limited to the Project site, persist beyond the duration of the Project, be continuous, and be reversible (except for total suspended particulates which are irreversible). Criteria air contaminant emissions over the Project's lifetime are estimated to be the following: **SO_2- 1,106 tonnes** **NO_x- 50,680 tonnes** **CO- 1,033 tonnes** **PM_{10}- 1,053 tonnes** **$PM_{2.5}$- 186 tonnes**	**($25)**	($25)
	Greenhouse Gas (GHG) Emissions	Adverse impacts due to GHG emissions from Project equipment (Scope 1 emissions). Project equipment emissions over the Project's lifetime will total approximately **5.1 Mt of carbon dioxide equivalent (CO_2e).** Adverse impacts due to upstream and downstream GHG emissions (Scope 3 emissions). Upstream and downstream emissions over the Project's lifetime will total approximately **8.6 Mt CO_2e.**	**($792)**	($3,286) - ($792)[viii]
	Climate Commitments	The Project would represent 2.98% of Canada's total GHG emissions from mining and 0.10% of Canada's total emissions. Potential adverse impacts on Canada's ability to reach its climate commitments including the Paris Agreement,	Net cost associated with adverse impact on climate commitments.	-

[viii] The high cost GHG estimate is based on Environment and Climate Change Canada's "95th percentile" social cost of carbon estimate which reflects a low probability, high-cost scenario for climate change impacts. See endnote 52.

		Canada's 2030 GHG emissions targets, and its Net zero emissions goal.		
Social	Social Wellbeing	Potential adverse impacts to social wellbeing due to the nature of the work associated with the Project. Fly-in/ fly-out requirements of Project employees and boom and bust dynamics of extractive natural resource industries are likely to adversely impact family and community cohesion. Additionally, Inuit employees may leave their communities to seek alternative employment following employment with the Project, further impacting family and community cohesion. Potential adverse impacts to social wellbeing due to increased levels of substance abuse, family violence, and gambling. Potential adverse impacts to social wellbeing due to influx of in-migrant workers, which may adversely impact community infrastructure including housing and social services. Additionally, an in-flux of non-Inuit workers may lead to cross-cultural conflicts and impact community cohesion. Potential adverse impacts to social wellbeing due to inequitable hiring practices. Project employment heavily favours non-Inuit employees (**Inuit only make up 17% of Project employment**) and male workers **(female workers only make up 9.3% of Project employment).**	Net cost associated with impacts to social wellbeing. **Net monetary impact not estimated** (Non-market valuation methods be used to estimate net monetary impact and/or quantitative/qualitative indicators could be used to assess impacts)	-
Health	Mental wellbeing	Potential adverse impacts to mental wellbeing in the form of increased levels of substance abuse, family violence, and gambling. Potential adverse impacts to mental wellbeing due to cross-cultural conflicts between Inuit and non-Inuit Project employees.	Net cost associated with impacts to mental wellbeing. **Net monetary impact not estimated.** (Non-market valuation methods could be used to estimate net monetary impact and/or quantitative/qualitative indicators could be used to assess impacts)	-

	Physical wellbeing	Potential adverse impacts to Inuit harvesting practices/ food availability due to impacts to caribou, ringed seal, artic char, walrus, and narwhal. Potential adverse impacts to physical wellbeing in the form of increased levels of substance abuse and family violence.	Net cost associated with impacts to physical wellbeing. **Net monetary impact not estimated.** (Non-market valuation methods could be used to estimate net monetary impact and/or quantitative/qualitative indicators could be used to assess impacts)	-
Indigenous Communities -Inuit[ix]	Inuit Government/ organization revenue	The Inuit; consisting of Nunavut Tunngavik Incorporated (NTI), Kitikmeot Inuit, Kivalliq Inuit, and Qikiqtani Inuit Association (QIA); are expected to generate revenues from the following sources: **Mineral royalty** **Land lease** **IBAs (royalty and lump sum payments)**	**$445** **18% of total resource rent**	$273 - $562
	Economic Activity	The Project is expected to have a net benefit for Inuit economic activity including training and education, employment, local business, and local infrastructure. **Net employment benefit- $23** **Net contracting benefit- $122**	**$145** Less net cost of impacts to food harvesting industry and tourism industry.	$145
	Environmental	Net cost to air quality. Potential adverse impacts to terrestrial species, birds, land/ topography, vegetation, archeological sites, aquatic species, surface water and groundwater.	**($25)** Net cost associated with impacts to terrestrial species, birds, permafrost disturbance, vegetation, archaeological and heritage sites, aquatic species, surface water and groundwater.	($25)
	Social	Potential adverse impacts on the social wellbeing of the Inuit.	Net monetary impact not estimated.	-

[ix] In practice, this account should be populated by the Indigenous communities that will be impacted by the project. For this study's analysis, the Indigenous Communities account has been populated using information from IA documents for illustrative purposes.

	Health	Potential adverse impacts on the mental wellbeing, physical wellbeing, and cultural and spiritual wellbeing of the Inuit.	Net monetary impact not estimated.	-
	Governance	Potential adverse impacts on Inuit rights and title.	Net monetary impact not estimated.	-
Summary	Project Developer	Net revenue impacts to the private project developer.	$1,246	$252 - $1,844
	Government Revenue	Net revenue impacts of the Project for the federal government, Government of Nunavut, and Inuit governments.	$1,198	$624 - $1,572
	Economic Activity	Net impacts of the Project on training and education, employment, and economic activity including upstream, downstream, and competing sectors.	$145	-
	Environmental	Net impacts of Project on land/ topography, vegetation, archeological sites, aquatic species, surface water and groundwater, air quality, GHG emissions, and climate commitments.	($792) Less net cost associated with impacts to terrestrial species, birds, permafrost disturbance, vegetation, archaeological and heritage sites, aquatic species, surface water and groundwater, and climate commitments.	($3,286) - ($792)
	Social	Net impacts of the Project on the social wellbeing of the population of Canada.	Net cost associated with adverse impacts to social wellbeing. Net monetary impact not estimated.	-
	Health	Net impacts of the Project on the mental and physical wellbeing of the population of Canada.	Net cost associated with adverse impacts to mental and physical wellbeing. Net monetary impact not estimated.	-

	Inuit	Net impacts of the Project on the Inuit population of Nunavut.	*$565*[x] Less net economic activity (food harvesting and tourism businesses), environmental, social, health, and governance costs.	$393 - $682
Total	Overall Impact of Project	Net impacts of the project *including* impacts to the private project developer.	**$1,817** (Excluding non-monetized project costs and benefits).	(Low GHG cost): $250 - $2,789 (High GHG cost): ($2,245) - $295
	Canadian Public	Net impacts of the project to Canada *excluding* impacts to the private project developer.	**$570** (Excluding non-monetized project costs and benefits)	(Low GHG cost): ($2) - $945 (High GHG cost): ($2,497) - ($1,549)

[x] Monetary benefit estimates for Inuit accounted for in government revenue and economic activity accounts.

Case Study Conclusions

The objective of the case study analysis is to illustrate how the Public Interest MAE Framework functions in practice and highlight the merits of MAE as a method relative to alternative methods used to inform public interest determinations such as EconIA. While the results provide much of the same information normally included in IA, such as impacts on valued components and economic and fiscal impacts, the results go beyond conventional IA by organizing the information into explicit accounts, providing quantitative estimates of project benefits and adverse effects to allow for explicit assessment of the magnitude and significance of impacts, allowing for transparent comparison of impacts to show whether the project generates a net benefit, indicating how the costs and benefits are distributed among key stakeholders, and providing the basis for assessing how the project can be designed to increase net benefits to society.

The results show that the project is estimated to generate an overall net benefit of $1.8 billion (reference scenario), with a potential range based on the sensitivity analysis of between $250 million and $2.8 billion. This illustrates that there is considerable potential for the project developer to fund impact mitigation measures while still maintaining project viability. The net benefit of $570 million, however, is arguably the more accurate estimate of the benefit to Canada given the owners of the Mary River mine are based outside of Canada. Even using this more conservative net benefit estimate, there is still considerable potential for further mitigation and benefit redistribution. The results also show the magnitude of some of the key adverse effects such as GHG emissions, which generate a net cost of $792 million. This helps identify one of the ways project net benefits could be increased, which is to reduce project emissions. The results also show that the distribution of costs and benefits among stakeholders varies, with the project developer receiving 52% of the benefits and the federal, Nunavut, and Inuit governments receiving 17%, 13%, and 18%, respectively. This information is helpful in identifying which parties gain from the project as well as opportunities for developing policies to achieve a different and potentially more equitable distribution of benefits.

The MAE results also provide a more accurate assessment of project benefits than the more commonly used conventional EconIA methodology that estimates the gross impacts of a project and is therefore prone to overestimating the benefits and underestimating the costs. In the case study, for example, an EconIA completed by the project proponent would emphasize the gross PY over the life of the project (5,031 PY for the combined construction phases and 903 to 1,177 average annual PY during operations) and total economic output ($12 billion GDP) without taking into account that much of this economic activity would still occur if the project did not proceed because the labour and capital have an opportunity cost and would likely be employed elsewhere in the Canadian economy. The net economic benefit and net employment gain to Canada based on the Public Interest MAE Framework is much lower ($1.8 billion net benefit, 44 PY for the combined construction phases, and 8 to 10 avg annual PY during the operations phase) (Table 7).

