



Climate Adaptation in the Canadian Mining Sector

Mining Association of Canada

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EXECUTIVE SUMMARY

This report analyses the results of a survey of 26 Canadian mining companies with operations across Canada. The questions are organized around key themes in order to determine whether mining companies are allocating resources to climate change, whether climate change is assessed as a risk, and what actions companies are taking.

Approximately one-third of companies polled consider climate change a medium- to low-level risk for their business operations. About the same amount of companies have taken concrete steps to mitigate the associated risks. Companies that have experienced more extreme weather events over the last 5 years were more likely to assess climate change as a business risk and take actions to mitigate those risks. Most actions taken so far have been related to engineering and infrastructure upgrades. Less attention has been paid to broader risks associated with, for example, health and safety or supply/value chain.

It is worth noting that many questions suffered from a low response rate. Nonresponse could signify a lack of information on climate change risks for the mining sector and associated best practices for risk mitigation.

Most respondents agree that more information and tools for identifying and acting on climate change adaptation risks would be useful, and that governments should play a larger role in developing climate/weather forecasts, frameworks and best practices, and policies (incentives and regulations) to help companies deal with climate change risks.



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1 Introduction

A changing climate presents a wide range of risks and opportunities for the Canadian mining sector. Extreme temperatures, increased or decreased precipitation, stronger storms, and rising sea levels could all have significant impacts on mining operations. The risks can be organized into three categories: core operations, value chain, and broad network. Risks to core operations would affect physical assets, production processes, health and safety. Value chain risks would affect supplies of natural resources, workforce and changing lifestyles, and customer demand. Finally, broad network risks include disruptions to supply chains and interruptions in electricity/water supply, among others.¹

The survey was administered by the Mining Association of Canada, with support from Natural Resources Canada through the Adaptation Platform's Mining Working Group. The Working Group also contributed to the design of the survey. The survey approach was chosen to get a sector perspective on how the various members of the Canadian mining sector are addressing climate change risks. The results will help inform the Mining Association and the Adaptation Platform's Mining Working Group in their efforts to support the management of risks associated with climate change within the natural resource sector.

This report contains an analysis of the results of a survey of 26 mining companies operating in Canada. The questions address to what degree mining companies in Canada are assessing climate change as a risk and what actions, if any, have been taken to adapt. The survey also extracts information about companies and their operations and describes barriers or information gaps that exist which prevent adaptive actions to address risks posed by climate change.

¹ See this International Council on Mining & Metals report for more discussion on implications: <http://www.icmm.com/document/5173>.



2 Survey

2.1 Questions

The questionnaire encompasses a variety of topics associated with climate change within the mining sector. It consists of 30 questions, mostly presented in a multiple choice format. A number of the questions allow respondents to provide additional information.

The topics covered by the questionnaire are designed to address three key questions: what companies are doing to monitor climate change impacts, how they are assessing climate change risks, and how they are managing climate change impacts.

For analysis purposes, the questions have been divided into 4 categories: Monitoring Climate Change Impact, Assessing Climate Change Risks and Opportunities, Managing Climate Change Risks and Opportunities, and Roles and Responsibilities. The complete list of survey questions is included as an appendix.

2.2 Respondents

The questionnaire was completed by 26 respondents from various mining companies across Canada. The companies surveyed have operations in multiple provinces and territories, with the largest number of participants' operations in Ontario (46%), British Columbia (35%), Quebec (32%) and Manitoba (32%). The commodities that the responding mining companies are mining at their operations are diverse; however, gold, copper and iron ore were the most common commodities (27%, 29% and 17% of respondents respectively). From the individuals filling out the questionnaire, 73% described their role in their firm as "environment", and 11% described their role as "upper management" or "corporate affairs". The remaining 16% did not disclose their role within their organization.



3 Results

This section presents the questions and responses around key topic areas. Within each topic area, there is a discussion about the responses as well as a description of the response rate.

3.1 Monitoring Climate Change Impacts

The questions in this section were designed to determine to what extent companies have experienced more severe weather and to assess the impacts of climate change on company operations.

3.1.1 Observed weather changes

The respondents were asked whether they had experienced any severe impacts, such as changes in snowfall, changes in rainfall, extreme temperatures, freezing rain, storm events, forest fires, water scarcity, etc. within the past five years. For each category, the respondents were to choose a number between 0 (representing not experienced) to 5 (representing very severe).

Of the 23 respondents for this question, 22 identified at least minor changes, with results shown in Figure 1. Where changes in weather patterns were observed, the weighted average responses were typically moderate, with too much rainfall, too much snowfall and storm events receiving the highest number of severe and very severe ratings (scores of 4 and 5 respectively). The number of responses were typically higher for weather events that were observed with greater severity. Determining correlations between the area of operation and changes in climate observed was not possible due to the multiple operational locations of the participating firms.



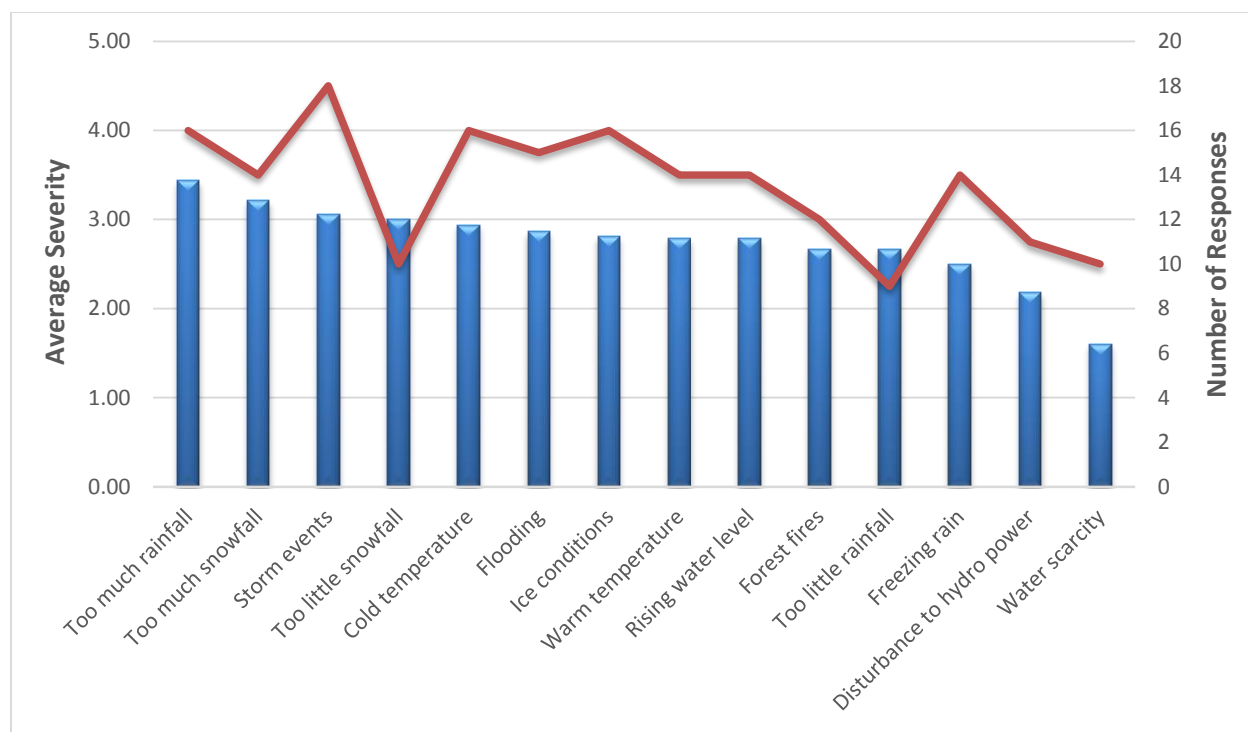


Figure 1: Observed weather events and their severity

3.1.2 Impacts on operations

The observed climate change impacts were most likely to result in interruptions in production, while instances of impeding access to property or of damage to assets were less common. Furthermore, in 5 out of 12 cases where production was halted, the interruption lasted beyond the length of the climate event. The types of damages experienced include: damage to railway lines, forest fires, power outages, flooding, and wind damage to structures.

