Northern Mineral Sector Investment Study

Final report

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pwc

Contents

Executive summary

Mineral development accounts for a significant portion of the economic activity in the Yukon, Northwest Territories, and Nunavut (collectively, "the North" or "Northern Canada"). Over the past ten years, investment in mineral exploration has been declining, leading to a decrease in projects available for development. The COVID-19 pandemic has exacerbated these challenges by increasing operational costs and reducing the 2020 exploration season. In this context, the three territorial governments of Yukon, Northwest Territories, and Nunavut engaged PricewaterhouseCoopers LLP ("PwC," "we," or "us") to conduct a study of how those governments can increase the investment in mineral exploration and development in the North.

The study approached this question through:

- Review of secondary sources including industry reports, news sources, and financial disclosures
- Review of comparable programs
- Interviews with government representatives, industry associations, mining and exploration companies, and Indigenous groups

Mineral exploration and development in Canada's North faces a range of challenges

Mineral exploration spending in the territories has been on a flat or downward trend over the last ten years, reflecting challenges in attracting investment. A decrease in exploration spending has significant long-term economic effects because it reduces the pool of projects available for development. It is important to note that conditions vary between and within terroriries; however, they face many common challenges.

One of the largest challenges for mine development in the territories, specifically Nunavut and the Northwest Territories, is lack of infrastructure. In these territories, a deficit of transportation, electrical, and telecommunications infrastructure significantly increases costs of mine development as well as exploration, relative to more connected mining regions. This has led to under-exploration and under-development of the North relative to other parts of Canada: Northern Canada has 40% of Canada's land mass, but only 12% of known mineral deposits. In addition, known mineral deposits in the North are less likely to be developed compared to other parts of Canada.[1]

There are significant challenges facing mining exploration and development in Canada's North beyond infrastructure. These include:

- Uncertainty and long timelines in regulatory and permitting processes
- Difficulty in engaging productively with communities
- Reduced and declining access to land
- Lack of clear government support for resource development

Together, these factors are important determinants of how many exploration projects are started in the North, their ability to raise financing, and ultimately their ability to become operating mines and generate long-term benefits for local communities and Canada's economy.

[1] Prospectors and Developers Association of Canada, 2016

We propose prioritizing enhanced exploration tax credits, infrastructure, and regulatory simplification to encourage investment

This study reviewed a range of policy options available to the territorial governments to increase investment in mineral exploration and development in the North. The table below summarizes our findings on each of the policy options reviewed.

Policy type	Criteria				Overall priority for the territories
	Cost	Ability to implement	Effectiveness	Risk	
Infrastructure investment					
Support the development and implementation of technological solutions					
Tax credits					
Regulatory simplification and access to land					
Geoscience investment					
Direct investment by governments					
Exploration grants					

Legend:  : Very high,  : High,  : Moderate,  : Low,  : Very low

The top priorities should be infrastructure, increasing exploration tax credits, and addressing regulatory and land access barriers

For Nunavut and the Northwest Territories, infrastructure development should be one of the top priorities for the territories in encouraging mineral exploration and development activity. In particular, transportation and energy infrastructure can have a transformational impact on whether mines will be developed. In many cases, particularly when governments are able to place infrastructure such that it can benefit multiple mines and communities, it is possible for the fiscal and socio-economic benefits to justify construction costs. For example, a report by the National Aboriginal Economic Development Board found that an infrastructure investment that enables development of a mine can generate a fiscal return of up to $11 for every $1 invested by the government.[2] It is important to note that infrastructure on its own does not fully address the challenges facing mining exploration and development. For example, although the Yukon has significantly more established infrastructure, it faces similar trends in declining exploration to other territories, indicating that other factors are at play such as regulatory challenges, as discussed below.

[2] National Aboriginal Economic Development Board, 2016

An increase in flow-through shares to match or exceed the value in other provinces should be a high priority to increase exploration investment. Exploration tax credits are commonly cited by industry participants as one of the top enablers of exploration investment in Canada. Given the importance of exploration in providing a pool of projects that can become mines, this should be a high priority for Northern mining policy. We agree with calls from industry participants to enhance flow-through shares in the territories to match the levels in other provinces, and to partially offset the higher costs of exploration in the North.

For all three territories, actions that can increase regulatory certainty and decrease timelines would have a high impact and a much lower cost than many other policy options considered. This initiative would complement fiscal incentives and be seen as a positive signal to investors that the government is supportive of mining activity. For example, where multiple reviews need to take place, it can decrease timelines if they are able to overlap as much as possible and coordinate on areas of shared concern. Any changes to regulatory and permitting regimes would require consultation with Indigenous governments, industry, and the federal government. Access to land has also been highlighted as a major barrier. We recommend that conservation decisions take into account mineral potential.

Geoscience and advancing technological solutions should be moderate priorities

Geoscience investment has been shown to be effective at encouraging mineral exploration, and is a particular priority in the North because the region has been studied in less detail compared to other mining regions. Recent government commitments on geoscience, including those with specific focuses on the North and on critical minerals, should continue.

Governments should consider support for technologies that could allow mines to overcome the challenges of a lack of traditional infrastructure such as off-grid power and transportation technologies that do not require roads. These solutions have the potential to lower costs for all mines operating in the North. Many of these potential solutions would also have a lower environmental impact than some traditional infrastructure, making them potentially more acceptable to local communities.

Lower priorities for the immediate future are direct investment in companies and exploration grants

Direct investment in exploration and mining companies has been effective at enabling projects to become producing mines. However in general, the more effective way to address financing should be to focus on creating a more attractive investment environment. This is a relatively high-risk policy because of the potential for financial losses by the government, and should be accompanied by policies that address the other challenges facing projects, particularly regulation and infrastructure. Moreover, direct investment should be done on a case by case basis and not as an overarching policy for investment attraction.

Exploration grants are one tool to offset exploration costs at early stages, but have not been as impactful as exploration tax credits in achieving this goal.

Policy initiatives should consider how to increase participation of Indigenous groups

Involvement of Indigenous groups in mining activity represents a significant opportunity for both Indigenous groups and industry. Currently, there is room for improvement in the extent to which Indigenous groups are able to participate in and benefit from mineral exploration and development.

Indigenous equity participation infrastructure that enables resource development or resource projects themselves could create incentives for Indigenous groups and industry to support development of mining projects. Several past programs in Canada, such as The Ontario Financing Authority Aboriginal Loan Guarantee Program, have been successful at enabling ownership of infrastructure assets by Indigenous groups, a trend that is accelerating. Partial ownership of resource projects may be negotiated as part of Impact and Benefit Agreements (IBAs). Some Indigenous groups have also expressed interest in meaningful ownership shares and control of mining projects.

Increased capacity in terms of basic and professional education, training, entrepreneurial skills and funding, and ability to engage in consultation would also enable greater participation and benefits for Indigenous groups. Among other options, greater consistency and predictability in the availability of government-sponsored training programs would help lead to better outcomes.

The increasing importance of critical minerals creates new investment opportunities

Critical minerals are minerals that are deemed essential to the economic sustainability or national security of a nation, and whose supply chain is vulnerable to disruption. Amid global trade tensions in recent years, critical minerals supply chains have become a high priority for many governments. The increased interest in critical minerals from Canadian sources represents a significant opportunity for Canada's North. The territories have endowments of many critical minerals, including advanced projects in cobalt, copper, platinum group elements (PGE), nickel, tungsten, tin, rare earth elements (REEs), and zinc, which are considered critical according to the Canadian government.

It is in the interest of governments to take actions to encourage development of critical minerals supply chains domestically, and by economic allies. Other jurisdictions' policy around encouraging critical minerals has focused on international collaboration, expansion of geoscience resources, and addressing regulatory barriers. Governments also recognize the importance of developing entire supply chains that arise from mineral extraction. The Canadian government should continue to participate in these international initiatives. It should also explore the possibilities of using US-based programs to support critical minerals development in Canada. Given the scarcity of some critical minerals in the US, the US will likely need to turn to Canada in diversifying its critical minerals supply chains.

Next steps

This study has assessed at a high level the policy actions that should be prioritized in order to encourage mineral exploration and development investment and support the Northern economy. The next steps towards implementing these policies is to engage the federal government, given its importance as a funding partner, local communities including Indigenous groups, and industry in order to gain agreement on the vision and priorities for mining in the territories.

1. Introduction and scope

Introduction

Mineral development accounts for a significant portion of the economic activity in the Yukon, Northwest Territories, and Nunavut (collectively, “the territories,” “the North,” or “Northern Canada”). Over the past ten years, investment in mineral exploration has been declining, leading to a decrease in projects available for development. The Northern mining sector faces a number of challenges including high capital and operating costs, lack of infrastructure, and regulatory barriers. The COVID-19 pandemic has exacerbated these challenges by increasing operational costs, reducing the 2020 exploration season, and impacting commodity markets. Recognizing the importance of mineral activity in a recovery from COVID-19 and the future economic well being of Northern Canada, the three territories are exploring policy actions to address the decline in investment. The responsible ministers from the three territories wrote to the Ministers of Natural Resources Canada and Crown-Indigenous and Northern Affairs Canada to request federal support for COVID-19 relief and recovery. The territorial governments, in partnership with Industry associations, have identified COVID-19 recovery actions for the northern mineral sector as a focus of their advocacy efforts with the federal government.

In this context, the three territorial governments of Yukon, Northwest Territories, and Nunavut engaged PricewaterhouseCoopers LLP (“PwC,” “we,” “our,” or “us”) to conduct an independent study of the policies that should be prioritized in order to increase the investment in mineral exploration and development in the North. In particular we were asked to assess the following:

- What infrastructure and/ or capital deficiencies are inhibiting mineral exploration and development investment?
- Whether there are instances where direct investments in exploration and/ or mining companies will accelerate a project to becoming a producing mine?
- What is the highest value, most cost effective investment mechanisms for encouraging investment within the Northern mineral resources sector?
- How investments can be directed to maximize benefits for Indigenous Governments and Development Corporations?
- How investments can be directed to maximize benefits to Canadian firms?

Our assessment was informed by the following sources:

- Review of secondary sources including Natural Resources Canada, industry reports, analyst and consultant reports, news sources, and financial disclosures
- Review of comparable policies
- Interviews with government representatives, industry associations, mining and exploration companies, and Indigenous groups

Structure of this report

The report summarizes our findings on the above scope elements. The rest of the report is organized as follows:

- Section 2 discusses the state of mineral exploration and development in Canada’s North
- Section 3 assesses policy options to encourage mineral exploration and development and our observations as to their relative effectiveness and applicability in encouraging mining and exploration in Canada’s North
- Section 4 considers how policy should be designed to meet the Northern governments’ goals
- Section 5 concludes, summarizing the report and its implications

Limitations

These findings are subject to our scope, methodology and assumptions described in this report, as well as the limitations described in Appendix B.This report has been prepared pursuant to a client relationship with the Government of the Northwest Territories (GNWT). GNWT may share this report with third parties including the governments of Yukon and Nunavut. The report may be shared only in its entirety. No person or entity shall place any reliance upon the accuracy or completeness of the statements made herein. In no event shall PwC have any liability for damages, costs or losses suffered by reason of any reliance upon the contents of this report by GNWT or any other person.

2. Mineral exploration and development in Canada's North

This section discusses the challenges facing mineral exploration and development in Canada's North, and how these have affected investment in recent years.

Overall industry perceptions are that mining in the territories is extremely challenging, and their reputation as a mining jurisdiction is reaching a critical point. Some industry members operating in the territories commented that they would not invest again given their experiences, and had warned others in the industry not to develop in the territories. In particular, this refers to regulatory processes, unavailability of land for development, and high costs of exploration, development, and operations. The point was made that mines developed to date enjoyed relatively large and high-grade deposits making them economic to develop despite the challenges of mining in the territories. This is less likely to be the case for remaining deposits, meaning that future developments are less likely to be able to be economically developed, unless current conditions are modified.

The role of infrastructure in mineral exploration and development

Below we discuss how deficiencies in infrastructure and capital investment have affected mineral exploration and development in Canada's North.

Infrastructure deficit in Canada's North has led to under-investment in mineral development

The most important factor in whether a mine will be developed is the quality of the deposit, particularly its grade and accessibility. However, aside from deposit quality, the infrastructure required for mine operations is one of the largest drivers of cost, and therefore of the net financial return to investors and hence the likelihood of development.

It is well-established that Nunavut and the Northwest Territories have a deficit of infrastructure compared to other regions of the country, and competing mining regions around the world. These issues also affect the Yukon to a lesser extent, as the territory has relatively more developed infrastructure. Key aspects of this infrastructure deficit are described in the table below.

Infrastructure	Northern conditions
Electricity	Many Northern mines are not located near existing power infrastructure, particularly in Nunavut and the Northwest Territories. For these mines, Typically, off-grid Northern mines involve construction of a diesel-fuelled generating plant, which adds to cost and environmental impact. Seasonal road access means that liquefied natural gas (LNG) cannot be used because it cannot be stored for long periods of time. We note that where power infrastructure does exist, it sometimes lacks the capacity that would be required to service new mines. This has been an issue in the Yukon, for example.
Transportation	Access to all-season road networks varies: while in Yukon most mines are connected to these networks, they are rare in the Northwest Territories and non-existent in Nunavut. For mines without access to all-season roads, transportation options include air transportation, seasonal ice roads, and seasonal shipping. Transportation infrastructure has a more significant impact on base metal operations compared to precious metals and diamonds, because of the high weight of the output relative to its value. Ports and ice roads both offer seasonal access, which significantly raises inventory and logistics costs and makes mines less resilient to changing conditions.

Infrastructure	Northern conditions
Telecommunications	Telecommunication options are limited in much of the North. In some areas, satellite is the only option, which is currently expensive and slower than wired connections. Lack of reliable internet access can limit implementation of technological solutions that can lower operating costs.
Employment	Northern mines are typically not located close to population centres. Therefore, a significant share of employees work on a fly in/ fly out schedule whereby they are flown in from other regions on a rotating schedule, adding to costs for transportation and wages.

These factors add significantly to the cost of developing and operating a mine. A report by the Mining Association of Canada (MAC) and coauthors found that compared to less remote areas, capital costs for mines in remote locations are twice as high for gold mines, 2.5 times higher for base metal mines, and 15-20% higher for diamond mines, while operating costs are 30-60% higher.[3] A study by the Prospectors and Developers Association of Canada (PDAC) also identified significant cost premiums associated with mining in Northern Canada, and noted that smaller mines are more affected by these costs.[4] Lack of infrastructure also increases the cost of exploration: the same MAC study found that exploration costs of remote and very remote projects (defined as more than 50 km away from a supply route) were 2.27 times more expensive than non-remote projects, and up to six times higher for the most remote locations.[5]

The result of this infrastructure deficit is that only relatively robust (i.e. large and/ or high-grade) deposits have been developed in Northern Canada. Northern Canada has 40% of Canada's land mass, but only 12% of known mineral deposits. On top of that, known mineral deposits in the North are less likely to be developed compared to other parts of Canada.[6] Mineral development in the territories has also been focused on relatively high-value minerals such as precious metals and diamonds because of the infrastructure challenges associated with commodities that have lower value per weight, such as base metals.

There are financial as well as cultural barriers to development of infrastructure in Canada's North. Major infrastructure projects, particularly transportation and energy projects, can be costly-- in the hundreds of millions or billions of dollars, and mining companies are often unable to justify the costs of the infrastructure if it will serve just one mine. There can also be opposition by communities and Indigenous groups to infrastructure construction due to impacts on wildlife and traditional activities, among other concerns.