The results also show that there are numerous impacts that were estimated using qualitative impact categorization and descriptions that must be taken into consideration for the public interest determination. Environmental impacts include impacts to terrestrial species, birds, permafrost disturbance, vegetation, archaeological and heritage sites, aquatic species, surface water and groundwater, and climate commitments, social impacts include adverse impacts on social wellbeing, and health impacts include adverse impacts to mental and physical wellbeing. As stated, with additional analyses these impacts could be estimated in monetary terms which would facilitate easier comparison between trade-offs. If, however, these impacts are kept in qualitative form, it is important to emphasize that the net monetary estimates of the proposed project exclude these qualitative impacts and therefore should not be relied upon in isolation in the decision-making process. As shown in the summary account, the monetary impact estimates and the qualitative impact estimates must both be taken into consideration by decision makers when determining if the project is in the public interest.

As discussed, Section 63 of the *Impact Assessment Act* states that the following factors must be considered by decision makers when making a public interest determination: the project's contribution to sustainability, the extent to which the adverse effects of the project are significant, mitigation measures that decision makers consider appropriate, the impact on Indigenous groups and the rights of Indigenous peoples of Canada, and the effects of the project on Canada's environmental obligations and climate change commitments. The Public Interest MAE Framework provides the information to make these assessments.

In sum, the advantages of the Public Interest MAE Framework are that it does the following:

- Estimates the net impacts of a project in a transparent matrix summary that allows for better comparison of costs and benefits and helps indicate the relative significance of project impacts;
- More accurately assesses the project benefits by providing estimates of **net** benefits instead of **gross** benefits; and
- Indicates the distribution of impacts between different parties and regions.

Table 7. Comparison of Economic Impacts for Mary River Mine

Indicator	**Conventional Economic Impact Analysis**	**Multiple Account Evaluation**
Gross employment	5,031 PY (construction) 903 to 1,177 PY (operations)	Not provided
Net employment	Not provided	**Nunavut employment:** 1,000 PY (construction) 178 to 232 avg annual PY (operations) **Canada employment:** 44 PY (construction, Inuit employment) 8 to 10 avg annual PY (operations, Inuit employment)
Employment benefit ($)	$559 million (wage bill)	$23 million (net)
Economic benefit to Nunavut ($) (including Government of Nunavut and Inuit)	$7.7 billion (gross)	$935 million[xi] (net)
Total benefit to Canada	$12.2 billion (GDP) (EconIA)	$1.8 billion (net)

Case Study Limitations

While the case study is intended to illustrate how the Public Interest MAE Framework may help inform a public interest determination, it is important to note some limitations. One limitation is that this case study only focuses on the net impacts of the proposed project by comparing two alternative scenarios: a development scenario and a non-development scenario. A more comprehensive assessment using the Public Interest MAE Framework could include various project alternatives such as the project as originally proposed, the project with

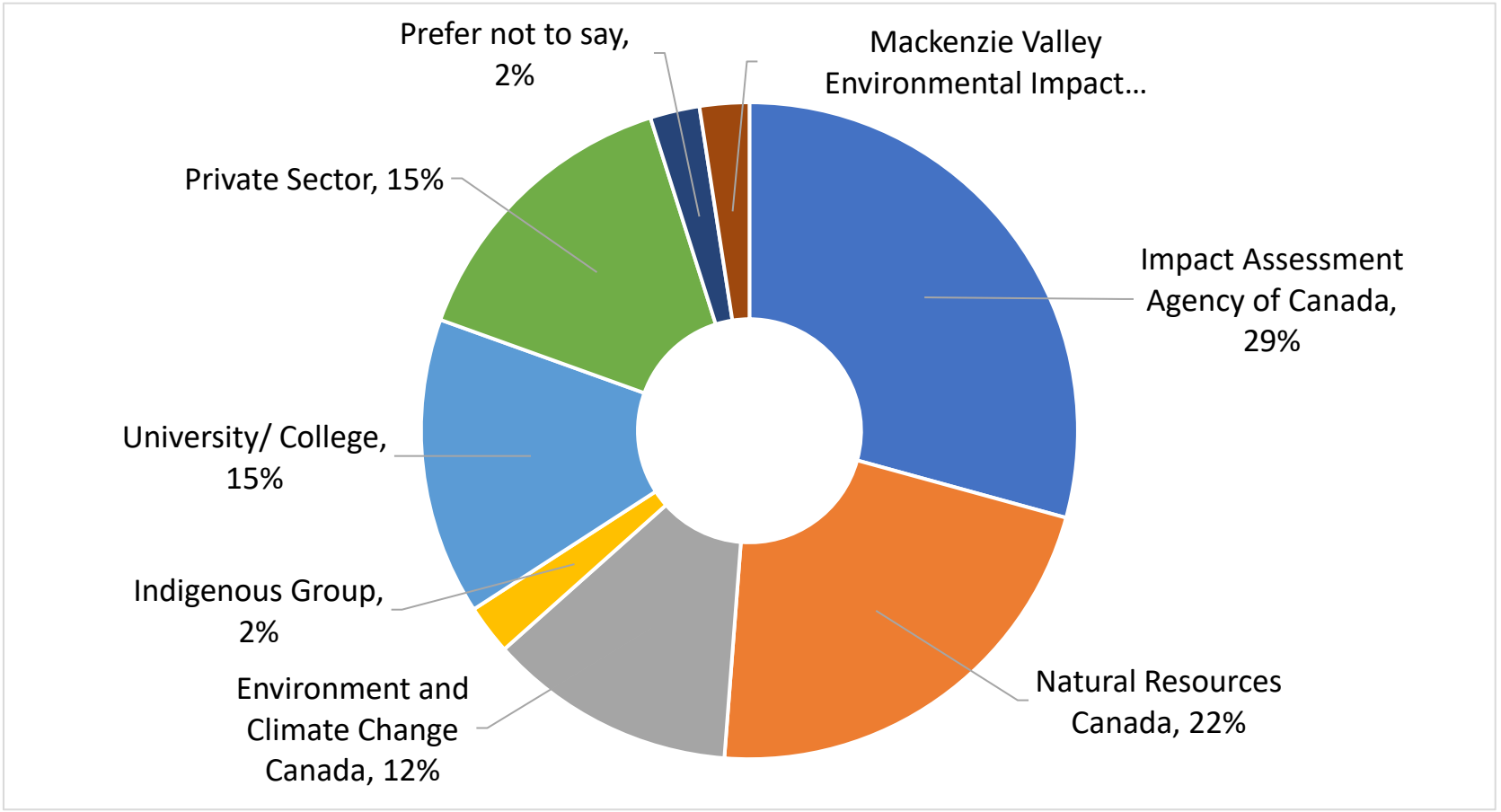
[xi] The net economic benefit to Nunavut estimate (under MAE methodology) includes Nunavut government revenue, Inuit government revenue, Inuit employment benefits, and contracting revenue for Inuit-owned businesses.

mitigation measures, and the project at various production levels. A second limitation is the challenge in providing monetary estimates for many of the environmental, social, and health impacts in both the Public Interest MAE Framework and Indigenous Community MAE Framework. Methods for estimating monetary impacts are well developed and more of the impacts in the case study example could have been estimated in monetary terms with additional analysis. But the comparison of costs and benefits will be constrained by the inability to quantify all impacts. However, by employing techniques to quantify impacts in monetary terms where feasible, providing qualitative and quantitative measures to supplement monetary estimates, and focusing on net as opposed to gross impacts, MAE provides a more transparent and accurate comparison of project costs and benefits that can help determine if the project is in the public interest, help identify the relative significance of impacts, and show how the project can be modified to increase the net benefit to society.

9. Survey for the Public Interest MAE Framework

A survey was conducted to gather information from IA experts, practitioners, and participants on several topics related to this study. Because this study primarily focuses on federal IA policy, the majority of respondents were affiliated with federal government agencies that consistently participate in federal IA processes including IAAC, Natural Resources Canada, and Environment and Climate Change Canada. However, the survey was also sent to persons affiliated with Indigenous groups, universities/ colleges, the private sector, and the Mackenzie Valley Review Board in an effort to solicit a broad range of perspectives. The breakdown of the respondents is presented in Figure 2.

Figure 2. Organizational affiliations of survey respondents



The survey consisted of statements that participants could respond to using a 5-point Likert scale (strongly agree, agree, neither agree nor disagree, disagree, or strongly disagree) as well as questions that participants could answer using comment boxes. The figures displayed below, however, use a simplified 3-point scale (agree, neither agree nor disagree, or disagree). The complete survey can be found in Appendix B. Survey topics include the following:

- Evaluation of existing estimation methods used in IA;
- Public interest and impact assessment;
- Evaluation of the Public Interest MAE Framework;
- Comparison between the Public Interest MAE Framework and existing estimation methods used in IA;
- Strengths and weaknesses of the Public Interest MAE Framework;
- Potential implementation challenges; and
- Suggested revisions to improve the Public Interest MAE Framework.

Prior to completing the survey, respondents were provided with an abbreviated version of this report which included the details of this study, background information, a draft of the proposed Public Interest MAE Framework, and the case study analysis of the Mary River mine. Additionally, many respondents attended presentations on the proposed Public Interest MAE Framework that were conducted by the authors of this report prior to the survey phase of this study.