According to respondents, climate change has not significantly threatened the safety of employees; however, it was not uncommon for emergency responders to be deployed (7 out of 26 respondents).



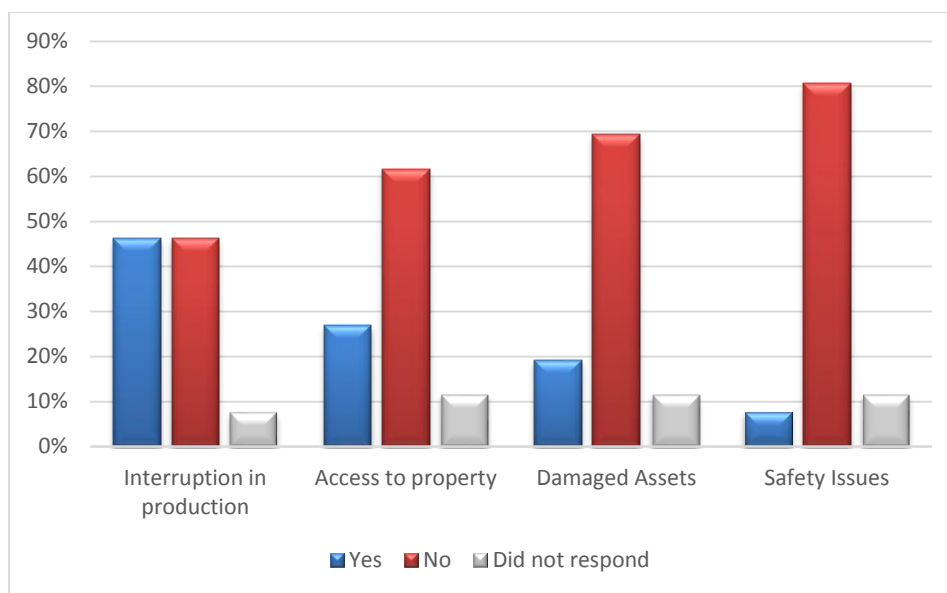


Figure 2: Impacts to affected operations

According to the companies polled, changes in local weather patterns over the past 5 years have been noticeable, but relatively moderate. Likewise, impacts on mining operations have not been severe.

3.2 Assessing Climate Change Risk

Questions in this section address climate change from a risk management point of view. Companies were asked to answer whether or not and to what extent do they assess climate change as a risk to their business.

3.2.1 Prevalence of climate change assessments

Firms were asked two broad questions to understand firstly whether the risks or opportunities of climate change have been assessed, and secondly whether or not climate change is identified as a risk. Figure 3 shows that 50% of respondents have assessed the risks and opportunities presented by climate change. Of those respondents that have performed a risk assessment, over two-thirds have identified climate change as a risk to their operations.



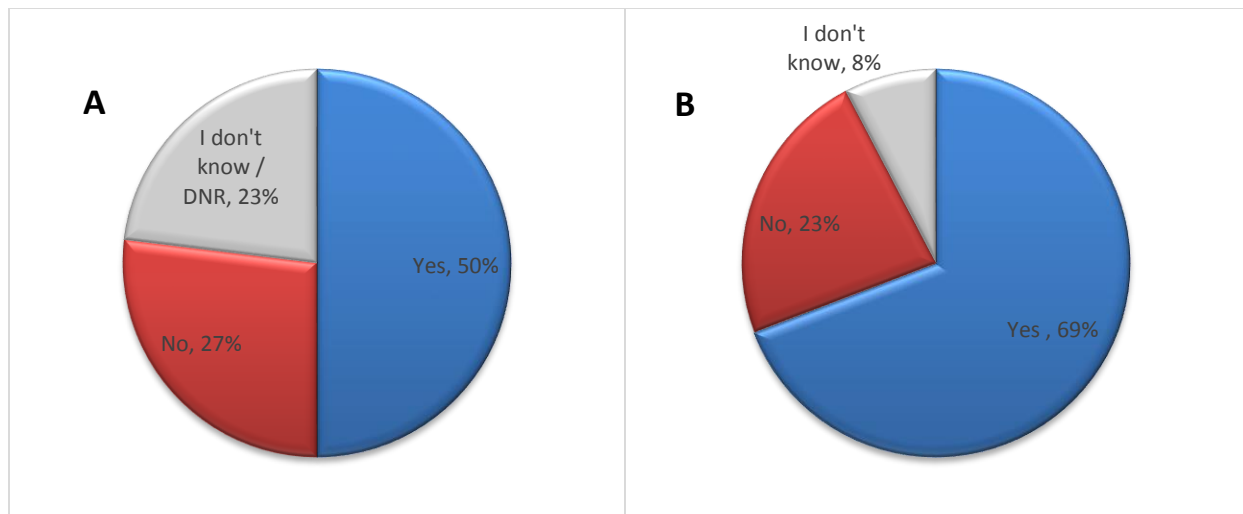


Figure 3: A. Companies that assess risks and opportunities from climate change; and B. Of the companies that do this assessment, whether climate change is identified as a risk

3.2.2 Climate Change Risks Identified

The respondents who assessed the risks and opportunities of climate change identified the areas of risk, shown in Figure 4 below. The main risks were associated with containment facilities for tailings ponds, site drainage, and mine closure/reclamation. Risks associated with buildings and other infrastructure were also common.



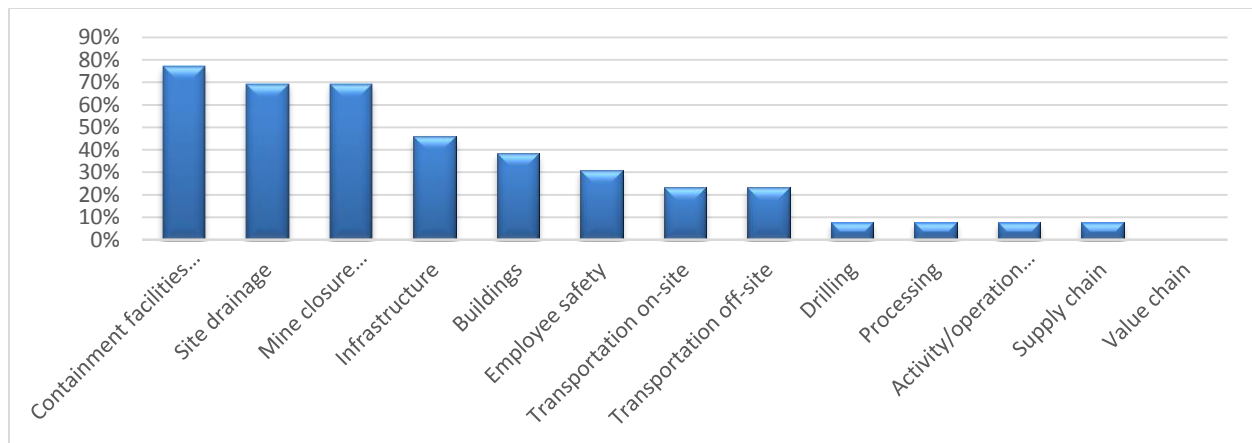


Figure 4: Business areas where climate change was identified as a risk

3.2.3 Scope of Risk Assessments

Companies were asked if they anticipated that climate change would have an impact on mining operations, the supply chain, and the value chain. Almost a third of respondents felt that mining operations will be affected, but impacts on supply and value chains are seen as less likely. Almost half of the respondents were uncertain or did not respond, perhaps reflecting a lack of available information about climate change risks and adaptation measures for mining (see Section 3.3.9).



