Managing Environmental, Social, and Government (ESG) Risk in the Mining Industry:

The Emerging Relevance of ESG Risk and the Dangers of Getting it Wrong

Final Submission for the McKinsey Risk Prize

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February 28th, 2014

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Executive Summary

This report investigates and compares the shift in risk exposures of mining companies that has occurred over the past two decades due to fundamental changes in the mining industry, such as technological progress and geographic expansion. These changes over time have made "technical" risks[1] significantly more manageable, but have increased importance of the less manageable Environmental, Social, and Government (ESG)[2] related uncertainties. These issues are explored using individual mining companies as examples to demonstrate overall industry-wide changes.

Losing a social license to operate has become the most critical ESG issue that most mining firms face. This can occur when local communities become resistant to a firm's presence and begin to actively take actions to disrupt the firm's operations.

Investors and financiers of mining operations must understand and appreciate this fundamental change in risk exposure as it represents a major shift from more manageable and predictable risks, towards less manageable and less predictable uncertainties. Investors who focus on technical risks, such as variations in ore grades, processing efficiency, and operating costs, rather than ESG risks, may actually be assuming substantially more risk than they believe.

Historical Focus of Risk Management – Technical Risk

At its core, mining a risky business. Events such as the 1890's Gold Rush in North America demonstrate how prospectors were willing to risk everything, including their lives, in the hopes of "striking it rich". Until the early 19th century, nearly all mining risks could be classified as uncertainty – there was simply no way to know what would be found below ground (Jardine, et al., 1996).

Progress during the ensuing years made mining substantially less risky, at least from a technical perspective. The past 50 years has seen major advances in the fields of geology and mining engineering. New methods of mapping the earth and a better understanding the underlying processes that govern rock formation have vastly improved our ability to forecast the success of mining opportunities. For example advanced geophysics techniques have enabled geologists to effectively "see into the earth" and discover deposits with a high level of accuracy.

Other technical risks, such as uncertainty in the actual grade (concentration) of minerals unground, the stability of excavated pits and underground workings, and the efficiency of mineral operations can all be mitigated to a large degree through detailed upfront engineering and geological investigations. Additionally, many financial risks, such as fluctuations in the price of the target minerals and currency fluctuations can be effectively hedged to meet given risk targets.

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[1] The term "technical risk" is used in this report to represent "known risks" or those risks related to engineering, operations, and finance where the probability of the risk occurring can be estimated.

[2] The term ESG is used throughout, but other terms such as Corporate Social Responsibility (CSR) or Sustainable practices could also be used interchangeably.

Furthermore, the risk of dishonest behaviour by miners has been greatly reduced through new protocols, such as the NI-43-101 standards, that help to protect investors from misleading, fraudulent, or unsubstantiated claims by mining companies. For example, the NI-43-101 standard sets minimum requirements for the number of boreholes and laboratory tests that must cover a given area before a firm can classify its property according to well-defined set of terminology, which communicates to the public in a standardized manner the level of certainty in the resource estimates (APGO, 2011).

Decisions to implement preventative actions for technical risks are typically evaluated using standard risk management tools, such as risk registries, rankings risks on a "likelihood vs impact" scale, or the costs of preventative actions are weighed against the "expected cost" of the risk[3]. In this manner, known risks are taken if the cost of prevention outweigh the expected cost, plus a margin of safety.

Examples of a Technical Risk

An example of a typical technical risk management exercise is balancing the cost vs. stability (i.e. riskiness) of open-pit mines. Pits with shallower slopes are more stable than equivalent pits with steeper slopes. However, shallower slopes require more waste material to be excavated. To evaluate this cost vs risk trade-off engineers calculate:

1) Probability of slope failures at various pit wall angles,
2) Likely impact of such slope failures,
3) Costs of excavating pits with various slope angle, and
4) Costs and benefits of remediation/ prevention measures, such as rock-slope anchors and monitoring systems.