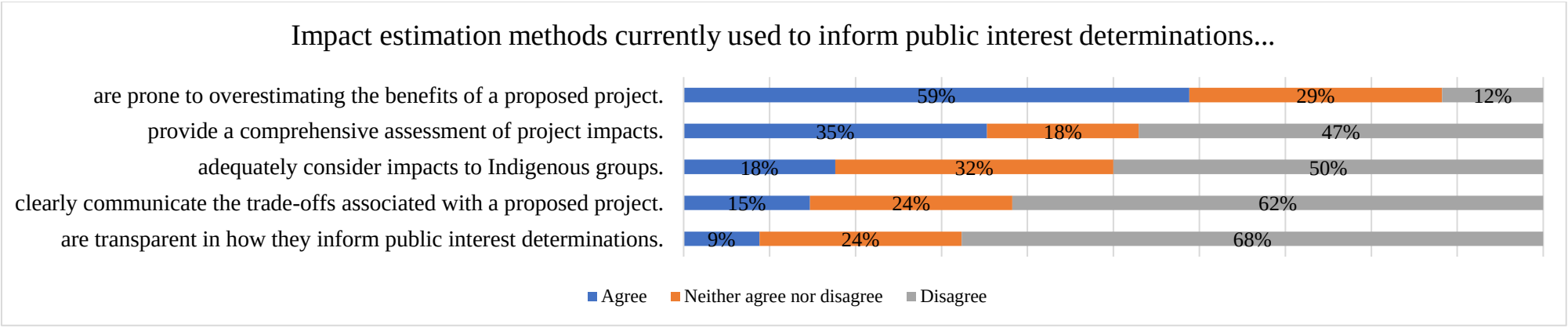
Survey Results

The results of the survey are separated into five sections summarized below. A more detailed version of the survey results can be found in Appendix B.

Evaluation of current estimation methods

The results of this section of the survey (Figure 3) indicate that respondents are critical of the current methods used to estimate impacts in IA. Only 35% of respondents believe that current estimation methods in IA provide a comprehensive assessment of impacts and just 18% believe that current estimation methods adequately consider impacts to Indigenous groups. The majority of respondents indicate that the current estimation methods do not clearly communicate trade-offs (62%), are prone to overestimating benefits (59%), and lack transparency in how they inform public interest determinations (68%).

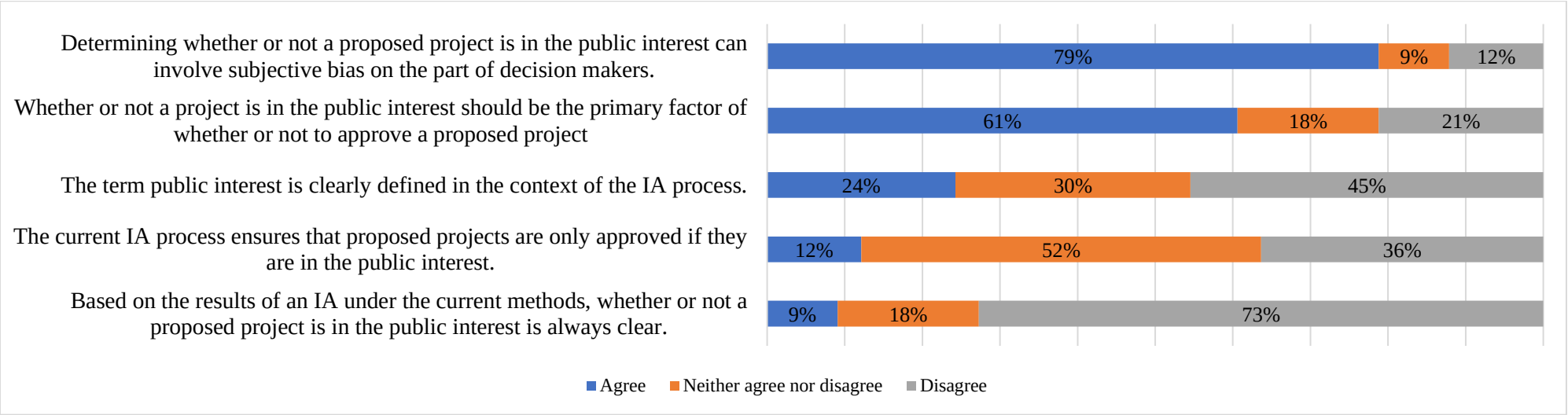
Figure 3. Survey results: Evaluation of current estimation methods



Public interest and IA

The results of this section of the survey (Figure 4) indicate that while the majority of respondents (61%) believe that a determination of whether or not a project is in the public interest should be the primary factor in deciding whether to approve a project, only 12% of respondents believe that the IA process ensures that projects are only approved if they are in the public interest and only 9% believe that current methods used in IA clearly indicate whether a project is in the public interest. Only 24% of respondents believe that the term public interest is clearly defined in the context of IA and 79% believe that the determination of whether a project is in the public interest involves subjective bias on the part of decision makers.

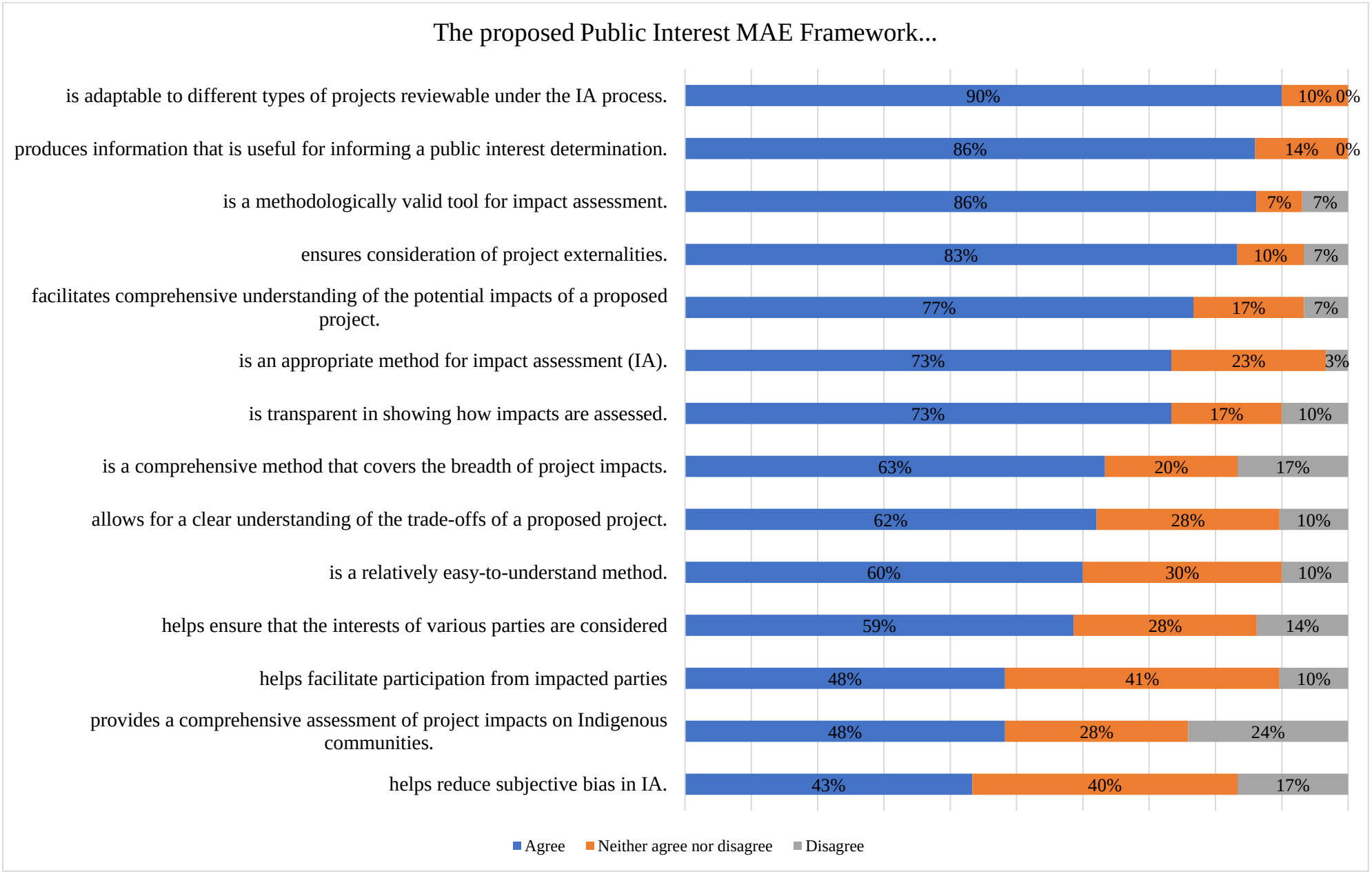
Figure 4. Survey results: Public interest and IA



Evaluation of the proposed Public Interest MAE Framework

The results of this section of the survey (Figure 5) indicate that respondents are generally supportive of the proposed Public Interest MAE Framework. The evaluation of the framework was divided into ten sections based on criteria for assessing the efficacy of methods that were adapted from the literature including suitability to context, flexibility, comprehension, subjectivity, robustness, usefulness of outputs, validity, participative qualities, equity, and consideration of Indigenous groups.[7] The proportion of respondents that believe the proposed Public Interest MAE Framework meets the ten criteria of an effective method ranges from 43% to 90% depending on the criterion, which far exceeds the proportion of respondents who believe that it does not meet the criteria (3% to 24%). The lowest ratings are for reducing subjectivity (43% agree and 17% disagree), facilitating public participation (48% agree and 10% disagree), and comprehensively assessing impacts on Indigenous communities (48% agree and 24% disagree).