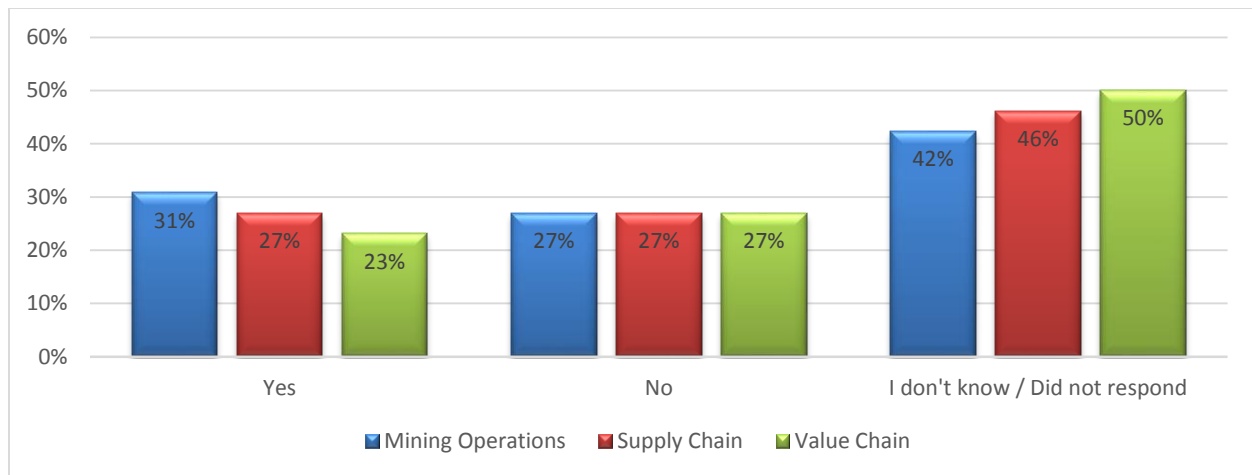


Figure 5: Anticipation of impacts of operations, supply chain, and value chain

3.2.4 Importance of Climate Change Risks

When asked about the importance of climate change risks relative to other concerns, responses were on the low to medium risk end. Four respondents labelled climate change as a medium-level risk, while 3 chose low or very low; nineteen respondents did not answer the question.



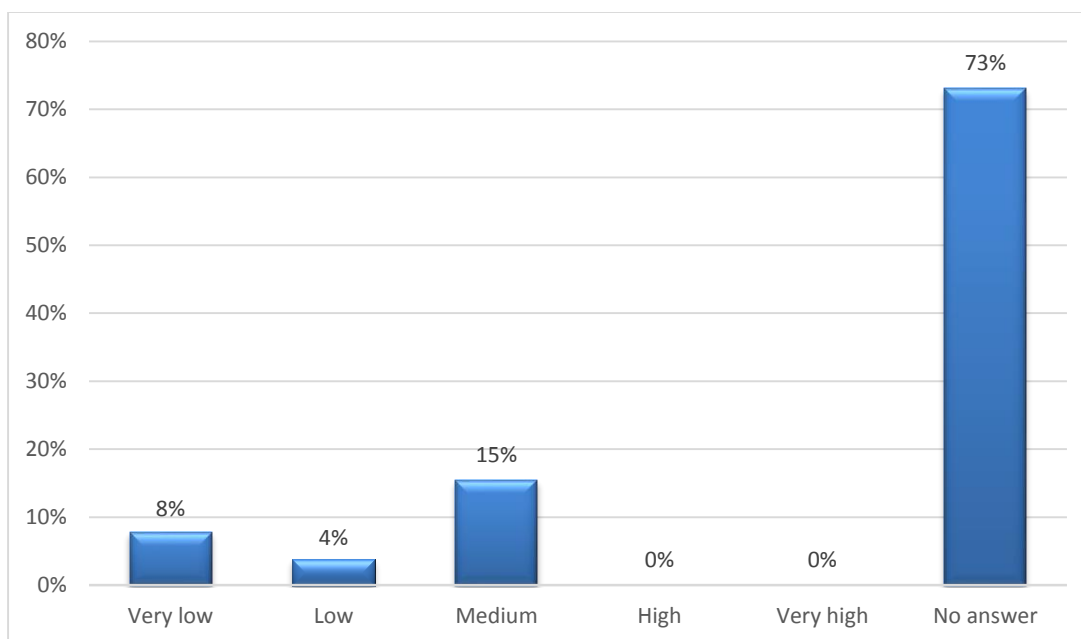


Figure 6: Climate change risk in relation to other concerns

Among the respondents, 42 percent have identified climate change as a risk. However, climate change was not once identified as a high- or very high-level risk.

3.3 Managing Climate Change Risks

This section covers questions addressing the measures companies are taking to address climate change risks. Companies were asked about the motivations for managing climate change risks, the business level associated with climate change decision making, existing or potential barriers, and whether or not companies report climate change-related information publicly. Respondents were also asked to identify specific types of tools and information they would find useful in addressing risks.

3.3.1 Understanding Climate Change

Firms were asked about the level of resources committed to improving understanding or information related to climate change adaptation, specific to their operations. As shown in Figure 7, about one third of the companies surveyed reported that they have committed resources to understanding how they will adapt their operations to deal



with climate change. But most respondents have not considered climate change adaptation plans, did not know if their company has, or did not respond.

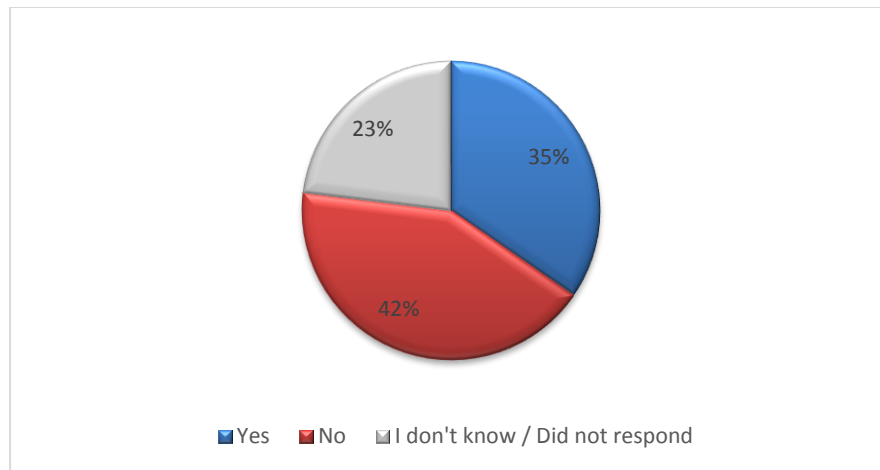


Figure 7: Companies that have dedicated or committed resources towards understanding how to adapt to climate change

3.3.2 Climate Change in Public Reporting

Less than a quarter (6 out of 26) of the survey participants indicated that they include climate change in public reporting forms.