Emerging technologies offer alternative solutions

In recent years, innovative solutions have emerged that can lower the costs of mining in remote areas without requiring investments in traditional infrastructure.

For example, Small Modular Reactors (SMRs) have the potential to provide power at a single mine site or community, with zero carbon emissions at the site. SMRs have the potential to be significantly more cost effective than diesel generation: analysis by Natural Resources Canada (NRCan) found SMRs have 20 to 60% lower costs than diesel in terms of levelized cost of electricity (LCOE).[7] We note that SMRs have not yet been deployed in commercial off-grid operations in Canada, and uncertainty about how they would be regulated and the level of community support are challenges for adoption. Although industry members we spoke to were very positive about the potential of this technology, they had concerns over their ability to permit SMRs and potential community opposition. In particular, it was felt that some communities may be concerned about the perceived risks associated with nuclear technology. Governments and utilities providers in Canada are working to reach commercial deployment of SMRs in Canada by 2026, and NRCan reports that some mining companies are advancing feasibility studies for SMR deployment.[8]

[3] Mining Association of Canada, 2015
[4] Prospectors and Developers Association of Canada, 2016
[5] Mining Association of Canada, 2015
[6] Prospectors and Developers Association of Canada, 2016
[7] Natural Resources Canada, 2020
[8] Ibid

In recent years, mining companies have also been exploring wind and solar as alternatives to diesel power generation, given the decreases in costs of these technologies. In the North, Diavik Diamond Mine installed a wind farm in 2012 that meets about 10% of its power needs, reducing reliance on diesel.[9] Agnico Eagle has explored developing a wind park at its Meliadine Mine in Nunavut.[10] Glencore's Raglan Mine in Quebec has successfully implemented wind power, in a federally-funded initiative that includes storing excess power in the form of hydrogen batteries.[11] A challenge for both wind and solar power is its reliability, particularly in the North. At this stage, it is seen as a way to reduce, but not entirely eliminate, diesel generation.

In transportation, hybrid airships are able to carry heavier loads than airplanes with lower emissions and no ground infrastructure requirements. As such, they can be an alternative to road or rail infrastructure, while having a significantly lower cost. At least one mining company in Canada has explored hybrid airships as a solution, but they have not yet been deployed in that context.[12] Several companies are currently advancing hybrid airship technology for commercial applications including mining.[13] However, hybrid airships have not been proven to be commercially viable for mining in a Northern climate and terrain, and mining companies are somewhat skeptical of their potential in the absence of a commercial demonstration.

A lack of telecommunications infrastructure can be a barrier to implementation of advanced digital technologies such as autonomous vehicles, remote monitoring, and automated and connected operational technologies. These technologies can increase efficiency and lower operational costs, and are growing in use in the mining industry and other sectors. Improvements in the quality of satellite internet technology could replace the need for wired connections. Although some digital solutions can be implemented with local networks, there are greater benefits available to being able to connect and share real-time data with offices in other locations.

Other technologies that can enhance the viability of operations in the North are water management, which has posed operational challenges at the Snap Lake Mine, and mining approaches that allow lower-grade deposits to be mined more efficiently. Dominion Diamonds and De Beers are investigating these technologies for use in the Ekati mine in the Northwest Territories and Chidliak deposits in Nunavut, respectively.

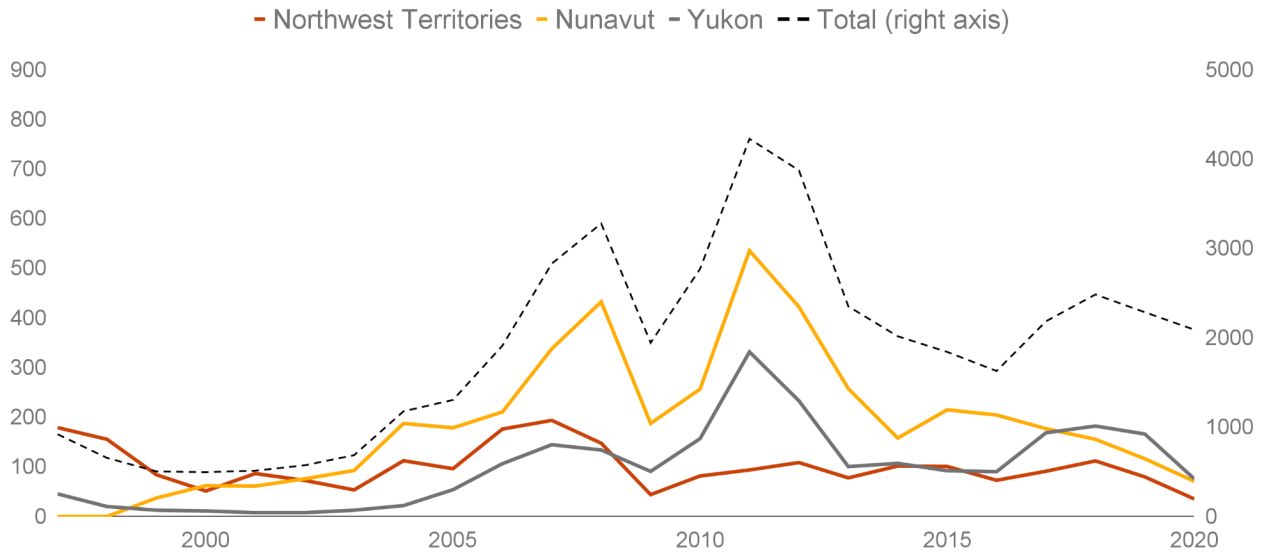
The role of capital deficiencies in mineral exploration and development

Mineral exploration expenditures in the territories has decreased in recent years

Since their peak in 2011, mineral exploration expenditures in all three territories have been decreasing, following the trend Canada as a whole. However, between 2016 and 2019 Canadian expenditures increased by over 30%, a trend that was not mirrored in Nunavut and the Northwest Territories. Of the three territories, spending in Nunavut has decreased the most, albeit from a higher level at its peak. These trends suggest that over these years, the territories have become less attractive to exploration relative to Canada as a whole. The relatively stronger performance of the Yukon post-2016 likely relates to better availability of transportation and energy infrastructure in the territory compared to Nunavut and Northwest Territories.

[9] Canadian Mining & Energy, 2014
[10] Nunavut News, 2019
[11] Natural Resources Canada, 2021
[12] Mining.com, 2016; Canadian Mining & Energy, 2017
[13] BBC, 2019; Flight Global, 2020

Exploration Plus Deposit Appraisal Expenditures, $ millions

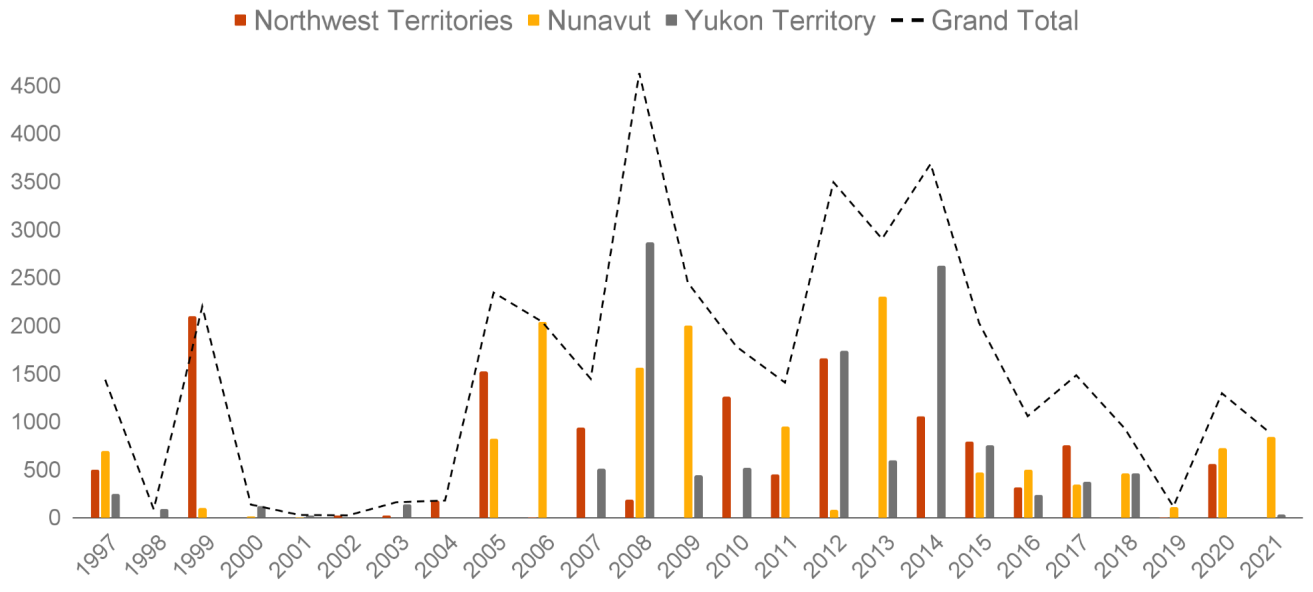


Source: Natural Resources Canada

Exploration spending is a critical indicator of the attractiveness of the territories. This spending is necessary to generate new discoveries and create a pipeline of projects that can become mines in the future.

The figure below shows capital cost announcements for public companies by territory. Capital costs reflect spending on mine development, expansion, sustaining capital, and closure. This data should be interpreted somewhat cautiously, because the announced costs do not necessarily correspond to when spending actually occurs. However, it is clear that capital costs have been lower over the past five years, compared to previous levels. Again, this suggests that mining activity in the territories is decreasing.

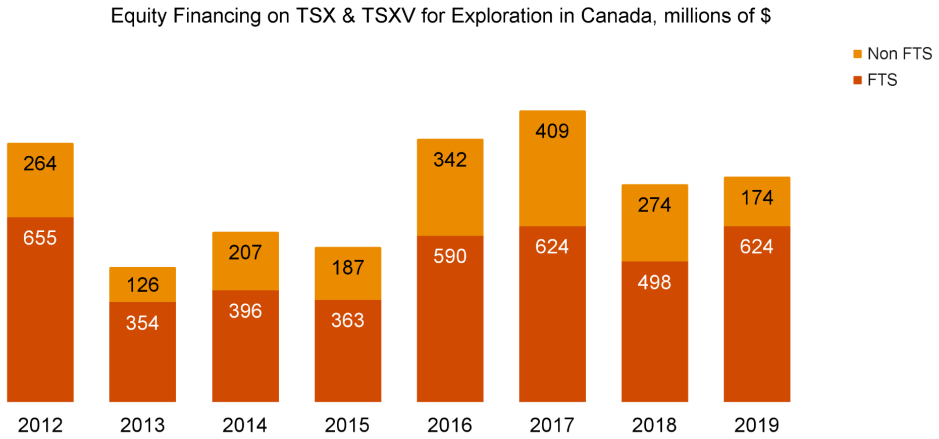
Capital costs by date announced, $ millions



Source: S&P Market Intelligence

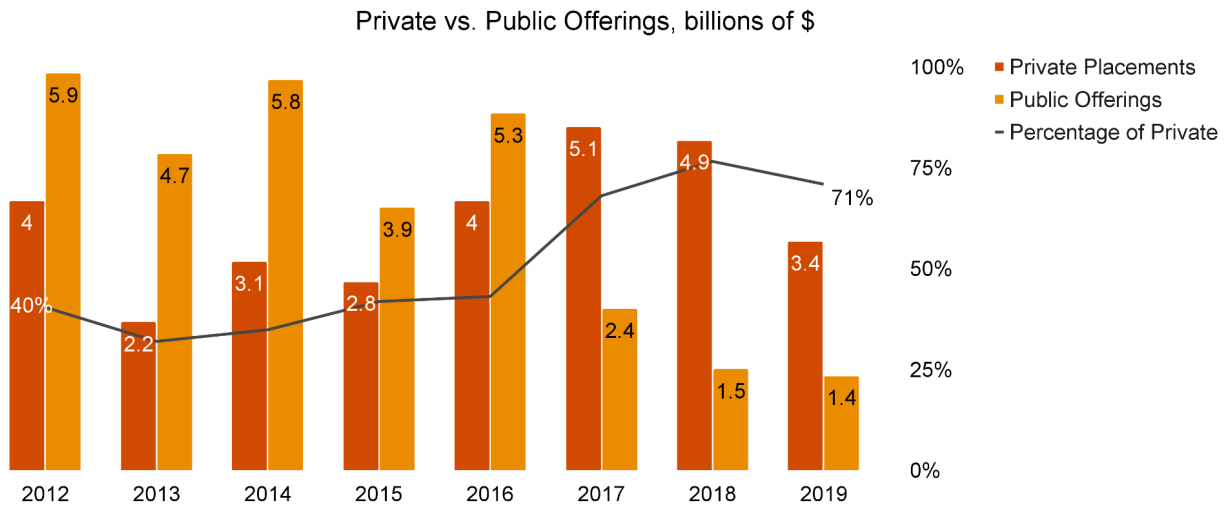
Investment sources

Flow-through shares (FTS) are the most common source of equity financing for exploration companies in Canada accounting for 67.4% of all equity financing between 2012-2019. The figure below shows the amount of equity financing raised on the TSX and TSXV for exploration in Canada. The proportion of FTS is larger in smaller financing deals, where the long term average share of FTS accounts for 78% of financing among deals worth less than $20 million.[14]



Source: 2020 PDAC Mineral Finance Report[15]

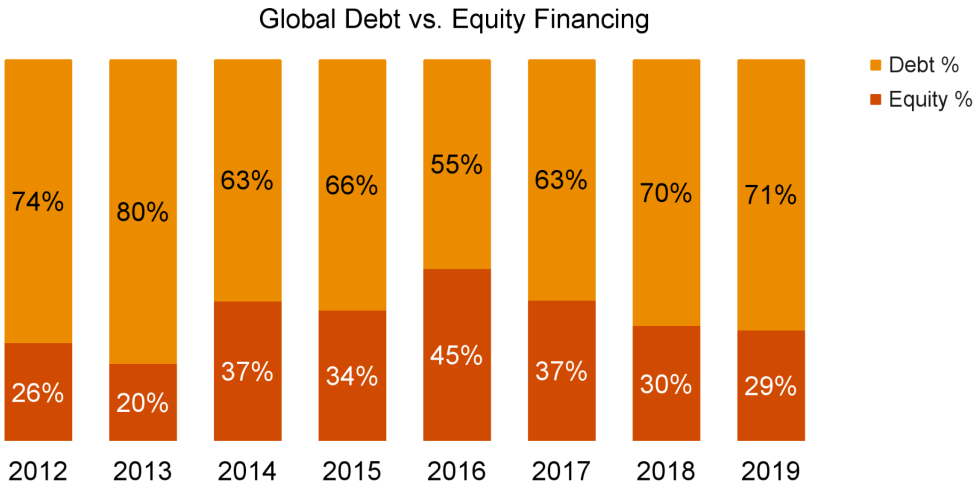
The proportion of FTS as a share of total equity financing has been volatile, decreasing from 74% in 2013 to 60% in 2017, and reaching 78% in 2019. It is also interesting to note that the share of equity raises for the mineral exploration companies on Canadian stock exchanges (TSX and TSXV) through private placements has been increasing in recent years at the expense of public offerings. This may be related to an increase in the cost of public offerings for this industry. A PDAC analysis on a random sample of financing transactions between 2011 and 2019 found that financing cash costs associated with public offerings rose from less than 6% of total deal size in 2014 to approximately 10% in 2018[16]. It is possible that the increased transaction costs are the result of falling investor interest in exploration.