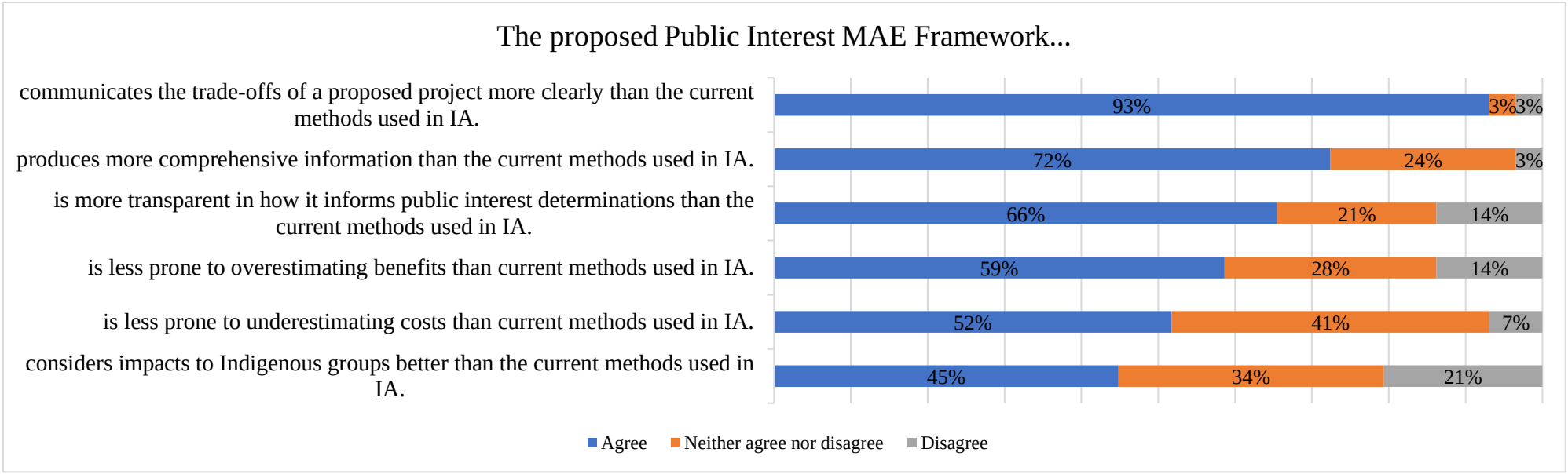
Figure 5. Survey results: Evaluation of Public Interest MAE Framework



Proposed Public Interest MAE Framework versus current estimation methods in IA

The results of this section of the survey (Figure 6) indicate that respondents believe the proposed Public Interest MAE Framework is an improvement over the current estimation methods used in IA. The majority of respondents indicate that when compared to the current estimation methods used in IA, the proposed Public Interest MAE Framework communicates trade-offs more clearly (93%), produces more comprehensive information (72%), is more transparent in how it informs public interest determinations (66%), is less prone to overestimating benefits (59%), and is less prone to underestimating costs (52%). The proportion of respondents who agree that the framework considers impacts to Indigenous groups better than current methods used in IA is a bit lower (45% agree, 21% disagree, and 34% neither agree nor disagree).

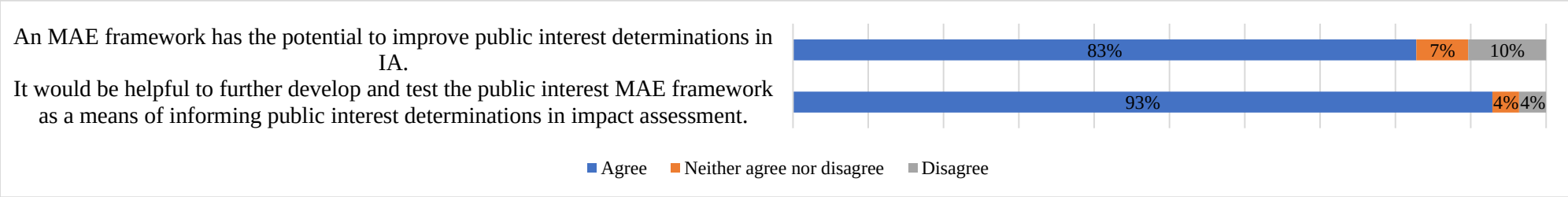
Figure 6. Survey results: Comparison between the Public Interest MAE Framework and current impact estimation methods



Potential of proposed Public Interest MAE Framework for IA

The results of this section of the survey (Figure 7) indicate that an overwhelming majority of the respondents believe that the proposed Public Interest MAE Framework has the potential to improve public interest determinations in IA (83%) and believe that it would be helpful to further develop and test the framework as a means of informing public interest determinations (93%).

Figure 7. Survey results: Potential of Public Interest MAE Framework



Open-ended responses

The final section of the survey covered various topics including the strengths and weaknesses of the Public Interest MAE Framework, potential challenges around implementation, and suggested revisions to help improve the framework, which were responded to with comment boxes.[xii] Many different answers were provided in this section of the survey, and therefore only common responses that were provided by more than one respondent are presented below. For complete results for this section, please refer to Appendix B.

Strengths of the framework

Respondents identified various strengths of the proposed Public Interest MAE Framework. Strengths that were identified by more than one respondent are that the Framework is comprehensive, clearly displays and summarizes information, focuses on net impacts, considers non-market impacts, increases transparency, focuses on Indigenous communities, and focuses on the distribution of impacts.

Weaknesses of the framework

Weaknesses that were identified by more than one respondent are that it is difficult to estimate non-market impacts in monetary terms, it is challenging to compare between quantitative and qualitative impacts, it is unclear how mitigation efforts are considered, it may limit the discretion of decision makers, it does not weight the significance of impacts, it does not provide enough focus on impacts to Indigenous communities, it is difficult to implement, assumptions drive the results, and it does not eliminate subjectivity.

Challenges in implementing the framework

Potential implementation challenges that were identified by more than one respondent are that quantifying impacts requires additional resources and skills, reaching consensus around methods and values for impacts can be challenging, the framework does not align with how IA works in reality, the framework requires access to confidential financial information, and the framework is overly complicated and complex.

Suggested revisions for the framework and additional thoughts

Respondents provided various suggestions for how the proposed Public Interest MAE Framework could be revised, all of which were taken into consideration for the final version of the framework and this report.

[xii] Comment box responses were coded following thematic content analysis methodology using NVivo 12. For complete lists of the themes identified in responses for each question, see Appendix B.

Survey Conclusions

The survey provides some useful information related to the objectives of this study. Respondents identified a number of limitations with the impact estimation methods currently used in IA that should be addressed. On the topic of public interest, the respondents indicated that while public interest is a key factor in IA and project approval, many believe that the term itself and the extent to which it informs project decisions is unclear in the context of IA. In their evaluation of the proposed Public Interest MAE Framework, the majority of respondents indicated that the framework meets the ten best practice criteria and therefore possesses the characteristics of an effective impact estimation method. Finally, respondents indicated that the framework has the potential to be an improvement over the current methods used to inform public interest determinations in IA.

Importantly, the survey results provide further evidence that the proposed Public Interest MAE Framework, if integrated into the IA process, has the potential to improve public interest determinations, most notably by comprehensively considering various types of impacts, increasing the accuracy of impact estimates by estimating net impacts, increasing transparency by clearly displaying all benefits and costs, integrating quantitative and qualitative information, helping assess the relative significance of impacts and allowing for comparison between trade-offs. The survey results are also helpful in that they identified some of the weaknesses and potential challenges in implementing the Public Interest MAE Framework. This input from the survey was reviewed and used to revise the Public Interest MAE Framework to address the survey comments and suggestions (Table 8).