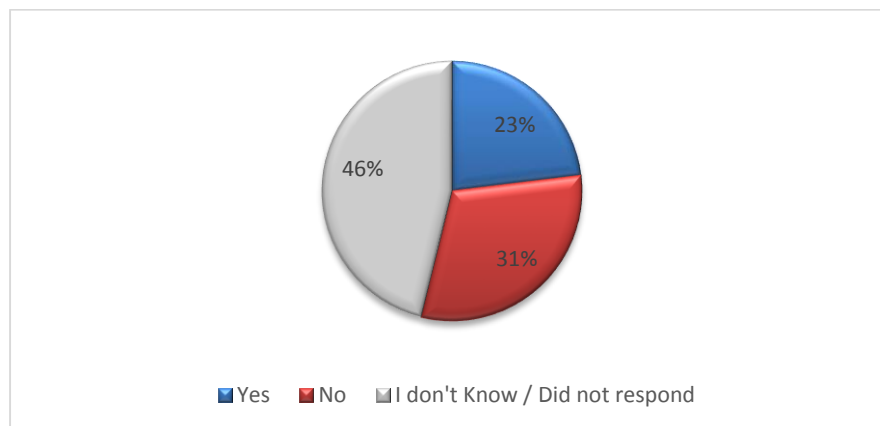


Figure 8: Companies that report publicly on climate change



3.3.3 Managing Climate Change Risks

Over one third of the companies surveyed have processes in place to factor climate change into key business decisions.

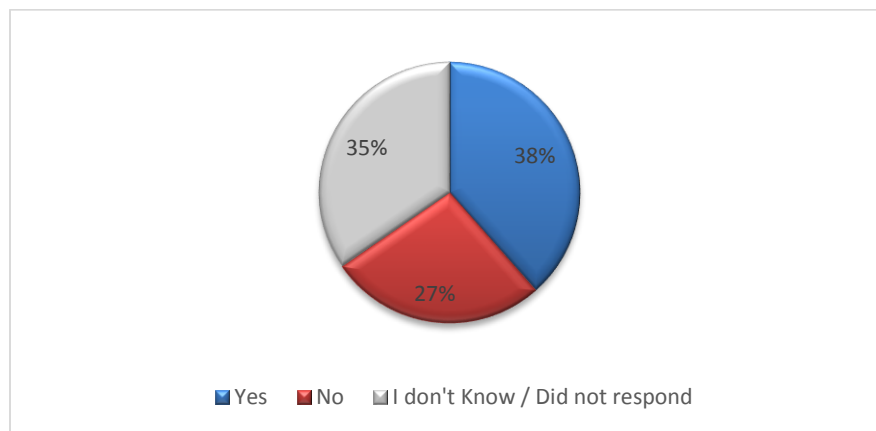


Figure 9: Companies that have processes to include climate change in key business decisions

When considering capital investments, however, 50 percent of respondents said they did factor climate risks into designs. This is not surprising because of the long-life of most infrastructure projects coupled with the long-term impacts of climate change.

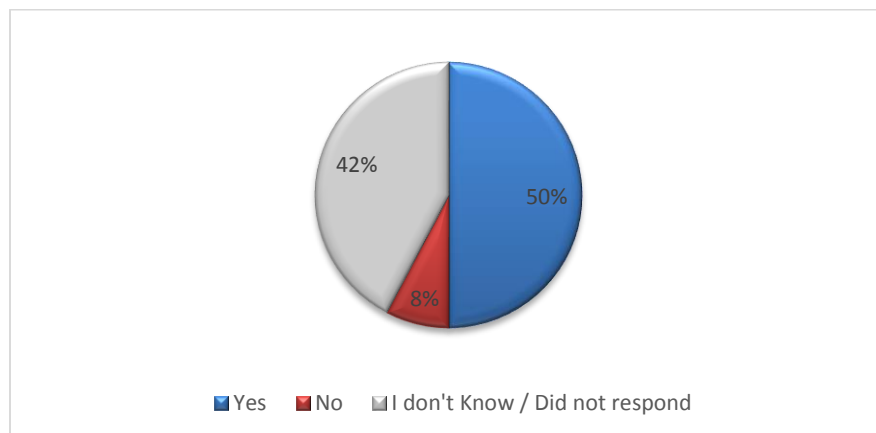


Figure 10: Companies that account for future climate risks in capital projects



3.3.4 Barriers for Assessment or Implementation

Few respondents recorded barriers to assessing risks or implementing adaptation measures, suggesting that most companies that do not factor climate change risks into business decisions do not see it as a serious risk for their operations. Most respondents did not know of any barriers or did not respond.

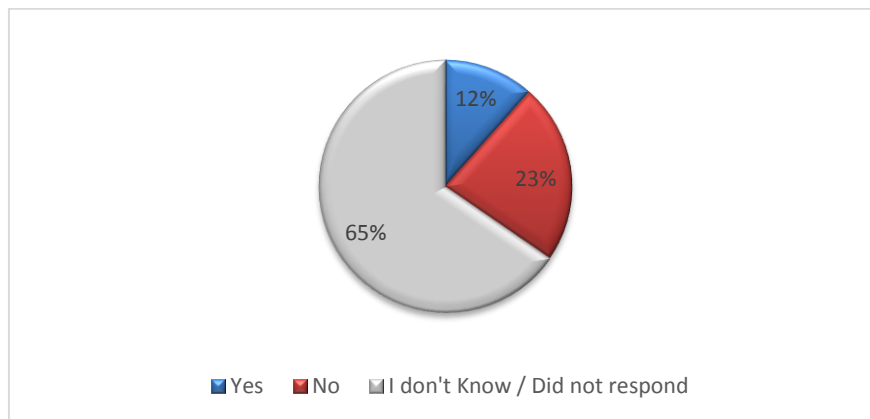


Figure 11: Companies that encounter barriers to assessing risks or implementing measures

Of the three respondents who did encounter barriers, three types of barriers were identified. All three companies had difficulty obtaining accurate scientific data, two had trouble obtaining enough data, and one company could not allocate sufficient staff time to the assessment or implementation of climate change measures.



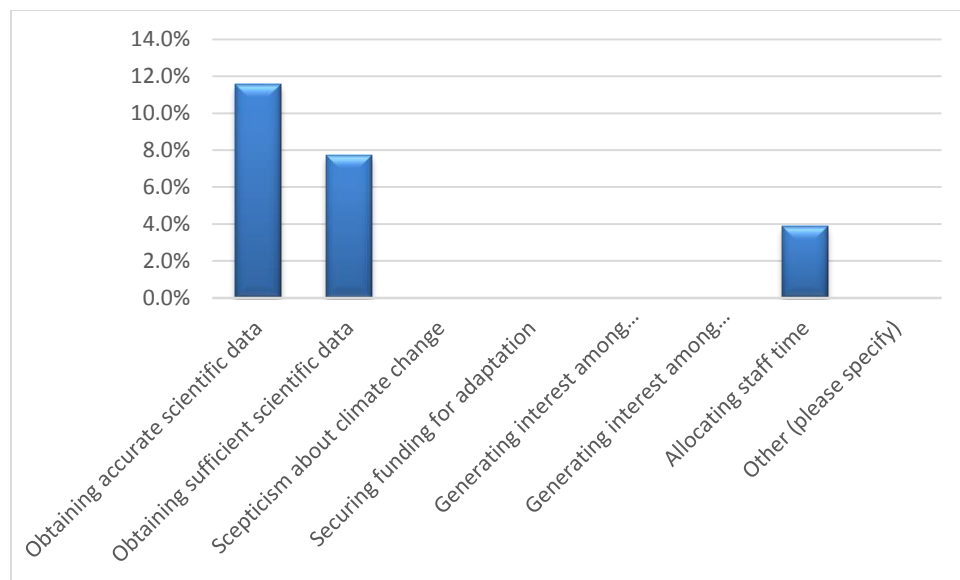


Figure 12: Barriers to assessing risks and implementing measures

3.3.5 Measures Taken to Manage Risks/Opportunities

Just over one third of companies have taken concrete actions to manage risks and/or take advantage of opportunities presented by a changing climate.