Source: 2020 PDAC Mineral Finance Report[17]

[14] Prospectors and Developers Association of Canada, 2020
[15] Ibid
[16] Ibid
[17] Ibid

In contrast to becoming increasingly private since 2012, the amount of funds raised by equity and debt for the global exploration industry has remained relatively constant. From 2012-2019, debt has on average accounted for 68% of financing and equity has accounted for 32%[18] Due to the fact that exploration and mining companies in the territories generally have access to similar investment sources as the overall Canadian and global exploration and mining industry, the financing trends are likely to be similar.



Source: 2020 PDAC Mineral Finance Report[19]

Barriers to financing in Canada's North

In addition to the high costs due to lack of infrastructure discussed above, there are a number of challenges facing mining exploration and development in Canada's North. Together, these factors are important determinants of how many exploration projects are started in the North, their ability to raise financing, and ultimately their ability to become operating mines and generate long-term benefits for local communities and Canada's economy.

Our research suggests that globally, there is good availability of financing for resource development. However, Canada, and in particular the territories, face challenges in attracting financing due to barriers that reduce the attractiveness of investment and increase its risk. For example, several interviewees have commented that Canada, and the territories in particular, have developed a poor reputation in their ability to get projects approved and built, which makes financing difficult.

Regulatory challenges

Challenges with permitting and regulation are often cited as one of the top challenges with exploration, development, and operation in the North. Permitting processes are described as lengthy, uncertain, and expensive, making it difficult to sustain financing over the required permitting period. Anecdotally, industry members indicated that this has become a significant deterrent to companies with experience in the North, and is a main contributor to declining exploration spending. This is reflected in recent rankings of the territories in the Fraser Institute's annual survey of mining companies. On policy perception, the Yukon, Nunavut and Northwest Territories ranked 39th, 51st, and 54th, respectively of 77 jurisdictions reviewed.[20] For Yukon and Northwest Territories, scores on policy perception have decreased over the last five years, while Nunavut has stayed about the same for this period.

Specific issues cited are longer timelines for issuing exploration permits, permitting authorities being unlikely to meet established timelines or milestones, and a lack of transparency i.e. understanding what the rules are and how they are applied. In the Northwest Territories, several industry members mentioned frustration with their inability to extend a land use permit for more than seven years without a new application, even with no major changes to the project.

[18] Ibid
[19] Ibid
[20] Fraser Institute, 2021

In both the Yukon and Northwest Territories, separate processes for land and water use planning are perceived to lead to further delays. In the Northwest Territories and the Yukon, it is felt that regulatory requirements are very high for early-stage exploration, and difficult to comply with for companies at that stage. This observation was reflected in the 2020 Northwest Territories Environmental Audit, which recommended streamlining the permitting process for low-risk exploration.[21]

Although assessing specific regulatory challenges is outside the scope of this study, we observe that initiatives to increase certainty of outcomes and reduce overall timelines are always helpful to investors. Where multiple reviews need to take place, it can decrease timelines if they are able to overlap as much as possible and coordinate on areas of shared concern. Industry participants often highlight Quebec and Saskatchewan as Canadian jurisdictions that have a more positive reputation with respect to permitting and regulation.

Ability to engage with communities

Engagement with local communities is essential to gaining a social license to operate, and in many cases is required for project permitting. In particular in Nunavut, the Nunavut Agreement ensures that Inuit have a strong say in how mining proceeds and how benefits are shared in communities. Mining and exploration companies are increasingly recognizing the importance of this engagement and place a high priority on it. These companies have described challenges with educating communities on what is involved in different stages of the mining process, what the impacts are, and how they can benefit. Companies need to commit significant amounts of time to education, particularly when there is turnover in local governments.

We also observe that when Indigenous communities are able to meaningfully engage with proponents, they are better able to take advantage of the opportunities provided, which may increase support for mining developments. Capacity to take advantage of employment, procurement, and provisions of Impact and Benefit Agreements (IBAs) increases the benefits that communities are able to receive, which can in turn create more support for projects. A lack of capacity to engage in those opportunities can create a situation where the potential benefits of mining activity is seen as a handout and not real participation.

A challenge specific to Nunavut is that in some communities, decision-making is done by consensus, meaning that in cases involving multiple communities, reaching an agreement may be challenging.

Access to land

Access to land has been cited by industry as a top concern for continued exploration activity. Elements of this include unsettled land claims, encumbered access, and availability of land for development.

Unsettled land claims, which exist in both Yukon and Northwest Territories, create a significant amount of uncertainty for industry, and act as a deterrent to exploring those regions. A report from the National Aboriginal Economic Development Board echoed this finding, noting that “Settled land claims create a stable investment climate and certainty about use and ownership over lands and resources for much of the North.”[22] The Canadian Minerals and Metals Plan (CMMP) has also recommended settling land claims and exploring ways to create increased clarity around land use and land access. A lack of clarity around land use planning can deter resource development, infrastructure construction, and geoscience research. Ongoing disagreements around the use of the land, capacity to engage in these decisions, and turnover in leadership at various levels contribute to the delays in addressing these processes.

Ongoing land use planning also creates a significant amount of uncertainty, as in some cases it may determine how and whether mining and infrastructure development would be able to take place in particular regions. This has been described as a particular challenge in the Yukon and the Northwest Territories. Although past mines have been developed in areas with unsettled land claims, completion of land use planning processes would allow greater certainty for investors and First Nations. The results of the land claim will determine openness to mining development; however, investors have indicated that certainty is preferable in any case.

[21] Stratos, Inc., 2020
[22] National Aboriginal Economic Development Board, 2016

In the Northwest Territories in particular, industry members were very concerned about the availability of land for development. Some industry members expressed concern around how Canada's commitment to conserving 30% of its land would be implemented in the territories. In particular, it was felt that assessment of mineral potential conducted in potential parkland was insufficiently rigorous, which could result in land with high mineral potential being unavailable for development. Protected land is often unavailable as an infrastructure corridor, meaning that it can encumber access and remove even more land from potential development.

Lack of clear direction from government

There is a general feeling in the mineral sector of a lack of clear support from governments for responsible mineral development in the territories. Industry feels that both territorial and federal governments lack a strong vision for resource development and that this has led to lack of coordination and action on policy issues. In particular when territorial governments engage with communities, it is felt that they could be more strongly supportive of activities that regulatory reviews have approved.

On the part of the federal government, it is also felt that there could be stronger recognition of Canada and the North as resource economies in strategies such as the Arctic and Northern Policy Framework and the Canadian Minerals and Metals Plan. Although mining fits into federal priorities including trade development, fighting climate change, and attracting foreign direct investment, industry perceives a lack of strong vision and leadership in supporting the mining sector. This vision should inform priorities and commitments for all relevant areas of government. For example, different policy areas such as tax policy, technological development, and education and training in the territories are all critical elements of supporting mineral investment, and should be addressed and prioritized in a coordinated way.

3. Policy approaches to supporting mineral investment

Governments in Canada and elsewhere have long recognized the value that mineral exploration and development provide to economies and communities. These include opportunities for training, employment and procurement, investments in communities, provision of infrastructure, and regional economic development, particularly in Northern and remote areas. Because of this recognition, governments have pursued policies that encourage investment in mineral exploration and development.

This section reviews different policy approaches to encouraging mineral investment, and assesses their value and cost-effectiveness.

Following consultation with the three territorial governments, we have reviewed the following types of policies:

- Infrastructure investment
- Supporting the development and implementation of technological solutions
- Tax credits
- Regulatory simplification
- Geoscience investment
- Direct investment by governments
- Exploration grants

Below we present a summary of our findings on the policies against criteria that include: cost, ability to be implemented in a timely manner in the territories over the short to medium term, and effectiveness. Based on our criteria, we have assessed the overall priority for the territories, given their goal of increasing exploration and development spending to lead economic recovery starting as soon as possible.

Policy type	Criteria				Overall priority for the territories
	Cost	Ability to implement	Effectiveness	Risk	
Infrastructure investment					
Support the development and implementation of technological solutions					
Tax credits					

Policy type	Criteria				Overall priority for the territories
	Cost	Ability to implement	Effectiveness	Risk	
Regulatory simplification and access to land					
Geoscience investment					
Direct investment by governments					
Exploration grants					

Legend:  : Very high,  : High,  : Moderate,  : Low,  : Very low

Infrastructure investment

Summary of policy impacts

Infrastructure development should be one of the top priorities for the territories in encouraging mineral exploration and development activity. In particular, transportation and energy infrastructure can have a transformational impact on whether mines will be developed. In many cases, in particular when governments are able to place infrastructure such that it can benefit multiple mines and communities, it is possible for the fiscal and socio-economic benefits to justify construction costs. Infrastructure initiatives that benefit particular mines may be able to be funded with user fees, as was done in BC's the extension of BC's Northwest Transmission Line.

A caveat for infrastructure initiatives is that Indigenous groups in the North have differing values with respect to infrastructure investment. Although some groups are supportive of infrastructure investment and may even be interested in equity ownership, others are against construction of infrastructure such as roads and hydro lines due to disruption of wildlife and traditional activities. As a result, some recent infrastructure initiatives in the territories have struggled to gain community support. For example, road upgrades associated with the Yukon Resource Gateway have been funded, but are taking more time than anticipated to advance. In some cases, a potential mitigation measure is support for Indigenous equity ownership of infrastructure projects, discussed in Section 4, which can increase support for those infrastructure projects. Development of technological solutions, discussed below, can also reduce environmental impacts of infrastructure solutions.

Infrastructure initiatives are often identified as one of the top priorities in encouraging Northern mineral development, specifically for Nunavut and the Northwest Territories. The Northwest Territories/ Nunavut Chamber of Mines and Yukon Chamber of Mines both identified it as a high priority that can be transformational for projects. The Canadian Minerals and Metals Plan (CMMP) also highlighted infrastructure as an action area to enhance economic competitiveness, recommending that "The federal, provincial and territorial governments should work with Indigenous Peoples, remote and isolated communities, and industry to identify enabling infrastructure needs in regions of high mineral development potential." The CMMP notes this as a particular priority for Northern areas, proposing that "The federal, provincial and territorial governments could consider dedicating additional resources to unlock the mineral potential of northern, remote and isolated areas."[23]

[23] Government of Canada, 2019

		Rating	Rationale
Criteria	**Cost**		Due to the high infrastructure needs and high cost of building in the territories, this is a relatively high cost initiative. Recent infrastructure initiatives have had costs between the hundreds of millions (e.g. $200 million for the Tłı̨chǫ highway project, $469 million for the Yukon Resource Gateway), to over $1 billion (proposed Slave Geological Province Corridor Project). Costs may be offset by charging user fees to mines benefitting from the infrastructure. Incremental investments such as extensions of existing infrastructure or refurbishment of legacy infrastructure may be lower cost.
	Ability to implement		Infrastructure initiatives typically involve cooperation between territorial governments, the federal government, Indigenous governments, and communities, and in some cases industry. These groups may have changes in leadership over the long timelines required to complete major projects. Therefore, the ability to implement is somewhat complex.
	Effectiveness		As described above, the presence of infrastructure can be the difference between whether a project can be economically developed or not, and is one of the major reasons why the North has seen fewer mines developed compared to other resource-rich regions. Infrastructure also often serves communities, creating wider economic benefits for the territories.
	Risk		A risk with infrastructure is that economic benefits do not justify the cost. Robust analysis of the costs and benefits of each proposed project, taking into account mineral potential, potential for other types of economic development, environmental benefits, and ability to raise revenue if applicable, can mitigate this risk. Cost overruns can also be a risk with major infrastructure projects.
Overall priority for the territories			Infrastructure development is among the most significant actions that governments can take to encourage resource development in the North; therefore, it should be a high priority. However, we note that infrastructure alone will not be sufficient to spur investment. Tax credits and regulatory simplification that address the high costs and challenges associated with exploration in the North are required to sustain a pipeline of projects that can become mines and benefit from infrastructure. Moreover, infrastructure may not be feasible in some areas due to physical or environmental barriers or Indigenous opposition. Therefore, the development of technological solutions should accompany infrastructure investment as part of a long-term strategy.

Legend:  : Very high,  : High,  : Moderate,  : Low,  : Very low

Background

It has long been recognized that infrastructure is a key enabler of mine development in many parts of Northern Canada and other remote parts of Canada. Governments often work to invest in areas where there is potential for resource development by multiple mines and/ or by local communities.

Generally, the highest priority infrastructure is transportation infrastructure (including all season roads, rail, and ports), followed by transmission lines and other energy solutions, due to their ability to reduce costs for natural resource operations and communities. We note that energy solutions that reduce or eliminate reliance on diesel can make projects more attractive to investors, who are increasingly concerned about projects' environmental, social, and governance (ESG) characteristics.

Program effectiveness

As described previously in this report, access to infrastructure has a significant impact on both exploration and mining costs. Infrastructure availability can significantly increase the likelihood of projects being developed, and can enable development of lower-grade resources that previously would otherwise not have been economic.

Recent infrastructure investments that were aimed at supporting mining activity include:

- The extension of the Northwest Transmission Line in northern British Columbia to reach Imperial Metals' Red Chris Mine, and up to ten potential new mines.[24] Opened in 2014, this project will be funded by a tariff on projects connecting to the new line.[25] It is a potential power source for multiple advanced exploration projects.
- The Monts Otish highway in the James Bay region of north-central Quebec, a 240-km road that provides access to Stornoway Diamonds' Renard Mine. This road was jointly funded by the Government of Quebec and Stornoway, and is publicly accessible. This project has been criticized for cost overruns: the total project cost increased from $260 million to $470 million, most of which was absorbed by the Government of Quebec.
- Joint investment between the Alaska government and Ambler Metals to construct an all-season road that would serve a prospective mining region.[26]
- Going back several decades, there are more examples of government infrastructure investment benefitting mine development, including infrastructure supporting the Nanisivik Zinc Mine in Nunavut in the 1970s (in which the government also took an equity stake), construction of the Talston dam and railroad in the 1960s, a railway to the Pine Point Mine in the 1960s,and Manitoba's provincial trunk highway connecting Thompson and Winnipeg in the 1940s.

We note that compared to other policy interventions, infrastructure initiatives are costly and often take many years to develop. However, their ability to contribute to resource development and to communities makes them a high-impact element of mining policy. When infrastructure investments are well-targeted, they can provide significant fiscal and economic returns: a report by the National Aboriginal Economic Development Board found that an infrastructure investment that enables development of a mine can generate a fiscal return of up to $11 for every $1 invested by the government.[27]

Recognizing the importance and effectiveness of infrastructure support, governments in Canada are advancing a number of new infrastructure projects. For example, recent funding announcements were made for the Tłı̨chǫ Highway Project in NWT, an extension of the Mackenzie Valley highway in the NWT, and for highways in the Yukon through Yukon Resource Gateway.[28] The Northwest Territories is also pursuing development of road and transmission line infrastructure along the Slave Geological Province, and an expansion of the Talston hydro facility.[29] These projects have been designed taking areas of resource potential into consideration.

Governments are often in the best position to invest in major infrastructure because of their ability to recognize the positive externalities of infrastructure, such as job creation and quality of life, and access to the funds required. They also have the ability to develop partnerships among mining companies and communities. Mining companies that had recently undertaken infrastructure construction noted that the government acting as a proponent for the construction may have had greater success than individual companies.