Table 8. Issues raised in survey regarding the Public Interest MAE Framework

Survey Comment	**Discussion**
It is difficult to estimate non-market impacts in monetary terms.	It is true that it is difficult to estimate all non-market impacts in monetary terms. However, methods such as contingent valuation and estimating offset/ replacement cost are well developed and widely accepted for estimating most non-market values.
It is challenging to compare between quantitative and qualitative impacts.	This is a challenge in all IA methods. MAE attempts to address this challenge by estimating as many impacts as possible in quantitative terms to allow for comparison.
It is unclear how mitigation efforts are considered.	The MAE Framework is capable of assessing a number of different scenarios and can be used to assess various mitigation options.
The MAE Framework may limit the discretion of decision makers.	The MAE Framework provides decision makers with information to make a determination and is not intended to constrain decision makers' discretion.
The MAE Framework does not provide enough focus on impacts to Indigenous communities.	The Indigenous account within the Public Interest MAE Framework is intended to comprehensively assess the impacts on Indigenous communities. It is important to emphasize that the proposed Indigenous account is a general framework that would be modified and adapted by Indigenous communities to meet their specific needs in each case. Additionally,

	the Indigenous Community MAE Framework focuses exclusively on impacts to Indigenous communities.
The MAE Framework is difficult to implement.	Implementing the MAE Framework will require additional resources, guidelines, and training. But as the case study and other applications of MAE indicate, it is feasible to conduct an MAE analysis with limited additional resources.
Assumptions drive the results.	It is true that the results are driven by the assumptions for all IA methods including MAE. The MAE Framework addresses this issue by stating assumptions transparently and by using, where appropriate, a range of assumptions to assess their impact on the results.
The MAE Framework does not eliminate subjectivity.	It is true that the MAE Framework does not eliminate subjectivity in IA. However, the framework attempts to reduce subjectivity by specifying in guidelines how the methods should be applied, by clearly and transparently stating the assumptions, and by including a range of scenarios to test alternative feasible assumptions.
The MAE Framework does not explicitly assess sustainability.	The MAE Framework addresses sustainability by including sustainability indicators in the accounts.
The MAE Framework does not consider cumulative impacts.	Although the MAE Framework does not have an explicit cumulative effects account it takes cumulative effects into account in several ways. First, the analysis estimates net impacts as opposed to gross impacts. Net impacts incorporate the effect of other changes that are occurring or will occur. Second, the BCA component of the analysis utilizes forecasts of key parameters that incorporate changes that will occur with and without the project. For example, the costs of climate change include the impact of all changes occurring in emissions from the project and changes in emissions from all other sources. Third, the estimates for sustainability indicators can include the cumulative effects from all current and future activities.

Survey Limitations

While the survey provides helpful information for this study, it is important to note some limitations. One limitation, as can be seen in Figure 2, is that the respondents were heavily weighted towards federal government employees. This, however, is not surprising considering the topics addressed in this study and its focus on federal IA policy. Still, obtaining responses from a broader and more diverse group of respondents would be helpful. A second limitation is that some questions required specific knowledge of estimation methodologies

and certain aspects of IA and were therefore difficult to answer. Although respondents represent a highly informed group, it is unlikely that all respondents had sufficient knowledge to answer all survey questions. Relatedly, the "neither agree nor disagree" response appears to have been used quite frequently and it is unclear what respondents meant when selecting this option. Respondents may have selected this response to indicate that they are neutral or indifferent to the statements or they may have selected it because they did not have enough information or knowledge to respond to the statement.

10. Conclusion

The purpose of this study was to develop an MAE framework to support public interest determinations in IA. The objectives of the Public Interest MAE Framework are to comprehensively consider all types of impacts to all parties (especially Indigenous groups), transparently and accurately communicate project trade-offs, and assess net project impacts. The literature review that was conducted in this study helped identify MAE as a potentially effective method to help inform public interest determinations in IA, as it appears to overcome many of the limitations of the impact estimation methods currently used in IA. As discussed, there are major limitations with the impact estimation methods currently used to inform public interest determinations in IA. The limitations of qualitative impact categorization, EconIA, BCA, and sustainability assessment are well documented in the literature and were cited in this study's survey in which the majority of respondents indicated that public interest determinations involve subjective bias and that the current estimation methods overestimate economic benefits. The strengths of MAE relative to other methodologies are that it integrates multiple methods into a single, comprehensive framework; estimates net rather than gross impacts, covers environmental, social, economic, cultural, and health impacts; ensures consideration of impacts that cannot be quantified; disaggregates impacts by key groups and regions; helps facilitate transparent comparison of trade-offs; helps assess the relative significance of impacts; and helps decrease subjective bias in decision making.

In this study, two interconnected frameworks were developed based on MAE methodology: the Public Interest MAE Framework and the Indigenous Community MAE Framework. As discussed, the Indigenous Community MAE Framework helps inform the Indigenous community account within the broader Public Interest MAE Framework but is also intended to serve as a standalone tool to help support Indigenous participation in IA and IBA negotiations with project developers and senior levels of government. A case study analysis was conducted to test the Public Interest MAE Framework and illustrate how the framework functions in practice, applying it to the Mary River mine. The conclusions from the case study are that the Public Interest MAE Framework estimated the net impacts of a project in a transparent matrix summary that allowed for better comparison of costs and benefits, more accurately assessed the project benefits by providing estimates of net benefits instead of gross benefits, and indicated the distribution of impacts between different parties and regions. A survey was conducted with IA experts, practitioners, and participants to evaluate current IA estimation methods and the Public Interest MAE Framework and obtain feedback on how the framework could be revised. Survey respondents indicated that there are significant limitations associated with current impact estimation methods in IA and that MAE appears to be both an effective tool for IA and an improvement over the estimation methods currently used in IA. The results of this study are further evidence that the Public Interest MAE Framework has the potential to inform public interest determinations and overcome some of the limitations associated with other impact estimation methods. The survey also helped identify various limitations and challenges with the proposed Public Interest MAE Framework that should be addressed in its development and implementation.

Following completion of this study, more work will need to be done by IAAC in collaboration with other governmental organizations, Indigenous groups, and stakeholders to refine the Public Interest MAE Framework and explore how it can be integrated into federal IA policy. This includes exploring how the framework can contribute to related projects such as Statistics Canada's recently announced project: "Census of Environment: A roadmap to environmental and economic sustainability."[54] Policy will need to be developed that clarifies who

is responsible for conducting the MAE in the IA process, whether it be proponents, IAAC, other government agencies, Indigenous communities, and/or stakeholders. Depending on their level of involvement in conducting MAE with the framework, IA practitioners will likely need to receive additional training and additional guidance may need to be developed. Furthermore, guidance will likely need to be developed covering the following topics:

- Non-market valuation techniques for the Public Interest MAE Framework;
- How to compare quantitative and qualitative trade-offs to ensure there is not significant bias towards quantitative impacts;
- How the Indigenous Community MAE Framework can be used by communities and how it informs the public interest determination;
- The process for identifying accounts, sub-accounts, and indicators (This includes developing consistent definitions of indicators such as employment by using standardized terms such as average annual person years instead of total person years to avoid misinterpretation of project benefits, providing estimates of net as opposed to gross impacts for economic indicators to avoid overestimating project benefits, and disaggregating costs and benefits by major stakeholder group and for Indigenous communities);
- How the project developer account should factor into decision making and when it should be included in the bottom line net impact estimate;
- How to navigate confidential financial information and sensitive traditional knowledge in a way that ensures that there are ways of incorporating important data and information without disclosing confidential and sensitive information;
- Cumulative effects and how the framework could be used in cumulative effects assessment; and
- How to best integrate sustainability assessment into the Public Interest MAE Framework.

This is not intended to be an exhaustive list of the next steps but rather highlight some important topics that must be addressed to increase the effectiveness of the Public Interest MAE Framework in practice.

Also, it would be useful to identify aspects of the Public Interest MAE Framework that could be adopted on an interim basis to improve IA while the larger framework is being refined. Some examples of interim steps that merit consideration include the following:

a. Develop consistent definitions of indicators such as employment by using standardized terms such as average annual person years instead of total person years to avoid misinterpretation of project benefits;
b. Estimate net as opposed to gross impacts for economic indicators to avoid overestimating alleged project benefits; and
c. Conduct BCA based on current Treasury Board of Canada guidelines to estimate project costs and benefits as part of the IA review process including disaggregating costs and benefits by major stakeholder group and for Indigenous communities.

11. Appendix A: Case Study Analysis: Mary River Mine (Inuit MAE Framework)

Table 9. Indigenous Community (Inuit) MAE Framework for Mary River Mine

Account	Sub-account	Summary of impacts/ sources of impacts	Net Impact[xiii] ($ are in Millions of CAD, black text indicates benefit and red text indicates cost)	Sensitivity (Millions of CAD)
Inuit Government/ Organization Revenue	Nunavut Tunngavik Incorporated (NTI) Revenue	**Mineral royalty revenue** (30% of total revenue generated through territorial mineral royalty accrues to NTI).	**$90**	$40 - $122
	Kitikmeot Inuit Revenue	**Mineral royalty revenue** (18% of total revenue generated through territorial mineral royalty accrues to Kitikmeot Inuit).	**$54**	$24 - $73
	Kivalliq Inuit Revenue	**Mineral royalty revenue** (22% of total revenue generated through territorial mineral royalty accrues to Kivalliq Inuit).	**$66**	$29 - $90
	Qikiqtani Inuit Association (QIA) Revenue	**Mineral royalty revenue** (30% of total revenue generated through territorial mineral royalty accrues to QIA). **Land lease revenue** (approx. $3 mil per year) **IBA revenue** (lump sum payments and royalty) QIA revenue benefits are accompanied by **IBA implementation expenses.**	**$234**	$179 - $277
Economic Activity	Training and Education	**Training and education fund** ($1 million in each of the first two years following IBA signing and $250,000 per year during production phase of mine). **Training and education center** built in Pond Inlet following approval of Phase 2.	**Net benefit to Inuit employment/ capacity** (monetary value included in IBA lump sum payments estimate).	

[xiii] Monetary values are presented as net present values in 2020 Canadian dollars.