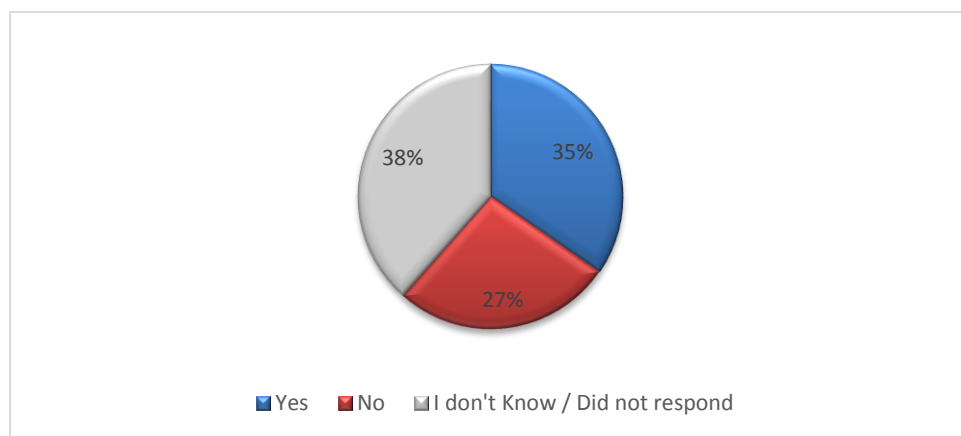


Figure 13: Companies taking actions to manage risks or opportunities related to climate change



The most common nature of the actions considered or taken among the companies surveyed has to do with engineering and design, followed by infrastructure upgrades and changes to business processes. Of those that selected 'other', one respondent identified climate change as a component of their environmental risk assessments for proposed future projects. Another responded that climate change is integrated into plans for 'business continuity'. One company considers climate change as part of its capital planning processes, but added that opportunities exist for further integration of climate change into business routines.

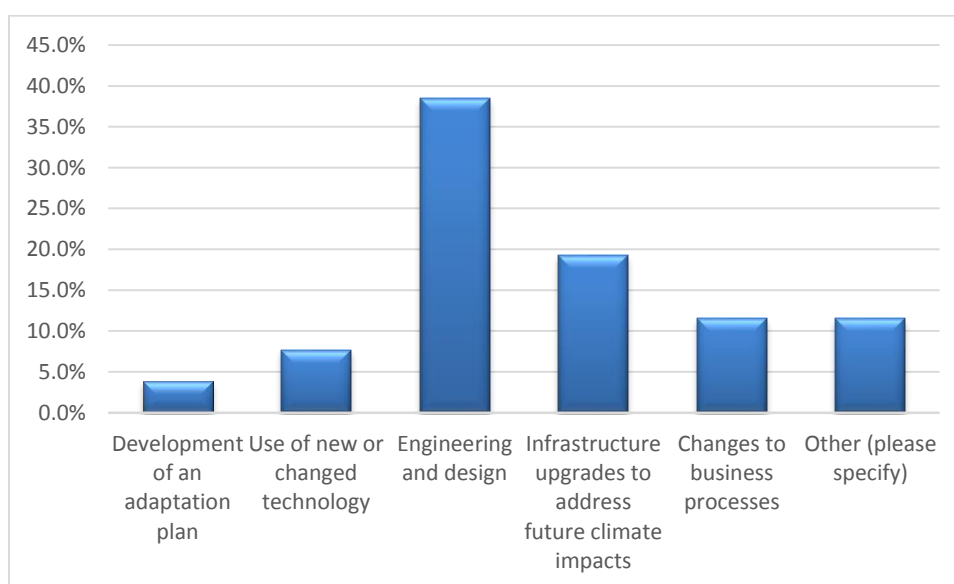


Figure 14: Nature of actions considered or implemented

3.3.6 Motivations for action

The reasons for implementing measures vary across the respondents, but there are a few common themes. Six respondents selected reducing environmental risks as the primary motivator, while five identified reducing risks to infrastructure, and four identified reduction of risks to business processes.



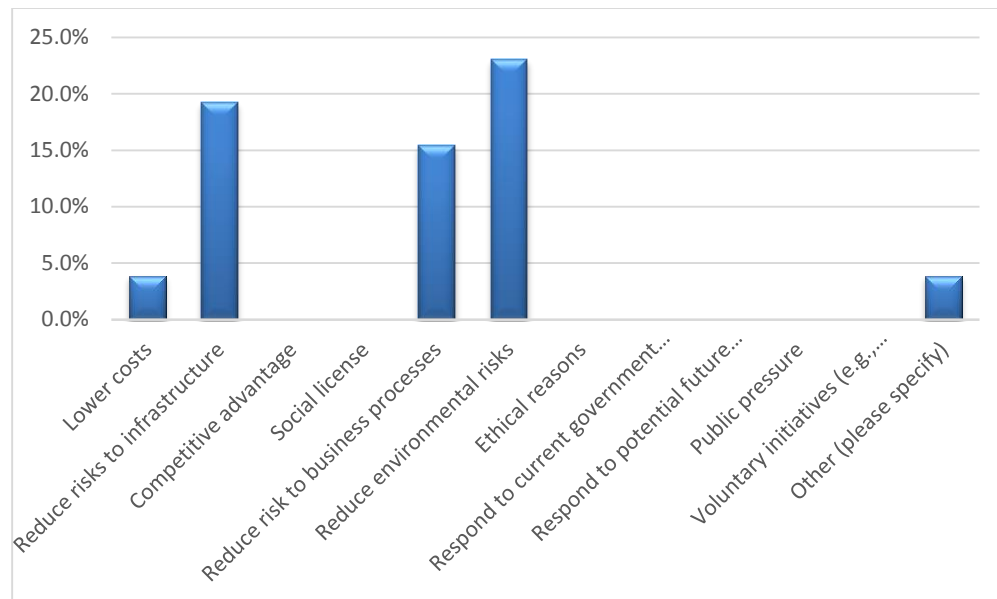


Figure 15: Primary motivation for employing adaptation measures

3.3.7 Business Level Managing Adaptation Measures

Management of climate change adaptation measures tends to occur at both the corporate level and the operational (mine site) level. Note that only one firm indicated that they have no defined business level to manage climate change adaptation; eleven respondents chose not to answer the question.