[24] Canadian Mining & Energy, 2014
[25] BC Hydro, 2014
[26] ADEA, 2021
[27] National Aboriginal Economic Development Board, 2016
[28] Mining Association of Canada, 2021
[29] Government of Northwest Territories, 2020

The approach likely to generate the highest return on investment for the government is to invest in infrastructure in regions that show high mineral potential. For example the Slave geological province in the Northwest Territories is often cited as a region that has high potential that could be unlocked with access to all-season roads. However, infrastructure constructed to serve a specific project may also provide socio-economic benefits that can justify its cost. In either case, governments would need to conduct an analysis of costs and benefits to assess the priority of different projects. This analysis should also take into account the potential for economic development outside of mining, such as tourism, and the environmental benefits of enabling reduction in diesel usage. To offset costs, governments may be able to charge fees for use of the infrastructure, and should consider those funding models.

When deciding where to locate transportation corridors, links to further processing should be considered. This is particularly important in the case of critical minerals, where further processing being located in Canada is of strategic importance to the federal government.

Applicability to the territories

Given the limited infrastructure available in the territories, infrastructure development should be a high priority for territorial and federal governments. Advancing the current infrastructure initiatives described above, many of which are explicitly targeted to mineral development, should be the first priority. Although these projects are costly, they are a high-value action from the perspective of encouraging project development.

It may be possible to leverage existing federal funding for infrastructure initiatives. For example, the National Trade Corridors Fund has committed $2.3 billion for transportation infrastructure, including in the North. The priorities of the Canadian Infrastructure Bank include trade transportation corridors and clean energy, with goals to invest $5 billion in each.[30]

It is important to note that infrastructure on its own does not fully address the challenges facing mining exploration and development. For example, although the Yukon has significantly more established infrastructure, it faces similar trends in declining exploration to other territories, indicating that other factors are at play such as regulatory challenges, as discussed below.

Supporting the development of technological solutions

Summary of policy impacts

In some areas, new technologies may be a more economical solution compared to traditional infrastructure construction. In electricity generation, costs for wind and solar power decrease, they are becoming increasingly viable. SMRs are also advancing towards commercial readiness, and due to their scalability have the potential to serve one or several mines, as well as communities. In the case of SMRs specifically, industry felt that the government could take a role in piloting and permitting initial installations, and educating communities about their safety.

Although transportation technologies like hybrid airships have not been commercially demonstrated as an economic solution in the North, a similar technology could alleviate significant transportation and logistical challenges. Advances in satellite communications technology would benefit mine operations and communities, and have the advantage that costs can be shared among many more users. In addition to potentially lowering capital and operating costs, these solutions have the advantage of reducing the disruption caused by traditional infrastructure. Several infrastructure projects in the North have been opposed by Indigenous groups on the grounds that they are damaging to wildlife and/ or traditional activities such as hunting and fishing.

Although this initiative is a long-term solution, it can be transformational by lowering capital and operating costs, decreasing the environmental footprint of mining, and benefiting communities.

Mining companies we spoke with are interested in technological solutions and are actively exploring them. However, the federal government can play a role in accelerating these technologies to commercial viability through funding, generating spillover benefits for economic development in the North.

[30] Government of Canada, 2021

In cases where regulatory challenges are a barrier, such as SMRs, the government can play a role in taking responsibility for consulting on use of the technology, installing pilot projects, and taking the lead on the permitting process.

		Rating	Rationale
Criteria	**Cost**		The cost of supporting technological developments will depend on the particular technology and its state of readiness; however, it would typically cost less than a major infrastructure initiative or substantial direct investment in a mine. As one example, NRCan's support for wind-powered Smart Grid technology at the Raglan mine involved a government contribution of $7.8 million.
	Ability to implement		A current barrier is that there is a lack of direction from federal and territorial governments on this point. Stronger vision and coordination will support implementation
	Effectiveness		Past technological breakthroughs have made a significant difference to mines' ability to operate in the North. One example is icebreaking ships that allowed navigation through Northern waters. New solutions can also overcome the challenges of traditional infrastructure.
	Risk		To execute this strategy, it will be necessary to identify which technologies are the most critical and which companies have the ability to bring them to commercial readiness. Governments should engage with industry to understand which technologies and providers can have the biggest impact on their operations.
Overall priority for the territories			Similar to infrastructure investments, technological solutions can significantly affect the likelihood of projects being developed and increase the number of deposits that could be economic. Therefore, although this is a longer-term initiative, it should be prioritized.

Legend:  : Very high,  : High,  : Moderate,  : Low,  : Very low

Tax credits

Summary of policy impacts

Flow-through shares are commonly cited by industry participants as one of the top enablers of exploration investment in Canada. Given the importance of exploration in providing a pool of projects that can become mines, this should be a high priority for territorial governments. We agree with calls from industry participants to enhance flow-through shares in the territories to match the levels in other provinces, and to partially offset the higher costs of exploration in the North. This program has the advantage of already being in place and being well-understood by investors.

An enhanced Northern Mineral Exploration Tax Credit has been a top recommendation of industry advocates including the Northwest Territories/ Nunavut Chamber of Mines, the Yukon Chamber of Mines, and PDAC, who cite the effectiveness of these tax credits in encouraging investment, and the importance of offsetting the relatively high costs of exploration in the North.

		Rating	Rationale
Criteria	**Cost**		Between 2007 and 2012, the average cost to the federal government was $440 million per year, which makes it a moderately expensive program compared to other options.[31] Additional allowances to offset the high costs of exploration in the North would add to the cost per private dollar of investment relative to existing flow-through shares.
	Ability to implement		This approach would be relatively straightforward to implement because flow-through shares are already in place as a tax structure in Canada.
	Effectiveness		Flow-through shares are considered by industry to be very effective at encouraging exploration investment. This approach directly addresses the high costs of exploration in the North relative to other jurisdictions.
	Risk		The cost of the program will vary from year to year based on total exploration spending. As with other programs, this initiative should be evaluated and properly monitored to ensure that it is supporting exploration spending that would not have occurred in the absence of the program and that it is not subject to abuse.
Overall priority for the territories			Overall priority is high because this is a simple action that can effectively address the cost challenges facing exploration in the North.

Legend:  : Very high,  : High,  : Moderate,  : Low,  : Very low

Background

Flow-through shares are a financing tool that allows a Canadian resource company to "renounce" it's Canadian Exploration Expenses (CEE) or Canadian Development Expense (CDE) to an investor by issuing equity or "flow-through" shares. The Canadian resource company can charge a premium for the flow through shares as a result of the tax deduction allowing more funds raised for exploration and development. Since the investor is able to claim a tax deduction for CEE (at 100%) or CDE (at 30%), the cost of the investment is substantially cheaper and thus more attractive.

In addition, flow-through share investors who are individuals may also be entitled to an "investment tax credit" ("ITC") equal to 15% of certain qualifying grassroots exploration expenditures flowed-through to them under a flow through share arrangement, generally referred to as "super flow-through shares." Generally speaking, qualifying expenditures are grassroots exploration activities conducted from or above the surface of the earth to determine the existence, location, extent or quality of a mineral resource other than coal. The ITC is a non-refundable tax credit that can be carried back three years, and forward twenty years to be used against taxes otherwise payable and is additional to any tax deduction available on eligible CEE.[32]

In addition to these federal tax deductions and credits, a number of provinces also offer their own parallel ITC similar to the 15% Federal ITC. In most cases, these credits are limited to individuals resident in that particular province and require that the exploration activity be carried out in the province in question.[33]

[31] Government of Canada, 2013

[32] The additional ITC available for certain "super flow-through shares" is only eligible on a certain subset of CEE expenditures and not available on CDE expenditures renounced to investors.

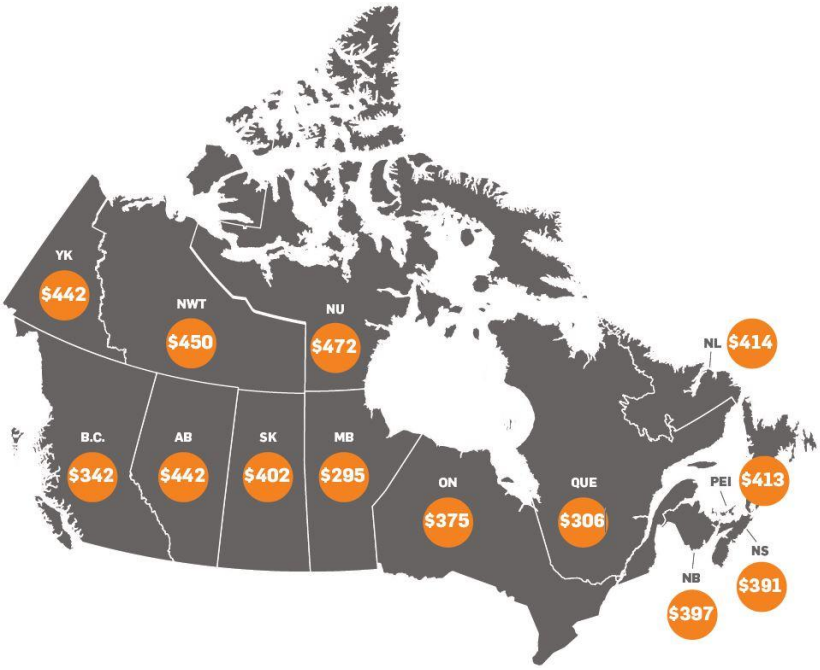
[33] NRCan: Mineral Tax Exploration Credit

- In Ontario, any resident individual may claim an additional 5% ITC against Ontario taxes payable on the CEE as long as the exploration activities are carried out within Ontario. An additional caveat for the Ontario tax credit is that the Canadian mining company conducting the exploration is required to have a permanent establishment in Ontario.
- Manitoba offers the highest investment tax credit of the provinces at 30% as long as the expenses are being incurred by qualifying corporations and the exploration is being carried out within Manitoba.
- Saskatchewan has a mineral exploration tax credit that offers an additional 10% deduction on qualifying CEE. To have expenses qualify, the company has to apply and receive approval from the provincial government. Additionally, this tax credit only applies to exploration undertaken within Saskatchewan.
- British Columbia offers an additional 20% tax credit to investors for exploration activities undertaken within British Columbia[34]

In Quebec, instead of an ITC, an investor can claim an additional 25% of the CEE if the expenditures are related to exploration within Quebec. In addition, investors can claim a further 25% deduction if the exploration is conducted above ground, meaning that there is a potential deduction of 150% of the CEE renounced to the investor. In Quebec, qualifying corporations are those limited to exploration and development and are not yet exploiting a mine in commercial quantities.

Policy effectiveness

Flow-through shares are the primary source of equity financing for Canadian exploration companies, accounting for 68% of exploration financing between 2011 and 2018. Over this time period, flow-through shares raised a total value of $4.5 billion for exploration companies.[35] These tax credits have a substantial impact in reducing the cost of investing for Canadian investors, as shown in the figure below, which illustrates the net costs for investors based on an initial investment of $1000.



Source: PDAC 2020 Mineral Finance Report

As can be seen in the figure above, the three territories have the three highest costs to investors amongst all provinces and territories. The impact of tax credits is apparent, as Manitoba, Quebec, British Columbia, and Ontario rank as the four cheapest provinces in terms of net costs.

[34]Mining Tax Canada: Flow-through shares
[35] Prospectors and Developers Association of Canada: Access to Capital

In addition to the relative cost of investing being higher in the territories due to lower tax credits, projects in the North also are subject to higher costs of exploration and development as a result of the general lack of infrastructure. As mentioned earlier, a study by the Mining Association of Canada found that remote projects (defined as being farther than 50 kilometers from an all weather road or supply center) faced average costs of over two times the costs faced by non-remote projects.[36] Indeed, the high cost of investing is cited by exploration companies operating in the territories as a top barrier. Seasonal access can also be more limited than other mining regions, contributing to the high costs. The fact that projects in the territories require more fundraising to successfully finance their projects, and suffer from facing relatively higher investment costs, highlights the need for a larger tax credit to be put in place to equalize the costs for exploration and development in the North.

Based on a 2016 questionnaire issued by PDAC, the three primary reasons for issuing flow-through shares are investor preference, availability, as 29% of participants stated that issuing flow-through shares was the easiest way to raise money or the only capital available to finance exploration work, and the premium, which allows companies to raise more money per share. Flow-through shares are also used to finance many aspects of company operations: 89% of survey participants cited the financing as helping to generate additional data on potential deposits, 83% claimed they attracted investors, and 61% stated that the financing from flow-through shares helped in discovering new deposits. Flow-through shares also have socio-economic impacts, such as generating business opportunities for Indigenous companies/organizations (83% of respondents agreed), employment opportunities for indigenous peoples (85%) and providing financial revenues to indigenous communities (74%).[37]

A primary example of a success story stemming from flow-through shares is The Agnico Eagle Meadowbank gold mine. The Agnico Eagle Meadowbank mine raised $30 million in flow-through shares which led to the discovery of a mine that employs 1,100 people, including 400 Inuit, and another 220 Nunavummiut through indirect and induced employment opportunities. In addition, the company has purchased over $1 billion of local goods and services, and has contributed almost $300 million in taxes to various levels of government since 2007. In addition to employing locals, Agnico invested $5 million to train Inuit employees, which is helping those communities build the capacity to receive greater benefits from future exploration and development projects.[38]

Applicability to the territories

These types of tax credits have proven to be successful in increasing the amount of investment in mineral exploration in many jurisdictions. The important thing to note is that the territories obviously do not have the same size tax base as provinces like Ontario and Quebec, so it would be important for any tax credit to be available to any investor across the country, so long as the exploration takes place in one of the territories. It would also need to be refundable, since investors outside of the territories would not have territorial tax liabilities. Furthermore, the size of the additional deduction available for investors needs to be large enough to offset the higher operational costs the mining and exploration companies face in the territories. Many industry members felt that the credit should be at least 50% in order to compete with other provinces and address the high exploration costs in the territories.

Regulatory simplification and access to land

Summary of policy impacts

Regulatory challenges are often cited by exploration and mining companies as among the biggest challenges of operating in the territories. In particular, the long timelines can make it difficult to raise financing for projects to continue. We recommend that each territorial government move forward with actions that will decrease the timelines associated with permitting and regulation and increase proponents' confidence in the process and outcomes. Recommending specific changes goes beyond the scope of this study.

We acknowledge that this is not a simple undertaking: any significant changes to regulatory processes will require consultation with affected stakeholders including Indigenous groups, industry, and the federal government. In some cases, meaningful changes will require changes to legislation. However, combined with other policy changes recommended, this action could have significant benefits for exploration and mining activity, at a much lower cost than other policy options.

[36] Mining Association of Canada, 2015
[37] Prospectors & Developers Association of Canada, 2016
[38] Prospectors & Developers Association of Canada, 2016

We note that some changes to regulatory systems are currently in progress: regulations for the Northwest Territories Mineral Resources Act are undergoing review. In the Yukon, the Yukon Mineral Development Strategy, which will be finalized in April, is recommending sweeping changes to the assessment and regulatory process including to underlying legislation. Many of the Strategy's recommendations are designed to decrease complexity and increase certainty.

Limits on access to land for exploration compound the other challenges facing mining and exploration in the North, namely regulatory challenges and high costs. We recommend the following changes to address these issues:

- Federal, territorial, and Indigenous governments should work to resolve unsettled land claims
- Land set aside for conservation should be subject to rigorous review of mineral potential, and efforts should be made to keep highly prospective land available for exploration

		Rating	Rationale
Criteria	**Cost**		Compared to other options discussed in this report, this option has a relatively lower cost. However, there would be costs associated with consultations, legal reviews, and other processes.
	Ability to implement		The three territories each have different regulatory frameworks involving combinations of federal and territorial legislation. They also have stakeholders that should be consulted, which can be a lengthy and complex process.
	Effectiveness		Regulatory challenges and access to land are among the top factors deterring investment; therefore, changes that can address these challenges would be highly effective, particularly when combined with factors such as infrastructure and tax credits that address high costs.
	Risk		Regulations have an important purpose in addressing environmental risks, health and safety, and the need for consultation. These factors should be considered in making any changes.
Overall priority for the territories			These changes are a high priority because of the extent to which they are currently affecting investment. In particular, combined with actions to address high costs, they can be very effective.