	Employment	There are expected to be **net employment benefits** for the Inuit. **Inuit employees are expected to make up 17% of total workforce** over lifetime of mine (direct employment), with higher average wages compared to the median wage in Nunavut, resulting in an estimated annual salary increase of $49,000. It is assumed that 25% of Inuit jobs during both construction phases and the five years of ERP and Phase 2 operations phases (following the construction phases) are net jobs for which the net benefit per job is equal to the average Inuit salary for the Project ($83,564).[55] Inuit employment benefits are accompanied by **personal income tax payments** due to the higher wages earned by project employees compared to median Nunavut wages. **Potential adverse impacts to employment in food harvesting and tourism industries** due to impacts to terrestrial and aquatic species.	**Net contribution to Inuit employment:** ERP Construction phase- **19 PY** ERP Operations phase- **8 avg annual PY** Phase 2 Construction phase- **25 PY** Phase 2 Operations phase- **10 avg annual PY** **Net Inuit employment benefit:** **$23** Less net cost associated with impacts to employment in food harvesting industry and tourism industry. (Non-market valuation methods could be used to estimate monetary value of adverse impacts and/or quantitative/qualitative indicators could be used to assess impacts)	-
	Local business	There are expected to be **net contracting revenue benefits** for Inuit-owned businesses. Benefits to local businesses are estimated to be **3.9%** of total project expenditures.[56] The contracting benefits are accompanied by **corporate income tax payments.** **Potential adverse impacts to food harvesting and tourism businesses** due to impacts to terrestrial and aquatic species.	**$122** Less net cost associated with impacts to food harvesting and tourism businesses. (Non-market valuation methods could be used to estimate the monetary value of adverse impacts and/or quantitative/qualitative indicators could be used to assess impacts)	-
	Local infrastructure	**Funding for five Daycare centers** following approval of Phase 2. **Funding for training and education center** built in Pond Inlet following approval of Phase 2.	**Net benefit to local infrastructure** (monetary value included in IBA lump sum payments estimate). **Net monetary impact not estimated.**	-

		Local infrastructure benefits are accompanied by **maintenance and operations expenses.**	(Non-market valuation methods could be used to estimate net monetary impact and/or quantitative/qualitative indicators could be used to assess impacts)	
Environmental	Terrestrial/ Arboreal Species	Establishment of a **wildlife compensation fund** intended to contribute to impact mitigation efforts. Potential adverse impacts to caribou,[xiv] wolf, fox, Arctic hare, ermine, and small mammal populations. Potential impacts include loss of habitat, disruption to movement corridors, mortality, and exposure to contaminants. Impacts expected to be short-term and not significant. Potential adverse impacts to peregrine falcon, snow goose, common and king eider, red-throated loon, thick-billed murres, and Lapland longspur populations. Impacts expected to be limited to displacement from Project footprint. Impacts expected to be long-term but minimal and not significant.	Net benefit to impact mitigation for wildlife/ terrestrial species (monetary value included in IBA lump sum payments estimate). Net cost associated with impacts to terrestrial and arboreal species. **Net monetary impact not estimated.** (Non-market valuation methods could be used to estimate net monetary impact and/or quantitative/qualitative indicators could be used to assess impacts)	-
	Land/ Topography	Potential adverse impacts to sensitive landforms including ice rich permafrost, saline permafrost, and thaw sensitive ground due to construction/ infrastructure footprint.	Net cost associated with permafrost disturbance and associated GHG emissions (monetary estimate included in GHG cost estimate in Public Interest MAE Framework).	-
	Vegetation	Potential adverse impacts to vegetation due to dust deposition from construction activities and trucks travelling on Milne Inlet tote road.	Net cost associated with impacts to vegetation. **Net monetary impact not estimated.** (Non-market valuation methods could be used to estimate net monetary impact and/or quantitative/qualitative indicators could be used to assess impacts)	-

[xiv] Caribou were selected as the indicator species (for terrestrial species) due to their significance in Inuit Culture.

Archaeological and Heritage Sites	Potential adverse impacts to archeological sites located around Milne Port and along sections of Milne Inlet tote road and proposed rail line.	Net cost associated with impacts to Archaeological and heritage sites. **Net monetary impact not estimated.** (Non-market valuation methods could be used to estimate net monetary impact and/or quantitative/qualitative indicators could be used to assess impacts)	-
Aquatic Species	Potential adverse impacts to marine mammals including polar bears, narwhals, ringed seals, bowhead whales, beluga whales, and walruses due to shipping related noise and disturbance, vessel strikes, blasting and dredging, and ballast water discharge. Potential impacts include loss and disturbance of habitat and mortality. Potential adverse impacts to fish including artic char, sculpin, and Greenland cod due to construction/ infrastructure footprint, shipping related noise and disturbance, ballast water discharge, and vessel prop wash. Potential impacts include loss and disturbance of habitat and mortality.	Net cost associated with impacts to aquatic species. **Net monetary impact not estimated.** (Non-market valuation methods could be used to estimate net monetary impact and/or quantitative/qualitative indicators could be used to assess impacts)	--
Surface Water and Groundwater	Potential adverse impacts to hydrology/ water quantity due to water withdrawal at construction camp and construction of culverts. Potential adverse impacts to water quality due to effluent discharge into Mary River (from sewage treatment plants, ore stockpile areas, and mine pit), post-closure pit lake water contamination, and acid rock drainage and metal leaching from newly exposed rock.	Net cost associated with impacts to surface water and groundwater. **Net monetary impact not estimated.** (Non-market valuation methods could be used to estimate net monetary impact and/or quantitative/qualitative indicators could be used to assess impacts)	-
Air Quality	Impacts to air quality disproportionately impact the local Inuit population and therefore the estimated net cost of the impacts to air quality has been included in this account. Potential adverse impacts to air quality due to dust deposition and increase in concentrations of criteria air contaminants including total suspended particulates, SO_2, NO_2, metals, CO,	**($25)**	($25)

		PM_{10} and $PM_{2.5}$. Dust deposition impacts expected to be negative, exceed threshold levels, extend beyond the Project site, and be irreversible. Criteria air contaminants are expected to be negative, exceed magnitude thresholds, be limited to the Project site, persist beyond the duration of the Project, be continuous, and be reversible (except for total suspended particulates which are irreversible).		
	GHG Emissions	Adverse impacts due to GHG emissions from Project equipment (Scope 1 emissions). Project equipment emissions over the Project's lifetime will total approximately **5.1 Mt CO_2e.** Adverse impacts due to upstream and downstream GHG emissions (Scope 3 emissions). Upstream and downstream emissions over the Project's lifetime will total approximately **8.6 Mt CO_2e.**	Net cost associated with GHG emissions (monetary estimate included in GHG cost estimate in Public Interest MAE Framework).	
Social	Social Wellbeing	Potential increase in access to medical and social services for Project employees and their families. Potential adverse impacts to social wellbeing due to the nature of the work associated with the Project. Fly-in/ fly-out requirements of Project employees and boom and bust dynamics of extractive natural resource industries are likely to	Net benefit to social wellbeing associated with increased access to medical and social services.	-

		adversely impact family and community cohesion. Additionally, Inuit employees may leave their communities to seek alternative employment following employment with the Project, further impacting family and community cohesion. Potential adverse impacts to social wellbeing due to increased levels of substance abuse, family violence, and gambling. Potential adverse impacts to social wellbeing due to influx of in-migrant workers, which may adversely impact community infrastructure including housing and social services. Additionally, an in-flux of non-Inuit workers may lead to cross-cultural conflicts and impact community cohesion. Potential adverse impacts to social wellbeing due to inequitable hiring practices. Project employment heavily favours non-Inuit employees (**Inuit make up 17% of Project employment**) and male workers (**Inuit female workers only make up 4.8% of total Project employment**).	Net cost associated with impacts to social wellbeing. **Net monetary impact not estimated.** (Non-market valuation methods could be used to estimate net monetary impact and/or quantitative/qualitative indicators could be used to assess impacts)	
Health	Mental Wellbeing	Potential adverse impacts to mental wellbeing in the form of increased levels of substance abuse, family violence, and gambling. Potential adverse impacts to mental wellbeing due to cross-cultural conflicts between Inuit and non-Inuit Project employees.	Net cost associated with impacts to mental wellbeing. **Net monetary impact not estimated.** (Non-market valuation methods could be used to estimate net monetary impact and/or quantitative/qualitative indicators could be used to assess impacts)	-
	Physical Wellbeing	Potential adverse impacts to Inuit harvesting practices/ food availability due to impacts to caribou, ringed seal, artic char, walrus, and narwhal. Potential adverse impacts to physical wellbeing in the form of increased levels of substance abuse and family violence, and gambling.	Net cost associated with impacts to physical wellbeing. **Net monetary impact not estimated.** (Non-market valuation methods could be used to estimate net monetary impact and/or quantitative/qualitative indicators could be used to assess impacts)	-