Management teams, including risk managers, then evaluate the various trade-offs and select the best option based on acceptable levels of risk at a reasonable cost. (Read, 2009)

This process naturally forces decision makers to accept risks related to the occurrence of unlikely, but negative, events. Unfortunately, these rare events occasionally materialise. For example, the largest non-volcanic landslide in North American history recently occurred at Rio Tinto's Bingham Canyon mine in Utah, USA. Amazingly, nobody was injured because the landslide was predicted in advance. This seemingly impossible feat was achieved because Rio Tinto had installed a laser scanning system that detected miniscule changes in the pit wall, which indicated that a slide was imminent. University of Utah geologist Jeffrey Moore explains: "The main lesson … is that failures like this are not unpredictable 'acts of God'…. with the right monitoring system and proactive approach, the time of failure can be forecasted with reasonable accuracy" (NASA, 2013). In the past this would have been classified as an unpredictable event, however technological improvements have transformed this into a manageable risk. This example shows the advanced state of technical risk management in high-stakes (i.e. high-value) situations.

[3] Expected cost = (probability of occurrence) x (cost if risk occurs)

Figure 1 – Bingham Canyon (Mining.com, 2013)

Emerging Risk Management Focus – Environmental, Social, and Government (ESG) Issues

Mining companies and their shareholders still focus on technical risks as important factors that affect the financial returns of a venture, however, these risk have become much more manageable as a result of scientific advances, new risk management techniques, and technology. Despite these improvements, the past decade has seen a dramatic shift in risk management focus as ESG issues have emerged from relatively low level concerns to become significant issues that nearly all mining firms take actions to address (ICMM, 2012).

Drivers and Trends of ESG issues

Interest in the mining industry's ESG performance has broadly matched society's interest in corporate ESG performance. Because mining has historically been associated with large scale environmental damage, the sector was targeted by NGOs and governments for ESG problems during the rise of the environmental movements. During the 1970's and 1980's governments around the world began issuing increasingly stringent environmental regulations, which added additional costs to miners as they were required to expend resources to meet the new regulations. Attention to social impacts also grew as NGOs increasing focused on CSR ideals during the 1990s (Foucaucourt, et al., 2011).

Importantly, these trends occurred at a time when mining companies, often multinationals, began moving to more remote regions of the world. This geographic move occurred in large part because of declining resource quality in easy to reach areas. More distant and remote regions offered many untapped and lucrative opportunities – this trend is expected to continue into the foreseeable future (ICMM, 2012). Note the orange line in Figure 2, which shows six developing countries.