Legend:  : Very high,  : High,  : Moderate,  : Low,  : Very low

Geoscience investment

Summary of policy impacts

There is strong evidence that publicly funded geoscience research supports exploration by increasing knowledge of mineral deposits in a region. In addition to helping increase the knowledge of mineral deposits, these programs seek to make the dissemination of new knowledge more efficient to help incentivize investment and reduce the risk to companies by providing a clearer picture of what minerals exist. This is a high priority in the territories specifically, where existing mapping has less detail compared to other mining regions. In particular, geoscience research can promote targeted infrastructure investments by locating infrastructure where promising deposits are located.

Discussions with mining and exploration companies have highlighted that geoscience programs are valuable and are complementary to other programs. For example, in its 2021 federal budget submission, the Prospectors and Developers' Association of Canada (PDAC) applauded federal recent commitments to increase geoscience funding.[39]

We have ranked geoscience initiatives as a moderate priority because in recent years the federal government has committed significant funding to these programs, including focuses on the North and critical minerals specifically. In light of that, these programs are not the highest-value priority for additional funding.

		Rating	Rationale
Criteria	**Cost**		The cost of incremental geoscience research is moderate compared to other policy options discussed in this report (e.g. $100 million over seven years for NRCan's GEM program).
	Ability to implement		There are well-established geoscience research capabilities at the national and some territorial levels; therefore, ability to implement is relatively high.
	Effectiveness		Geoscience research is supportive of exploration activity, along with other factors. Interviews suggested that lack of geoscience knowledge is not currently one of the top barriers to exploration in the North.
	Risk		Geoscience investment is considered lower risk compared to other policy options because the funding is not dependent on external factors.
Overall priority for the territories			Geoscience is an important factor and the work currently being done is valuable in supporting exploration

Legend:  : Very high,  : High,  : Moderate,  : Low,  : Very low

Background

As of 2020, Canada is developing a Pan-Canadian Geoscience Strategy (PGS) to ensure high-quality, publicly available geoscience which will lower risks associated with exploration and support land-use decisions. The PGS is being developed by the National Geological Surveys Committee and consists of representatives from the federal, provincial, and territorial geological surveys. The scope of the PGS is to go beyond just looking at mineral exploration and to include geoscience that contributes to sustainable and safe land ownership, and to help Canada meet the growing demand for critical minerals to help support economic recovery[40]. As of July 29, 2020, the government announced a new investment to renew the two flagship geoscience programs, which are:

- Targeted Geoscience Initiative (TGI)
- Geo-Mapping for Energy and Minerals (GEM)

The TGI is a program with $5 million in annual funding that works collaboratively with provinces, territories, industry, and academia to generate geoscience knowledge and innovative techniques to more effectively discover new mineral deposits. Phase five of this program occurred between 2015 to 2019.[41]

Policy effectiveness

An evaluation of the program carried out in 2020 identified three primary types of target outcomes:

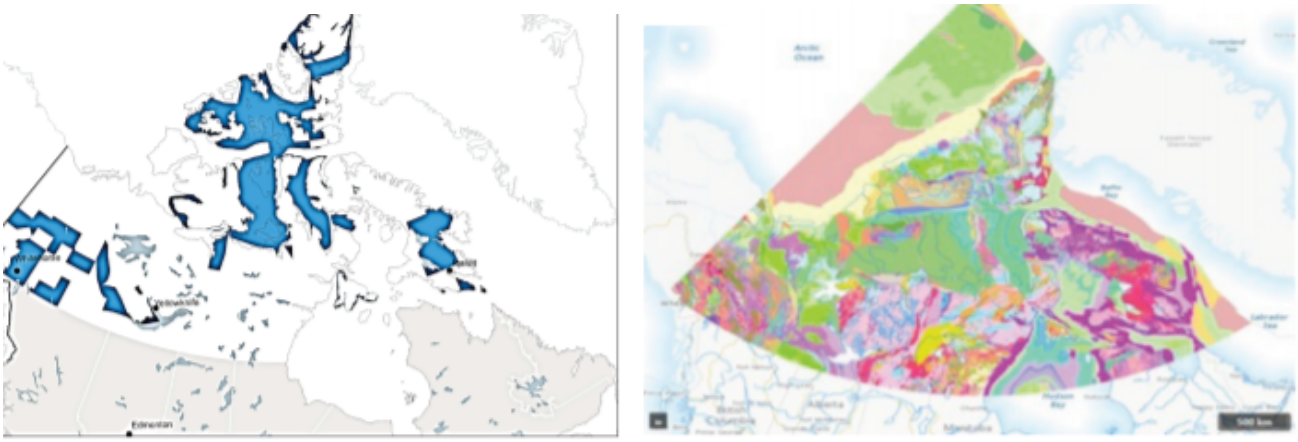
[39] Prospectors and Developers' Association of Canada, 2021
[40] Mines Canada, Update to Action Plan 2020
[41] Natural Resources Canada, Targeted Geoscience Initiative

- Immediate outcomes of creating collaborative research groups and distributing new public geoscience knowledge throughout the mineral exploration industry.
- Medium-term outcomes of encouraging adoption of innovative approaches to detect ore deposits by industry and having new exploration occur as a result of new geoscience knowledge.
- Long term outcomes of generating new knowledge and methodologies for exploration companies to more effectively discover buried minerals and creating a pool of highly qualified and trained individuals available for employment[42].

The evaluation found that this program has been very successful in meeting its target immediate outcomes, and has made progress towards its intermediate and long term intended outcomes. One of the primary findings of the evaluation is that it is often difficult to quantify net investment as a result of geoscience investments. While geoscience investments are integral in helping to lower the amount of risk for companies by providing a more accurate picture of mineral deposits, there are a host of other factors that also come into play. For example, the evaluation notes that if a company gleans important knowledge from these programs, they still may not begin an exploration project unless such a project is economically feasible. Therefore factors such as accessibility to the region, commodity prices, shareholder interests, and regulatory requirements are all cited as key issues that need to be met for geoscience initiatives to have a greater impact.[43]

The GEM is a geological mapping program, also run by NRCan, that was renewed for seven years in 2013 with $100 million of funding. This program is focused on advancing geological knowledge specifically in the North. The first phase, which lasted from 2008-2013 involved 21 field projects in the three territories and northern parts of Ontario, British Columbia, Quebec, Saskatchewan, Manitoba, and Newfoundland, 35 regional geophysical surveys, and over 700 new maps and data published by NRCan. This first phase resulted in new exploration investments by over 100 companies, which generated $40 million in direct employment opportunities and over $300 million in indirect investments.[44]

Similar to the TGI, this program has immediate, intermediate, and long-term target outcomes. Immediate target outcomes were improving awareness and accessibility of new regional geoscience data amongst industry and Northerners, and providing tools to facilitate the use of such data. The intended intermediate scope is for Northerners and exploration companies to use the new data to aid in their decision making processes, and the target long term outcome is to have a strong, stable Northern economy as a result of long-term, responsible investments. An evaluation carried out in 2018 concluded that the GEM had made progress towards all of its goals and was on track to generate geoscience research that would not otherwise be available.[45] The increase in geological mapping as a result of GEM progress is shown below.



The above figures highlight the GEM progress in geological mapping from 2008 (left) to 2020 (right)[46]

[42] Natural Resources Canada, Evaluation of TGI Phase 5
[43] Ibid
[44] Natural Resources Canada, GEM program
[45] Natural Resources Canada, Evaluation of GEM-2 Program
[46] Natural Resources Canada, Geological Survey of Canada

GEM reports have been used by the Northwest Territories to plan the route of the Tłı̨chǫ All-Season Road. It has also helped to find new mineral potential in the Southern Mackenzie area and diamond potential in Nunavut and the Northwest Territories. Additionally, a 2020 study by Ernst and Young concluded that the GEM and TGI together are estimated to have provided approximately $1.22 billion in economic benefits to Canadians, which amounts to a 7:1 return on investment.[47]

There are also geoscience programs that are focused specifically on a province or territory. In Canada, these include the following:

- Geoscience BC
- The Northwest Territories Geological Survey

Geoscience BC generates research and data about British Columbia's minerals, energy and water resources. The overarching goal behind this program is to advance knowledge, inform responsible development, encourage investment and stimulate innovation. Overall, this program has completed 129 research projects on minerals and had 27 underway as of 2019.[48]

The Northwest Territories also have a provincial geoscience initiative that operates as a division of the department of Industry, Tourism, and Investment. The purpose of this program is to advance geoscience knowledge within the Northwest Territories. This program works to map the geology of the region, assess mineral deposits and industrial minerals, and conduct research on geochemistry and geophysics.[49]

Jurisdictions in Australia have implemented programs that include support for geoscience, among other elements. These include:

- Western Australia - Exploration Incentive Scheme (EIS)
- Northern Territory - Resourcing the Territory Initiative (RTI)
- Southern Australia - Plan for Accelerating Exploration Copper (PACE)

The EIS in Western Australia, in addition to offering grants, seeks to develop high-quality geophysical data, generate modelling of cover to facilitate underground exploration, and apply 3D technology to assist in identifying mineral prospects. The 2015 study commissioned by the Western Australia government to evaluate this program claims that the main reason for the substantial increase in exploration spending as a result of the program is due to the provision of geoscience data that opened up parts of the state for exploration.[50]

The RTI of the Northern Territory in Australia is running from 2018 to 2022 and is replacing a previous initiative that ran from 2014-2018. This program has a budget of $26 million AUD for the entirety of its duration, which is split between geoscience initiatives and grants. While no formal evaluation has been conducted on this program or its predecessor, the Northern Territory claims that the promotion of investment opportunities facilitated $360 million AUD in new investment over a decade.

The PACE program in Southern Australia was developed in 2004 and seeks to help overcome one of the main barriers faced in exploration in Southern Australia, which is its deep cover that limits geological understanding and makes drilling more expensive. The PACE program provides pre-competitive geophysical exploration data in order to encourage mineral discoveries. The goals of the program are to generate more than $400 million in private mineral exploration and create and sustain 1000 direct and indirect jobs. This program spent $55 million AUD in funding between 2004 and 2014 and the most recent phase began in 2015 with funding of $20 million AUD. A 2014 program review finds that there was a 22% increase in exploration license cover over target regions, improved accessibility of geoscience reports, 3616 holes drilled, and 15 successful discoveries.

[47] Natural Resources Canada, Departmental Results Report
[48] Geoscience BC
[49] Northwest Territories Geological Survey
[50] Government of Western Australia: Exploration Incentive Scheme

It is estimated by the 2014 review that the program generated $4.5 billion in 2010 AUD and an increase in exploration spending of $700 million AUD, a return of 20:1. The estimated net gain to the economy was $2.4 billion AUD over the program lifetime (2004-2014).[51]

Applicability to the territories

Geoscience investment may yield greater results in the Territories than it would in the rest of the country as large areas of the North are relatively undiscovered and unexplored in terms of mineral deposits. That being said, to have a larger impact, the ability to efficiently disseminate new information to potential investors and companies needs to be in place in addition to the geoscience research being conducted. Stakeholders interviewed as part of this study noted that geoscience was valuable.

Direct investment by government

Summary of policy impacts

Direct investment by governments in advanced projects is capable of helping accelerate the development of a mine, and has done so where this type of policy has been pursued, notably in Quebec. Direct investment by governments in advanced projects is a relatively high-cost and risky policy option, often requiring hundreds of millions of dollars in order to have an impact. Government direct investment in mines is also relatively risky. For example, in the case of the Nemaska Lithium mine in Quebec, the government lost the value of its initial equity after the company went into creditor protection, and ended up making a significant additional investment beyond its original plans.

One of the reasons that direct investment by governments is effective, both at the exploration stage and at the development stage, is because it acts as a signal of government support, and indicates the government's confidence that projects will be built. In cases where there are significant barriers to projects being built (such as regulatory uncertainty or a lack of infrastructure), these barriers should be addressed alongside any direct investments by governments. This will ensure that the program is credible as a signal of confidence, and increase the likelihood of return on the government's investment.

When investment by governments is structured as an investment fund for exploration projects, examples from other jurisdictions have highlighted the importance of professional management that the market has confidence in. If such a policy were pursued, this would be a critical element. For this reason, and because it does not work within existing policy frameworks, it would require setup of new organizational and governance structures that would be capable of making investment decisions, and would be somewhat complex to implement.

		Rating	Rationale
Criteria	**Cost**		Typical costs depend whether investments are made in exploration projects or mines entering development. For exploration, past programs have had moderate costs (e.g. $50 million in initial funding for SIDEX, $92 million USD for Chile's Fondo Fenix). Investment in mines entering development carries a high cost, given the goal of influencing whether projects can be developed (e.g. $1 billion capitalization of Quebec's CRNE fund, hundreds of millions invested in individual projects).
	Ability to implement		In order for a direct investment fund to be effective, either investing in exploration projects or mines, it is very important for investors to have confidence that the fund is run professionally and making sound decisions. This factor is a main lever for funds' effectiveness: when government investment is seen as a "stamp of approval" that can spur additional private investment.

[51] The Evaluation of the Plan for Accelerating PACE, 2014

		Rating	Rationale
	Effectiveness		Financing in development-stage projects by governments has been effective in advancing projects where it has been applied in other jurisdictions. In particular, financing needs can be high for certain critical minerals projects where processing capacity is required along with mining operations.
	Risk		This policy's effectiveness in increasing investment and in fiscal sustainability is dependent on the government's ability to select projects that are viable and where support of the government to advance the project is required. Some members of industry are skeptical of the government's ability to pick winners. There is also a risk of cost overruns when projects do not perform as expected and require additional investment to proceed (as was the case with Nemaska Lithium in Quebec).
Overall priority for the territories			In general, projects' ability to attract financing can be best addressed by improving the projects' attractiveness to investors (for example by investing in infrastructure and removing regulatory barriers). However, combined with these efforts, investment funds can be effective when they are seen by investors as high quality decision makers. Notwithstanding, this approach should be applied on a case by case basis rather than as an overarching policy to encourage investment.

Legend:  : Very high,  : High,  : Moderate,  : Low,  : Very low

Discussion of existing programs

Below we summarize three programs that involve direct investment by governments in exploration projects and mines. The Fonds Capital Ressources Naturelles et Énergie is focused on advanced projects and mines, while the other two programs covered (SIDEX in Quebec and Chile's Fondo Fenix) invest in early-stage exploration projects.

Fonds Capital Mines Hydrocarbures/ Fonds Capital Ressources Naturelles et Énergie, Québec

Background

The Fonds Capital Mines Hydrocarbures (Capital Mines and Hydrocarbons) was established in 2015 with a mandate to invest in mining and hydrocarbon (oil and gas) projects in Quebec. Funding was $1 billion, of which up to $800 million was earmarked for mining, and at least $500 million for areas covered by the Plan Nord (north of the 49th parallel).[52] In 2019, its mandate was expanded to include all natural resources and energy projects, and it was renamed Capital Ressources Naturelles et Énergie (CRNE), or Capital Natural Resources and Energy.[53] This report refers to the fund as CRNE.

The fund makes equity investments of at least $1 million in projects, where government contribution may not exceed 50-60% of project costs, depending on the location. Projects must be worth at least $5 million, be located entirely in Quebec, and have a preliminary economic assessment. There is no requirement that project owners or operators be based in Canada or Quebec.