	Cultural and Spiritual Wellbeing	Potential adverse impacts to culturally significant species including caribou, ringed seal, artic char, walrus, and narwhal. Potential adverse impacts to culturally significant archeological sites located around Milne Port and along sections of the Milne Inlet tote road and proposed rail line.	Net cost associated with impacts to cultural and spiritual wellbeing. **Net monetary impact not estimated.** (Non-market valuation methods could be used to estimate net monetary impact and/or quantitative/qualitative indicators could be used to assess impacts)	-
Governance	Rights and Title	**Potential benefits to Inuit rights and title due to the negotiations of the Inuit Impact and Benefit Agreement (IIBA) and Inuit Certainty Agreement**, which contain governance-related provisions including the following: • **Dispute resolution mechanism**, including a mediation and arbitration provision; • **Shared-decision making mechanisms** in the form of three consensus-based committees: the Joint Executive Committee, the Employment Committee, and the Contracting Committee, all of which have QIA representatives; • **Reporting requirements**; • **Monitoring, enforcement, and adaptive management provisions**; and • **Provisions that require parties to review the IIBA** every three years and **renegotiate** if one or both parties believe the IIBA or any of its provisions are not achieving the intended objectives. **Potential adverse impacts to Inuit rights and title due to issuance of water license, mineral claims and leases, and property lease** to Baffinland Iron Mines Corporation. **Potential adverse impact on right of Inuit to harvest wildlife (under Nunavut Land Claims Act**) due to adverse impacts on terrestrial and aquatic species.	Net benefits to Inuit rights and title. Net cost associated with impacts to Inuit rights and title. **Net monetary impact not estimated.** (Non-market valuation methods could be used to estimate net monetary impact and/or quantitative/qualitative indicators could be used to assess impacts)	-

	FPIC	It is unknown whether the Inuit provided FPIC for the Project based on the IA documents. The IIBA and Inuit Certainty Agreement provide evidence that the Inuit have provided FPIC, but there does not appear to be an explicit written record that the Inuit provided their FPIC for the Project. Also, the QIA has stated that it does not support the expansion of the Project (Phase 2) due to concerns regarding the Inuit employment and monitoring and enforcement of environmental impacts.[57]	Unknown.	-
Summary	Inuit Government/ Organization Revenue	Net revenue impacts of Project for NTI, Kitikmeot Inuit, Kivalliq Inuit, and QIA.	$445	$273 - $562
	Economic Activity	Net impacts of Project on Inuit training and education, employment, local business, and local infrastructure.	$145 Less net cost of impacts to food harvesting and tourism industries.	$145
	Environmental	Net cost to air quality. Potential adverse impacts to terrestrial species, birds, land/ topography, vegetation, archeological sites, aquatic species, surface water and groundwater.	($25) Less net cost associated with impacts to terrestrial species, birds, permafrost disturbance, vegetation, archaeological and heritage sites, aquatic species, surface water and groundwater.	($25)
	Social	Net impacts of the Project on the social wellbeing of the Inuit.	Net benefits and costs associated with impacts to social wellbeing. Net monetary impact not estimated.	-
	Health	Net impacts of the Project on the mental, physical, and cultural and spiritual wellbeing of the Inuit.	Net cost associated with impacts to mental, physical, and cultural and spiritual wellbeing. Net monetary impact not estimated.	-

	Governance	Net impacts of the Project on Inuit rights and title.	Net benefits and costs associated with impacts to Inuit rights and title. Net monetary impact not estimated.	-
Total	Inuit	Net impacts of the Project on the Inuit people of Nunavut.	**$565** (Excluding non-monetized project costs and benefits).	$393 - $682

Case Study Assumptions

Table 10. Mary River Case Study Analysis Assumptions

Parameter	Input Value
Spot price iron ore (Ref) (CAD/tonne)	$124
Spot price iron ore (Low) (CAD/tonne)	$95
Spot price iron ore (High) (CAD/tonne)	$142
Production volume ERP (mtpa)	4.6
Production volume 2026 onward (mtpa)	12
Capex (ERP) (MM$)	$956
Capex (Phase 2, 12 MTA) (MM$)	$1,292
Opex ERP and Phase 2 (MM$/tonne)	$55
Cost of Sales (% of Opex)	50%
Closure Cost (MM$)	$208
Discount rate % project	8%
Discount rate % GHG	3%
GHG emissions	
Construction (annual Kt CO2eq)	28-56
Operations (annual Kt CO2eq)	156
Closure phase (annual Kt CO2eq)	84
Fiscal Regime	
CIT Rate (Effective rate, taxable income)	27.0%
Federal Share	0.56

NTI Share	0.44
Mineral Royalty (Effective rate, taxable income)	11.2%
NTI Share	30%
QIA Share	30%
Kitikmeot Inuit Share	18%
Kivalliq Inuit	22%
Land Lease Payments ($MM)	$3
Employment and contracting	
Net Change in Wage Benefit	49,251.63
ERP Construction (Avg Annual PY)	106
ERP Operations (Avg Annual PY) (Low)	178
Phase 2 Construction (Avg Annual PY) (High)	144
Phase 2 Operations (Avg Annual PY) (Low)	232
Closure Phase (Avg Annual PY)	75
Contracting (% of total expenditures)	3.90%
IBA Provisions	
Milestone payments (ERP) (MM$)	$58
Milestone payments (Phase 2) (MM$)	$30
IIBA Royalty (% of net sales revenue)	1.19%

Note. All dollar values are in 2020 Canadian dollars.

12. Appendix B: Survey on multiple account evaluation framework for Simon Fraser University study

Consent form

Q1. Taking part in this study is entirely up to you. You have the right to refuse to participate in this study. By clicking 'I AGREE' below you indicate that you consent to participate in this study. You do not waive any of your legal rights by participating in this study.

Answer Choices	Responses
I agree, please take me to the survey	100%

Respondent's organizational affiliation

Q2. Which organization or group are you affiliated with?

Answer Choices	Responses
Impact Assessment Agency of Canada	29%
Natural Resources Canada	22%
Environment and Climate Change Canada	12%
Indigenous Group	2%
University/ College	15%
Private Sector	15%
Prefer not to say	2%
Other (please specify)	2%

Evaluation of existing estimation methods used in impact assessment

Q3. Impact estimation methods currently used to inform public interest determinations...

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
provide a comprehensive assessment of project impacts.	0%	35%	18%	44%	3%
clearly communicate the trade-offs associated with a proposed project.	0%	15%	24%	47%	15%
are prone to overestimating the benefits of a proposed project.	29%	29%	29%	12%	0%
adequately consider impacts to Indigenous groups.	3%	15%	32%	38%	12%
are transparent in how they inform public interest determinations.	0%	9%	24%	50%	18%

Public interest and impact assessment

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
Q4. In your view, whether or not a project is in the public interest should be the primary factor of whether or not to approve a proposed project.	18%	42%	18%	21%	0%
Q5. The term public interest is clearly defined in the context of the IA process.	6%	18%	30%	39%	6%
Q6. The current IA process ensures that proposed projects are only approved if they are in the public interest.	0%	12%	52%	33%	3%
Q7. Based on the results of an IA under the current methods, whether or not a proposed project is in the public interest is always clear	0%	9%	18%	55%	18%
Q8. Determining whether or not a proposed project is in the public interest can involve subjective bias on the part of decision makers	24%	55%	9%	12%	0%

Evaluation of the proposed Public Interest MAE Framework

Theme 1: Suitability to context

Q9. The proposed Public Interest MAE Framework...

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
is an appropriate method for impact assessment (IA).	27%	47%	23%	3%	0%
addresses the factors outlined in the Impact Assessment Act that the Minister or Governor in Council must consider when making a public interest determination (factors summarized below).	10%	70%	13%	7%	0%
can feasibly be implemented by the Impact Assessment Agency of Canada.	13%	40%	33%	13%	0%

Theme 2: Flexibility

Q10. The proposed Public Interest MAE Framework...

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
is adaptable to different types of projects reviewable under the IA process.	13%	77%	10%	0%	0%

Theme 3: Comprehension

Q11. The proposed Public Interest MAE Framework...

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
is a relatively easy-to-understand method.	7%	53%	30%	10%	0%
is no more difficult to understand than other methods used in IA.	13%	43%	13%	17%	0%
is relatively easy to explain to someone that is not familiar with it.	0%	50%	27%	23%	0%

Theme 4: Subjectivity

Q12. The proposed Public Interest MAE Framework...

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
is transparent in showing how impacts are assessed.	3%	70%	17%	10%	0%
helps reduce subjective bias in IA.	13%	30%	40%	17%	0%

Theme 5: Robustness

Q13. The proposed Public Interest MAE Framework...

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
is a comprehensive method that covers the breadth of project impacts.	13%	50%	20%	17%	0%
ensures consideration of project externalities (indirect costs or benefits to a third party caused by a project).	10%	73%	10%	7%	0%
follows logical steps.	10%	57%	20%	0%	0%

Theme 6: Usefulness of outputs

Q14. The proposed Public Interest MAE Framework...

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
facilitates comprehensive understanding of the potential impacts of a proposed project.	17%	60%	17%	7%	0%
presents results in understandable terms.	13%	63%	17%	3%	0%
provides a range of possible impact estimates through the use of a sensitivity analysis.	13%	60%	23%	0%	0%
produces information that is useful for informing a public interest determination.	17%	67%	13%	0%	0%
allows for a clear understanding of the trade-offs between the benefits and costs of a proposed project.	14%	48%	28%	10%	0%

Theme 7: Validity

Q15. The proposed Public Interest MAE Framework...

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
is a methodologically valid tool for impact assessment.	18%	68%	7%	7%	0%

is likely to be viewed as a methodologically valid tool by decision makers.	21%	38%	38%	3%	0%
relies on scientifically valid information.	14%	59%	21%	7%	0%
relies on valid estimation methods.	7%	62%	24%	7%	0%

Theme 8: Participative qualities

Q16. The proposed Public Interest MAE Framework...

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
helps facilitate participation from parties that are likely to be impacted by a proposed project.	7%	41%	41%	10%	0%

Theme 9: Equity

Q17. The proposed Public Interest MAE Framework...