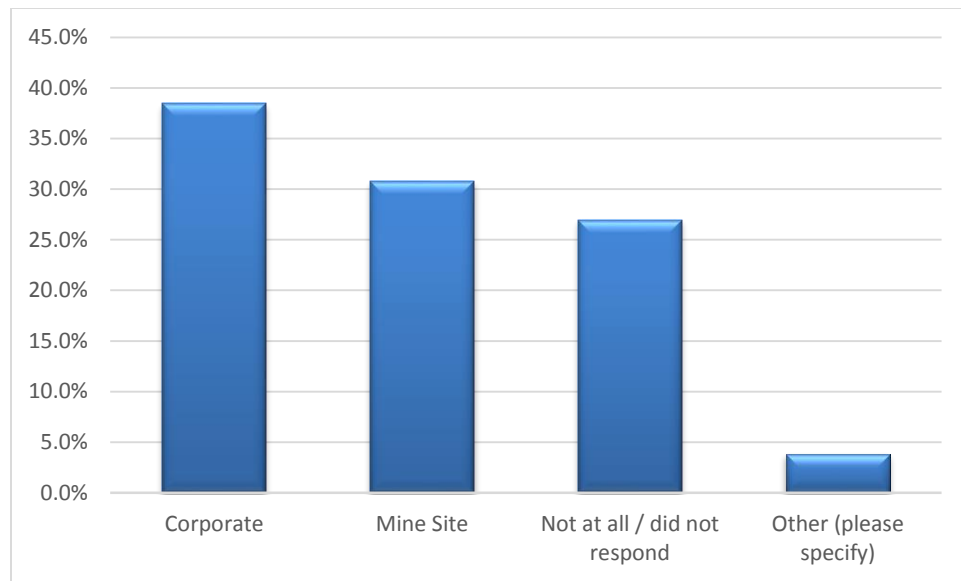


Figure 16: Business level dealing with adaptation measures

3.3.8 Measuring Outcomes

Few companies indicated that they are measuring outcomes and successes of their actions related to climate change adaptation. Seven respondents were not aware of company efforts to measure outcomes and twelve did not respond.

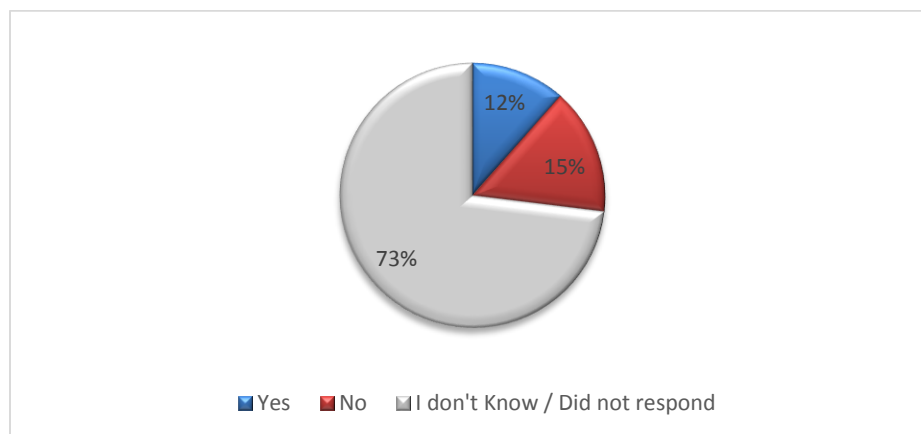


Figure 17: Companies that measure outcomes of adaptation measures



Of the firms that are measuring outcomes, they are doing so in a few different ways: One company is measuring actual weather patterns to compare them to their project design assumptions, while another is keeping track of interruptions to transportation and operations closures caused by unpredictable weather. And lastly, one company does not measure outcomes on an ongoing basis, but rather as extreme climate events occur.

3.3.9 Climate Change Information Availability

Respondents identified several tools, shown in Figure 18 below, which would be useful for assessing risks and planning adaptation measures. The response level for each option is fairly high, suggesting that there is not enough good information on climate change risks or adaptation measures, or on the other hand that such information has not been adequately sought out. Companies polled want better projections of future climatic conditions as well as frameworks and best practices (for benchmarking purposes) for dealing with the associated risks brought by changing climate.

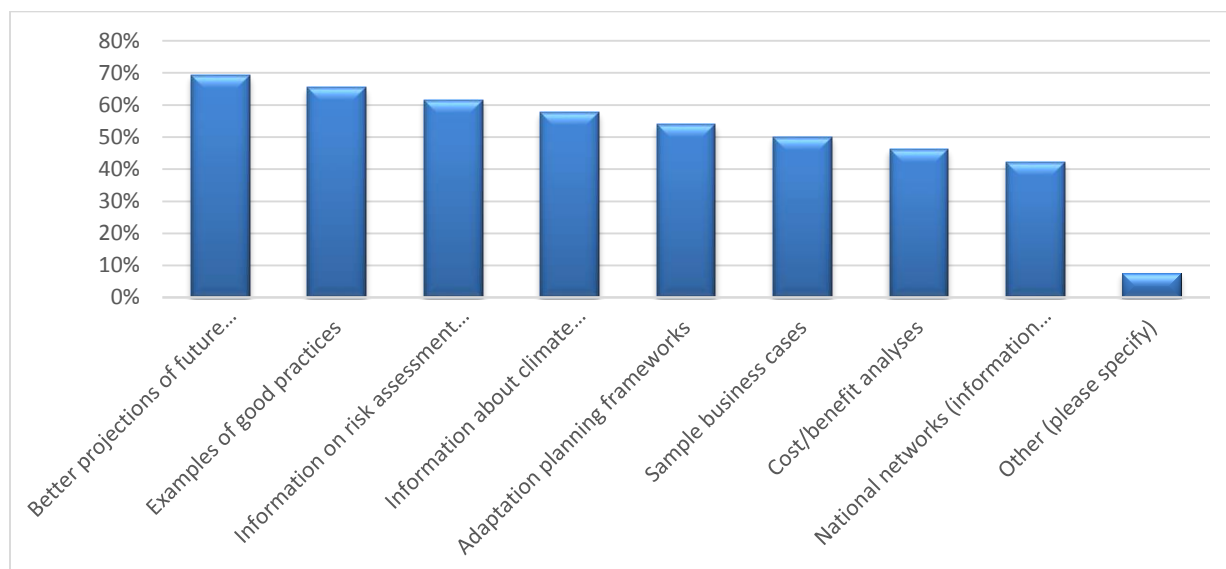


Figure 18: Information or tools that respondents would find useful for assessing risks or planning adaptation measures



In summary, just over a third of respondents said they have formal processes in place and have taken action to adapt to climate change (Figure 9). Few barriers were identified, though the ones that were are consistent with the information and tools that companies felt they were missing. A few companies reported difficulties in obtaining accurate and sufficient scientific data, and the majority of respondents felt that better projections of future climate changes, and information on climate change impacts would be useful. So far, most actions that companies have taken involve engineering design and infrastructure upgrades.

The management of climate change measures within the surveyed companies was split between the corporate and operational levels. However, the measurement of outcomes is not a common practice, suggesting that firms have yet to adopt climate change adaptation frameworks. Respondents felt that more information was needed in order to properly assess risks and opportunities associated with climate change.