Projects are evaluated based on their risk and financial factors, the economic benefits of the program, technical and environmental aspects, and social acceptability. The consideration of social acceptability includes community and environmental factors, health and safety, and inclusion of Indigenous communities.

[52] Government of Quebec, 2016
[53] Investissement Quebec, 2019

Policy effectiveness
As described below, this program has provided significant investments to mines that likely supported their development. The large scale of the fund allows it to provide relatively large investments that have a substantial impact on overall project finances. It also acts as a strong signal that the government of Quebec is supportive of mining investment, and committed to ensuring that projects are developed.

In terms of financial performance, the intention is that the CRNE will continue to fund its activities indefinitely, returning any surplus funds to general government revenue. In 2019 and 2020, the fund ran deficits of $204 million and $127 million respectively.[54]

The effectiveness of any one program in Quebec needs to be considered in light of the large amount of overall funding available to support the mining sector. As described in the examples below, CRNE often co-invests with the programs described below. These programs include:

- **Ressources Quebec:** Ressources Quebec is a subsidiary of Investment Quebec, and has a mandate to invest in mines and hydrocarbons (oil and gas) through the entire project life. The CRNE falls under Ressources Quebec, but is not the only program that invests in mining. Ressources Quebec also runs the SOQUEM program, which both invests and conducts exploration activity, and has participated in over 350 exploration projects.
- **Plan Nord:** The Plan Nord, established in 2015, committed to invest $2.7 billion over 25 years on initiatives to support economic development in Northern Quebec, including infrastructure construction that will enable mining activity. In 2017/18, the Plan Nord announced over $970 million in funding for extensions and improvements to Route 138, the James Bay Road, and Route 389.
- **Fonds de solidarité FTQ:** The fund has a mandate to stimulate economic development in Quebec, and as of 2019 held $15.9 billion dollars in assets. It is a partial owner of the SIDEX fund described below, and often co-invests with SIDEX and the CRNE.
- **SIDEX:** a government-run investment fund for mining exploration projects, described in further detail below
- **Flow-through shares:** Quebec's flow-through shares regime is relatively generous compared to the territories
- **Eligible expenses:** Since 2015, spending on environmental studies and community consultations has been considered an eligible exploration expense

Together, these policies have created a reputation for Quebec as a very mining-friendly province. This is reflected in relatively favourable rankings in the Fraser Institute's annual survey of mining companies: in 2020 Quebec ranked in the top ten globally and second overall in Canada (after Saskatchewan) in terms of investor perception.[55] In terms of policy specifically, Quebec is ranked third in Canada.

Impact on mine development
CRNE does not publish a list of projects funded, but information on several projects is available publicly. Our research identified at least one instance where funding from the CRNE appears to have accelerated its reopening as a producing mine, and another where that outcome is likely to occur in the future, as described below. We note that in both these cases, government programs other than CRNE also provided significant financial support for the projects. In addition to those projects described below, several companies that CRNE has invested in are progressing their projects towards development, including the BlackRock base metal mine, and Quebec Precious Metals' Kipawa rare earths project, and Monarques Gold.

Lake Bloom Iron Mine
Champion Iron Limited's Lake Bloom mine is an example of government investment supporting the development of a project that has continued to attract private investment. In 2017, Champion Iron Limited purchased the Lake Bloom iron mine, which had been out of production since 2014. The CRNE invested $25.2 million to support the restart, bringing their total equity investment to $51.4 million, or 37.2% of the company.[56]

[54] Auditor General of Quebec, 2020
[55] Fraser Institute, 2020
[56] Canadian Mining Journal, 2018

This was not the only government support for the mine: through other programs, the Quebec government also invested in the Pointe-Noire facility that would process the iron ore, and the federal government contributed $55 million to the expansion of the Port of Sept-Îles that would enable transportation of the end product.[57] The mine restarted in 2018, creating 450 jobs and producing 7 million tonnes of iron ore per year.[58]

Since that time, the mine has continued to attract private investment. In 2019, Champion Iron Limited bought back its equity from CRNE for $211 million, with financing from the Caisse de dépôt et placement de Québec (CDPQ). At that time, the CEO noted "we would like to [. . .] to thank the Sprott Private Resource Lending group, the Glencore International AG, CDPQ and the Ressources Québec teams for being early supporters of Champion. In a difficult financing environment, these partners shared our vision and were instrumental in providing the capital required to restart Bloom Lake and help get us to where we are today."[59] In 2020, Champion Iron Limited invested $513 million to double the capacity of the mine, creating 375 new jobs.

In total, this project received a significant amount of government support that appears to have been an important factor in the mine's reopening. The mine's reopening has led to additional private investment and economic activity, particularly as iron prices have increased. In this case, the CRNE was able to make a return on the money invested.

Nemaska Lithium

The example of Nemaska Lithium highlights how governments take on risk when investing directly in mining projects. In 2018, the CRNE invested $80 million, and Ressources Quebec purchased $50 million in guaranteed bonds as part of a total of $1.1 billion in funding for a lithium ore mine and processing plant in the Mauricie region. The processing plant would be the first of its kind outside China, and the project was seen as a strategic investment in developing Quebec's lithium supply chain. It was also anticipated to benefit a nearby Cree community.[60]

At the time, the president and CEO praised the impact of the government's investment: "It confirmed that the government was committed to development in northern Quebec. . . It has had a big impact on us." He added that the government's investment had helped attract further private investment: "That really helped the rest of the world to put money into the project."[61]

Although lithium demand is increasing with development of electric vehicle supply chains, the project was also relatively risky: the company's processing approach had not been proven at a commercial scale, and maintaining its contracts with buyers depended on the quality of the output, which had not yet been proven. An increase in Australian supply, which is to be processed in China, drove the price of lithium down in 2018. In 2019, while the mine and plant were approximately half way through construction, total project costs increased from $1.1 to $1.5 billion, and the project needed additional investment of $375 million.[62] The company was not able to secure the additional financing, and went into creditor protection in December of 2019.

In December 2020, Investissement Quebec and The Pallinghurst Group, a private investor, purchased the company with 50% ownership for each, creating New Nemaska Lithium. Together they will invest up to $600 million to move the project forward.[63] Shareholders in the original Nemaska Lithium were disappointed to not be repaid.[64] The project is now continuing to advance.

In this case, government investment appears to have had a significant impact on the project's ability to advance towards becoming a producing mine. However, it has involved a very substantial level of investment from the government, and a significant risk if the project does not meet expectations.

[57] Port of Sept-Îles, 2012
[58] Parti Libéral du Québec, 2017
[59] Champion Iron Ore Limited, 2019
[60] Parti Libéral du Québec, 2018
[61] Canadian Mining Journal, 2018
[62] La Presse, 2019
[63] Mining.com, 2020
[64] Nemaska Shareholders Group, 2020

Société d'investissement dans la diversification de l'exploration (SIDEX), Québec

Background
Quebec's Société d'investissement dans la diversification de l'exploration (SIDEX), or Diversification of Exploration Investment Partnership, is an institutional fund that invests in exploration companies with projects in Quebec. The Government of Quebec founded SIDEX in 2001 with the goal of increasing investment in mining exploration, with a focus on diversification. SIDEX's current mission is to invest in exploration projects located in Quebec in order to:

- "Diversify Quebec's mineral base by promoting exploration for minerals with attractive market potential;
- Stimulate investments for the exploration of existing mining districts that show strong potential for diversification;
- Open new territories with strong discovery potential to exploration and attract new investments, thus generating a leverage effect
- Promote new entrepreneurs and innovation."

SIDEX is a limited partnership created by the Finance Ministry of Quebec, which owns 70% of SIDEX, and the Fonds de solidarité FTQ, which owns 30% of the fund. The program was initially funded at $50 million, and to date has invested $90 million. The fund's mandate has been renewed twice: once in 2009 (to 2017) and again in 2015 (to 2025). Neither extension involved any additional commitment of funds.[65]

It provides equity financing for exploration companies of between $50,000 and $1.5 million, with the limitation that it generally will not own more than 10% equity of the company. Between 2015 and 2019, SIDEX has also run a program called Field Action, which provided up to $200,000 per company, funded at a total of between $3 million and $6 million annually. For context on these figures, between 2017 and 2020, total mineral exploration spending in Quebec has been between $500 million and $600 million.[66]

Companies applying for funding provide information on the company, project, and management team. SIDEX evaluates projects based on the quality of the exploration company and project, use of innovative approaches, and substance mined (focusing on diversification). As part of their review, SIDEX takes into account the social and governance performance measures and impacts because of their relationship to project quality and performance.

SIDEX publishes information on critical mineral endowments in Quebec, and has invested in critical minerals including cobalt, uranium, molybdenum, silica, and Rare Earth Elements.

Policy effectiveness
As noted above, SIDEX has made a return on its original funding of $50 million dollars, and earnings have grown the program: as of 2020, the fund had paid dividends to its two shareholders of $16 million, and increased the fund's value to approximately $95 million.[67] SIDEX's approach is to eventually sell its equity in projects that it has invested in, and to re-invest that capital in new projects.

Stakeholders in the Quebec and Canadian mining sectors feel that the program has been successful in encouraging investment. Although the capital it provides is always valuable to projects, the major impact of SIDEX on projects' ability to advance is as a signal of quality and commitment from the government. The fund's portfolio managers are seen by industry as having sound technical judgement on project quality. Therefore, SIDEX funding is seen as a signal of a good investment, which may make it easier for SIDEX-funded projects to attract additional private investment. The fund is also seen as an indication of the government's commitment to mining activity, and to ensuring that projects are able to pass the permitting and regulatory process if they meet the appropriate standards.

An important consideration is the effect of commodity prices on SIDEX's investments. SIDEX was established during an upswing in the commodity cycle, which has very likely contributed to its success. The timing of a fund's establishment with respect to the business cycle is an important consideration.

[65] Government of Quebec, 2015
[66] Natural Resources Canada, 2020
[67] Kitco News, 2020

It is easier for funds to generate positive returns, as SIDEX has done, in a time of high prices. When prices are low, it may be difficult for such a fund to generate a return on its investment.

Impact on mine development
SIDEX does not have a mandate to support mines coming into development and production, and typically only invests in greenfield projects. However, it may consider investing in more advanced projects if it was involved at the beginning of the project. SIDEX has provided investment for at least two exploration projects that later became operating mines: the Bracemac-McLeod Mine owned by Glencore, and the Nunavik Nickel Mine, owned by Canadian Royalties. Based on interviews with companies that received funding from SIDEX, the SIDEX investment helps them to attract further investment, and is seen as a signal of both quality and commitment of the government to the project.

Fondo Fenix, Chile

Background
Chile's Fondo Fenix was established in 2011 through an organization called CORFO (Corporación de Fomento de la Producción de Chile or Production Development Corporation of Chile). The program's goal was to stimulate investment in exploration, eventually leading to the discovery of new mining sites. Chile also hoped to maintain its position as a global leader in mining.

The program was funded by issuing debt to six investment funds that would be in charge of investing the funds. The debt was required to be matched by additional private investment. In total, CORFO provided financing of $92 million USD and private funds contributed $58 million USD.[68] The government selected the investment funds based on their investment strategy and company background. The debt was to be repaid 10 years after program initiation. Any additional earnings would be kept by the investment funds. The projects funded were determined by the individual investment funds, but needed to be located in Chile.

Policy effectiveness
Although the program has likely led to an increase in exploration spending, overall results are mixed. All of the program's funds were invested, likely boosting exploration spending in the country beyond what it would have been. This was driven by private funds being able to spread risk by financing a larger number of projects, and by sharing risk with the government. However, since the project's inception in 2009 none of the funded projects have entered a development or production stage. Additionally, at least one of the private investment funds has gone bankrupt, meaning that a portion of the initial government loan will not be repaid.

On the positive side, one project funded by the program, a rare earth element deposit, was sold to a mining company in 2019 and the project is now advancing.[69] Project information is not public, making it difficult to assess the outcomes of the investments as a whole.

One factor cited as challenging for the program is the investment funds' lack of mining experience. Although this was one of the criteria used to select the private funds, not all of the funds had direct experience investing in mining exploration.[70] Additionally, many of the small exploration companies operating in Chile lack experience relative to junior mining companies in Canada. We note that Fondo Fenix funds could be provided to foreign exploration companies, as long as the projects were located in Chile.

Applicability to the territories
Investment in advanced projects by governments (evidenced here by the CRNE fund) appears to be effective in encouraging natural resource development and in advancing mines towards production. Two key factors in this success are the significant levels of financial support, and the signal to private investors that the government is confident that the project will be built. The CRNE fund has a relatively high cost both in terms of total funding ($1 billion) and the funding provided per project. On a per project basis, funding is often at least $50 million (although some projects are funded at lower levels), and can increase to the hundreds of millions, as in the case of Nemaska Lithium.

[68] Government of Chile, 2011
[69] Hochschild Mining, 2021
[70] Chile Explore Report, 2018

As noted above, CRNE-funded projects have typically been supported by other government programs, such as those that provide additional direct investment by governments or funding for infrastructure.

Investment in advanced stage projects can involve governments taking on a high level of risk, particularly in new and unproven technologies. This was illustrated in the example of Nemaska Lithium, where the government's initial investment has grown significantly following financial difficulties of the project. If governments step in to fund projects that markets have decided not to finance, there is a risk that they would not choose the highest quality projects. Again, professional fund management that the market has confidence in would be an essential element of any such program.

The SIDEX program is considered a success due to having supported project investment in a cost-effective way. The example of Chile's Fondo Fenix highlights the extent to which involvement in project financing is risky, and the importance of experienced, professional fund managers.

In all cases, direct investments work best when governments complement them with actions to address the other barriers to development in the region. In the case of Quebec for example, provincial and federal governments were also building infrastructure to support mines.

Industry has highlighted the fact that some types of critical mineral operations require higher capital costs because of the need to build related further processing capacity. In these cases they may struggle with raising sufficient capital to advance the projects, and may benefit in particular from government support.

Grant programs

Summary of policy impacts

Grant programs are one way that governments incentivize exploration activity by lowering the cost of operating for exploration companies, particularly junior companies. These policies are perceived to be helpful, but are not typically cited as a key enabler of exploration activity. Flow through shares are typically cited as the top enabler of exploration spending. Compared to many of the policy options explored here, grants are a relatively low-cost option. Because it is also relatively low impact, in the sense of not being described as a key enabler, we have not recommended it as a high priority.

		Rating	Rationale
Criteria	**Cost**	◔	Current grant programs are relatively low cost compared to other policy options discussed here (in the hundreds of thousands at the provincial/ territorial level).
	Ability to implement	◔	Ability to implement is high because these programs are already in place.
	Effectiveness	◔	Although grant programs partially offset the high costs of exploration in the North, those in industry typically describe flow-through shares as having a higher impact.
	Risk	◔	This program is low-risk because costs are often capped at a certain level, making costs predictable. This assessment assumes that program administration is able to ensure that grants are used as intended by the government.
Overall priority for the territories		◔	Overall, enhancing grant programs should be low priority because of its relatively low importance as an enabler of exploration spending.

Legend: ● : Very high, ◔ : High, ◑ : Moderate, ◔ : Low, ○ : Very low

Background

Grant programs are very wide ranging in terms of geographical distribution, as almost every province and territory has their own, and the amount of funding that can be received. In the North, each of the territories currently has one grant program, as listed below.