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
helps ensure that the interests of various parties are incorporated into the public interest determination.	14%	45%	28%	14%	0%

Theme 10: Indigenous groups

Q18. The proposed Public Interest MAE Framework...

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
provides a comprehensive assessment of project impacts on Indigenous communities.	10%	38%	28%	24%	0%

can realistically be implemented by Indigenous groups participating in IA.	3%	31%	48%	14%	3%
helps Indigenous communities identify potential changes to proposed project designs (including mitigation measures) to meet their interests.	3%	31%	48%	17%	0%
helps decision makers decide whether a project is in the interests of Indigenous communities.	10%	31%	31%	28%	0%
helps decision makers identify potential changes to proposed project designs (including mitigation measures) to better meet the interests of Indigenous communities.	3%	38%	31%	28%	0%

The proposed Public Interest MAE Framework versus current estimation methods in impact assessment

Q19. The proposed Public Interest MAE Framework...

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
produces more comprehensive information than the current methods used in IA.	14%	59%	24%	3%	0%
is less prone to overestimating benefits than current methods used in IA.	24%	34%	28%	14%	0%
is less prone to underestimating costs than current methods used in IA.	17%	34%	41%	7%	0%
communicates the trade-offs of a proposed project more clearly than the current methods used in IA.	17%	76%	3%	3%	0%
considers impacts to Indigenous groups better than the current methods used in IA.	14%	31%	34%	21%	0%
is more transparent in how it informs public interest determinations than the current methods used in IA.	24%	41%	21%	14%	0%

Final thoughts

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree

Q20. An MAE framework has the potential to improve public interest determinations in IA.	24%	59%	7%	10%	0%
Q21. It would be helpful to further develop and test the Public Interest MAE Framework as a means of informing public interest determinations in impact assessment.	36%	57%	4%	4%	0%

Q22. What are the key strengths of the MAE framework for impact assessment?

Table 11. Strengths of the proposed Public Interest MAE Framework identified by survey respondents

Strengths	Number of responses	Percentage of responses
Comprehensive	7	19%
Clearly displays and summarizes information	5	14%
Focuses on net impacts	4	11%
Considers non-market impacts	3	8%
Transparency	2	6%
Focuses on Indigenous communities	2	6%
Focuses on distribution of impacts	2	6%
Decreases subjectivity	1	3%
Predictable	1	3%
Consistent	1	3%
Improves information and understanding	1	3%
Integrates benefits of multiple methods	1	3%
Incorporates sensitivity analyses	1	3%
Addresses sustainability and climate change	1	3%
Provides greater justification for decision makers	1	3%
Rigorous	1	3%
Useful for assessing marginal projects	1	3%
Helps identify potential significant adverse impacts	1	3%
Total responses	**36**	**100%**

Q23. What are the key weaknesses of the MAE framework for impact assessment?

Table 12. Weaknesses of the proposed Public Interest MAE Framework identified by survey respondents

Weaknesses of the MAE framework	Number of responses	Percentage of responses
Difficult to estimate non-market impacts in monetary terms	3	16%
Challenging to compare between quantitative and qualitative impacts	4	13%
Unclear how mitigation efforts are considered	2	6%
Limits discretion of decision makers	2	6%
Does not weight the most significant impacts	2	6%
Does not provide enough focus on impacts to Indigenous communities	2	6%
Onerous, difficult to implement	2	6%
Assumptions drive results	2	6%
Does not eliminate subjectivity	2	6%
Does not consider cumulative impacts	1	3%
Not all impacts are quantified in case study	1	3%
May encourage proponents to aim for minimum acceptable net benefit	1	3%
Does not achieve what it sets out to achieve	1	3%
Biasedly weights quantitative data over qualitative data	1	3%
Relationship between PI and IC frameworks unclear	1	3%
Focuses on limited set of indicators	1	3%
Does not state limitations of non-market valuation	1	3%
Total responses	**31**	**100%**

Q.24 What are the main challenges in implementing the MAE framework into the impact assessment process?

Table 13. Potential challenges in implementing proposed Public Interest MAE Framework identified by survey respondents

Potential challenges in implementing the MAE framework	Number of responses	Percentage of responses
Quantifying impacts requires additional resources and skills	5	19%
Reaching consensus around methods and values for impacts	3	12%
Does not align with how IA works in reality	3	12%

Relies on confidential financial information	2	8%
Overly complicated, complex	2	8%
Does not consider the intangibles	1	4%
Comparing between qualitative and quantitative impacts	1	4%
Does not consider long-term impact estimates	1	4%
How to deal with estimating the value of extinction- species, language, etc.	1	4%
Path dependency associated with current IA process	1	4%
Capacity limitations of small communities and Indigenous groups	1	4%
Limited availability of disaggregated data	1	4%
Maintaining consistency over time	1	4%
Analytical limitations of methods	1	4%
Dependent on quality, accuracy of inputs	1	4%
Will not be applicable across all projects	1	4%
Total responses	**26**	**100%**

Q25. Do you have any suggestions on how the MAE framework can be revised to make it more suitable to impact assessment?

Table 14. Suggested revisions to the Public Interest MAE Framework

Suggested revisions	Number of responses	Percentage of responses
Estimate, quantify more impacts for case study	1	7%
Be clear about limitations of MAE framework	1	7%
Discuss connection, gap between MAE results and final decision	1	7%
Accounts for Indigenous framework must be defined by the communities themselves	1	7%
Reframe so that it is not focused on public interest	1	7%
Be clear that objective is to decrease, not eliminate subjectivity	1	7%
Include tool for estimating non-market impacts	1	7%
Address factors that are currently outside the Framework	1	7%
CBA guidance should be adapted to IA	1	7%
Focus on net impacts for non-market impacts	1	7%
Develop recommendations around whether or not to include project developer account	1	7%

Add guidance on the kinds of questions decision makers should consider in making trade-off judgements	1	7%
Be clear about the role of value judgements in the MAE framework, IA	1	7%
MAE framework should report how different parties feel about the trade-offs	1	7%
Total responses	**14**	**100%**

Q26. Is there anything else you would like to add?

Table 15. Additional thoughts raised by survey respondents

Additional thoughts	Number of responses	Percentage of responses
Hard to tell how much MAE will benefit IA	2	20%
Framework is a huge improvement over current approach to IA	1	10%
Framework may interfere with decision making	1	10%
Create a French version of report	1	10%
A good exercise since it will force valuation of the unvalued resources	1	10%
Hopefully this is first step in treasury board approved framework	1	10%
Guidance on framework implementation needs to be further developed	1	10%
Who will be responsible for conducting MAE analysis	1	10%
There should have been an I don't know option for survey	1	10%
Total responses	**10**	**100%**

13. Endnotes

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[42]An economic activity account is included in all but one of the MAE guides consulted in the literature review. Some of the MAE guides, however, have different versions of the economic activity account and propose contrasting methods for assessing economic activity (e.g., economic impact analysis versus benefit-cost analysis). For the purposes of this table, all interpretations of the account have been combined into a single economic activity account. The economic activity account for the public interest MAE framework is further defined in Table 4. For more information about how economic activity accounts are defined in the literature, please refer to the cited guides.

[43]A project's *net contribution to GDP* and *net contribution to employment* are more accurate indicators of a project's impacts on economic activity as they measure the real, or net, impacts of the project by taking into account opportunity costs of the resources employed. It is important to differentiate between net economic impacts that contribute to an increase in GDP and employment and distributional impacts that result in no net change in GDP and employment. In a well functioning economy, most impacts at the national and provincial level in this account are likely to be distributional and the net economic impact of the project is expected to be relatively small on the assumption that the resources employed in the project would be otherwise employed in other economic activities if the project was not built. The net impacts at the regional level are likely to be closer to the gross impacts because most of the resources employed by the project will be imported into the region and therefore result in a net change.

While decision makers may be interested in the total number of jobs required for a project, it is the *net employment impacts* of the project that are more appropriate for informing the public interest determination: estimating the net change in jobs that is expected to be provided by a project. Employment impacts of a project should only be considered benefits if the workers would otherwise be unemployed or if they are expected to receive a higher salary compared to their previous employment. Employment benefits should be estimated using employment benefit methodology from an accepted BCA framework and presented in *monetary units* factoring in the changes in salaries of project employees, the total number of employees, and the employment period.

[44] Non-market valuation methods often involve estimating a community's *willingness to pay (WTP)* for benefits provided by a project and *willingness to accept (WTA)*, or compensation demanded, for adverse impacts imposed by a project. Although WTP and WTA are similar in concept, it is important that they not be used interchangeably as they often result in different values. For more information on WTP and WTA see Knetsch (2020).

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[48] It is important to note that employment impacts should only be considered benefits if the community workers would otherwise be unemployed or if they are expected to receive a higher salary compared to their previous employment. Community employment benefits should be estimated using employment benefit methodology from an accepted BCA framework (e.g., Shaffer, 2010) and presented in *monetary units* factoring in the changes in salaries of project employees, the total number of employees, and the employment period.

[49] Non-market valuation methods often involve estimating a community's *willingness to pay (WTP)* for benefits provided by a project and *willingness to accept (WTA)*, or compensation demanded, for adverse impacts imposed by a project. Although WTP and WTA are similar in concept, it is important that they not be used interchangeably as they often result in different values. For more information on WTP and WTA see Knetsch (2020).

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