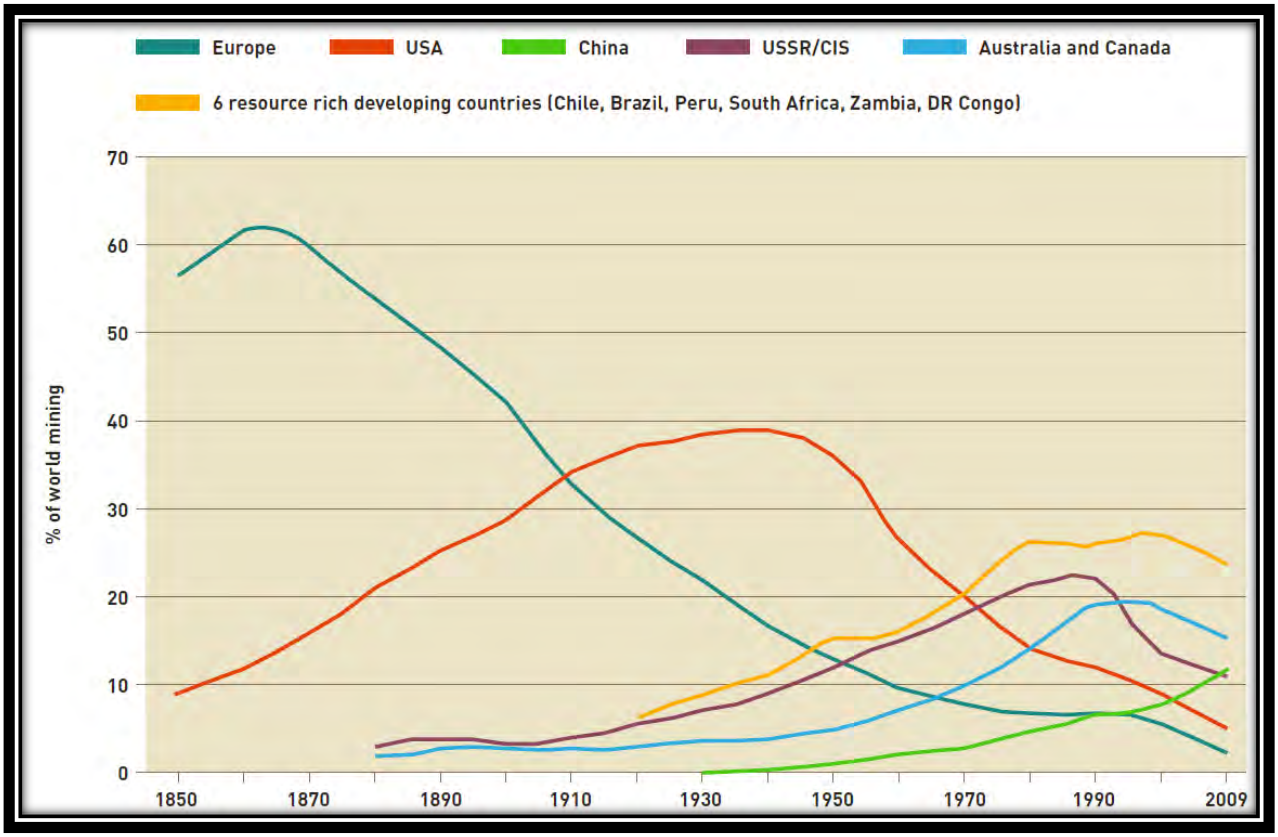


Figure 2 – Location of world mining by region, 1850 to the present. (ICMM, 2012)

These regions are often geographically remote, economically underdeveloped, and have less stable governments, where environmental protection regulations are less effective and state protection of the social welfare may not be well developed (Yakovleva, 2005).

As large-scale multinational mining firms began moving into developing countries they were faced with a new set of challenges. Codes of practices and regulatory agencies were typically not well developed so firms were requested to uphold environmental best-practices from their home countries. (Hilson & Haselip, 2004). Many of the larger firms chose to uphold this request, but unfortunately, many smaller firms underestimated the ESG challenges related to working in dramatically new social environments (Foucaucourt, et al., 2011).

Many of the biggest conflicts revolved around the treatment of, and engagement with, indigenous and local peoples. Firms that are perceived to be unfair to workers or local residents, that don't pay a fair royalty to the local country, or that unduly damage environment are more likely to attract the negative

attention of local governments and community groups. These individuals, with the help of the media and global human rights NGOs, increasingly have the ability to disrupt operations through transportation blockades, strikes, court interventions and fines, more stringent regulations, or even full revocation of the firm's license to operate (Yakovleva, 2005).

Role of Financial Institutions

Shareholders and financiers of mining companies are aware that ESG failures can lead to major disruptions and significant losses as a result. These groups are demanding a greater degree of transparency and reporting of mining company's ESG risk exposure and their risk management measures. For example, the Equator Principles Association has created an ESG risk management framework that participating financial institutions declare will be used to restrict project financing to firms that fail to meet minimum standards of ESG due diligence (Equator Principles Association, 2013).

Also leading this effort are large institutional investors who increasingly challenge management decisions and even limit investments in companies based on ESG practices. These actions are taken both because they believe weak ESG systems lead to greater uncertainty and added exposure to potentially liabilities, but also because they believe ethical investing is morally correct and encourages mining firms to improve their behaviour.

The best example is Norway's USD$820 Billion Sovereign Wealth Fund, which is a principle-based investor for whom ESG considerations are potentially important determinants of long-term performance. The fund actively engages with companies to evaluate their ESG performance (Norwegian Ministry of Finance, 2012). In 2009 the fund divested its entire USD$245m investment in Barrick Gold Corporation (Barrick), after details were released of wide-spread environmental damage at its Porgera Gold Mine in Papua New Guinea. In total, the fund has divested over USD$1.2 Billion in mining company investments due to poor ESG performance (Norwegian Ministry of Finance - Asset Managment Department, 2009).