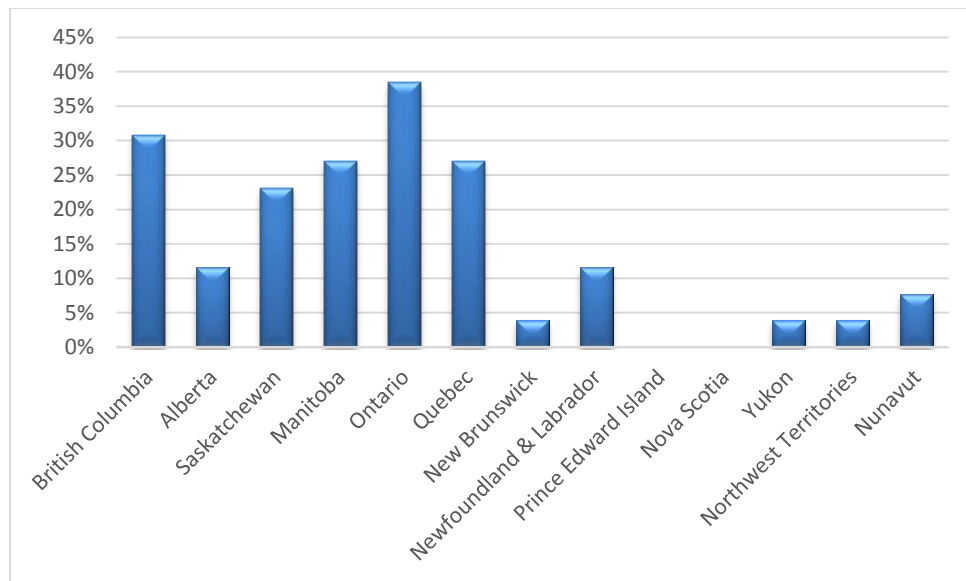
3.4 Roles and Responsibilities

This section covers the relationship between government and industry. Respondents were asked about their area of operation and the types of mining operations their firms own. Finally, survey participants were asked about the role of government with respect to climate change adaptation.

3.4.1 Provinces of Operation

Companies surveyed identified operations in most provinces, with Ontario and B.C. listed as areas of operation for the greatest number of mining companies.



**Figure 19: Province of operation**

3.4.2 Survey Respondent Profiles

Respondents were asked what role they play within their firm. The surveys were typically completed by an employee involved in the environment division of the companies surveyed. There were also respondents representing upper management, strategic initiatives, and corporate affairs.

Companies surveyed represent both underground and open pit mining operations, extracting a variety of commodities including iron ore, uranium, copper, gold, silver, molybdenum, zinc, lead, limestone, diamonds, nickel, cobalt, platinum, potash, coking coal, and oil sands.



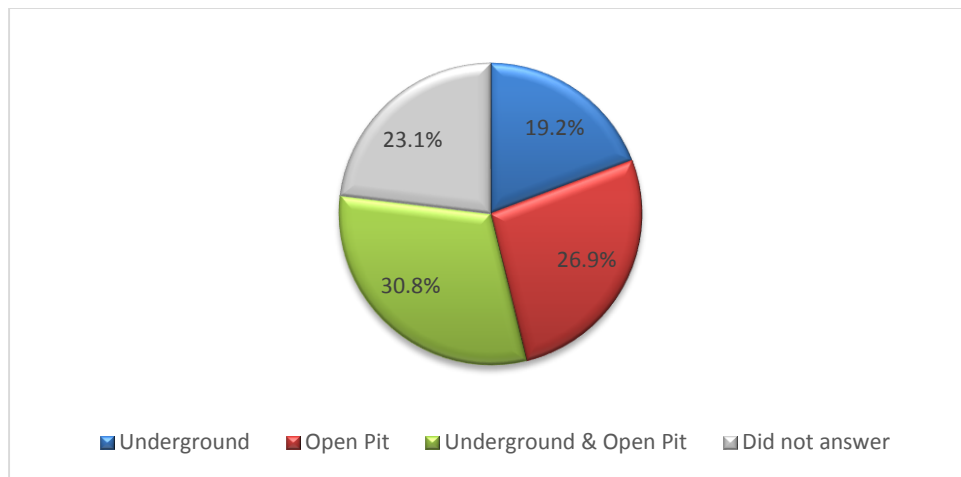


Figure 20: Types of operations

3.4.3 Role of Governments in Supporting Industry

Half of the survey participants responded that there is a role for governments to play in supporting industry's efforts to reduce the risks and impacts associated with climate change.

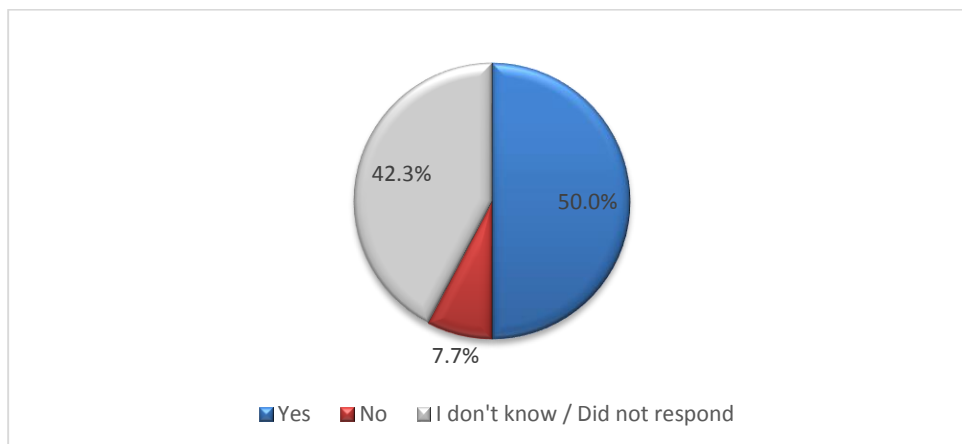


Figure 21: Companies that see a role for government in supporting industry's adaptation efforts



Ten respondents offered suggestions for the types of actions that governments should be taking. These recommendations spanned three broad categories: climate/weather data, policy/incentives, and regulatory.

Six companies wanted better climate and weather data provided by the government in order to properly assess future risks. In particular, one company was concerned with the increased risk of fires, while another was more concerned with assessing risks to infrastructure with regards to flooding and melting permafrost. Three companies suggested that a forecast of the expected effects of climate change by region would be useful. It was also suggested that this kind of analysis could be used by governments to develop a sound methodology for measuring the effectiveness of climate change actions. Another suggestion was for governments to take a larger role in analysing the cumulative effects of human activity on the environment, including the climate.

Three companies identified new policies and incentives as priorities for governments. One respondent wanted to see incentives for GHG reduction and energy efficiency, but did not provide details on the type of incentive. Another suggested more broadly that governments could formulate policies pertaining to energy, insurance, taxes, community, environment, biodiversity, and infrastructure, designed to de-risk the mining industry from the risks posed by climate change. Finally, one respondent suggested grants for industry adaptation measures or studies leading to the implementation of adaptation measures.

One respondent wanted governments to regulate climate change adaptation measures, making it mandatory for companies to assess the risks of climate change and encourage the development of an appropriate adaptation plan.

Only two respondents answered that government has no role to play in supporting industry's efforts to reduce the risks and impacts of climate change. The majority of respondents feel that governments could do more to support industry efforts, specifically by providing crucial information and financial or regulatory support to compel industry action where none has been taken.



4 Summary: Climate Change Adaptation in Canada's Mining Sector

This section contains a synthesis of the survey responses presented in the previous section and an assessment of some broader questions related to the survey.

4.1 What level of importance does the Canadian mining industry attribute to climate change?

Only 11 out of 26 respondents identified climate change as a risk to their operations. When asked to assess the importance of climate change risks in relation to other business risks, 19 out of 26 respondents did not answer the question. It is therefore difficult to assess the overall level of importance for the industry as a whole; however, the 7 that did respond identified climate change as a medium to very low risk, which suggests that at this stage climate change is not a primary concern for the Canadian mining industry.