- Nunavut - Nunavut Prospectors Program (NPP)
- Northwest Territories - Mining Incentive Program (MIP)
- Yukon - Mineral Exploration Program (MEP)

The Nunavut prospectors program has a budget (as of 2019-2020) of $150,000 and contributes up to $8,000 to qualified prospectors to help cover basic expenses such as assistant wages, materials and supplies, etc. while they are exploring Nunavut mineral deposits.[71] Between 1999-2018, total funding of $1.7 million was paid to fund 186 prospectors[72]. The Northwest Territories Mining Incentive Program allows prospectors that are licensed to operate in the NWT to apply for grants of up to $25,000 and corporations to receive grants of up to 60% of their eligible expenses, to a maximum of $240,000. Eligible expenses include food/consumables, wages, fuel, travel, equipment rental, among others.[73]

The Yukon Mineral Exploration Program offers a grant reimbursing up to 50% of eligible expenses to a maximum of $40,000. This program is limited to prospectors or companies that have exploration spending of less than $300,000. This program grew substantially in 2020, in 2019 it had $1.4 million in funding and 51 projects that were funded and in 2020 those numbers increased to $2.5 million in funding and it funded 96 projects.[74]

Other provinces offer similar grant programs, as listed below.

- Saskatchewan - Targeted Mineral Exploration Incentive (TMEI)
- Newfoundland and Labrador - Junior Exploration Assistance Program (JEAP)
- Nova Scotia - Mineral Resources Development Fund (MRDF)
- New Brunswick - Junior Mining Assistance Program (JMAP)
- Ontario Prospector Grants

In Saskatchewan, the TMEI is focused specifically on drilling projects to support new discoveries, and the program has a maximum annual funding of $750,000. Eligible companies can receive grants of 25% of approved costs, up to $50,000 per year for drilling projects undertaken in the specific TMEI area.[75] In 2019-2020, 5 companies received the full $50,000, which supported 37 new exploratory drill sites, generating approximately $2 million in expenditures by exploration companies.

The Newfoundland and Labrador JEAP offers different amounts of funding depending on the type of activity and company. For grassroots activities, the program will provide financial support of 75% of approved costs to companies with no mineral revenue, and 50% for those with mineral revenue, and for non-grassroots activities, it provides 50% for companies with no revenue and 40% for those with mineral revenue.[76] All funding is subject to a maximum of $150,000 per project in Newfoundland and $225,000 per project in Labrador. In 2019, there was a total of $1.3 million in funding given to 23 different projects.[77]

The Nova Scotia MRDF has seven funding streams from which prospectors, exploration companies, and researchers can receive funding designed to employ post-secondary students and support mining sector projects. These streams include prospecting an exploration grants ($20-$30,000), shared funding exploration grants (>$30- $200,000), marketing grants, post-secondary research grants (max $90,000), education, outreach, and engagement grants (max $50,000), innovation

[71] Nunavut Department of Economic Development and Transportation
[72] Nunavut Prospector Program and Introduction to Prospecting Course, 2019
[73] Government of Northwest Territories - MIP corporate application guidelines
[74] CBC, 2020
[75] Government of Saskatchewan, Targeted Mineral Exploration Incentive
[76] Prospectors and Developers Association of Canada, 2018
[77] Government of Newfoundland and Labrador, Junior Exploration Assistance 2019

grants (max $100,000), and major project grants (max $500,000)[78]. In 2019-2020, the MRDF had a budget of $1.5 million, which was an $800,000 increase from 2018-2019, and the program gave out 42 grants, worth $1,365,200.

The New Brunswick JMAP provides grants for up to 50% of eligible project costs, up to a maximum of $100,000. Eligible expenses include core drilling for exploration, trenching, geological surveys, sampling/testing, among others. They do not however accept expenses such as meals, transportation costs, office expenses, vehicle or field camp rentals, or wages.[79]

The Ontario prospector grants are offered by the Ontario Exploration Corporation (OEC) and are up to $85,000 to prospectors that have properties with high economic potential. This total offering of $85,000 is done throughout three phases, with the prospector receiving $10,000, 25,000, and 50,000 in phases 1,2, and 3, respectively. The OEC retains an overall 1.5% net smelter royalty of companies that reach phase 3.
Territories in Australia have provided similar programs that include grant funding (among other elements including geoscience, described above). These include:

- Western Australia - Exploration Incentive Scheme (EIS)
- Victoria (Australia) - TARGET Minerals Exploration Initiative (MEI)
- Northern Territory (Australia) - Resourcing the Territory Initiative (RTI)

The EIS in Western Australia provides funding through five different program elements. These elements include the Co-Funded Innovative Drilling Program, which provides grants of up to 50% of drilling costs, subject to a limit, the development of high-quality geophysical data that is available publicly, modelling of cover to facilitate underground exploration, the application of 3D technology to assist in identifying mineral prospects, and providing funding for strategically valuable research. Current program funding is $10 million AUD, of which the co-funded Innovative Drilling Program accounts for approximately 50%. A study commissioned by the Western Australia government, done in 2015, found that $1 million AUD in program spending increased overall exploration spending by $19.1 million AUD.[80]
The TARGET MEI in Victoria offers grants covering up to 50% of project costs and has a total funding budget of $15 million AUD. Since the program was launched in 2016, three have been two rounds of funding during which 20 projects have been funded, amounting to a total of $5.7 million AUD being distributed.[81]

The RTI Program in Northern Territory has many elements, one of which is providing grants for greenfield exploration. The program provides co-funding of up to 50% of drilling costs, up to a cap of $125,000 AUD for diamond drilling and $100,000 AUD for reverse-circulation drilling and geophysical acquisition. Additional funding of up to $10,000 AUD is available for completing work and using local suppliers. The program has funded more than 15 projects to date, and In 2017, five drilling projects and three exploration projects were funded, with a total value of $750,000 AUD. Five of these funded projects were found to have a total value of $3.85 million AUD suggesting there is also substantial private investment (approximately four dollars for every one dollar of program spending.[82]

Applicability to the territories

Grant programs help to directly reduce the costs that companies have to incur to operate. Having these sorts of programs, and increasing the amount available in the North is one tool that can be used to help offset the unequally high operating costs that are faced in the Territories. Given that the grants are typically relatively small compared to total exploration costs, they are not considered one of the most important enablers of exploration activity. For that reason, we do not recommend enhancing it as a high priority activity.

[78] Government of Nova Scotia, Mineral Resources Development Fund
[79] Government of New Brunswick, Junior Mining Assistance Program
[80] Exploration Incentive Scheme Economic Impact Study, 2015
[81] The Evaluation of the Plan for Accelerating PACE, 2014
[82] AU$3.5 million for Yalco Project by Marindi Metals and Teck Australia; AU$330,000 for Berjaya exploration, Mariner Exploration and Coppermine Creek exploration led by Pacifico Minerals. Another AU$15,400 was for Jervois Project conducted by Bowgan Minerals. https://geoscience.nt.gov.au/gemis/ntgsjspui/handle/1/3https://geoscience.nt.gov.au/gemis/ntgsjspui/handle/1/3

4. Considerations in policy design

Enabling participation of Indigenous Governments/Development Corporations

Involvement of Indigenous groups in mining activity represents a significant opportunity for both Indigenous groups and industry. Mining is the most viable economic activity in many remote parts of Canada, and can create benefits for communities in terms of jobs, income, and procurement opportunities, among others. In Northern Canada, the majority of land is covered by Land Claims and Self-Government agreements, meaning that engagement and consultation with Indigenous groups is essential for projects to advance. In recent years, investors have recognized the importance of Indigenous involvement and support to projects' success. Indigenous workers can also help to alleviate the skill shortage faced by many mining operations in remote areas.

A 2012 report by the National Aboriginal Economic Development Board noted that "Increasing the participation of Indigenous people as equity partners, entrepreneurs, and workers, is the most effective way to see these economic opportunities move ahead and close the socio-economic gaps between Indigenous and non-Indigenous Canadians."[83] Overall, the representatives from industry and government that we spoke with in relation to this study agreed with this statement. Although many Indigenous groups are interested in participating in mining under the right circumstances, some Indigenous groups we spoke with highlighted the fact that mining should not necessarily be seen as the only path to economic prosperity.

This section describes how investments can be directed to support involvement of Indigenous groups including governments and development corporations. In considering these policy options, it is important to note that the legal framework surrounding Indigenous groups is different across the three territories, and also that each Indigenous group has different values, cultures, needs, and priorities.

Equity participation

Several stakeholders we spoke with identified equity participation of Indigenous groups, in infrastructure development, and in resource projects, as one way to incentivize productive cooperation between industry and Indigenous groups, and create lasting benefits for Indigenous communities. Through equity participation, Indigenous groups would have input into projects as owners, for example, through board membership, and would have the ability to share in the profits of resource development. Compared to revenue or profit sharing arrangements, equity partnerships have the benefit of not reducing the project's profitability.

There are several examples of Indigenous-owned infrastructure initiatives in Canada including:

- the Snare Cascades Dam in the Northwest Territories, owned by the Tłı̨chǫ First Nation
- the Tłı̨chǫ Highway Project in the Northwest Territories, a partnership between the Government of the Northwest Territories and the Tłı̨chǫ Government
- the Lower Mattagami River Project in Ontario, partially owned by the Moose Cree nation
- the Wataynikaneyap Power transmission line in Ontario, owned by 17 First Nations
- the Kingsvale Electricity Transmission line in British Columbia, in partnership between the Lower Nicola Indian Band Development Corp and Valard construction

It is important to note that not all Indigenous groups are interested in infrastructure construction or ownership. However, to the extent that Indigenous groups are interested in equity participation, the major barriers are access to capital and ability to conduct due diligence, ensure that the project is commercially viable, and negotiate an agreement. A study by the First Nation Major Projects Coalition (FNMPC) reviewed programs in Canada that have been successful in this regard:[84]

[83] The National Aboriginal Economic Development Board, 2012
[84] First Nations Major Projects Coalition, 2021

- The Alberta Indigenous Opportunities Coalition (AIOC), established in 2019, provides loan guarantees of between $20-$250 million to support Indigenous equity partnerships. The AIOC also conducts commercial due diligence on the projects. The AIOC recently arranged for financing of a cogeneration electrical plant.
- The Ontario Financing Authority Aboriginal Loan Guarantee Program, announced in 2009, provides loan guarantees for transmission and renewable energy projects. To date, ten projects have been funded under the program and none have had to rely on the loan guarantee.
- The First Nations Finance Authority, established in 2005, is a fund of $1.3 billion that can be lent to First Nations groups that meet certain credit requirements.
- The Canadian Infrastructure Bank (CIB), which has recently adopted a mandate to provide $1 billion in funding to Indigenous-led projects.

The federal 2021 budget also committed $4.3 billion over four years for Indigenous-led infrastructure projects, which could encourage spending in the North.[85]

Equity ownership by Indigenous groups in mining projects can also incentivize cooperation between Indigenous groups and industry. Because of the large size of most resource projects, this type of equity ownership is usually acquired as part of Impact and Benefit Agreements (IBAs), but can also be acquired on commercial terms, particularly for smaller projects. For example, equity ownership was one provision of the recent IBA between Sabina Gold and Silver and the KIA related to the Back River gold mine in Nunavut.[86] Through interviews it was identified that some Indigenous groups would be interested in majority equity ownership of projects, which would allow greater control over mining practices, and create revenue streams that can be used for larger economic and social development initiatives. Compared to ownership of infrastructure, project equity can be seen as more risky because it depends on global commodity prices and other factors. In contrast, infrastructure revenue streams are often more predictable.

Indigenous ownership of either infrastructure that enables resource development or resource projects can create venues for Indigenous groups and industry to find compromises in support development of sustainable mining projects. For example, the Red Dog mine in Alaska is located on land owned by the Inupiat through the NANA Regional Corporation, which has negotiated with the mine operator, Teck, for adjustments of shipping and trucking schedules to protect sea mammal hunts and caribou migration, respectively.[87]

To ensure that equity ownership and other revenue from IBAs creates long-term benefits for communities, it is important that governance structures are in place to manage funds. Governments can support these structures by enabling access to financial instruments such as trusts that allow funds to be managed collectively in line with the community's goals.[88]

Capacity for consultation

Involvement of Indigenous groups with a mining project often begins with consultation. The capacity of Indigenous groups to understand what is being proposed and the opportunities for them is essential in order to make informed decisions about how to proceed.

A challenge identified by mining and exploration companies we spoke to was limited capacity to engage with industry when approached to consult. This was noted across territories, particularly by junior mining companies that have fewer resources to devote to consultation. One aspect of this is a lack of understanding of exploration and mining processes, what would be involved, the environmental protections that are in place, and how communities can benefit. Negative experiences with mining in the past (for example where companies have left environmental damage) have sometimes led to a lack of trust among Indigenous people. One lack of alignment cited by industry is that Indigenous groups would sometimes look for IBAs at the exploration stage, when companies do not have revenue and have limited abilities to provide benefits. Some industry participants felt that governments could do more to help educate communities about the mining process communities can expect through different phases of engagement.

[85] Government of Canada, 2021
[86] Sabina Gold and Silver, 2021
[87] Nana Regional Corporation, 2021
[88] National Indigenous Economic Development Board, 2015

Indigenous groups we spoke to emphasized the importance of exploration companies conducting early engagement and consultation with relevant Indigenous groups so that they understand the impacts of the project and the opportunities it may create and are able to make an informed decision. Even without any formal agreements in place, early engagement can build the basis of a positive relationship. Increasingly among industry there is an understanding that this engagement is critical for the ability of projects to move forward. As one example, the Yukon First Nation of Na-Cho Nyäk Dun recently brought legal action against the Yukon government for approving exploration activity without sufficient consultation.[89]

It was also noted that mining companies, and particularly early-stage exploration companies, sometimes do not engage with nearby Indigenous groups at an early stage in the project. These companies are often operating on tight budgets and have limited capacity for community engagement. They may also lack understanding of the Indigenous groups' priorities and interests.

Stakeholders felt that more education of communities about mining processes and the economic opportunities they create would support effective communication with industry. There is also room to educate industry, particularly smaller companies, about the concerns of local Indigenous groups.

In December 2020, the federal government introduced legislation to implement the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), which includes commitment to free, prior and informed consent by Indigenous people to any resource projects. Several members of industry we spoke to were concerned that the lack of a clear definition of "consent" in this context would lead to uncertainty for projects.[90]

Capacity for employment and economic opportunities

One of the significant ways that Indigenous communities can benefit from mining activity is through opportunities for local employment and procurement. Mining companies we spoke with were keen to maximize the opportunities created for Indigenous people through these channels.

There has been significant progress in employment: mining is the largest employer of Indigenous people in Canada. However, this employment is often in lower-skilled and lower-paying roles. There have been a large number of initiatives to improve training availability, and yet the problem persists. A 2015 report from the Macdonald Laurier Institute highlighted the fact that coordinated efforts covering entire regions have often been more successful, and recommended that training efforts be more long-term than project-based.[91] Indigenous groups we spoke with also cited instances where Indigenous employment promised as part of agreements with mining companies did not materialize, creating distrust. These groups also raised concerns that lower-skilled jobs would be automated, decreasing employment opportunities for Indigneous people. The trend towards automation in mining increases the importance of providing education and training for higher-skilled occupations in mining employment and procurement for Indigenous people.

Poor outcomes in elementary and secondary education contribute to challenges in training and employment at higher levels. Attainment of high school diplomas and achievement on skills testing in the territories is significantly lower than elsewhere in Canada, and is significantly lower than average for Indigenous people and in more remote areas.[92] This root issue will need to be addressed in addition to mining-specific training and education. Some industry members also felt that mining should be taught more in schools, such as through the Mining Matters initiative.

In terms of procurement, mining and exploration companies often prioritize local Indigenous suppliers. Often Indigenous suppliers need to build capacity in order to supply goods and services that are required in mining and exploration, which can be challenging given the specialized and industrial nature of much procurement spending. A lack of credit availability and lack of industry-specific entrepreneurial skills are among the challenges they face. Joint Ventures where Indigenous ownership has an opportunity to grow have been successful in many cases. For example, Indigenous suppliers to diamond mines in the Northwest Territories, including the Det'on Cho and Tłı̨chǫ development corporations, are often cited as a success story in building Indigenous procurement capacity. When done well, these ventures can create opportunities to grow capacity and training in communities.

[89] CBC, 2021
[90] Government of Canada, 2021
[91] Macdonald Laurier Institute, 2015
[92] Conference Board of Canada, 2014

When governments are leading infrastructure construction and other relevant work, it can be an opportunity to grow capacity through local procurement. Knowledge sharing of successful Indigenous business ventures is seen as a helpful solution.

These are challenges that have long been discussed, and many programs currently exist to support training and capacity development. Indigenous groups and industry commented that almost all of those interested in mining jobs in the territories already had those jobs. Therefore, further improvements need to address root causes of capacity. Below we present some observations on how these programs can be most effective:

- Training that operates consistently and predictably, rather than on a piecemeal basis, provides more benefits
- More government involvement in training initiatives can support the above, rather than relying on industry
- Training programs often have better outcomes when participants are not required to leave the territory
- Training should happen with a long-term view to the opportunities that will be created, and should be started as early as possible ahead of employment opportunities
- Training that provides versatile skills that can be used in several sectors can be more valuable
- For Indigenous students, having Indigenous teachers and role models can enhance outcomes
- Some programs that take a “high touch” approach to mentorship and essential skills have been effective in addressing personal barriers to education and work
- Strength of the education system at lower grades will lay the foundation for long-term success by preparing individuals for future training
- Given the lack of availability of education and training for many mining roles, improved online learning may be part of the solution, provided that it is done well and leads to recognized credentials; increased access to high-speed internet would be an important enabler of this solution
- Procurement contracts can be used as an opportunity to create training roles
- Training should be tailored to the types of roles that will be common in the future, for example reflecting a shift away from diesel equipment

Governments recognize that to build an inclusive Northern economy, it is essential to increase the capacity of Indigenous communities to benefit from the employment and procurement opportunities offered by mining and other industries. However, because education is a territorial responsibility, this has not been a part of federal initiatives. We observe that greater coordination between governments through initiatives such as the CMMP is required to address this issue.

Encouraging participation of Canadian firms

Currently, the companies conducting exploration and mining in the North are Canadian corporations owned by a mix of domestic and foreign mining head office companies. Since these Canadian corporations are subject to Canadian federal and territorial tax, most policies designed to encourage mineral investment do not limit eligibility based on the corporation’s ultimate ownership. In recent years, awareness of the strategic importance of the North, and of critical minerals, has led to more concern over foreign ownership by certain countries, particularly China. As a recent example, the federal government blocked acquisition of the Hope Bay mine by a Chinese state-owned enterprise on the grounds of national security. Many foreign companies operating in the North are based in the US or Australia, which are not typically seen as a national security threat.

Canadian suppliers are able to benefit from exploration investment from companies with either Canadian or foreign head offices. Mining and exploration companies often pursue local procurement where possible, particularly if they are able to procure from Indigenous-run firms. The research conducted as part of this study did not identify major ways in which Canadian firms differ from foreign firms in their behaviour.

Given most companies operate their exploration activities through Canadian resident corporations, there is no significant difference in the tax revenue to Canadian governments between Canadian subsidiaries that are owned by foreign firms or Canadian firms. In addition, other Canadian tax rules protect the Canadian tax base from improper erosion by foreign ownership, such as the need for arm's length transfer pricing on services and interest charges from related entities or limitations on thin capitalisation from foreign related party lending.

Overall, there does not seem to be a strong case for limiting program eligibility to Canadian firms, given the importance of foreign firms in the investment landscape.

Policy considerations for critical minerals

Background

Critical minerals are minerals that are deemed essential to the economic sustainability or national security of a nation, and whose supply chain is vulnerable to disruption. Vulnerability in critical minerals often arises from heavy reliance on imports, especially if the supply is heavily concentrated geographically and substitutes are limited. Critical minerals are often discussed in the context of their entire supply chain, and proximity to processing and manufacturing is an important consideration in decisions around where to develop mines. For example, mining of lithium is heavily linked to processing of lithium, manufacturing of batteries, and manufacturing of electric vehicles, and there are significant advantages to these activities being geographically clustered.

Many critical minerals are significant in the fight against climate change: a report from the World Bank shows that demand for minerals required in green technology, such as solar, wind, geothermal, and energy storage, will increase by 500% by 2050.[93] These minerals include graphite, nickel, lithium, cobalt, and copper. The supply chain for electric vehicles has been a particular focus in Canada and the US. Politicians and industry members from the two countries recently met to discuss how to enhance cooperation in this field.[94]

Amid global trade tensions in recent years, critical minerals have become a high priority for many countries. The United States, the EU and Japan, and Canada have published lists of minerals and metals that they consider critical, along with policy actions to increase the security of critical minerals supply chains. The focus on critical minerals is a significant opportunity for Canada: for example, of 35 minerals identified as critical by the US, Canada is an important supplier of 13.[95] Ten of these minerals have known locations in the territories.[96]

International collaboration has been important for countries and regions looking to diversify their critical minerals supply chains. Canadian and EU stakeholders meet annually through the CETA Raw Materials Dialogue, and have agreed to share information, share research and innovation on common areas of interest, and align on ESG standards and criteria.[97] Canada also engages with Japanese stakeholders on critical minerals. The most important partner in critical minerals development will be the US because of its close economic relationship with Canada and the high priority it is placing on critical minerals development. In 2019, Canada and the US committed to a Joint Action Plan on Critical Minerals Collaboration, which will promote joint initiatives such as information sharing, R&D cooperation, supply chain modelling, and increased support for industry. Canada's intention is to increase investment in Canadian exploration of mining and critical minerals, and to support downstream industries.

Policy actions to support critical minerals

It is in the interest of governments to take actions to encourage development of critical minerals domestically, and by economic allies. At the core of the discourse around critical minerals is the fact that market prices for minerals do not fully reflect the value that governments place on the source country of the minerals. Therefore, some deposits of critical minerals that may not have been economic to develop may become so if this value can be properly reflected. Policy to encourage critical minerals development needs to focus on lowering the costs of exploration and development of critical minerals, or increasing the price received by producers to fully reflect its strategic value, or both.

[93] World Bank, 2020
[94] Financial Post, 2021
[95] Government of Canada, 2020
[96] USGS, 2020
[97] European Commission, 2020

Current policy around encouraging critical minerals has focused on international collaboration, expansion of geoscience resources, and addressing regulatory barriers. The US has been unique in specifically discussing financial incentives for development of critical minerals.

Increasing global cooperation on geoscience knowledge
Lack of knowledge of the location and properties of critical minerals has been a barrier to development. This is particularly true for the territories, where geoscience mapping has been lower quality compared to other mining regions. Starting in 2020, Geoscience Australia, Geological Survey of Canada and USGS are coordinating efforts of critical mineral mapping and research efforts through the Critical Minerals Mapping Initiative (CMMI).[98] This initiative will help the three countries gain a better understanding of known resources, increase knowledge of critical mineral by-products, and identify new sources of critical minerals. Among other initiatives they will create a global digital database to increase knowledge of the distribution of critical minerals in ore deposits, and thereby enhance the quality of mapping available.

Addressing regulatory barriers
The US federal strategy on critical minerals, released in 2019, and Ontario's recent discussion paper on critical minerals strategy both focus on the need to shorten permitting timelines and decrease regulatory uncertainty. We know from discussions with industry members that these actions can make it easier for projects to attract and secure funding, and to be developed in a timely manner. Timing of projects is particularly important in the context of critical minerals: for example, the US has set a goal to be independent of "unsecure sources" of critical minerals and metals by 2030.[99]

US-based programs
In addition to addressing regulatory barriers and promoting geoscience, the US has proposed financial incentives to support development of critical minerals domestically, specifically in the form of grants and loan guarantees. For example, a US executive order from September 2020 instructs federal departments to explore the possibilities of using the Defense Production Act to expand domestic mining operations, for example by providing grants, and of providing loan guarantees. Although these policy directives were provided under the previous US administration, recent public statements suggest that policy direction on critical minerals has not changed.

The Canadian government should explore the possibilities of using these US-based programs to support critical minerals development in Canada. The US federal critical minerals strategy, published in 2019, highlights the importance of increasing investment and trade in critical minerals with America's allies. Given the scarcity of some critical minerals in the US, the US will likely need to turn to Canada in diversifying its critical minerals supply chains. In this context, it could be possible that US-led programs to promote critical minerals development could be extended to companies operating in Canada. For example, Canadian companies are already eligible to apply for US grands under the Defense Production Act and other programs.[100]

Consideration should be given to extending the cooperation between Canada and the US in areas such as:

- Price guarantees to critical minerals
- The joint developments of breakthrough technologies that would overcome infrastructure barriers and reduce environmental impacts
- Joint investments in infrastructure

Promoting critical minerals in the territories

The increased interest in critical minerals from Canadian sources represents a significant opportunity for Canada's North. The territories have endowments of many critical minerals, including advanced projects in cobalt, copper, platinum group elements (PGE), nickel, tungsten, tin, rare earth elements (REEs), and zinc, which are considered critical by the Canadian government.

[98] USGS, 2020
[99] Steptoe & Johnson LLP, 2020
[100] Financial Post, 2021

Actions discussed in Section 3 to promote investment in mineral exploration and development also apply to critical minerals. The importance of geoscience and regulatory simplification are reflected in critical minerals policy from the US and Ontario. The 2020 update to the Canadian Minerals and Metals Plan (CMMP) discusses the importance of advancing geoscience techniques, including in critical minerals, as a way to plan infrastructure investments.[101] However, critical minerals face some unique challenges in financing and development that may require different approaches.

One challenge for critical minerals production that is not addressed in existing policies is price insecurity. Supply of critical minerals can be volatile and difficult to predict because of their production as by-products and in recycling markets. Therefore, prices can fluctuate making it difficult for producers to raise financing. This was one aspect of Nemaska Lithium's difficulties after an increase in lithium supply from Australia led to a decrease in prices.[102] The governments of Canada and its allies providing a price guarantee could provide stability that would help critical minerals miners raise capital.

A second challenge not currently being addressed is the additional capital cost requirements that some miners of critical minerals face in developing projects. As noted above, the concept of critical minerals also encompasses their supply chains including further processing. The need to develop processing facilities can increase the capital cost requirements, making projects difficult to finance. In this case, investment by governments in those projects can help to achieve governments' goals of developing domestic supply chains for critical minerals.

[101] Government of Canada, 2020
[102] BNN Bloomberg, 2020

5. Summary

This study has assessed at a high level the policy actions that should be prioritized in order to encourage mineral exploration and development investment and support the Northern economy.

Exploration expenditures in Canada's North have been decreasing in recent years, and the region has developed a negative reputation among many in the mining industry. Key issues include lack of infrastructure in many regions, challenges engaging with local communities, regulatory barriers, lack of access to land, and perceived lack of support and direction from governments.

In order to address these challenges, a major shift in policy direction is required. The policy actions that should be given high priority are:

- Investment in infrastructure, particularly transportation and energy infrastructure that can serve multiple mines and communities
- Creating a Northern Mineral Exploration Tax Credit to match other jurisdictions in Canada and offset the high costs of exploration in the North
- Regulatory simplification at the territorial level that would increase certainty and reduce timelines

It is important to note that these actions should be pursued together in order to address the range of complex challenges affecting mineral exploration in the North.

Support for geoscience initiatives and technologies that can overcome infrastructure challenges should also be pursued. The Canadian government should also consider how it can support critical minerals development specifically, through cooperation with the US and other international governments.

In order to ensure that Indigenous groups are able to participate in and benefit from mining exploration and development, we recommend that territorial governments pursue policies that enable equity ownership of infrastructure that enables resource development, and in resource projects. Policies that enable education and training, entrepreneurship, and capacity for consultation are also needed.

The next steps towards implementing these policies is to engage the federal government, given its importance as a funding partner, local communities including Indigenous groups, and industry in order to gain agreement on the priorities.

Appendices

Appendix A: References

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Appendix B: List of interviews

The following individuals were interviewed as part of this study (listed alphabetically by organization name). A total of 31 individuals representing 18 organizations were interviewed.

Organization	Individual
Aurora Geosciences	Gary Vivian
Baffinland Iron Mines	Brian Penny, President and CEO
Cheetah Resources	David Connelly, Vice President of Corporate Affairs and Strategy
Crown-Indigenous Relations and Northern Affairs Canada	James Lariviere, Manager, Mineral Resource Development
Det'on Cho Corporation	Paul Gruner, President and CEO
First Nations Major Project Coalition	Mark Podlasly, Director, Economic Policy
Fortune Minerals	Robin Goad, President & C.E.O. and Rick Schryer, ice President of Regulatory & Environmental Affairs
Minto Mine	Jack Cartmel, CFO and Heidi Conrad, Finance and Planning Manager
Mountain Province Diamonds	Tom McCandless, Vice President Exploration
Newmont Gold	Jennie Gjertsen, Manager, Sustainability and External Relations
North Arrow Minerals	Ken Armstrong, President and CEO
Natural Resources Canada	[confirming list of attendees]
Northwest Territories/ Nunavut Chamber of Mines	Tom Hoefer, Executive Director
Osisko Metals	Jeff Hussey, President and cOO
Qikiqtani Inuit Association	Stephen Bathory, Special Advisor
Selkirk Development Corporation	Zach Fulton, CEO
Yukon Chamber of Mines	Samson Harland, Executive Director
Yukon FN Chamber of Commerce	Albert Drapeau, Executive Director
Unaffiliated (former Member of Parliament)	Leona Aglukkaq
Unaffiliated (formerly De Beers Canada Corp and Fortune Minerals)	Glen Koropchuk

Appendix C: Limitations

Receipt of new information: PwC reserves the right at its discretion to withdraw or revise this report should we receive additional data or be made aware of facts existing at the date of the report that were not known to us when we prepared this report. The findings are as of August 2021 and PwC is under no obligation to advise any person of any change or matter brought to its attention after such a date that would affect our findings.

Technology assessment : We are not technical experts and are not in a position to assess the technical aspects of technology discussed in this study. Thus, any statement in this report regarding the technical aspects of these technologies reflects our understanding based on secondary research.

Use limitations: This report has been prepared solely for the use and benefit of, and pursuant to a client relationship exclusively with the Government of the Northwest Territories (GNWT). We understand that GNWT may share our report with third parties. GNWT can release this report to third parties only in its entirety and any commentary or interpretation in relation to this report that GNWT intends to release to the public either requires PwC's written consent or has to be clearly identified as the GNWT's own interpretation of the report or GNWT is required to include a link to the full report. PwC accepts no duty of care, obligation or liability, if any, suffered by GNWT or any third party as a result of an interpretation made by the GNWT of this report.

Further, no other person or entity shall place any reliance upon the accuracy or completeness of the statements made herein. In no event shall PwC have any liability for damages, costs or losses suffered by reason of any reliance upon the contents of this report by any person other than the GNWT.

This report and related analysis must be considered as a whole: Selecting only portions of the analysis or the factors considered by us, without considering all factors and analysis together, could create a misleading view of our findings. The preparation of our analysis is a complex process and is not necessarily appropriate for partial analysis or summary description. Any attempt to do so could lead to undue emphasis on any particular factor or analysis.
We note that significant deviations from the above listed major assumptions may result in a significant change to our analysis.