I believe Norway's fund made the correct decision to divest its stake in Barrick, who's ESG failures continued and 4 years later announced a massive USD$5.1 Billion writedown on its delayed Pascua-Lama mine in the Andes. Construction of the project was halted when a Chilean court accepted an injunction filed by local indigenous communities and environmental regulators ordered major changes to the project be implemented to protect water supplies of the downstream residents.

Assessment of Current ESG Practices

In general, ESG risk management frameworks in the mining industry are nascent, but have made a great deal of progress. Unfortunately though, they are still not performing particularly well. Unlike technical risks, which are reasonably well managed, significantly more work is needed before ESG risks can be properly understood and effectively managed (Hill, et al., 2011).

The remainder of this report will review and evaluate the ESG risk management practices of Barrick, which can be viewed as a proxy for current best-practices across the industry. Given Barrick's record of

ESG troubles this may seem like an odd selection, but their risk framework broadly matches industry best-practices, which tend to be led by the largest firms (Raufflet, et al., 2014).

Case Study: How Risk is Measured and Managed at Barrick Gold Corp.

The following section is based on Barrick's 158 page 2012 Corporate Responsibility Report (Barrick Gold Corporation, 2012), personal discussions with Barrick employees, and information obtained from hearing Barrick's former CEO, Arron Regent, discuss Barrick's ESG practices at conferences.

Barrick has developed a well-funded and relatively advanced ESG risk management program, which pragmatically focuses on achieving a social license to operate. To demonstrate transparency, Barrick follows the well-respected Global Reporting Initiative's (GSI) Sustainability Reporting Guidelines and it benchmarks performance against industry leading ESG and sustainability bodies such as the UN Global Compact (UNGC) and the International Council on Mining and Minerals (ICMM) Sustainability Principles.

Because of its large size and myriad of possible issues to cover, Barrick focuses on what it calls "material issues", or issues that are important to their stakeholders and that can impact their license to operate. The following sections briefly outline the main features and salient points of the ESG risk management framework.

2. Issues Identification

Identify top issues in the context of social and environmental impacts.

Wide range of sources used, including stakeholders, NGOs, experts, investors, and industry trends.

1. Prioritization

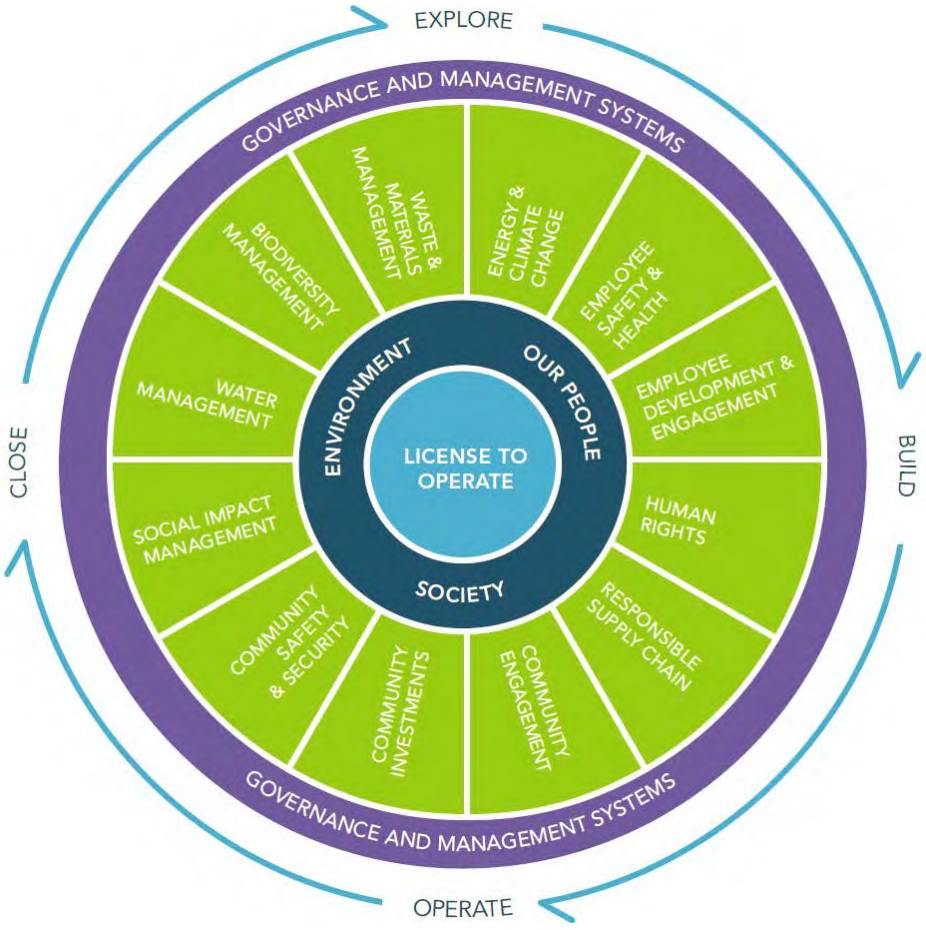
Rank identified issues by importance to stakeholders and potential impact to license to operate.

Guided by a Materiality Rating Matrix; informed by experts. Issues categorized as high, medium, or low.

3. Analysis & Reporting

Prioritization process identified 12 material issues of high importance.

Issues presented in graphic below highlight major areas to investigate and progress in managing them are discussed in the Responsibility Report.



(Barrick Gold Corporation, 2012)

The essence of this system is a relatively simple risk vs. impact matrix that is created for each project. Risks are first identified through engagements with a comprehensive array of stakeholders and experts, then each risk is prioritized based on its potential impact (e.g. obtaining a license to operate or affecting

stakeholders), and finally these risks are studied intensively and preventative actions are taken in accordance with their relative importance.

The specific actions taken varies from location to location, but are generally practical, organized, and well-funded efforts that appear appropriate. While the specifics of each issue are not discussed at this time, one issue, stakeholder engagement, is reviewed as an example.

Stakeholder Engagement

While environmental issues are important, many of Barrick's actual problems have resulted from mishandling social and political situations. Often environmental issues are a driver of social and political concerns, although environmental issues alone becoming significantly easier to measure, predict, and manage (Hill, et al., 2011).

Early dialogue with stakeholders is one of the most effective means of obtaining a social license to operate. This process begins very early in the life of a mine, often before initial exploration works begin. For Barrick this includes outreach programs to host communities through town-hall meetings, question and answer sessions, community newsletters, one-on-one discussions, and in some cases the establishment of local liaison offices in nearby communities. During active mining Barrick takes even stronger actions such as community participatory water monitoring programs, where local residents are involved in water sampling and analysis in order to increase transparency and build trust. Compensation of various forms, including scholarships for local residents, is often provided to affected communities (Barrick Gold Corporation, 2012).

Dialogue is also regularly maintained with outside stakeholders, such as international NGOs, shareholders, academics, government agencies, and Socially Responsible Investor groups. Additionally, Barrick participates in well regarded industry associations such as ICMM, where best-practices are discussed and areas for future improvement are highlighted. Finally, independent external consultants evaluate Barrick's ESG performance, which includes interviewing local stakeholders, on an annual basis (Barrick Gold Corporation, 2012).

Stakeholder engagement acts as both a means of collecting valuable information to help identify potential ESG issues early, but also begins building trust amongst potential opponents by showing the firm respects their concerns.

Evaluation of ESG Management Effectiveness

In my opinion, the general effectiveness of ESG management in the mining sector has been poor. Barrick spends a great deal of time and resources on its ESG systems, which are arguably near industry leading, and yet its centerpiece project was blocked because of upset local residents and several social justice groups continue to work diligently to protest it, as shown on Figure 3.

Figure 3 – Annual protest flyer in Toronto. (www.ProtestBarrick.net, 2010)

The interesting twist is that Barrick's ESG risk management systems themselves appear relatively robust and sensible. One must ask: what's gone wrong?

In my opinion, Barrick's troubles are related to four main problems:

1) The early stage of ESG risk management practices,
2) Cultural mis-alignment,
3) The underlying uncertainty of the risks being addressed, and
4) A general failures of industry-wide ESG risk management programs.

Early stage of development: ESG management systems are still being refined and were initially created for developed countries. However these systems have proven less effective when used in extreme conditions, such as Barrick's operations in Papua New Guinea, Tanzania, and Chile, where abject poverty is wide-spread, the governments are unreliable, and the mines attract unwanted attention from locals, including illegal miners and migrant workers. Significant ESG related problems are relatively rare in developed regions with a history of mining (Hill, et al., 2011). More demanding social environments greatly increases ESG problems.

Culture: I believe the mining industry culture is not well aligned with the attitudes required to deal with ESG uncertainties. Decision makers within the firms are generally very experienced and have technical

backgrounds from developed countries; for much of their careers, technical risks were the dominant concern. For example, a colleague at an (anonymous) Vancouver based mining firm explained that they "calculate ESG risk impacts" as follows:

We use discounted cash-flow methods to calculate the present value of cash flow impacts caused by the occurrence of a given ESG risk factor, such as project delays, remedial works, or fines.

These models are adapted from traditional methods of costing "technical" risks such as the cost of repairing a landslide. These "technical" risks are reasonably well understood and can be roughly estimated, or mitigated to some degree. However ESG issues can rarely be assigned a reasonable probability so these models are less appropriate.

Underlying uncertainties: Unlike technical risks, ESG uncertainties tend to be unpredictable and their impact more difficult estimate. Many firms still view ESG risks as extraneous issues that just happen without warning (Hill, et al., 2011). Losing one's license to operate, disruptions, strikes, and resource nationalization, are more likely classified as uncertainties and therefore don't fit well with the traditional method of costing risks.

Industry-Wide Failure: I believe most current ESG systems are insufficient and leave managers with a false sense of security. Managers in developed countries are likely to misjudge the "unknown-unknown"[4] events and interconnected systemic risks when attempting to forecast the behaviour of affected people from very remote and economically disadvantaged regions over the life of a mine (e.g. 15 to 50 years) (Hill, et al., 2011).

This means many mining firms, especially those operating in remote regions, are exposed to more risk than suggested by traditional risk management systems. However, the planning process and frameworks remains useful tools that provide structured ways of considering possible scenarios and anticipating reactions to uncertain events. Additionally, by identifying major ESG risks, management will be able to communicate to staff the importance of recognising potential problems early and adapting quickly to changing conditions.

Recommendations

I believe additional resources and project flexibility must be built directly into mine project plans in order to better manage unforeseen events. This is required because of the material nature of ESG risks and the apparent failure of mining companies to adequately address these risks, as seen by firms such as Barrick, who continue to encounter significant problems despite comprehensive ESG programs.

While mining firms continue to expand their ESG programs, I believe their history of focusing on technical risks suggests that a cultural shift must move decision makers away from believing that ESG risks can be managed and "contained" in the same way as technical risks. Uncertainty must be accepted,

[4] As discussed in Lecture 1 of JBS Risk Management course, as adapted from Knight, 1921

creative problem solving should be embraced, and efforts to identify and adapt to ESG issues should be given even greater importance, particularly for firms operating in developing countries.

While I cannot propose a better risk management model at this time, it is clear to me that more work is needed.

Conclusion

Three main points can be drawn from this report:

- ESG related uncertainties facing mining firms have grown substantially in importance during the past two decades, while technical risks have become more manageable. This has largely occurred due to firms initiating operations in regions that are geographically remote, have less effective governance systems, and are economically disadvantaged.
- Shareholders and financiers should seriously investigate ESG risks exposure when making investment decisions as these issues can have material negative impacts on projects. Early warning signs should be monitored as they may indicate potential future problems. However, the underlying uncertainty of ESG issues will remain and likely increase in importance in the future. Investors should consider adjusting their risk-return assumptions accordingly.
- Risk managers at mining firms should continue to grow their ESG programs in order to identify and actively adapt to uncertainties. Obtaining and maintaining a social license to operate is a critical success factor and firms are advised to practice early engagement with local communities in order to convey a message of respect and understanding to potentially affected communities.

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