Half of the companies surveyed indicated that they have assessed the risks and opportunities presented by climate change and of those companies over two-thirds have labelled climate change as risk to their business. Many companies are not assessing risks, and some that have assessed risks have decided that they are not significant. Most companies did not indicate that they faced barriers to assessing risks, but of those that did, difficulty obtaining accurate and sufficient data was a common theme. This result is consistent with the information and tools that most of the respondents believe would be useful in developing risk assessments and adaptation plans. In fact, 11 out of the 15 respondents that did not identify climate change as risk (or did not know) identified one or several tools or types of information that they would find useful. A lack of information and tools is therefore potentially the reason why most companies have not identified climate change as a risk.

4.1.1 Extreme weather and climate change risk assessments

There is a slight relationship between the companies' risk assessments and their experience of extreme weather events over the past five years. Companies that identified climate change as a risk responded to the question on the severity of



extreme weather events (see Figure 1) with an average total score of 25. Companies that did not identify climate change as a risk, however, averaged a total score of 18. There is also a relationship between the severity of extreme weather events experienced and the number of aspects of a firm's mining operations that were identified as a risk. The ten companies that experienced the most severe weather events identified an average of 2.9 aspects of their business operations that are at risk, while the ten companies that experienced the least severe weather events identified an average of 1.3 aspects at risk. Companies that have recently experienced more harsh weather events are more likely to have identified climate change as a risk.

4.2 What are companies doing about climate change risk?

Nine out of 26 companies indicated that they have dedicated or committed resources towards improving their understanding of climate change adaptation for their specific operations. And half of the respondents answered that climate change risks are factored into infrastructure design. Furthermore, 10 respondents selected engineering and design and 5 selected upgrades to infrastructure as key facets of their climate change risk management actions. Other more intangible actions, such as adaptation plans, changes to business processes, or even use of new technology have not typically been addressed by the participating companies.

The identified actions, namely in engineering and design as well as infrastructure upgrades, match the most commonly predicted risks of mine closures or complications with one of more aspects of mining infrastructure. Actions for dealing with employee safety and supply/value chain risk have not been identified.

Companies with operations in British Columbia and/or Alberta were less likely to view climate change as a risk to their operations (7 no, 1 yes and 2 unknowns). Answers from companies with operations ranging from Saskatchewan to the eastern provinces were more likely to declare climate change a risk to business operations (13 no, 20 yes and 1 unknown).

Companies with underground mines or open pit mines tended not to view climate change as a risk (1 yes to 4 no for underground, and 2 yes to 5 no for open pit); but



companies that operate both types of mines were likely to indicate that climate change is viewed as a risk (6 yes and 2 no).

There are no discernible relationships between the level of the respondent nor the type of commodity mined and the types of responses.

4.3 Gap Analysis

Employee safety, supply chain, and value chain have all been identified as potential risks but have not been addressed. Overall, the level of risk identification occurring among the participating companies is low, but there appears to be interest in enhancing information and providing better access to tools to help assess risk and implement adaptation measures, whether through an information sharing network or through greater collaboration with governments. Survey results suggest that companies would be receptive to the idea of a national network for mining companies, in partnership with governments, to study the effects of climate change on mining operations and develop tools, best practices, and practical frameworks for adaptation measures.

4.3.1 Key roles and responsibilities for government and industry that have been raised in the survey responses

More than half of the companies surveyed would like to see: better projections of future climate changes and impacts by region in order to predict effects on their particular operations; examples of good practices; information on risk assessment methods and tools; adaptation planning frameworks; and sample business cases. And over 40% of respondents would find cost-benefit analyses and a national information sharing network useful.

Moreover, there is broad support for governments to play a larger role, with only 2 respondents in disagreement. Most in agreement felt that it was the role of governments to provide better climate and weather data, including forecasts of climate change impacts by region. There was also support for policies, incentives, and regulations for climate change adaptation to de-risk the mining industry.



5 Conclusion

Climate change is not viewed as a serious risk by those polled. At worst, it is considered a medium-level risk compared to other business risks. However, it is important to note that many questions had low response rates, which made meaningful interpretations of some results difficult.

Many companies have not assessed the risks of climate change on their business operations. For those that have, the majority have identified climate change as a business risk. These companies have taken concrete actions, mostly with regards to engineering and design and infrastructure upgrades. Less work has been done on mitigating risks associated with health and safety, supply/value chain, and other broad impact areas.

The survey revealed that companies are not accessing enough information or tools to help them identify and manage risks. This is either because some companies have not yet felt the need to do so (companies that have experienced more severe weather in the last five years were more likely to assess climate change as a risk), or because there is not enough accessible information for adaptation within the mining sector. There appears to be broad support for better access to information on climate change adaptation risks and measures, as well as for collaboration with other mining companies and governments on addressing risks.



Project: Climate Adaptation in the Canadian Mining Sector

/// APPENDICES

Topic 1: Monitoring Climate Change Impact	
24	Has your firm dedicated or committed resources towards improving understanding or information related to the impacts of climate change (specific to your operation)?
3	Where the above have impacted your operations, what were the impacts to the affected operation(s)?
	Was production halted during the event?
	Was production halted beyond the length of the event?
	Were assets damaged? (if yes, please explain)
	If assets were damaged were the impacts material?
	Were there safety related incidents?
	Was access to the property compromised?
	Were emergency responders deployed?
	Were other business impacts experienced? If yes, please explain below:
2	Has your firm experienced any of the following in the past 5 years at one or more of your operations? (Check all that is applicable and indicate the severity in comparison to previous years/periods)
5	If yes, please identify the aspects of your firm's mining operations that were identified as susceptible to future climate change. (Check all that is applicable)
Topic 2: Assessing climate Change Risk and Opportunities	
1-A	Within your company have implications with a changing climate been identified as a risk?
1-B	Describe how this risk has been identified and at what level (mine site or corporate)? (e.g. identified through corporate risk registry process or identified at site as part of tailings management)
25	Has your firm dedicated or committed resources towards improving understanding or information related to climate change adaption specific to your operation?
15	Does your firm take into account your supply chain when considering climate change adaptation?
7	Does your firm consider future climate change to pose significant risks to its operations?
4	Has your firm assessed the risks or opportunities related to future changes in climate on any aspect of its business?
Topic 3: Managing Climate Change Risks and Opportunites	
26	What kind of information or tools do you believe would be useful for your firm to assess risks and plan adaptations to climate change impacts? (Please check all that apply)
11	Does your firm have processes in place to consider a changing climate in its key business decisions?
16	When you, or your consultants, design capital projects are future climate risks being factored into the design?
12	Is your firm taking actions to manage risks or take advantage of opportunities arising from changing climate conditions?
13	If yes, what is the nature of the actions being considered or implemented? (Please check all applicable)
20	If actions related to climate change adaptation are underway, is your firm measuring the outcomes and success of your actions?
21	If yes, how is your firm measuring actions? Please elaborate:
18	Did your firm encounter any barriers in assessing risks or implementing climate change adaptation measures?
19	If yes, in which area did your firm encounter barriers? (Check all that apply)
20	If actions related to climate change adaptation are underway, is your firm measuring the outcomes and success of your actions?
21	If yes, how is your firm measuring actions? Please elaborate:
Topic 4: Roles and Responsibilities	
27	Please select the provinces and territories in which your company operates (Please check all that apply)
28	Please describe the role you play in your firm: (Engineering, Geology, Environment, Community Engagement, Safety & Health, etc.)
29	Please indicate whether your operation(s) involve underground mining, open pit mining or both
30	Please list the types of commodities mined at your operation(s)
14	At what business level does your firm approach management of climate change adaptation? (Please check all that apply)
22	Is there a role for government to play in supporting industry's efforts to reduce the risks and impacts associated with a changing climate?
23	If yes, please elaborate on what actions government should consider: