STRATEGIC ANALYSIS FOR A NEW ENTRANT

INTO THE NIOBIUM INDUSTRY

By

Andy William King Yu
Bachelor of Commerce, University of British Columbia, 2002
Chartered Accountant, Chartered Accountant School of Business, 2004
Certified Public Accountant, Oregon Board of Accountancy, 2006

PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF BUSINESS ADMINISTRATION

In the
Faculty
of
Business Administration

SIMON FRASER UNIVERSITY

Summer 2013

Approval

Name: **Andy William King Yu**

Degree: **Master of Business Administration**

Title of Project: **STRATEGIC ANALYSIS FOR A NEW ENTRANT INTO THE NIOBIUM INDUSTRY**

Supervisory Committee:

____

Dr. Andrew von Nordenflycht
Senior Supervisor
Associate Professor

____

Dr. Aidan Vining
Second Reader
Professor

Date Approved: ______________________________________

Abstract

Taseko Mines Limited ("Taseko") believes that it can penetrate the highly concentrated niobium industry through its Aley Niobium Project ("Aley"). This thesis addresses the following questions: Is the niobium industry attractive enough to further advance the exploration and development of Aley? If so, how should Taseko finance the additional exploration and engineering work necessary to develop Aley to the feasibility stage?

This paper concludes that the following support Taseko's assumptions about the attractiveness of the niobium industry and its entry into the industry: a foreseeable demand growth for niobium, a steadily increasing niobium price, and a low intensity competitive environment. The paper further concludes that Aley is an attractive niobium project and Taseko can be successful in exploring, developing and operating Aley.

Due to the attractiveness of both the niobium industry and Aley as a niobium project, Taseko should further advance Aley to the feasibility stage. After evaluating a number of financing options as well as Taseko's internal capabilities, Taseko should use the free cash flows generated from its operations to finance the advancement of Aley.

Dedication

I dedicate this project to my FAMILY

My Papa, Antonio and my sister Dianne;

To the memory of my beloved Mama, Nedila – your love has inspired me to be the best I can be – I miss your love and guidance every day; and

To my lovely wife, Stella – you continue to inspire me to be the best I can be – your love keeps me going every day.

Acknowledgements

Thank you to my EMBA group – Polaris: Sheri Willey, J.P. Harrison and Brian Young for making the EMBA experience fun and full of good memories. We will always strive to chart the best course.

Thank you to Mr. Russell Hallbauer (President and CEO of Taseko Mines Limited) and Peter C. Mitchell (former CFO of Taseko Mines Limited) for granting me permission to write about Taseko and the Aley Niobium Project.

Thank you to Dr. von Nordenflycht and Dr. Vining for your guidance. I truly learned a lot during the process.

Thank you to my sister, Dianne Michelle Yu, and to my father, Antonio Yu, for their support throughout the EMBA program.

Lastly, thank you to my wife, Stella, for being supportive and patient despite my not spending much time with you during our first month of marriage while researching and writing this paper.

Table of Contents

.

List of Figures

.

List of Tables

Glossary

°C	Degrees Celsius
Aluminothermic Reaction	Aluminothermic reactions are exothermic chemical reactions using aluminium as the reducing agent at high temperature.
Carbonatite Deposit	Carbonatites deposits are igneous rocks largely consisting of the carbonate minerals, calcite and dolomite which contain the niobium mineral pyrochlore, rare earth minerals or copper sulphide minerals.
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization
Feasibility Study	A feasibility study is a report that explores the practical implications of a decision to proceed or abandon a particular project. Detailed feasibility studies require a significant amount of formal engineering work, are accurate to within 10-15% and can cost between ½-1½percent of the total estimated project cost.
FeNb	Ferroniobium (“FeNb”) is an iron niobium alloy with a niobium content of 60-70%.
Flotation	Flotation is a method of mineral separation whereby after crushing and grinding ore, froth created in slurry by a variety of reagents, causes some finely crushed minerals to float to the surface where they are skimmed off.
g/t	Gram per tonne
HLSA	High-strength low-alloy steel (“HSLA”) is a type of alloy steel that provides better mechanical properties or greater resistance to corrosion than carbon steel.
Indicated Mineral Resource	An “Indicated Mineral Resource” is that part of a Mineral Resource for which quantity, grade or quality, densities, shape and physical characteristics can be estimated with a level of confidence sufficient to allow the appropriate application of technical and economic parameters to support mine planning and evaluation of the economic viability of the deposit. The estimate is based on detailed/reliable exploration and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes that are spaced closely enough for geological and grade continuity to be reasonably assumed.
Inferred Mineral Resource	An “Inferred Mineral Resource” is that part of a Mineral Resource for which quantity and grade or quality can be estimated based on geological

evidence and limited sampling and reasonably assumed, but not verified, geological and grade continuity. Limited information and sampling gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes is the basis for the estimate.

Kg	Kilogram
Ksi	Kilopound per square inch
Kt	Kilo tonne
Lb(s)	Pound(s)
Measured Mineral Resource	A "Measured Mineral Resource" is that part of a Mineral Resource for which quantity, grade or quality, densities, shape, and physical characteristics are so well established that they can be estimated with confidence sufficient to allow the appropriate application of technical and economic parameters, to support production planning and evaluation of the economic viability of the deposit. The estimate is based on detailed and reliable exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes that are spaced closely enough to confirm both geological and grade continuity.
Mineral Reserve	A "Mineral Reserve" is the economically mineable part of a Measured or Indicated Mineral Resource demonstrated by at least a Preliminary Feasibility Study. This Study must include adequate information on mining, processing, metallurgical, and economic and other relevant factors that demonstrate, at the time of reporting, that economic extraction can be justified. A Mineral Reserve includes diluting materials and allowances for losses that may occur when mining the material.
Mineral Resource	A "Mineral Resource" is a concentration or occurrence of diamonds, natural solid inorganic material, or natural solid fossilized organic material including base and precious metals, coal, and industrial minerals in or on the Earth's crust in such form and quantity and of such a grade or quality that it has reasonable prospects for economic extraction. Specific geological evidence and knowledge estimate or interpret the location, quantity, grade, geological characteristics and continuity of a Mineral Resource.
Mt	Million metric tonne
Nb^2O^5	Niobium pentoxide is an inorganic compound that is the main precursor to all materials made of niobium.
NI 43-101	National Instrument 43-101 Standards of Disclosure for Mineral Projects (NI 43-101) governs a Canadian company's public disclosure of scientific

This instrument governs disclosure, including oral statements, written documents and websites. NI 43-101 requires a company to file a technical report at certain times, prepared in a prescribed format. In some circumstances, the qualified person must be independent of the company and the property. A company is required to use specified terminology when disclosing resources, reserves, and technical information about its mineral projects

Offtake Agreement	An offtake agreement is an agreement between a producer of a resource and a buyer of a resource to purchase/sell portions of the producer's future production. Producers and buyers normally negotiate an offtake agreement prior to the construction of a facility such as a mine in order to secure a market for the future output of the facility. If the company can convince lenders there will be a market for the resource, it will be easier for the company to obtain financing to construct a facility.
oz	Troy ounce (31.1035g)
Pre-feasibility study	A preliminary feasibility or pre-feasibility study determines whether to proceed with a detailed feasibility study and as a "reality check" to determine areas within the project that requires more attention. Preliminary feasibility studies include the factoring of known unit costs and estimating gross dimensions or quantities.
Probable Mineral Reserve	A “Probable Mineral Reserve” is the economically mineable part of an Indicated and, in some circumstances, a Measured Mineral Resource demonstrated by at least a Preliminary Feasibility Study. This Study must include adequate information on mining, processing, metallurgical, economic, and other relevant factors that demonstrate, at the time of reporting, that economic extraction can be justified.
Proven Mineral Reserve	A “Proven Mineral Reserve” is the economically mineable part of a Measured Mineral Resource demonstrated by at least a Preliminary Feasibility Study, including adequate information on mining, processing, metallurgical, economic, and other relevant factors that demonstrate, at the time of reporting, that economic extraction is justified.
Pyrochlore	Pyrochlore is a brown or dark reddish mineral that is isomorphous with microlite and is an oxide and fluoride of sodium, calcium, and columbium.
t	Metric Tonne
Tpd	Metric tonne per day
Tpy/tpa	Metric tonne per year/annum

1: INTRODUCTION

This paper analyses Taseko Mines Limited's ("Taseko" or the "Company") opportunity to enter the niobium industry through its Aley Niobium Project ("Aley"). Taseko is a Canadian public mining company, which holds mineral claims and exploration rights to the Aley Project located in Northern British Columbia ("BC"). After years of exploration, Taseko released a report concluding Aley has the potential to be a niobium mine with an estimated production of 12 million pounds of niobium annually for twenty years. Based on this encouraging result, Taseko's current focus on Aley is further defining the mineral resources to advance the project to the feasibility stage, the permitting process, mine development and construction and, finally, niobium production and sales.

Taseko believes that the niobium industry, without fierce rivalry and with increasing demand and price for niobium, is a very attractive industry that will grow 5-7% annually with niobium prices increasing from the current $41/kg to approximately $60/kg by 2020. It believes that Aley has the potential to be a competitive niobium mine that can penetrate the highly concentrated niobium industry.

Furthermore, Taseko believes it has the internal capabilities to bring Aley to the production phase. With its recently completed expansion of its Gibraltar Copper-Molybdenum Mine ("Gibraltar"), its experience with the permitting process with its New Prosperity Gold-Copper Project ("New Prosperity"), and its access to debt and equity capital, Taseko believes that it has the experience and resources to make Aley the first niobium mine in BC.

The two important decisions Taseko needs to make concerning Aley are as follows: Is the niobium industry attractive enough to warrant investment in the exploration and development of Aley? If so, how should Taseko finance the additional exploration and engineering work necessary to bring Aley to the feasibility stage?

This paper will analyse Taseko's assumptions about the niobium industry. To do so, it will conduct a comprehensive industry analysis to assess the industry's attractiveness. After reaching a conclusion about the industry's attractiveness, this paper will evaluate the financing options available to Taseko and provide a recommendation to Taseko on which financing option to take based on its internal capabilities as well as external factors.

Chapter 2 provides an overview of Taseko and its current operations and projects. It will discuss Taseko's current strategic position, financial and operational performance and the various issues and challenges it faces. Chapter 3 will discuss the properties of niobium, industry applications and substitutes. Chapter 4 provides a comprehensive niobium industry analysis, including a description of the industry, its value chain, competitive structure and the sources of advantage in the industry. This paper will use Michael Porter's (1979) Five Forces model to make a general industry assessment. In addition, a P.E.S.T. analysis will explore how external forces are affecting the Five Forces. A Sources of Advantage analysis will determine the factors that niobium projects, exploration companies and niobium miners could use to succeed in the industry. Finally, a S.W.O.T. analysis will provide a summary of implications of the industry analysis to Taseko and Aley. Chapter 5 outlines the options available to Taseko for financing the advancement of Aley and the comparative feasibility of such options. Based on the findings of the previous chapters, Chapter 6 will state conclusions and offer recommendations as to how Taseko should proceed with the Aley Project.

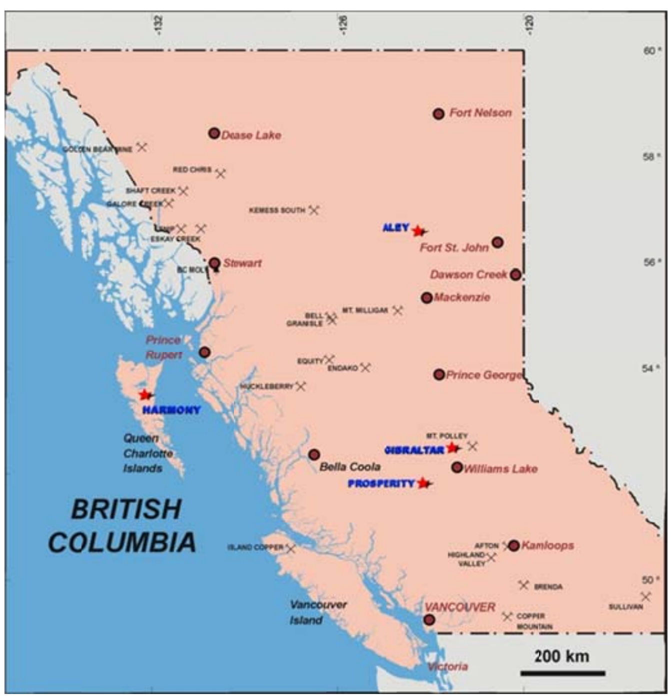
2: <u>BACKGROUND</u>

This chapter will discuss Taseko's current strategic position, financial and operational performance and the various issues and challenges it currently faces. The discussion provides context on how entering the niobium industry fits into the Company's growth strategy. In addition, this section also identifies Taseko's internal capabilities as an explorer, developer and operator of mining projects.

2.1 Taseko Mines Limited

Taseko is a Canadian mid-tier, BC-based public mining company trading on the Toronto Stock Exchange (TSX: TKO) and the NYSE MKT (NYSE MKT: TGB) with a market capitalization of $381 million as of June 30, 2013. Taseko is currently owns (75%) and operates Gibraltar Mine, which is located near Williams Lake, BC. In addition to Gibraltar, Taseko also has the New Prosperity Project, also located near Williams Lake, which is in the permitting stage; the Aley Niobium Project located in northern BC, which is in the advanced exploration stage; and the Harmony Gold Project located in the Queen Charlotte Islands (Haida Gwaii), BC, in the exploration stage. Figure 1 below shows the location of Taseko's four projects in BC:

Figure 1: Location of the Taseko's Mineral Properties



Source: Taseko 2012 Annual Information Form (2013)

The following discussion of Taseko's mining projects will provide background information on the projects. In addition, it will indicate where each project fits into Taseko's growth strategy and the key competencies Taseko has developed as operator or developer of the projects.

2.1.1 The Gibraltar Copper-Molybdenum Mine

Gibraltar produces copper primarily in the form of copper concentrate. It also produces molybdenum and silver as a by-product. It is the second largest open-pit mine in Canada. Copper concentrate come from copper bearing ores that are grinded and crushed followed by a flotation milling process at Gibraltar. After milling, Taseko sells the concentrate, which is around 30% copper, to copper smelters, which smelt, and refine the concentrate into refined copper.

Gibraltar currently sells its product at market prices based on the London Metal Exchange ("LME") to commodities trading companies or smelters. These companies buy the concentrate and either sell it to the smelters and refiners or process the concentrates themselves if they are vertically integrated. The industry frequently refers to these companies as "offtakers" since the miner and the offtaker sign an "Offtake Agreement".

Gibraltar commenced production in 1972. Due to lower copper grades, the Gibraltar mine is a "swing" producer. Swing copper producers enter when copper prices are high and exit when prices are low. For example, Gibraltar suspended mining and milling operations in 1993 and 1998 due to low copper prices.

In July 21, 1999, Taseko purchased the Gibraltar mine assets, including all mineral interests, mining and processing equipment and facilities. From 1999 to 2004, Gibraltar was on a "care and maintenance" program while Taseko geologists and engineers conducted exploration to evaluate Gibraltar's copper reserve and resources. The mine re-opened in October 2004 based on a 12-year mine plan that ends in 2016.

Gibraltar became an unincorporated joint venture between Taseko and Cariboo Copper Corp. ("Cariboo"), a Japanese consortium that includes Sojitz Corporation, Dowa Mining Co. Ltd. and Furukawa Co. Ltd. on March 31, 2010. The Company and Cariboo hold 75% and 25% beneficial interests in the Joint Venture, respectively. Cariboo paid Taseko $187 million to acquire a 25% beneficial interest in Gibraltar.

Since the re-start in 2004, Taseko pursued further exploration resulting in an estimate of 801.6 million tonnes ("Mt") of total proven and probable reserves as of March 31, 2011. Based on the additional reserves, Taseko increased Gibraltar's mine life expectancy, from 2016 to 2037.

To mine the expanded ore reserves and to mill the additional ore, a phased expansion of Gibraltar has been underway since 2007. The phased expansions included the expansion of Gibraltar's mining fleet of haul trucks, drills and shovels as well as mill infrastructure improvements to increase mill/concentrator throughput and lower operating costs.

The Company completed the Gibraltar Development Plan 1 ("GDP1") concentrator construction in February 2008 at a capital cost of $76 million. It increased the mill's processing capacity form 36,000 tonnes per day ("tpd") to 46,000 tpd. Following GDP 1, the Company completed Gibraltar Development Plan 2 ("GDP2") in 2011 at a cost of $224 million to increase the concentrator throughput from 46,000 tpd to 55,000 tpd.

Gibraltar Development Plan 3 ("GDP3") commenced in 2011. GDP3 included the construction of a new 30,000-tpd concentrator to complement the existing 55,000-tpd facility and the construction of a new molybdenum recovery facility, which will service both Gibraltar concentrators. The construction of GDP3 continued in 2012 and commissioning commenced in Q1 2013. Taseko was able to complete GDP3 on time and on budget at a total cost of approximately $325 million. The Company expects to complete ramp-up of the new concentrator to design capacity in Q3 2013. Because of the GDP3 expansion, the Gibraltar workforce increased from 481 employees at the end of 2011 to 612 employees as of December 31, 2012.

As Taseko's only operating mine, Gibraltar is the sole source of operating cash flow for the Company. As demonstrated above, Taseko has demonstrated the following key competencies as operator of Gibraltar:

- Ability to recognize an undervalued mining asset, expand its resources through exploration, and make it profitable;
- Ability to successfully operate a mine;
- Ability to build the infrastructure necessary to expand capacity and production; and
- Ability to attract new investors to invest in Taseko's mining assets.

2.1.2 The New Prosperity Copper-Gold Project

The New Prosperity Project is located approximately 125 kilometres southwest of the City of Williams Lake, BC. The project is 100% owned by Taseko and is not subject to any royalties or carried interest. Exploration of the large copper-gold deposits began in the 1930's. In

1969, Taseko acquired the project for $28.7 million and has done extensive exploration to advance the project towards commercial production.

From 1969 to 1997, Taseko drilled a total of 154,631 metres in 452 holes on the New Prosperity Project. As Taseko turned its attention to re-starting Gibraltar, it deferred exploration work on New Prosperity from 2000-2005. As copper prices steadily increased, the Company restarted exploration on New Prosperity in late 2005. Taseko completed a pre-feasibility study in the first quarter of fiscal 2007, and a full feasibility study in September 2007.

The years of exploration, engineering, metallurgical and environmental studies costing approximately $47 million culminated in the release of the National Instrument 43-101 ("NI 43-101") compliant technical report in 2009. The report indicated proven and probable reserves of 831 million tonnes grading 0.23% copper and .41 grams/tonne ("g/t") gold translating into 7.7 million ounces recoverable gold and 3.6 billion lbs. recoverable copper making it the 7th largest undeveloped copper-gold reserve in the world.

The proposed mine plan utilizes a large-scale conventional truck shovel open-pit mining and milling operation similar to Gibraltar. The company plans to build a 70,000-tpd concentrator with annual production averaging 110 million lbs. copper and 234,000 ounces gold over the 33-year mine life. The Company estimates capital cost for New Prosperity to be at $1 billion.

After undergoing a provincial Environmental Assessment Office ("EAO") review, Taseko received the environmental assessment certificate for the New Prosperity project from the BC government on January 2010, based on the EAO's conclusion that the development of New Prosperity would not cause significant adverse environmental effects. The only environmental factor identified by the EAO was the likely adverse environmental effects on fish and fish habitat on Fish Lake. However, the EAO determined the impact on fish and fish habitat was justified because of the significant economic benefit New Prosperity would bring to BC and Canada (Taseko Mines Limited, 2011).

Following the provincial approval, a three-person panel review (the "Panel") conducted the federal environmental assessment process. After six weeks of public hearings in 2010, the Panel's findings were essentially consistent with the provincial assessment. However, according to Taseko's New Prosperity Project Description (2011, p. 2), the Panel had determined that development of the project would result in additional adverse environmental effects on:

- Fish and fish habitat in Fish Lake;
- Navigation;

- Use of the land and resources by First Nations for traditional purposes;
- Potential or established Aboriginal rights or title; and
- Cumulative effect on grizzly bear in combination with foreseeable projects, including logging and ranching.

Due to the above concerns, Canada's Minister of Environment announced in November 2010 that he would not grant Taseko the federal permits to proceed with the development of New Prosperity.

In response to the rejection, Taseko has revised its plan and has put forth a new design proposal, which adds construction costs and life-of-mine operating expenditures of approximately $300 million to the original design. The new plan outlines:

- Preservation of Fish Lake; and
- Taseko's commitment to working with Aboriginal representatives to ensure local benefit from the project through employment, contracting and education/training opportunities

On February 2011, the Company submitted a new project description with the above changes. On November 2011, the federal government announced that New Prosperity would undergo an environmental assessment by a review panel for the second time. New Prosperity is currently in the 30-day public hearing process that commenced in July 2013. Once the public hearings conclude, the Panel will have a maximum of 70 days to write and submit a report to the federal Minister of Environment. The Ministry of Environment will then have a maximum of 120 days to decide if it should grant the necessary permits for the project to proceed. Based on this schedule, Taseko expects a decision from the federal government in 2013.

As Taseko's next potential operating mine, New Prosperity is the Company's biggest potential source of near-term growth. Subject to federal government approval, the Company is planning to begin construction in 2015. Through its experience with New Prosperity, Taseko has demonstrated that it has the competencies to advance an exploration project to the feasibility and permitting stage.

2.1.3 The Harmony Gold Project

The Harmony project is located at the Queen Charlotte Islands (also known as Haida Gwaii) on the northwestern coast of BC. Taseko acquired the 100% owned project in 2001. It has measured and indicated resources of 64 million tonnes grading 1.53 g/t (of gold), containing approximately 3 million ounces of gold. Due to its focus on its other projects, Taseko has done minimal exploration on Harmony over the years.

2.1.4 The Aley Niobium Project

The Aley Project is located near Mackenzie, Northern BC. Taseko acquired 100% of Aley in 2007 through the acquisition of all the issued and outstanding shares of Aley Corporation, a private company that holds title to the Aley mineral claims.

Since acquisition, Taseko has incurred $22 million in exploration expenditures comprising of geological mapping and diamond drilling. In 2012, a NI 43-101 compliant technical report documented the establishment of a measured and indicated resource of 286 million tonnes grading 0.37% niobium pentoxide (“Nb^2O^5”). This resource estimate translates into 739 million kilograms (“kg”) of niobium with an estimated production of 12 million lbs. of niobium annually for twenty years. Simpson’s technical report (2012, p. 9) had the following conclusions:

- The geology is sufficiently well understood to support the mineral resource estimation presented in this report and summarized in the section above.
- Core drilling has identified a continuous body of near-surface niobium mineralization.
- Average grades for all the drill assays returned from the Central Zone as of the report effective date were 0.32% Nb^2O^5.
- As of March 1, 2012, the Aley deposit is estimated to contain a measured and indicated resource of 286 million tonnes grading 0.37% Nb^2O^5. An additional 144 million tonnes averaging 0.32% Nb^2O^5 is classified as inferred

Based on the above findings, the report warrants additional exploration and engineering work to define the extent of the niobium mineralization, to upgrade the resource classification to reserves and to follow up on other targets on the property. In addition, the report recommends the continuation of metallurgical test work designed to support a pre-feasibility study. Following these recommendations, Taseko’s current focus on Aley is upgrading the resources announced in March 2012 to a NI 43-101 compliant reserve.

Aley could potentially be the Company’s source of long-term growth. Taseko could leverage on the key competencies it gained from Gibraltar and New Prosperity in advancing Aley towards production. The next section will further discuss Taseko’s growth strategy.

2.2 Taseko's Current Strategic Position

2.2.1 Taseko's Current Strategy

With $254 million in revenue in 2012, the Business in Vancouver Magazine (2013) ranked Taseko the 14th largest mining company in BC in 2012 (See Appendix A). As mentioned in Chapter 1, Taseko's goal is to build value through operating and developing major mining projects and become a multi-mine operator in BC. Taseko believes that having multi-mine operations in BC will lessen the Company's reliance on its single operating asset, Gibraltar. Analysts identify Taseko's reliance on only one mine as a key risk factor, since Taseko's cash flow is dependent on the production and operating costs of Gibraltar.

Taseko focusses on BC since it is a low-risk, politically stable, mining-friendly and low taxation jurisdiction. In addition, Taseko can take advantage of infrastructure synergies by having mining operations in one jurisdiction.

According to Taseko's February 2013 Corporate Presentation (2013), Taseko has the following growth strategy:

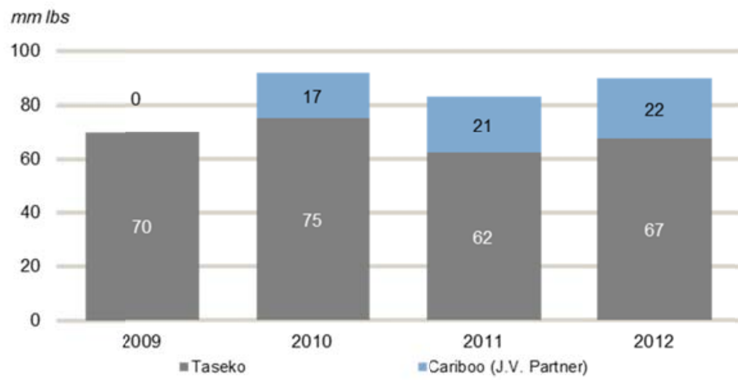
- Be a low-cost copper producer at Gibraltar and generate excess cash flow for developing other projects; and
- Achieve growth through its current project pipeline, instead of acquisitions.

2.2.2 Taseko's Current Performance

After outlining Taseko's growth strategy, the next step is to assess the Company's current performance.

***Copper Production*:** Despite the completion of GDP2 in 2011, Gibraltar's copper production in 2012 was 89.8 million lbs., an increase of only 8% compared to the prior year production of 82.9 million lbs. as shown in Figure 2.

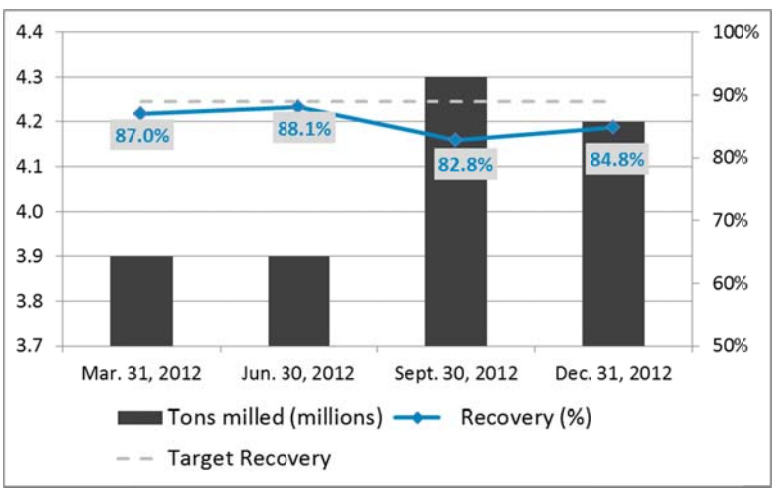
Figure 2: Gibraltar's Copper Production (2009 – 2012)



Source: Taseko Company Presentation (2013)

Production results for 2012 were slightly below expectations since the Company only achieved GDP2's designed milling capacity in the latter part of 2012 as shown in Figure 3. Mill availability was lower than planned, in large part due to significant planned downtime associated with GDP3 tie-ins and construction activities in 2012.

Figure 3: Copper Tons Milled at Gibraltar (Q1 – Q4 2012)



Source: Taseko Company Q4 2012 Earning Release Presentation (2013)

Copper Sales/Revenue**:** The below-than-expected production in Gibraltar resulted in relatively constant copper revenues for 2012 compared to 2011 as illustrated by Figure 4 due to a slight 9% increase in copper sales volumes (2012: 66 million lbs. vs. 2011: 61 million lbs. (75% share of Gibraltar sales) being offset by a 7% decrease in average realized copper prices.

Figure 4: Taseko Revenue (2009- 2012)

Source: Taseko Company Presentation (2013)

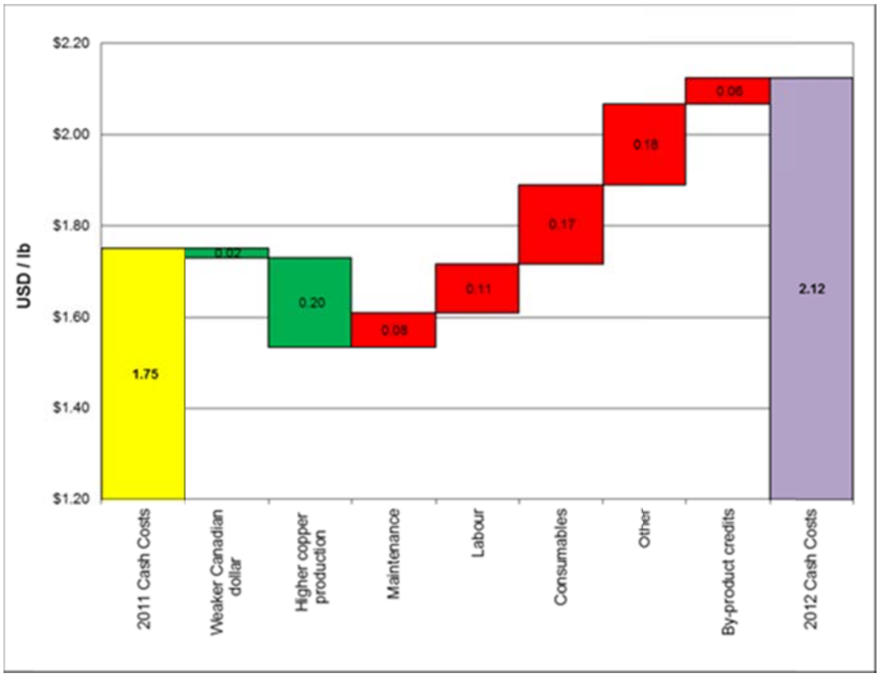
Average realized copper price of US$3.61 per pound for 2012 compared to US$3.89 per pound in 2011. As demonstrated by Figure 5 below, copper markets demonstrated significant volatility since the financial crisis of 2008/2009. Record average prices for 2011 overall combined with significant declines in the last four months of 2011 evidenced the volatility. Copper prices had not significantly recovered in 2012 resulting in the lower realized copper prices in that year. In Q2 2013, copper had one of its worst performing quarters since late 2011 as prices fell to approximately US$3.00 per lb. A key factor in the current copper price decline was concern over the US reducing its quantitative easing due to signs of a recovering economy and the cutting of Chinese growth forecasts for the second half of 2013 as interbank borrowing costs climbed to a record high (Taseko Mines Limited, 2013, p. 6).

Figure 5: Five-Year Spot Copper Prices (USD per lb.)

Source: Kitco Base Metals (2013)

Production Costs: In 2012, net operating cash costs per lb. of copper produced averaged US$2.12, a 21% increase over the US$1.75 averaged during 2011. Figure 6 shows the factors contributing to the increase:

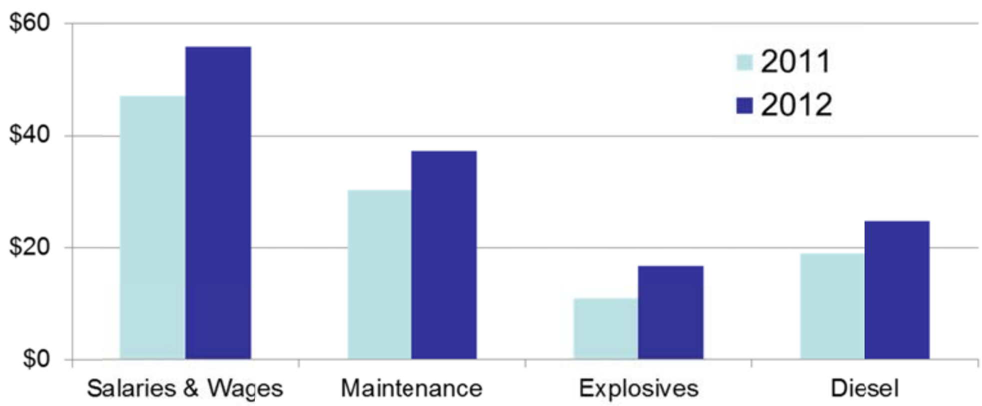
Figure 6: Gibraltar Net Operating Cash Costs of Production per lb. of Copper (2011 compared to 2012)



Source: Taseko YE 2012 Management Discussion and Analysis (2013)

The increase in net operating cash cost in 2012 was primarily attributable to increased mining costs of $80.2 million in 2012 compared to $53.8 million in 2011. This variance of $26.5 million equates to US$0.24 per lb. more than 2011. Figure 7 shows the cost drivers contributing to the unfavourable variance:

Figure 7: Gibraltar Production Cost Variance 2011 vs. 2012

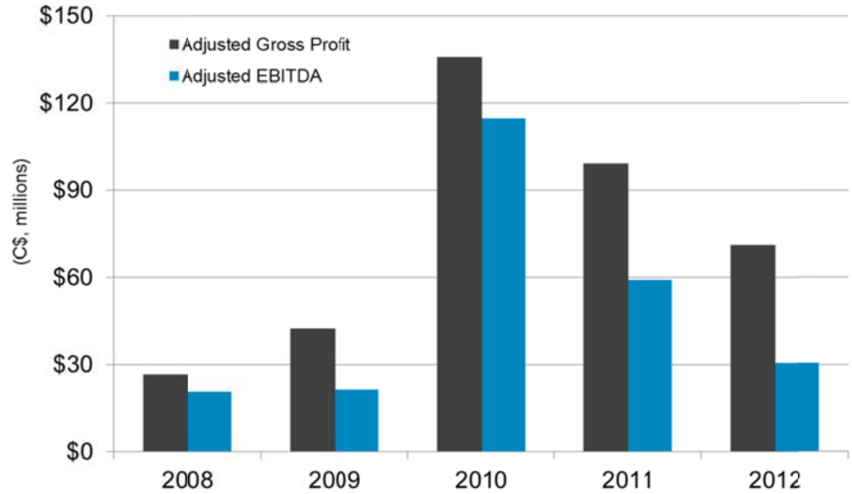


Source: Taseko Company Q4 2012 Earnings Release Presentation (2013)

The increase in costs is due in part to the preparation of the mine to satisfy the expanded mill requirements in 2013 (Taseko Mines Limited, 2013). Increased headcount required for GDP3 start-up affected the labour costs for both mining and milling. The workforce increased from 481 employees at the end of 2011 to 612 employees on December 31, 2012. Total labour costs increased from $47.1 million in 2011 to $55.9 million in 2012. This increase is largely attributable to the training requirements in preparation for the GDP3 start-up. Higher explosive costs in 2012 relate to an increase in powder factor utilized in order to improve throughput in the mill. Higher diesel costs in 2012 relate to longer truck haul requirements during the year.

Profitability: Lower than expected copper production and sales in 2012, coupled with the decrease in the market price of copper and increase in production costs resulted in a decrease in adjusted gross profit and adjusted EBITDA in 2011 compared to 2012 shown in Figure 8 below:

Figure 8: Taseko Adjusted Gross Profit and Adjusted EBITDA (2009-2012)



Source: Taseko Company Presentation (2013)

***Share Price/Market Capitalization*:** Due to the decrease in profitability above as well as general macroeconomic conditions such as the lingering global economic uncertainty and the depressed price of copper, Taseko's share price have decreased from highs of $3.48 in the beginning of 2013 to the low $2.00 range in August 2013.

Figure 9: Taseko Share Price – One-Year Performance (Aug 2012 to Aug 2013)

Source: Yahoo Finance (2013)

Based on the performance analysis above, Taseko's growth strategy is highly vulnerable, owing to its dependence on the performance of the Gibraltar Mine and the volatile price of copper. The cash flows necessary to fund its project pipeline is contingent upon the success of the GDP3 ramp-up and an improvement in copper prices.

Therefore, it is necessary to consider other funding options for the advancement of the Aley Project. Before considering the options available and evaluating the alternatives, this paper will first evaluate the attractiveness of the niobium industry. The next chapter will discuss niobium's properties, characteristics and applications. After that discussion, this paper will perform a comprehensive industry analysis of the niobium industry.

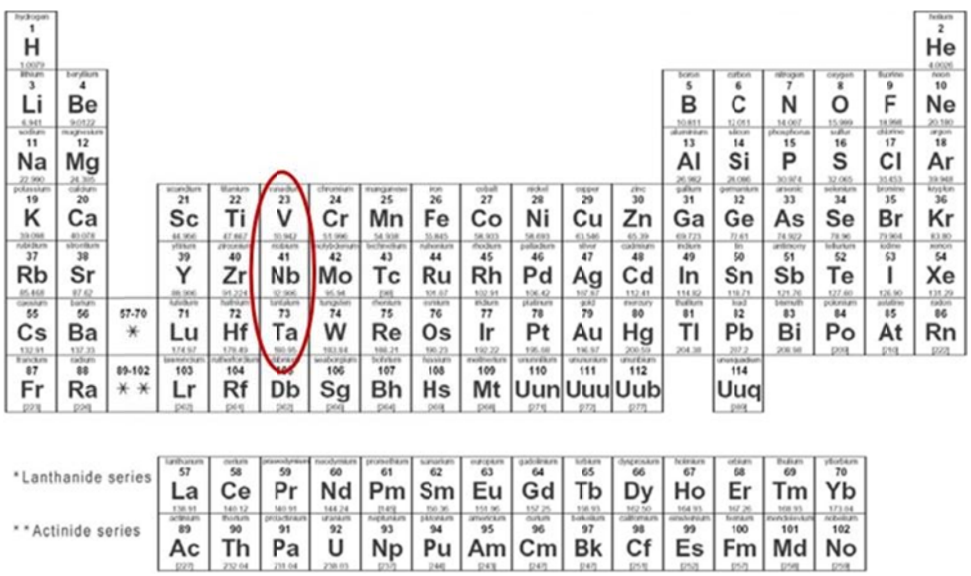
3: <u>WHAT IS NIOBIUM?</u>

This chapter will discuss niobium's unique properties as the first step in assessing the attractiveness of the niobium industry. It will discuss its mineralogy, applications and potential substitutes.

3.1 Mineralogy

Niobium is a soft, relatively light, transition metal with the symbol Nb and the atomic number 41. Figure 10 shows where niobium is in the periodic table. It is grey, metallic and bluish when oxidized as shown in Figure 11. The English chemist Charles Hatchett discovered it in 1801. He originally named the element "columbium," in honour of Christopher Columbus. In 1950, its name changed to "niobium" in honour of Niobe, a figure in Greek mythology whose father was Tantalus (for whom the element tantalum (Ta) is named due to niobium's similar physical and chemical properties (SinoLatin Capital, 2010).

Figure 10: Niobium in the Periodic Table



Source: SinoLatin Capital (2010)

Figure 11: Niobium in Metal Form

Source: Wikipedia (2013)

Despite presenting a high melting point (2,468 °C), it has a low density in comparison to other refractory metals (IAMGOLD, 2012). Furthermore, it is corrosion-resistant and exhibits superconductivity properties. Having a high melting point makes it a good conductor of heat and electricity. Its low density makes it lightweight and easy to fabricate but also strong and durable. These properties make it optimal for the applications discussed below.

Niobium does not occur naturally as a free metal. Niobium pentoxide is the main precursor to all materials made of niobium (Wikipedia, 2013). It is the inorganic compound with the formula Nb^2O^5. It occurs in the minerals pyrochlore and columbite. Pyrochlore is mined primarily for its niobium content. Miners mine columbite primarily for tantalum with niobium extracted as a by-product. In the Aley deposit, niobium occurs in pyrochlore as crystals precipitated from the carbonatite magmas (Simpson, 2012).

Brazil and Canada primarily has the majority of world's niobium deposits. According to the U.S. Geological Survey's ("USGS") 2013 Mineral Commodity Summary on niobium (2013), two countries have 4.1 million tonnes and 200,000 tonnes of niobium reserves respectively. Niobium ore grade at deposits mined in 2012 ranged from 0.55% Nb^2O^5 in Canada to 3% Nb^2O^5 in Brazil (Papp, 2012). The Nb^2O^5 grade in pyrochlore ores determines the content of niobium. For example, a tonne of ore (1,000 kg) of 3% Nb^2O^5 grade will have 30 kg of niobium.

3.2 Industrial Applications

Due to its properties, niobium is used in making high-strength low-alloy steel ("HSLA") required in the manufacture of automobiles, bridges, pipes, jet turbines and other high technology applications.

An alloy means a metal made by combining two or more metallic elements. Low-alloy steels are harder and have better mechanical properties. In addition, it is also more corrosion resistant under certain environmental conditions. HSLAs also have a lower carbon content, which increases the weldability and formability of the steel while maintaining its strength (Wikipedia, 2013).

Table 1 list the four main types of niobium products, percentage of the niobium market, applications and principal markets.

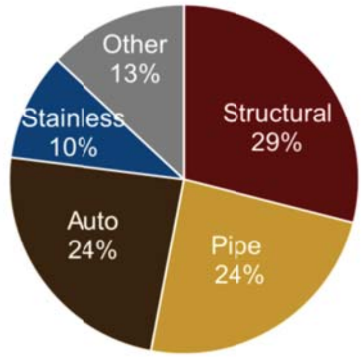
Table 1: Niobium Products

Product	**% of Market**	**Applications**	**Principal Markets**
Standard-Grade Ferroniobium (Iron-niobium alloy) (FeNb) ~60% Nb content	90.2%	• High strength low alloy steel (HSLA) • Stainless steel • Heat-resistant steels	• Automotive industry • Structural (Heavy engineering and infrastructure) • Oil and gas pipeline • Stainless steel
Vacuum Grade Ferroniobium (VG FeNb) 99% Nb content	3.0%	• Super alloys	• Aircraft engines • Power generation • Petrochemical sector
Niobium Metals and Alloys ~50-65% Nb content	3.4%	• Superconductors	• Particle accelerators • Magnetic resonance imaging • Various small-tonnage uses
Niobium Chemicals >99% Nb content	3.4%	• Functional ceramic • Catalysts	• Optical

Source: IAMGOLD (2012)

Since 90% of the niobium market is FeNb, this paper will refer to the niobium industry as the FeNb industry going forward. Figure 12 shows the FeNb consumption by principal markets.

Figure 12: FeNb Consumption by Principal Market



Source: IAMGOLD (2012)

HSLA has the following applications:

Infrastructure (29%): Since HLSA steel with FeNb is lighter but stronger, it is ideal for modern infrastructure such as bridges and buildings. According to IAMGOLD (2012, p. 4), engineers built the Millau Valley Bridge in southern France using steel with 0.025% niobium. This reduced the weight of the steel and concrete by 60%. Another example is the Øresund Bridge connecting Sweden and Denmark, which engineers built with steel containing .022% niobium. This reduced the weight of the bridge by 15Kt and saved US$25 million in construction costs (IAMGOLD, 2012, p. 4).

Automobiles (24%)**:** HLSA steel with FeNb reduces the weight of the car, which in turn lowers fuel consumption reduces and carbon dioxide (“CO^2”) emissions. According to IAMGOLD (2012, p. 4), US$9 of Nb per car leads to a 100kg weight reduction and on-going fuel savings of 1 litre per 200km, yielding a reduction of 2.2 tonnes of CO^2 per vehicle, which is greater than the total amount of CO^2 created during the production of all the steel required for the vehicle.

Oil and Gas Pipelines (24%)**:** HSLA steel pipes with FeNb used in transporting oil and gas have greater toughness and resiliency to withstand high pressure and prevent fractures.

Other Applications**: (23%):** Because of newer designs requiring stronger and lighter steel, HSLA steels containing FeNb is also used in shipbuilding, aeronautics, communication, medical and defence industries.

Due to the need of the above industries for FeNb, the Defense Logistics Agency of the United States has classified niobium as a strategic mineral since the 1950s. A strategic mineral refers to mineral ore and derivative products that come largely or entirely from foreign sources are difficult to replace, and important to a nation’s economy, in particular to its defence industry

(Crockett & Sutphin, 1993, p. 2). Since the US does not mine niobium, the various niobium materials, including FeNb, are included in the National Defence Stockpile.

3.3 Substitutes

According to USGS (2013), the following materials can be substitutes for niobium, but a performance or cost penalty may ensue:

- Molybdenum or vanadium, as alloying elements in high-strength low-alloy steels;
- Tantalum or titanium, as alloying elements in stainless and high-strength steels; and
- Tungsten, molybdenum, tantalum, or ceramics are substitutes for high-temperature applications.

Due to its unique properties, niobium in the form of FeNb has been an important ingredient in the manufacture of HSLA. In addition, its substitutes do not as pose a significant competitive threat since the substitutes cannot match the value that FeNb brings to HSLA. These two factors are the first indication that the FeNb could be an attractive industry. The next chapter will examine the FeNb industry in further detail.

4: INDUSTRY ANALYSIS

This chapter will evaluate Taseko's assumptions on the attractiveness of the FeNb industry. It will tackle the following questions in order to assess the industry's attractiveness: What is the FeNb industry and what is its value chain? Is there adequate future demand for FeNb? What is the competitive landscape of the industry? What is the intensity of the competitive forces prevalent in the industry? What effect do external factors have on those competitive forces? What sources of advantage drive success in the industry? What are strengths and opportunities Taseko/Aley can capitalize on and the weaknesses and threats it needs to mitigate in order to succeed in the industry? The following subsections will answer these questions.

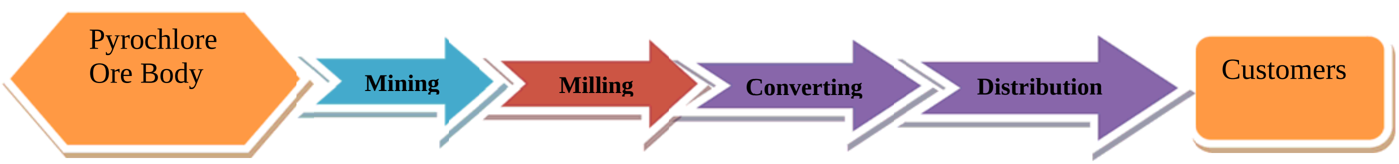
4.1 Industry Definition

The FeNb industry is defined as the extraction and processing of niobium-bearing ores for the purpose of producing and selling to FeNb.

4.2 Industry Value Chain Analysis

The industry value chain incorporates the mining of pyrochlore ore, milling the ore into pyrochlore concentrate, converting the pyrochlore concentrate into FeNb, and selling it to customers. Figure 13 illustrates this process:

Figure 13: The FeNb Industry Supply Chain



Source: Author

In the following subsections, this paper will describe each stage in more detail and identify key inputs to facilitate the analysis of supplier power in section 4.5.4.

4.2.1 Mining

There are two main types of mining methods used to mine pyrochlore ore: open-pit is the prevalent method in Brazil while the Niobec mine in Canada uses underground mining. The geological characteristics and size of the pyrochlore ore body will determine which mining method is most economically feasible. The Aley deposit will be an open-pit mine.

Figure 14: Open-Pit Mining vs. Underground Mining

Open-Pit Mine (CBMM, 2013)

Underground Mine (IAMGOLD, 2013)

Major inputs for the open-pit mining process include:

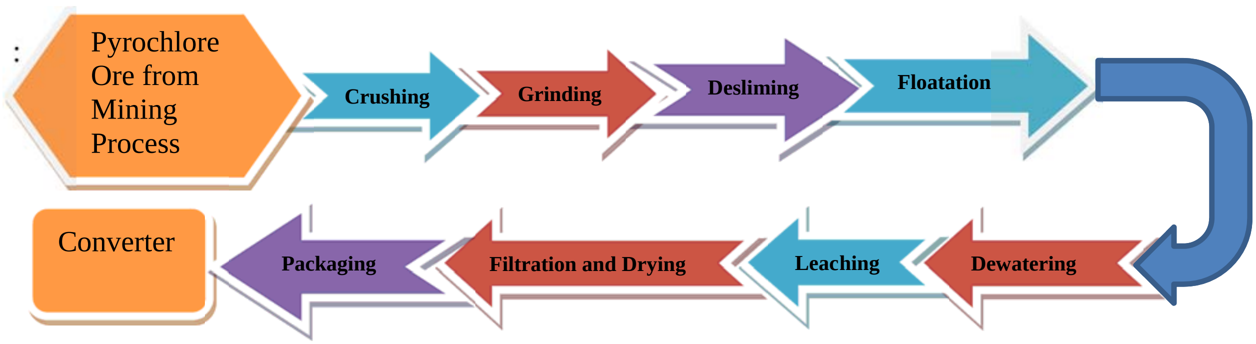
- Explosives to blast the ore body into smaller pieces;
- Mobile mining equipment, such as backhoes and shovels, that scoop the ore and haul trucks that transport the ore;
- Electricity that runs the shovels and diesel that runs the haul trucks;
- Tires for haul trucks;
- Labour that operates the mining equipment; and
- Other parts needed to maintain the mining equipment.

The underground mining process has similar inputs with the exception of the shovel. Instead of shovels, planting explosives in the ore body requires more drills and hauling the blasted ore onto haul trucks requires more loaders.

4.2.2 Milling

The milling process begins after the haul trucks dump the ore into the crusher. Milling encompasses the following process as illustrated by Figure 15:

Figure 15: The Milling Process



Source: Prepared by Author Based on Information from Roscoe Postle Associates, Inc. (2011)

The crusher crushes the pyrochlore ore into smaller pieces. After crushing, the ore travels via conveyor belt to the mill, where ball and rod mills grind the ore into finer material. After grinding, the desliming circuit removes material small particles before floatation. After desliming, the magnetic separation and floatation separates the pyrochlore content from the grinded ore. The ore mixes with water and other chemical agents and goes through floatation cells causing the pyrochlore content to "float." Froth forms into slurry that proceeds to the dewatering process. In the dewatering process, fresh water first dilutes the slurry to 30% solids, and then the slurry is pumped to the dewatering cyclones to remove moisture. After dewatering, the thickened slurry at 60% solids goes to leaching tanks with concentrated hydrochloric acid. After leaching, the leached product goes to the belt filter to remove more water. After filtering, the final pyrochlore concentrate goes to a propane counter current dryer where moisture is reduced to less than 0.1%. After drying, an automated packing and handling system packs the concentrate into big bags for delivery to the converter.

Major inputs for the milling process include:

- Milling equipment: the crusher, the conveyor belts, ball mills, floatation cells;
- Electricity and natural gas to run the mill;
- Labour to run the mill;
- Chemical reagents needed for the floatation process; and
- Grinding media (steel balls and rods for grinding mills).

4.2.3 Converting

An aluminothermic reaction completes the conversion of pyrochlore concentrate into FeNb. The process involves a reaction between niobium oxide (in the pyrochlore concentrate), metallic aluminum and iron oxide to produce aluminum oxide (slag), and metallic ferroniobium (IAMGOLD, 2013).

Each element in the reaction needs to be precise to obtain the desired quantity of niobium in the FeNb. The combination of these ingredients produces a powerful exothermic chemical reaction that generates enough heat to raise the temperature above 2,200°C, melting the ingredients in less than ten minutes (IAMGOLD, 2013). The iron will combine with the niobium, producing FeNb ingots. Aside from the pyrochlore concentrate, inputs in this process include aluminum flakes and chops, quick lime, and sodium nitrate.

4.2.4 Transportation and Distribution

After packaging, the mines ship the FeNb by rail or truck to the nearest port and by ship to the steel mill specified by the customer. The mines notify the customer of the shipment and the mine responsible for the shipping and invoicing. Major inputs for the transportation and distribution process include rail, trucking and ocean freight fees.

The supply chain subsection above not only gives an idea of the processes involved in converting pyrochlore ore into FeNb. It also gives an idea on how cost advantage opportunities in each process.

4.3 Demand Analysis

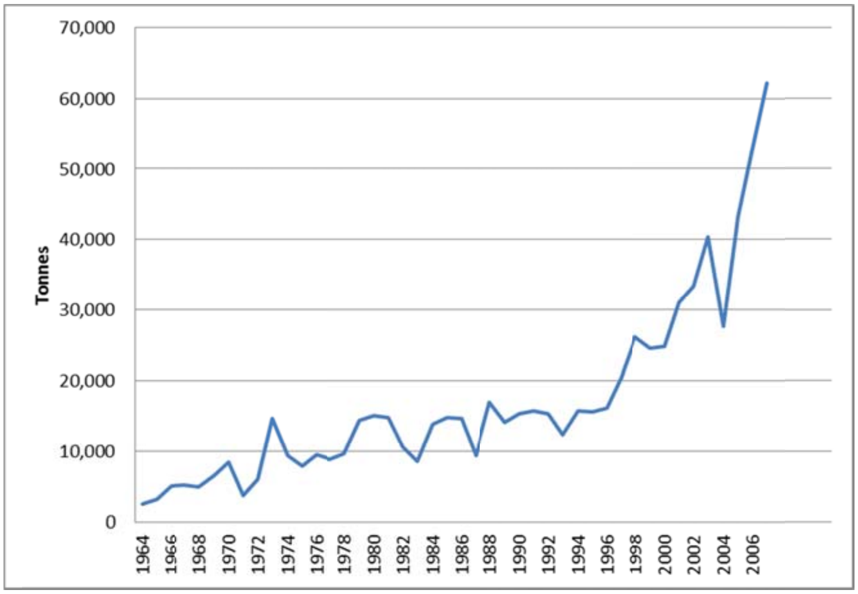
One of the most important factors of an industry’s attractiveness is the future demand for its products. The goal of the demand analysis performed in this section is to determine the FeNb demand’s future prospects. Is the future demand going to be high, moderate or low growth? The analysis will encompass a discussion of the FeNb demand’s historical growth, its geographical distribution, its demand drivers and its forecast demand growth.

4.3.1 Historical Growth

According to the Papp (2013), reshaping of niobium demand began in the 1960s with the discovery of the strengthening effect of small amounts of FeNb in steel, which eventually led to a widespread and growing use of FeNb in HSLA steel. As shown in Figure 16, the demand for FeNb rose from 2,500 tonnes in the mid-1960s to more than 60,000 tonnes in the mid-2000s

The dramatic increase in demand started in the 1990s as China increased its consumption and production of steel coinciding with the development of its infrastructure.

Figure 16: World Demand for FeNb

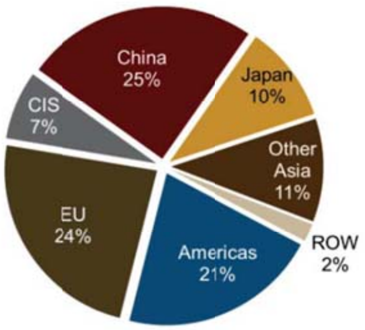


Source: Graph Prepared by Author Based on Data from USGS (2012)

4.3.2 Geographical Distribution of Demand

As shown in Figure 17 below, the largest consumers of FeNb are in China, North America and Europe. China is the world's fastest-growing market for FeNb and the main driver of the demand for FeNb due to the size of its steel industry and the rapid rate of expansion in output in recent years.

Figure 17: World Consumption of FeNb by Region



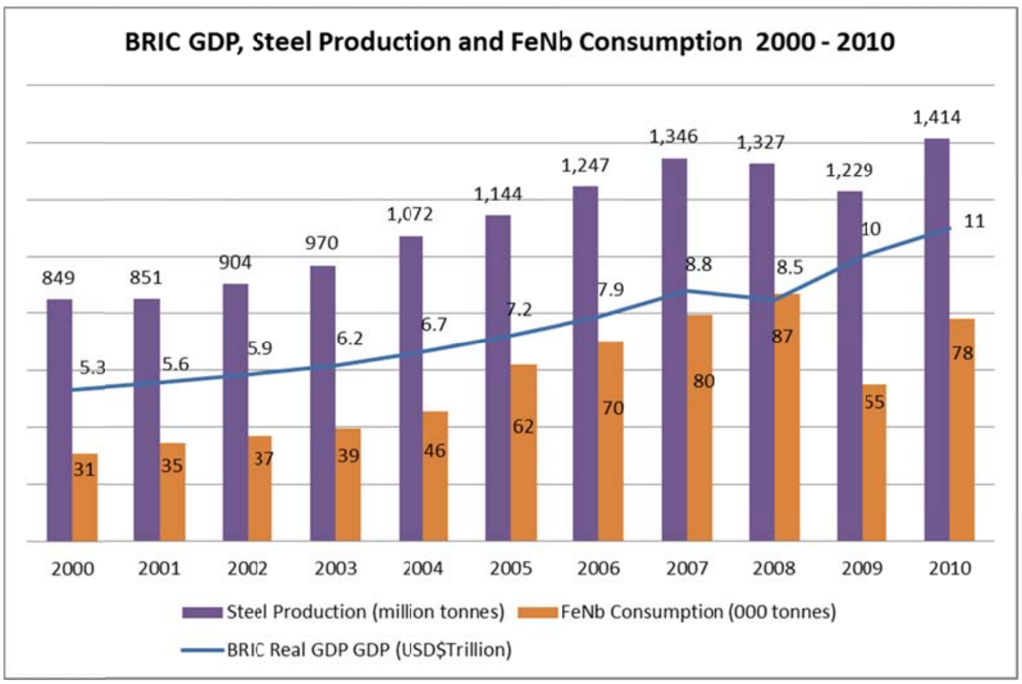
Source: IAMGOLD (2012)

4.3.3 Demand Drivers

According to IAMGOLD (2012), the FeNb demand has grown at a compound annual growth rate of 10%. Two factors drive the growth: 1) robust demand for steel, particularly among the "BRIC" countries and 2) growth in the amount of niobium being used to produce an increasingly higher grade of steel.

As the "BRIC" countries (Brazil, Russia, India and China) expanded their economies during the last decade, their demand for steel also increased. Infrastructure expansion and the production of consumer goods such as automobiles need steel. Figure 18 reflects the correlation between the BRIC's economic growth and steel consumption:

Figure 18: BRIC GDP, Steel Production and FeNb Consumption 2000-2010



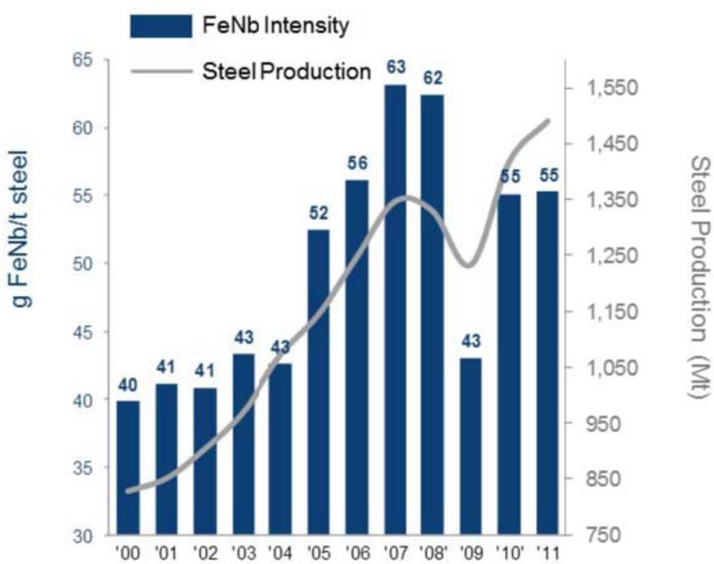
Source: Prepared by Author Based on Data from IAMGOLD (2012) and IMF (2013)

BRIC had an average 8% GDP growth per year from 2000 to 2010. In the same period, the world's steel production also grew by an average of 5% and FeNb consumption grew by 12%.

As GDP contracts, the BRIC's demand for steel and FeNb decreases. As demonstrated by Figure 18 above, the BRIC GDP growth staggered in 2008 due to the global financial crisis. Both steel production and FeNb consumption fell in the following year 2009. Due to the sustained Chinese demand and signs of global recovery from the crisis, steel production and FeNb consumption recovered in 2010.

Currently, 15% of all steel produced worldwide contains FeNb and may increase to 20% in the near future (Roskill Consulting Group Ltd., 2011). As the construction, automotive, oil and gas, and high technology industries demand higher quality lightweight steel, the steel mills have increased their usage of FeNb to meet the requirements of their customers. As Figure 19 illustrates, HSLA steel producers added 40 grams of FeNb per tonne to produce HSLA steel in 2000. By 2008, HSLA steel producers added 63 grams per tonne. Intensity of FeNb use dropped during the 2008/2009 economic crisis but showed signs of recovery in 2010.

Figure 19: FeNb Usage Intensity and Steel Production, 2000-2010



Source: IAMGOLD (2012)

According to the Papp (2012, p. 52.5), the global unit consumption of niobium per tonne of steel produced was 55 to 60 g, for highly developed countries, 100 g/t, and for China, 40 g/t. This data suggests significant potential for an increase of niobium consumption as the Chinese economy continues to develop.

4.3.4 Demand Growth Forecast

Based on the above demand drivers, industry analysts anticipate that the demand for FeNb will grow 12% over the next three years and 10% thereafter (Roskill Consulting Group Ltd., 2011). Based on the FeNb sales of approximately 100,000 tonnes in 2012, Table 2 outlines the demand forecast through 2020:

Table 2: Forecast Demand for FeNb (000s tonnes per year)

2012	2013	2014	2015	2016	2017	2018	2019	2020
100	113	127	143	157	173	190	209	230

Source: Roskill Consulting Group Ltd. (2011)

The demand projections stated above indicates the FeNb industry has the potential to become an attractive investment since there is a foreseeable growth in demand for FeNb. However, the supply side of the equation also needs to be analysed in order to assess industry prospects.

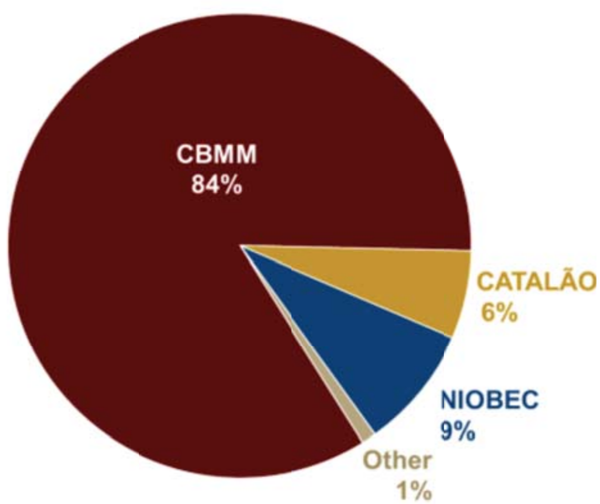
The next section will discuss the industry's competitive environment and structure, how it competes for the current demand as well as whether it has the capacity to meet future demand.

4.4 Industry Competitive Structure and Environment

This section will discuss the industry's competitive structure, the current competitors in the industry and their competitive behaviour.

Three mines currently supply 99% of the world's FeNb: Companhia Brasileira de Metalurgia e Mineração ("CBMM"), Catalão, owned by Anglo American PLC ("Anglo") in Brazil and the Niobec Mine operated by IAMGOLD Corporation ("IAMGOLD") in Quebec, Canada. Figure 20 shows their respective market shares.

Figure 20: FeNb Incumbent Producers Market Shares



Source: IAMGOLD (2012)

Since the FeNb industry currently has only three major players, the FeNb industry is an oligopolistic industry. More specifically, it is a Stackleberg Oligopoly for the following reasons:

- There are only three major FeNb producers serving many customers;
- FeNb is a homogenous product;
- With its 84% market dominance, CBMM acts as the leader who chooses an output and therefore sets the price of FeNb;
- Both Niobec and Catalão follow the price CBMM sets and choose outputs that maximize profits given CBMM's set price and output. They both accept CBMM's lead due to its market dominance and its initiative to promote the use of FeNb; and
- Barriers to entry exist in the form of the concentration of niobium reserves.

4.4.1 Major Producers

This section will discuss ownership structure, location of the mine, niobium reserves, mine type, current production capacity and performance the three major producers, CBMM, IAMGOLD and Anglo American. This discussion will give context not only to the competitive environment but also to the sources of cost advantage discussed, in section 4.7.

CBMM**:** With 84% of the market, CBMM is the largest producer of FeNb and other niobium-based products and is the only niobium producer present in all product segments. Moreira Salles Group of Brazil (a conglomerate also dominant in banking) owns 70% of this private company. In 2011, CBMM sold a 15% stake in CBMM for US$1.95 billion to a Japanese and Korean steel consortium. The Consortium is composed of six companies:

- Four Japanese companies: JFE Steel Corporation, Nippon Steel Corporation, Sojitz Corporation, and Japan Oil, Gas and Metals National Corporation; and,
- Two Korean companies: POSCO, and National Pension Service.

In August 2011, CBMM announced the sale of another 15% stake for US$1.9 billion to a Chinese consortium comprising:

- China's CITIC Bank; and
- A group of steelmakers – Baoshan Iron & Steel., Shougang Corp., Anshon Iron & Steel Group Corp. and Taiyuan Iron & Steel Group Co.

CBMM's mine is located in Araxá, in the state of Minas Gerais, Brazil. It mines pyrochlore ore from the Barreiro carbonatite complex, which is the largest pyrochlore deposit in the world. In addition, it is also has the highest $Nb^{2}O^{5}$ grade at 2.5% According to IAMGOLD (2012), its reserves are sufficient for at least 400 years at current production rates. Table 3 outlines the CBMM's niobium reserves and grades.

Table 3: CBMM's Niobium Reserves

	Tonnes (Mt)	Grade % $Nb^{2}O^{5}$
Weathered Rock	829	2.50%
Hard Rock	936	1.57%
	1,765	

Source: Roskill Consulting Group Ltd. (2011)

CBMM's mine has been operational since 1961. It currently mines the "weathered rock" reserve referred to in Table 3 using the open-pit mining technique. Since the weathered rock is softer due to weathering, mining the ore only requires backhoe shovels, trucks, and requires no blasting or heavy equipment. This process is cost-efficient compared to other operations.

Since CBMM is a private company, limited data regarding its operations and profitability is publicly available. Its current FeNb production capacity is 120,000 tonnes per year ("tpy'). CBMM has undergone several expansions over the years to meet the demand for FeNb from the initial 22,000 tpy to the current 120,000-tpy capacity. CBMM is planning another expansion to 150,000 tpy for completion by 2014/2015. Due to continued expansion of the concentrator and converter, CBMM's facilities are the most advanced.

***IAMGOLD*:** The Niobec Mine, wholly owned by IAMGOLD, has been operational since 1976 and is comprised of an underground mine with a concentrator and a converter. It is located in Chicoutimi, Quebec, and is the only non-Brazilian major FeNb producer. It mines pyrochlore ore from the Saint-Honoré carbonatite complex, which has the niobium reserve and resources shown in Table 4:

Table 4: Niobec's Niobium Reserves and Resources

As at December 31, 2012	Tonnes (Mt)	Grade % Nb^2O^5	Contained Nb^2O^5 (million kilograms)
Proven and Probable reserves	423	0.42%	1,768
Measured resources	292	0.44%	1,271
Indicated resources	344	0.38%	1,292
Measured and indicated resources	636	0.41%	2,563
Inferred resources	84	0.31%	263

Source: IAMGOLD Annual Report (2013)

According to IAMGOLD's 2012 annual report (2013), Niobec produced 4,707 tonnes of FeNb in 2012 compared to 4,632 tonnes in 2011. IAMGOLD's operating margin per kg of FeNb sold was $15 in both 2012 and 2011, which translates to $70.6 million and $69.5 million in operating margin in 2012 and 2011 respectively. IAMGOLD's earning from Niobec was $52.2 million and $46.9 million in 2012 and 2011, respectively.

IAMGOLD expects Niobec mine's production for 2013 to be between 4,700 tonnes and 5,100 tonnes with an operating margin ranging between $15 and $17 per kilogram. Niobec is also undergoing an $80 million expansion in 2013 that includes the completion of the feasibility study of converting Niobec into an open-pit mine to extend Niobec's mine life from the current 16 years to 46 years and increase its FeNb production capacity to 15,000 tpy.

Anglo American: Anglo wholly owns the Catalão Mine. It is located in Catalão, state of Goiás, Brazil. It has been operational since 1973 with three open-pit mines, a concentrator and a converter. It mines pyrochlore ore from the Catalão carbonatite complex, which has the niobium reserve and resources described in Table 5:

Table 5: Catalão's Niobium Reserves and Resources

As at December 31, 2012	Tonnes (Mt)	Grade % Nb ${}^{2}O^{5}$	Contained Nb ${}^{2}O^{5}$ (kt)
Proven and Probable reserves	5.9	1.03	54
Measured resources	2.6	1.29	34
Indicated resources	0.8	1.02	8
Measured and indicated resources	3.4	1.22	42
Inferred resources	0.9	0.83	7

Source: Anglo American Fact Book 2012/2013 (2013)

Catalão produced 4,400 tonnes of FeNb in 2012 compared with 3,900 tonnes in 2011. Anglo's earnings from Catalão were $47 million and $33 million in 2012 and 2011 respectively. (Anglo American PLC, 2013)

Anglo expects Catalão's production to decline in 2013 owing to lower grades and recoveries. Catalão extracts lower-quality ore with higher levels of contaminants as the mine approaches the end of the weathered ore (Anglo American PLC, 2013). To counter this trend, Anglo embarked on Boa Vista Fresh Rock project in 2012 that aims to adapt the existing plant to process fresh rock instead of weathered ore, which can lead to an increase in production capacity to approximately 6,500 tpy.

From the discussion above, all three producers are gearing up to increase output and FeNb production capacity to meet the forecast for increase in demand, as discussed in section 4.3.4. Assuming all capacity expansions proceed, the total global FeNb production capacity will reach approximately 172,000 tpy, while forecasted demand will be approximately 173,000 tonnes in 2017. Therefore, demand may surpass the production capacity after 2017. The next section will discuss the potential new entrants.

4.4.2 Potential Entrants

Several junior exploration companies are exploring for niobium around the world. Information about the potential new entrant's ore deposits, Nb ${}^{2}O^{5}$ grades and project status is contained in Table 6.

Table 6: Current Niobium Projects

Location	Operation Name	Owner	Reserve Size			Resource Size				Ore Grade	Status
			Proven (Mt)	Probable (Mt)	Total	Measured (Mt)	Indicated (Mt)	Inferred (Mt)	Total	%Nb2O5	
Malawi (Africa)	Kanyika	Globe Metals	-	-	-	5.3	47	16	68.3	0.30	Feasibility , projected start up 2015
Australia	Dubbo	Alkane Resources	8.07	27.86	35.93	35.7	37.5	0	73.2	0.46	Feasibility, projected start-up 2016
Canada (NWT)	Thor Lake	Avalon Rare Metals	-	-	-	10.88	110.56	182	303	0.22	Feasibility , projected start up 2017
Canada (Quebec)	Crevier	MDN Inc.	-	-	-	12.5	12.9	15.4	40.8	0.20	Feasibility suspended
Canada (BC)	Blue River	Commerce Resources	-	-	-	0	51.8	8.8	60.6	0.11	Pre-feasibility
Canada (BC)	Aley	Taseko Mines	-	-	-	112.7	173.2	144.2	430.0	0.37	Drlling done, going to pre-feasibility

Source: Author's Research from Websites of Potential Entrant Companies

Table 6 reflects the stage of each exploration project in descending order from advanced to less advanced stages with Aley at the bottom. Globe Metals and Mining Ltd.'s Kanyika is the most advanced. It is located in Malawi, Africa. Globe Metals estimates Kanyika can produce 3,000 tpy of niobium for 20 years. It is currently completing is definitive feasibility study and negotiating with the Malawian government for a Mining Development Agreement. It is aiming to be on production on 2015.

Alkane Resources Ltd.'s Dubbo Zirconia Project ("Dubbo") is located in New South Wales, Australia. Alkane estimates that it will produce 1,967 tpy of niobium as one of its by-products. It has currently submitted its environmental impact statement to the Australian government and is aiming to be on production by 2016.

Avalon Rare Metals Inc.'s Thor Lake (Nechalacho) Project is located in the Northwest Territories. Avalon estimates that it will produce 2,230 tpy of niobium as one of its by-products. It is currently in the feasibility stage and is aiming to begin production in 2017.

MDN Inc.'s Crevier Project ("Crevier") is located in Quebec. MDN estimates that Crevier can produce 1,200 tpy for 25 years. Crevier's feasibility study is temporarily on hold while MDN looks for a strategic partner.

Commerce Resources Corp.'s Blue River Project ("Blue River") is located in British Columbia. According to estimates, Blue River can produce 2,800 tpy of niobium for 10 years. It is currently completing a pre-feasibility study

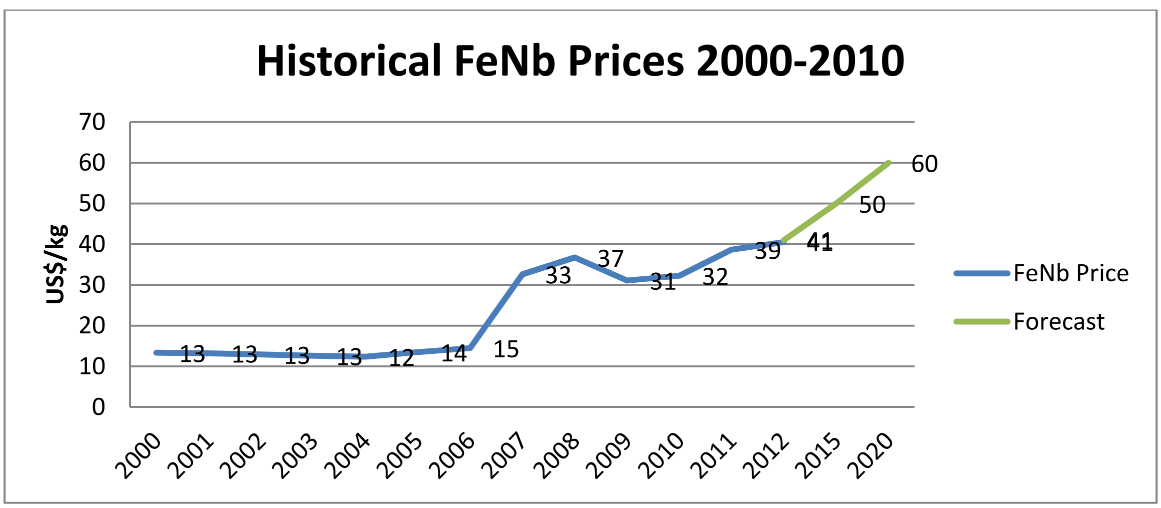
From the information above it appears there are a number of potential new entrants beginning in 2015, who can fill the excess projected demand forecast to take place in 2017. This scenario assumes the incumbents to do not increase their capacities.

It is also worth noting that despite being in the earlier stages of exploration, Aley has the biggest resource estimate out of all the potential new entrants. Section 4.7.2 will evaluate Aley's potential, as a niobium producer, will be using the "Sources of Advantage" analysis.

4.4.3 World FeNb Prices

As mentioned in the prior sections, CBMM sets the FeNb price while IAMGOLD (Niobec) and Anglo American (Catalão) adopt that price. As illustrated by Figure 21, in the early 2000s FeNb prices remained relatively flat in the US$12.00 to US$13.50/kg range. In response to the increase in demand discussed above, CBMM rapidly increased prices to US$32.63/kg in 2007. Due to the FeNb's demand price inelasticity, FeNb consumption continued to increase in 2008 despite the increase in price in 2007.

Figure 21: Historical and Forecasted Niobium Price Performance



Source: Prepared by Author Based on Data from IAMGOLD (2012) and Roskill (2011)

In response to the 2008/2009 economic crisis, CBMM delayed its announced capacity expansion and cut back production to adjust to lower customer demand without drastically lowering the price. As a result, FeNb prices remained relatively stable through the crisis compared to other commodities.

Industry analysts expect FeNb to perform well in the near term with prices remaining in excess of US$40/kg. The FeNb price is forecasted to increase to $50/kg by 2015 and $60/kg by 2020 (Roskill Consulting Group Ltd., 2011) as indicated in Figure 21.

The competitive structure analysis above led to the conclusion that the FeNb industry is a Stackleberg Oligopoly with CBMM as its leader. The analysis demonstrated that all three incumbents are gearing up to increase their FeNb production capacities to meet the forecasted growth in demand. The estimate that demand will exceed production capacity in 2017 attracts potential entrants such as Taseko. Further, the FeNb price is steadily increasing and forecasted to increase in the future. All these factors indicate that this is a very attractive industry.

Next, this paper will apply Michael Porter's Five Forces to evaluate how the intensity of competitive forces is affecting the attractiveness of the industry.

4.5 Five Forces Analysis

This section will briefly characterize the strength of each force based on the factors driving it with the goal of identifying the intensity of each force.

4.5.1 Rivalry: Low

The following factors affect the level of rivalry:

Firm Concentration**:** Section 4.4 concluded that the competitive structure of the FeNb industry is a Stackleberg Oligopoly where only three firms compete. Since CBMM has the dominant market share at 84%, Niobec and Catalão just adopt the price that CBMM sets. Therefore, no price retaliation occurs between the incumbents. With CBMM's continued market dominance, rivalry among incumbents is low. Potential new entrants such as Taseko will also have to take the price CBMM sets due to its market dominance.

Industry Growth**:** As the demand drivers discussed in section 4.3.3 increase the demand and the price of FeNb, rivalry among the three firms in the industry decreases since there is more of the demand to share amongst the three incumbents.

Industry growth may increase rivalry among the niobium exploration companies such as Taseko since companies will compete for niobium exploration projects that were previously uneconomical to mine but are now attractive projects due to higher FeNb prices.

Lack of Product Differentiation**:** Since FeNb is a homogenous product, buyers are indifferent as to which FeNb producer supplies its FeNb. Due to this indifference, rivalry may increase as the incumbents can compete for the same customer.

4.5.2 Threat of Entry – Low to Moderate

The following factors determine the intensity of threat of entry:

Concentration of Niobium Reserves: The concentration of pyrochlore ore bodies is a barrier to entry since economically mineable ore bodies are concentrated and are difficult to discover. As discussed in section 3.1, niobium reserves are highly concentrated, mostly in Brazil and Canada. The three incumbent companies already own the majority of the reserves. Aside from the projects discussed in section 4.4.2, most of the niobium exploration projects that are in the pipeline are speculative and would not be large enough to have an impact on the competitive landscape of the industry.

Initial Capital Requirements**:** All phases of the mining life cycle (exploration, development and construction, and production) require significant capital investment. For example, IAMGOLD estimates capital expenditures for the proposed conversion of Niobec from an underground to an open-pit mine to be at $1.94 billion (IAMGOLD, 2013). Therefore, incumbents like Niobec, as well as potential new entrants such as Taseko, need access to significant amounts of capital to develop their projects. In addition, capital cost overruns are a major threat to entrants. According to Ernst and Young (2011), the average capital cost overrun of mining construction projects is about 71% of the original project cost estimate. For example, Vancouver-based Baja Mining Corp. suspended its Boleo copper-cobalt-zinc project in Mexico after cost estimates rose by more than 22% or $246-million. The significant capital investment associated with developing a mine and the high risk of cost overruns will discourage new entrants who do not have the financial capacity to enter the industry.

Long Lead-Time to Production: Ore bodies takes years to explore, finance, develop and construct resulting to longer investment payback periods and smaller net present values (“NPVs”).

Lower Ore Grades: Since most of the high-grade pyrochlore ore have already been discovered and owned by the incumbents, new entrants are left with lower-grade ores that need more inputs to process. New entrants can therefore have a higher cost per kg of FeNb produced that will result to lower operating margins.

Government Policy: The complicated and long permitting process as well as the high cost of closure expenditures such as environmental remediation and reclamation required by governments also discourages entry.

The following factors may increase the threat of entry:

Increasing and Stable Price of FeNb: The increasing and stable price of FeNb encourages entry since potential entrants are attracted to the potential profit they can make if FeNb prices continues to increase. As discussed in section 4.4.2, there are a number of companies around the world, including Taseko, who are exploring for niobium.

Homogenous Product**:** Since FeNb is a homogenous product, entrants do not need to pursue significant product innovations nor acquire or develop proprietary technology to develop differentiation.

Customer Access**:** Since FeNb trades globally, it is not hard to find a buyer.

4.5.3 Threat of Substitutes - Low

The following factors keep the threat of substitutes low:

FeNb Alternatives: The main substitute for FeNb is ferrovanadium. The other substitutes mentioned in section 3.3 are substitutes for niobium in general (not FeNb specifically). However, the large-scale substitution of FeNb by ferrovanadium is slim since no amount of ferrovanadium can provide the same grain refinement given be FeNb (Roskill Consulting Group Ltd., 2011).

Stable Price of Niobium**:** As discussed in section 4.4.3, after CBMM increased the price of niobium, prices have been much more stable than other substitutes, as reflected in Figure 22:

Figure 22: Niobium Price Performance Relative to Substitutes

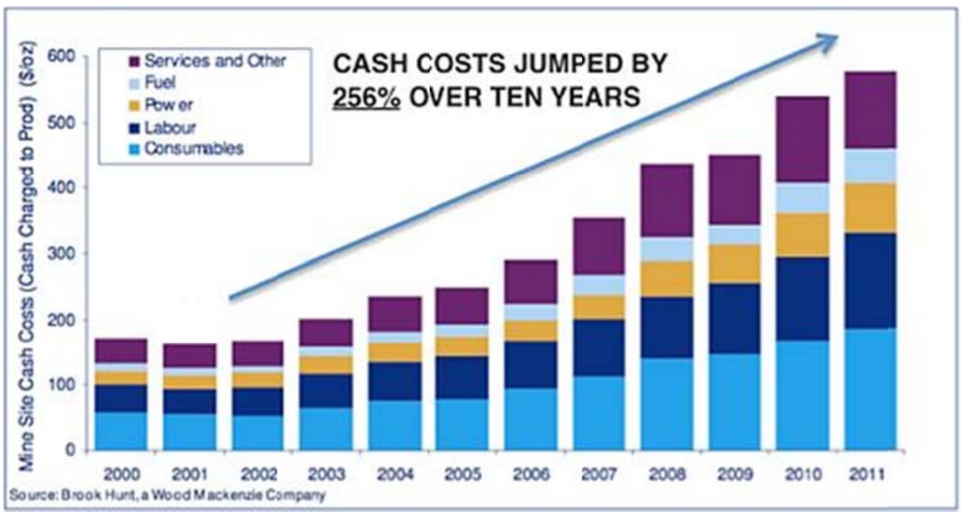
Source: IAMGOLD (IAMGOLD, 2013)

While other substitutes experienced significant price collapse during the 2008/2009 economic crisis, CBMM held the niobium price relatively constant by decreasing output. From a customer's perspective, the niobium price stability makes it more attractive compared to its substitutes since price stability enables them to estimate costs more accurately.

4.5.4 Bargaining Power of Suppliers – High

As illustrated by Figure 23, costs have escalated in the mining industry for the past decade:

Figure 23: Mine Site Cash Cost Escalation



Source: Brook Hunt from (Volkering , 2013)

The cost escalation illustrated above reflects the power of the following suppliers:

Labour**:** The labour supply is a powerful factor due to the scarcity in the availability of skilled mining labour. Mining labour is highly skilled and needs technical training at all levels, which can take time to develop. Mining used to replenish its workforce from within through generations upon generations of family working in the industry. In the '80s and '90s, mining literally skipped over a whole generation as mines only maintained rather than increased production due to low commodity prices. As a result, the link between generations was broken.

According to KPMG (2011), the following factors drive the current labour scarcity:

- Inability to find and/or train local residents in developing countries;

- Remote nature of today's mining projects resulted in unwillingness of people to be away from their families;
- Surge in commodity prices during the last decade resulted in increased labour costs. Competition comes from other resource extraction industries such as oil and gas.
- Most mining labour is unionized, making producers vulnerable to labour strikes.

The above factors have increased the bargaining power of skilled mining labour resulting in premium wages.

Utilities and Heavy Equipment Manufacturers**:** The suppliers of major inputs are monopolies such as utility companies and oligopolies such as heavy equipment manufacturers. Since the suppliers are highly concentrated, the FeNb producers have little choice on suppliers to deal with. For example, mining companies have to be in a long wait list for heavy mobile equipment (i.e. haul trucks, shovels, etc.) since only a few companies manufacture this equipment.

Consumable Suppliers**:** The surge in global mining in the last decade (2000-2010) resulted into higher prices and lower availability of key inputs such as fuel, chemical regents and grinding media giving suppliers of these commodities a greater bargaining power. According to Ernst & Young (2012), the mining industry experienced cost inflation between 10% and 15% in 2011, with overall cost inflation averaging roughly 5–7% in the last 10 years (this equates to a doubling of costs every 10–14 years).

The reason for the cost increase is simple: more demand for the goods and services across the resource sector as companies race to get assets into production so they can start taking advantage of a price boom that has been going for more than a decade (Jordan, 2012). The resulting scarcity in consumables and the increase in input costs increase the bargaining power of the suppliers as companies face tremendous pressure to keep input costs in line to maintain operating margins.

Government Regulation: Governments have strong bargaining power for the following reasons. Governments grant the permits to operate mines. Getting the permits is a complicated and long process. In addition, governments can also revoke permits and expropriate mines. In addition to permitting powers, governments have the power to extract rents from the profits of a mining company. For example, in order to ensure the exploitation of the niobium deposit, CBMM has a profit sharing agreement with the Brazilian state of Minas Gerais that concedes 25% of CBMM's net operational profits to the state. Lastly, miners are also dependent on governments to build the infrastructure necessary to make their remote mines accessible.

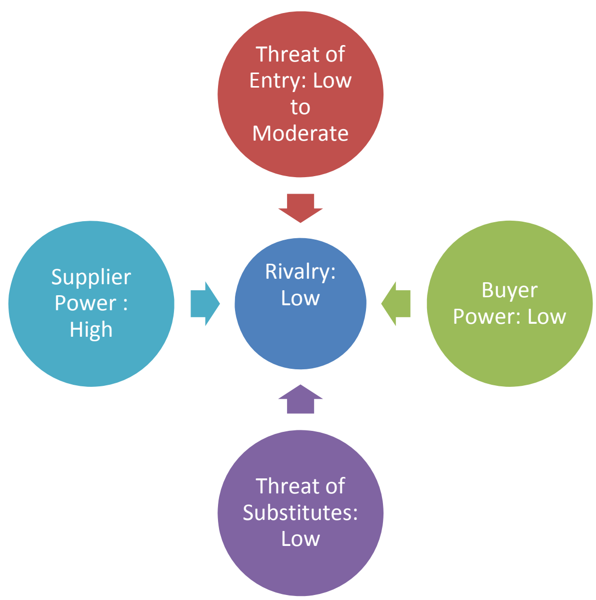
4.5.5 Bargaining Power of Buyers – Low

The main factor keeping the power of buyers low is the absence of buyer concentration. There are a number of offtakers and steel mills globally that can buy the FeNb. The buyers are fragmented. According to CBMM, it has 350 customers in 50 countries. One factor that might have driven the combined 30% investment of the Japanese-Korean Consortium and the Chinese Consortium into CBMM is to secure the consortium members' supply of FeNb. Due to their weak bargaining power, the consortium of steelmakers needed to integrate vertically with CBMM to increase their bargaining power as buyers.

Making direct investments in FeNb producers such as CBMM through backward integration increases the bargaining power of the buyers since they now can have a steady source of FeNb and have a say in CBMM's operations based on their ownership interest.

Figure 24 summarizes the results of the Five Forces analysis. With low competitive intensities in four out of the five forces, the FeNb industry appears very attractive.

Figure 24: Five Forces Analysis for the FeNb Industry



Source: Author's Analysis using Michael Porter's Five Forces (Porter, 1979)

The next section will assess how external factors are increasing or decreasing the intensity of the forces using a P.E.S.T. analysis.

4.6 External Environment Trends Analysis

The Political, Economic, Social and Technological analysis ("P.E.S.T") will consider the various macro-environmental factors that will affect the attractiveness of the FeNb industry. The goal of this section is to discuss how these factors increase or decrease the intensity of the five forces discussed above.

4.6.1 Political Environment

***Resource Nationalism in Developing Economies*:** For operations such as CBMM and Catalão, which are located in developing economies like Brazil, resource nationalism presents the biggest political threat to the industry. According to Wikipedia (2013), resource nationalism is the tendency of people and governments to assert control over natural resources located on their territory. The control can either be in the form of expropriation or higher taxes. A good example of the effects of resource nationalism is CBMM's profit-sharing agreement with the Brazilian state of Minas Gerais that concedes 25% of CBMM's net operational profits to the state. According to the Eurasia Group (2012), governments use resource nationalism to address fiscal imbalances and "dual-speed" economies, boost social spending and plug budget deficits. Miners in weak economies combined with a prosperous mining sector face greater threat from resource nationalism.

According to Ernst & Young (2012), resource nationalism comes in various forms:

- Imposition/increase of royalties or mining taxes;
- Mandated in-country beneficiation or export levies to encourage in-country processing of minerals for the host country to capture more of the value chain; and
- Governments are retaining state or national ownership of resources through expropriation or mandating local ownership requirements or caps on foreign ownership.

Government Support in Developed Economies: The opposite is true for operations like Niobec, located in developed economies, such as Canada, with a mature mining industry. To stimulate economic growth, governments of developed economies encourage investment in mine development through tax incentives and other government programs that aim to generate sustainable job creation in the long-term. A good example of government support is the provincial government of British Columbia's Mineral Exploration and Mining Strategy (BC Ministry of Energy and Mines, 2012), which has the following targets:

- Create eight new mines and expand nine existing ones by 2015;

- Increase mineral exploration to ensure future mining activity; and
- Ensure mine development improves the social and economic well-being of First Nations and respects cultural values.

The following are the key components of this strategy:

- Low provincial corporate tax rates at 11% as well as tax incentives such as :
    - Mining Exploration Tax Credit provides a 20% refundable tax credit for eligible mineral exploration in BC;
    - British Columbia Mining Flow-Through Share (“FTS”) Tax Credit provides a non-refundable 20 per cent tax credit; and
    - New Mine Allowance and other mineral tax provisions allow new mines and major expansions to deduct 133% of their capital costs, until 2016.
- Streamlining the regulatory processes through reducing the backlog of exploration application permits and working with the federal government to eliminate duplication in environmental assessments.

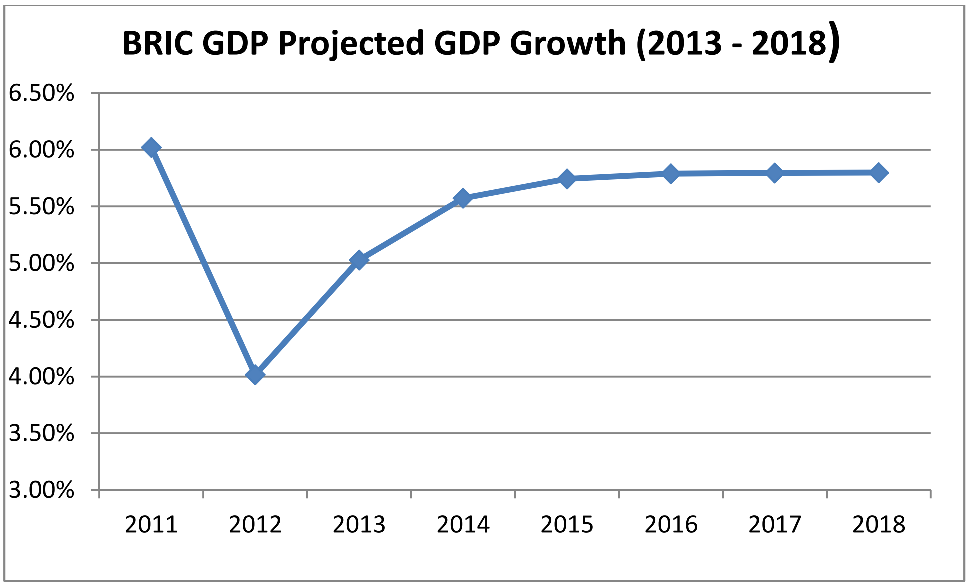
These government policies affect the Five Forces in the following ways: Resource nationalism decreases rivalry since higher taxes will squeeze out miners who are expropriated or driven out of business. Higher taxes and regulations will create entry barriers thereby reducing threat of entry. Resource nationalism increases the bargaining power of governments since it allows them to take a greater chunk of the miner’s profits.

Government support increases the threat of entry since tax breaks and other incentives attract new entrants. At the same time government support decreases the bargaining power of governments since governments are willing to accommodate mining projects due to their job creation potential.

4.6.2 Economic Factors

BRIC's Forecasted Economic Growth**:** As mentioned in the demand analysis in section 4.3.3, the main driver for FeNb is the BRIC's demand for steel, in turn driven by the BRIC's economic growth. As the Figure 25 below shows, BRIC GDP growth shrank by 2% points in 2012 (4% GDP from 6% in 2011).

Figure 25: BRIC GDP Growth Forecast



Source: IMF (2011 and 2012 are actual growth rates) (IMF, 2013)

The most important reason for the growth slowdown in 2012 is the ever-worsening economic situation in Europe, followed closely by the general lack of economic leadership and market confidence coming from the aging industrial countries (Azzarello & Putnam, 2012, p. 1). In addition, the BRIC economies also face very distinct issues and structural problems of their own, which are strikingly different from country to country. For example, China has slowed growth to reduce risks in its economy and make it more sustainable following a once-in-a-decade political leadership transition in 2012.

According to IMF estimates (2013), the BRIC GDP growth rate will improve in 2013 to 5% and stay in the 5.5% - 6% range through 2018. These annual projected growth rates will almost double the BRIC GDP from $14.5 trillion in 2012 to $25.5 trillion in 2018.

Like the BRIC's GDP, the World Steel Association projects steel consumption to increase in 2013 and 2014. As Table 7 indicates, it projects steel consumption to increase around 3% in the short-term, globally as well as in the BRIC countries.

Table 7: Steel Consumption Short Range Forecast

Apparent Steel Use (ASU)

Short Range Outlook for Apparent Steel Use, finished steel products (2012-2014)

Regions	ASU, Mt			Growth Rates, %		
	2012	2013 (f)	2014 (f)	2012	2013 (f)	2014 (f)
European Union (27)	140	139	144	-9.3	-0.5	3.3
Other Europe	35	37	38	4.1	6.1	4.1
CIS	56	58	60	3.3	2.0	3.8
NAFTA	131	135	139	7.8	2.9	3.0
Central & South America	47	50	52	2.6	6.2	4.3
Africa	27	29	31	7.1	8.1	7.6
Middle East	49	49	52	-1.2	0.8	6.1
Asia & Oceania	928	957	984	1.8	3.2	2.8
World	1 413	1 454	1 500	1.2	2.9	3.2
Developed Economies	389	390	400	-1.9	0.4	2.3
Emerging & Developing Economies	1 024	1 063	1 101	2.5	3.9	3.5
China	646	669	686	1.9	3.5	2.5
BRIC	785	814	838	1.9	3.7	3.0
MENA	63	65	70	2.2	3.2	7.1
World excl. China	766	785	815	0.7	2.4	3.8

Source: World Steel Association (2013)

***Confidence Crisis in the Mining Industry*:** Despite the recent record highs reached by the Dow Jones Industrial Index, market capitalization of mining companies, including the companies mining for niobium; have been falling across the board. According to PwC (2013), market capitalization fell in the first four months of 2013 for 37 of the Top 40 miners—losing over $200 billion, or 17% of the year-end 2012 level. PwC (2013) further states that the mining industry had a dismal performance in 2012 compared to 2011 as shown below:

- Revenue were stagnant at $731 billion —a 6% increase in production volume offset by softer prices;
- Net profits were down by 49% to $68 billion; and
- The issuance of $108 billion of debt, including $43 billion of bonds, sent gearing from 13% to 24%.

The main driver for the mining industry's weak financial performance in 2012 was lower mineral prices reflecting slowing/declining demand coupled with rising costs resulting in lower operating margins. In addition to poor financial performance, PwC (2013) believes that there is a "confidence crisis" in the mining industry. This crisis in confidence is a result of the following factors:

- Commodity price volatility coupled with on-going cost escalation that leads to further depressed margins;
- Undisciplined acquisitions and expansion in recent years resulting in impairments of mining assets, decreasing book value as well as the fair value of assets;
- Recent turnover in senior managements of mining companies that contributes to more uncertainty to the direction of the mining companies; and
- The on-going threat of resource nationalism is becoming more prevalent in developing economies.

The economic factors discussed above affect the Five Forces. BRIC's forecasted economic growth decreases rivalry as the projected BRIC economic growth will increase the demand for FeNb. It also decreases barriers to entry, as potential entrants will be attracted to enter the FeNb industry to take advantage of the increase in demand. Finally, it increases supplier power since economic growth will cause demand for commodities, which will further increase the cost of inputs.

The confidence crisis in the mining industry decreases rivalry as it may cause diversified mining companies like Anglo American and IAMGOLD to divest niobium operations considered non-core to their business. The crisis may also decrease the threat of entry since new entrants will be discouraged to enter the market due lack of financing because of the capital market's lack of confidence in the mining industry. In addition, the crisis may also decrease supplier power since the demand from other mining sectors for their inputs and labour will decrease.

4.6.3 Social Environment

The biggest social impact on the industry is the "Social License to Operate" ("SLO"). Obtaining government permits alone does not give full license to proceed with mining. SLO requires miners to gain the support not only from the government but also from other stakeholders such as communities living around the project and indigenous peoples.

SLO presents opportunities for mining companies. According to Ernst & Young (2012), mining companies are finding that having the reputation as “a company that does the right thing by all stakeholders” makes it easier to access new projects and raise capital.

SLO also presents a threat to mining companies in the form of costs. According to Ernst & Young (2012), SLO obligations are becoming increasingly expensive because of higher expectations and emphasis on SLO issues. Costs are rising not only in terms of actual payments, but also in the time and money involved in developing appropriate agreements.

SLO has the following effect on the Five Forces:

- Decreases rivalry since some miners may choose to exit the market if the cost of the SLO initiatives is too high;
- Decreases threat of entry since pursuing SLO initiatives will involve additional investments; and
- Since SLO makes miners accountable to the community, other stakeholders in the community also become “suppliers” thereby increasing supplier power.

4.6.4 Technological Factors

Technological Advances in Mining and Processing Niobium: Technological advances enable incumbents to continually expand capacity as well as have access to previously un-mined reserves. This is evidenced by Niobec’s plans to convert is underground mine into an open-pit mine and Catalão’s Boa Vista Fresh Rock Project. In addition, technological advancements have also increased the efficiency of the conversion process. CBMM has made innovations in the aluminothermic process that uses less aluminium.

Technological Advances in FeNb Applications: In addition, steel manufacturers are doing on-going research to develop lighter and stronger steel. For automotive applications, the World Steel Association has the FutureSteelVehicle (FSV) program, which developed fully engineered, steel-intensive designs for electrified vehicles that reduce greenhouse gas emissions over their entire life cycle. The FSV features steel body structure designs that reduce mass by more than 35% over a benchmark vehicle and reduce total life cycle emissions by nearly 70% (WorldAutoSteel, 2013).

On the infrastructure construction side, bridge designers and engineers can now specify new high performance steels that have yield strengths of 70 ksi and 100 ksi (World Steel Association, 2009).

The two technological factors identified above affect the Five Forces. They increase rivalry since technological advances enable current producers to expand production capacity and access previously unexploited mine reserves. They decrease the threat of entry since technological advancements in mining and processing niobium will allow incumbents to continue expanding their capacities to meet the excess demand. In addition, the two technological factors may decrease the need for inputs and labour thereby decreasing supplier power.

4.6.5 P.E.S.T. Effect on Five Forces Analysis

Table 8 summarizes the effect of the P.E.S.T. analysis on the intensity of the five forces in the FeNb industry:

Table 8: Effect of P.E.S.T. Factors to the Five Forces in the FeNb Industry

	Rivalry	Threat of Entry	Suppliers	Buyer	Substitute
Political - Resource Nationalism	-	-	+	N	N
Political - Government Support	N	+	-	N	N
Economic - BRIC Economic Growth	-	+	+	N	N
Economic - Crisis Confidence	-	-	-	N	N
Social – SLO	-	-	+	N	N
Technological Advances	+	-	-	-	N
	Decreasing	**Stable**	**(see below)**	**Stable**	**Stable**
		Legend:	Decreasing	Increasing	Neutral

According to the analysis above, rivalry within the FeNb industry is decreasing based on the external factors considered. The threat of entry, bargaining power of buyers, and the threat of substitutes all remain constant. The bargaining power of suppliers is increasing for companies, which operate in political jurisdictions that implement resource nationalism. On the other hand, the bargaining power of suppliers is decreasing for companies, which operate in jurisdictions with government support.

Overall, this analysis concludes that the FeNb industry is indeed an attractive industry for Taseko to enter. This industry is not only currently attractive but also the competitive forces are likely to stay weak or even get weaker in the future.

The next step is to analyse what are the sources of advantage in the industry, and then to assess whether Taseko has or can acquire some of these advantages in order to be competitive in the industry.

4.7 Sources of Advantage Analysis

This section will identify potential sources of advantage for niobium projects, niobium exploration companies and niobium miners. In order to determine the sources, this section will tackle the following questions:

1.) What are the sources of advantage in a niobium mining exploration project?

2.) Can Aley become a competitive niobium mine and generate a return on investment?

3.) How competitive is Taseko in the exploration/development of its mining projects?

4.) How competitive is Taseko in production, i.e. what are the drivers of cost and customer utility in niobium production and how does Taseko rate on these?

4.7.1 Sources of Advantage of a Potential Niobium Project

This section will first analyse the sources of advantage of one niobium project over another. Then, it will compare Aley to other niobium exploration projects based on the criteria below. Since projects in the exploration stage do not have revenues, companies are primarily looking at the potential return the project can generate for their investment. To evaluate the potential return on investment, that analysis needs to consider the cost of the exploration and the future cash flows from the project.

Future Cash Flow from the Project: The quality and concentration of the deposit will drive the future cash flows. The size or tonnage of the ore body determines the quality. The niobium grade (% Nb^2O^5) drives the concentration. The better the quality, the more tonnes of ore can be extracted from the project, which translates to a longer mine life. A longer mine life translates into greater future cash flow. The better the concentration, the more niobium can be extracted per tonne of ore milled, which translates to lower operating costs. If the estimated future cash flow outweighs the cost of exploration and development, the exploration company should pursue the exploration project.

Costs of Exploration**:** The cost of exploration can vary from project to project depending on the location of the project, the complexity of the ore body and other factors. The more geographically remote the project is**,** the larger the exploration cost is since personnel and equipment need to be transported further using chartered aircraft and helicopters. The more complex the ore body is, the more drilling and analysis needs to be done to define the mineralogy of the ore body.

Stage of Exploration: This is the main driver of future costs associated with the project. Stages of exploration are as follows:

- Staking – This stage involves staking the mineral claims for exploration, getting the exploration licenses from the government and paying the tenure fees to keep the claims in good standing.
- Drilling – This stage involves the drilling of the mineral property for core samples. Drillers use diamond drill rigs to extract core samples that are delivered to assay labs for analysis. The analysis will determine estimated size (tonnage) and the concentration (the grade) of the niobium deposit. The deposit becomes classified as a "resource" if drilling results indicate a tonnage and grade that has reasonable prospects for economic extraction.
- Pre-feasibility - A preliminary feasibility study determines whether to proceed with a detailed feasibility study. This stage completes the preliminary engineering and mine design. The decision whether to proceed to the feasibility stage will be based on known revenues, operating and capital cost in the industry.
- Feasibility – The detailed feasibility study assesses whether the project can be mined profitably using the company's best estimate of the project's own forecasted revenues, capital and operating costs.
- Environmental impact assessment – The project's potential environmental impacts are evaluated at this stage. If the environmental impacts are within the parameters of environmental laws, the project proceeds to the permitting stage.
- Permitting – The company uses the results of the feasibility study and the environmental impact assessment to apply to the government for a mine development and operating permit.

Based on the exploration stages outlined above, a project in the initial stages would require more work and expenditures to progress to the next stages. Therefore, the more advance the project is, the lesser the cost a company needs to incur going forward.

Government Support**:** Another important source of advantage for exploration projects is government support. The level of government support is a crucial factor in determining whether to advance the project. Governments can make it harder for companies to apply or renew exploration permits. In extreme cases, governments can revoke licences and permits. Government support comes in the form of a red-tape-free permit application and renewal process, tax incentives and access to geological data regarding the project.

4.7.2 Relative Competitive Analysis of Aley as an Exploration Project

The analysis below compared the Aley project to Globe Metal's Kanyika Project in Malawi, Commerce Resource's Blue River Project in BC and MDN's Crevier Project in Quebec. Each source of advantage was ranked 1 – 4, with 4 being the highest. The analysis included the Kanyika, Blue River and Crevier projects since they are primarily niobium projects. The analysis did not use the other projects discussed in section 4.4.2, such as Dubbo and Thor Lake, since niobium is only a by-product. Table 9 summarizes this analysis:

Table 9: Relative Competitive Analysis of Niobium Exploration Projects

Source of Advantage	Weight	Aley	Kanyika	Blue River	Crevier
Estimated Future Revenues	60%	2.4	1.2	0.6	0.6
Stage of Exploration	20%	0.2	0.6	0.4	0.6
Government Support	20%	0.8	0.4	0.8	0.6
Total		**3.4**	**2.2**	**1.8**	**1.8**

***Estimated Future Cash Flows*:** Aley scored the highest on this criterion since it has the highest estimated life-of-mine ("LOM") revenues. Table 10 outlines the estimated future revenues.

Table 10: Estimate LOM Revenues of Niobium Exploration Projects

Project	Estimated Kg ('000s) of Nb per Year	USD$/kg - based on long-term price forecast	Estimated Annual Revenue ($000s) (Undiscounted)	Mine Life	Estmated Life of Mine Revenue (USD$Billion) (Undiscounted)
Aley	5,443	$ 60	$ 326,587	20	$ 6.5
Kanyika	3,000	$ 60	$ 180,000	20	$ 3.6
Blue River	2,858	$ 60	$ 171,458	10	$ 1.7
Crevier	1,178	$ 60	$ 70,709	25	$ 1.8

Source: Author's Research from Websites of Potential Entrant Companies

The table above shows that Aley has $6.5 billion in estimated LOM revenues, which almost double the estimate of Kanyika. Capital and operating costs were not included in the analysis since not all projects have these figures publicly available. Therefore, the analysis only used the estimated LOM revenues to estimate the future cash flows. Despite not taking into account capital and operating costs, Aley has a significant margin over the other niobium projects.

Stage of Exploration: Aley scored the lowest since it just completed drilling in 2012. The most advanced projects are Kanyika and Crevier, both of which are in the feasibility stage. Blue River is in the pre-feasibility stage.

Government Support**:** Aley scored high on this criterion since the BC government has the BC Mineral Exploration and Mining Strategy that aims to promote the development of new mines through tax and other incentives. Projects like Aley and Blue River, located in BC, have an advantage over projects in Africa such as Kanyika, which is under more threat of resource nationalism.

From the analysis in Table 10, the Aley Project is an attractive niobium project that can potentially generate a return on investment due to the potential cash flow it will generate from operations.

4.7.3 Sources of Advantage of a Niobium Exploration Company

The last section concluded that Aley is an attractive niobium project. This section will determine if Taseko is competitive in doing the exploration and development work required. First, this section will analyse what are the sources of advantage of an exploration company. Then, the analysis will compare Taseko to other niobium exploration companies based on the criteria below using a relative competitive analysis.

Third party consultants usually perform exploration activities such as drilling and assaying. The exploration companies have managers in-house to oversee the exploration program and evaluate the results. Since most of the costs are outsourced, it is difficult to gain a cost advantage since companies need to pay market rates for these third-party services. The following subsections describe the sources of advantage for exploration companies.

***Access to Capital*: Exploration programs are very expensive to undertake. To illustrate, Taseko already has spent approximately $22 million on Aley to define its resources. Therefore, access to capital is a main source of advantage for an exploration company. Capital for exploration usually comes from the following sources:

- Cash flow from the company's operating assets;
- Equity financing through the issuance of the company's shares; and
- Joint venture with a third party – joint venture partners acquires an interest on the project and funds the exploration program in proportion to their interest.

Note that debt financing is rarely available for exploration projects since there are no assets to use as security for the debt facility and there are no future cash flows to service the debt. The company with an operating asset with free cash flows has the most advantage since it does not have to rely on the capital markets nor divest a portion of its interest through a joint venture.

***Mine Life Cycle Experience*:** The experience of the company's management in the various stages of exploration is crucial for a successful exploration program. In addition, experience in constructing and operating a mine is a source of advantage since having this experience is very important in the feasibility stage. A well-qualified management team with diverse background in geology, mine engineering, finance and government relations is better positioned to see a project through from staking to production.

4.7.4 Relative Competitive Analysis of Taseko as an Exploration Company

Based on the criteria above, the analysis compared Taseko to Globe Metals, Commerce Resources and MDN. Each source of advantage was ranked 1– 4, with 4 being the highest. Table 11 summarizes the results.

Table 11: Relative Competitive Analysis of Niobium Exploration Projects

Source of Advantage	**Weight**	Taseko	Globe Metals	Commerce Resources	MDN
Access to Capital	60%	2.4	1.2	0.6	0.6
Mine Life Cycle experience	40%	1.6	1.2	0.4	0.4
Total		**4**	**2.4**	**1**	**1**

Access to capital: Taseko scored the highest on this criterion since it has Gibraltar to supply free cash flows from its operation to fund Aley. Exploration companies such as Globe Metals, Commerce Resources and MDN primarily raise their capital through equity financings. Since they do not have producing properties, they cannot access the debt markets for financing. Therefore, they have to issue new shares and dilute existing shares when they need additional equity financing. Given the current confidence crisis in the mining industry, raising equity financing is even harder.

Mine Life Cycle Experience: Taseko scored the highest on this criterion since it has a solid track record is exploration, as demonstrated by exploration programs in Gibraltar and Prosperity, which resulted into increased reserves. In addition, through operating the Gibraltar Mine, building GDP3 and undergoing the permitting of the New Prosperity Project, Taseko's management has the necessary experience and qualifications to advance the Aley project to production. The other companies are exploration-stage companies with no producing mines. Therefore, they have limited direct experience in permitting and operating mines.

The analysis in Table 11 concluded that Taseko has the necessary sources of advantage as a niobium exploration company.

4.7.5 Sources of Cost Advantage of the Incumbent Niobium Miners

This section will analyse the sources of advantage of the incumbent FeNb producing companies and assess whether Taseko can develop those sources of advantage to be a viable niobium mine and a FeNb producer.

Since FeNb is a homogenous product and the firms in the industry take the price that CBMM sets, the source of advantage depends primarily in costs of producing FeNb. Nonetheless, as mentioned in section 4.7.6, the FeNb buyers also have customer preferences that allow for some customer utility advantages.

Industry Cost Structure**:** The value chain in section 4.2 drives the industry cost structure. It is measured based on the kg of FeNb produced. The mining, milling, and converting cost per kg produced and offsite costs determine the cost per kg of FeNb produced.

Mining cost per kg produced includes:

- Mining operations, which incorporate explosives for blasting, salaries and benefits of mobile mine equipment (drill, truck, shovels, etc.) operators, consumables such as fuel/electricity, tires, etc. for the mobile mine equipment, and operating leases for the mobile mining equipment;

- Mining engineering, which incorporates the salaries of mine engineers who direct the mining operations; and
- Mine maintenance, which incorporates salaries of maintenance personnel who maintain the mobile mine equipment and spare parts and other consumables required for maintenance.

Milling cost per kg produced includes:

- Mill operations, which incorporate salaries and benefits of milling personnel, consumables such as electricity to run the mill, grinding media for the ball and rod mills and chemical reagents for the floatation process;
- Mill engineering, which incorporates the salaries of metallurgy engineers who direct the milling operations; and
- Mill maintenance salaries of maintenance personnel who maintain the mill and spare parts and other consumables required for maintenance.

Converting cost per kg produced includes:

- Converter operations, which incorporate salaries and benefits of personnel who operate the converter, consumables such as electricity to run the converter, and chemical reagents and raw materials such as aluminum for the converting process; and
- Converter maintenance, which incorporates salaries of maintenance personnel who maintain the converter and spare parts and other consumables, required for maintenance.

Offsite costs include:

- Freight and transportation
- Taxes and
- Royalties paid to the government.

Mining Cost Advantage Drivers: The type, size and shape of the pyrochlore ore body will determine real cost advantage.

*Open-pit mining vs. underground mining***:** According to the British Geological Survey (2011), massive, or steeply dipping, low-grade near-surface ore bodies are amenable to open-pit mining.

If the ore body is too deep and open-pit mining becomes unfeasible, underground mining becomes the preferred option. Since more drilling and blasting is required in underground mining, the mining cost per kg is far less in open-pit operations than underground mining.

Weathered Ore vs. Fresh Ore: Weathered ore is closer to the surface and has been "weathered" by the elements such as tropical heat and rain. Fresh ore is further from the surface and has not been subjected to weathering elements. Due to the altered and decomposed nature of the weathered ore, it is softer than fresh ore. Therefore, drilling and blasting are not necessary in the stripping and mining of weathered ore. Since there is no drilling or blasting costs, the mining cost per kg of mining weathered ore is lower than mining fresh ore.

Strip Ratio: Finally, the formation of the ore body determines the "strip ratio" in the mining process. The strip ratio is the ratio of waste to ore mined. For example, a 3:1 strip ratio means the miner needs to remove 3 tonnes of overburden or waste material to access 1 tonne of ore. A lower ratio is favourable since the miner utilizes more of its labour, fuel, explosives, machines hours, etc. mining ore rather than moving waste. The size and formation of the pyrochlore ore body will be the main driver behind the strip ratio. If the pyrochlore ore body is beneath more waste and if it is irregularly shaped, the strip ratio will be larger since the miner removes more waste to access the ore.

Consumables in the mining process cannot provide significant cost advantage since consumables such as fuel, tires, and explosives are commodities with relatively uniform global prices. At first glance, labour might be an obvious source of cost advantage since companies in developing countries like Brazil have relatively lower wages. However, according to KPMG's research (2012), labour costs in Brazil are significantly higher than in the other BRIC countries and approach the cost levels of the developed economies. In addition, a heavy burden for both direct and indirect taxes also affect Brazil's total cost performance.

***Milling Cost Advantage Drivers*:** Similar to the mining process, consumables in the milling process do not provide significant cost since consumables such reagents are commodities with relatively uniform global prices. In addition, there is no significant labour cost advantage as mentioned in the mining process. The real cost advantage drivers in the milling process is Nb^2O^5 grade of the ore that goes through the milling process and the throughput or capacity of the mill.

Grade: The floatation process can extract more niobium from ore with a higher the Nb^2O^5 grade. Cost advantage occurs since the inputs (electricity, reagents, etc.) yield more niobium if the grade is higher. If the grade is lower, the milling process uses more reagents as well as electricity to release the niobium.

Production Volume: Higher tpd milled results to cost advantage since some costs, such as labour, are fixed. Mills are highly automated. The higher the tpd, the more niobium concentrates are produced for conversion to FeNb. The size, capacity and age of the mill and technology behind the mill drive the tpd milled.

Converting Cost Advantage Drivers**:** Innovations to the aluminothermic process result into cost advantages. For example, CBMM introduced a submerged electric arc furnace to the FeNb production in 1994. It resulted in 25% savings in aluminium consumption by the replacement of iron oxide (hematite) with metallic iron powder (Sousa). These improvements to the aluminothermic process generate lower converting cost per kg of FeNb.

Offsite Cost Advantage Drivers**:** The proximity of the mine to the FeNb markets as well as distribution system drive the offsite cost advantage. Taxes and royalties paid to the government are dependent on the mining policies of the government.

4.7.6 Sources of Customer Utility Advantage:

Customers are typically commodities trading companies or steel mills. They are known in the mining industry as "offtakers" since a miner and the customer sign an "Offtake Agreement". According to Roskill (2011), most companies sell FeNb under long-term contracts and only 5% of total production is sold via the spot market. Offtakers prefer long-term contracts to the spot market for the following reasons:

- Long-term contracts specify the minimum kg of FeNb they will receive, which enables offtakers to have a predictable supply of FeNb; and
- Long-term contracts specify the FeNb price, which enables buyers to have predictable pricing.

Sources of Customer Utility Advantage: The niobium reserves and resources determine the stability of the FeNb supply. A larger niobium deposit reserves results to a longer the mine life. A longer mine life ensures customers that there is certainty in the supply of FeNb. Customers do not want to sign long-term offtake agreements and face a future supply shortage due to depletion of the miner's niobium reserves.

Worldwide Distribution Network: Customers prefer to purchase from producers who can deliver to any part of the world.

4.7.7 Relative Competitive Analysis of Taseko as a Niobium Miner

As the undisputed market leader, CBMM has most of the sources of advantage outlined above:

Mining Cost Advantage: CBMM's mine is an open-pit that is mining weathered ore that requires no drilling and blasting.

Milling Cost Advantage: CBMM has the highest Nb^2O^5 grade out of all the incumbents at 2.5% Nb^2O^5. In addition, CBMM has continuously expanded its production capacity in the past few years. Its current production capacity is 120,000 tpy, well above the other incumbents.

Converting Cost Advantage: CBMM also has the converting cost advantage since it is the pioneer in the innovations to the aluminothermic process.

Steady Source of FeNb: With the world's largest niobium reserves, CBMM can supply the world's FeNb needs for centuries.

Worldwide Distribution Network: CBMM sells its products to 350 customers in more than 50 countries through subsidiary companies in Europe: CBMM Europe BV (Amsterdam); Asia: CBMM Asia Pte Ltd. (Singapore); and North America: CBMM North America, Inc. (Pittsburgh). Despite not disclosing any cost information publicly, CBMM clearly has the sources of advantage that makes it the dominant player in the FeNb industry.

Despite this dominance, projects such as Niobec and Catalão are still in the FeNb industry, earning positive rents. Table 12 shows that Niobec and Catalão generated $73 million and $ 81 million in operating profit in 2012, respectively. Therefore, Aley's potential, as a niobium mine, should be measured against these projects. Since the Niobec mine is the closest o Aley both geologically and geographically, it will be the basis of comparison in the following relative competitive analysis.

Table 12: Niobec and Catalão 2012 Operating Profit/Margin

2012 Results		
	Niobec	**Catalao**
Niobium production (millions of kg FeNb)	4.7	4.4
Niobium sales (millions of kg FeNb)	4.7	4.4
	$ millions	**$ millions**
Revenue	$ 191	$ 173
Cost of sales excluding depreciation	118	92
Operating Profit	$ 73	$ 81
Realized FeNb Price /kg	$ 41	$ 39
Cost of sales (excl. depreciation) / kg	$ 25	$ 21
Operating margin ($/kg)	$ 15	$ 18

Source: IAMGOLD (2013) and Anglo American (2013) 2012 Annual Reports

According to Niobec's annual report, it is targeting an operating margin of $15-$17 for the 2013 fiscal year. The relative competitive cost analysis in Table 13 below will evaluate if Aley's potential operating margin/kg of FeNb will be below, match, or exceed the targeted operating margin of Niobec. Each cost advantage source will be ranked 1 – 2, with 2 being the highest. The analysis will use zero if there is no apparent cost advantage between the two operations. Note that the analysis did not incorporate Niobec's expansion plans to be an open-pit mine.

Table 13: Relative Competitive Analysis Between Aley and Niobec

Source of Advantage	Niobec	Aley
Mining Cost Advantage drivers		
Mining Method	1	2
Type of Ore	0	0
Strip Ratio	0	0
Milling Cost Advantage drivers		
Grade	2	1
Capacity and Age	1	2
Converting Cost Advantage drivers		
Method	0	0
Offsite Cost Advantage drivers		
Transportation	1	2
Tax and Royalties	1	2
Totals - Cost Advantage	**6**	**9**
Customer Utility Advantage		
Steady Source of FeNb	2	1
Distribution	0	0
Totals - Customer Utility Advantage	**2**	**1**

Mining Method: Since Aley will be an open-pit mine, its capital and operating cost will be potentially lower than Niobec's underground operation. As shown in Table 12, Catalão has a higher operating margin compared to Niobec ($18/kg vs. $15/kg) partly due to being an open-pit mine.

Type of Ore: Both Aley and Niobec have a carbonatite-hosted deposit, which will require drilling and blasting. Therefore, there might be no cost advantage between the two operations.

Strip Ratio: This factor was not evaluated since underground mines such as Niobec do not have a strip ratio.

Grade**:** Niobec has a higher Nb^2O^5 grade at .55% Nb compared to Aley's .37% Nb^2O^5. Therefore, less input might be necessary to extract the niobium from the ore.

Capacity and Age**:** Since Aley's concentrator will be newer than Niobec's; it potentially can be more efficient and handle greater capacity. Ignoring Niobec's expansion plans, Niobec's capacity is around 5,000 tpy.

Converting Method: Aley will likely use the same converting method. Therefore, there might be no cost advantage between the two operations.

Transportation**:** Since Aley is closer to the FeNb consuming countries in Asia, in particular, China, transportation cost could be potentially lower than Niobec.

***Taxes*:** Starting in 2013, all mining operations in Quebec will be required to pay a royalty or a tax on profits, whichever is greater. The new tax rates will be 16%, 22% or 28%, depending on tax bracket of the company. Aley might have an advantage since these rates are significantly higher than the BC provincial tax rate of 11%.

***Steady Source of FeNb*:** Since Niobec has a substantially bigger reserve and resource base (1,142 Mt) than Aley (430 Mt), it potentially has a longer LOM (46 years – with expansion) compared to Aley's LOM of 20 years.

Distribution: Both Taseko and IAMGOLD currently have efficient distribution systems for products. Therefore, there might be no cost advantage between the two operations.

Based on the analysis in Table 13, Taseko can be successful in operating Aley since it could potentially have a cost advantage over Niobec and realize a better operating margin. It is important to note that the realization of these cost advantages will take time since mining operations typically have higher operating costs at the start of the mine life. Due to bigger reserves and resources and a potentially longer mine life, Niobec scored higher on the customer utility advantage. Despite that, Aley is still an attractive mining project that can provide future cash flows to Taseko during its mine life.

4.8 Industry Analysis Conclusion and S.W.O.T. Analysis

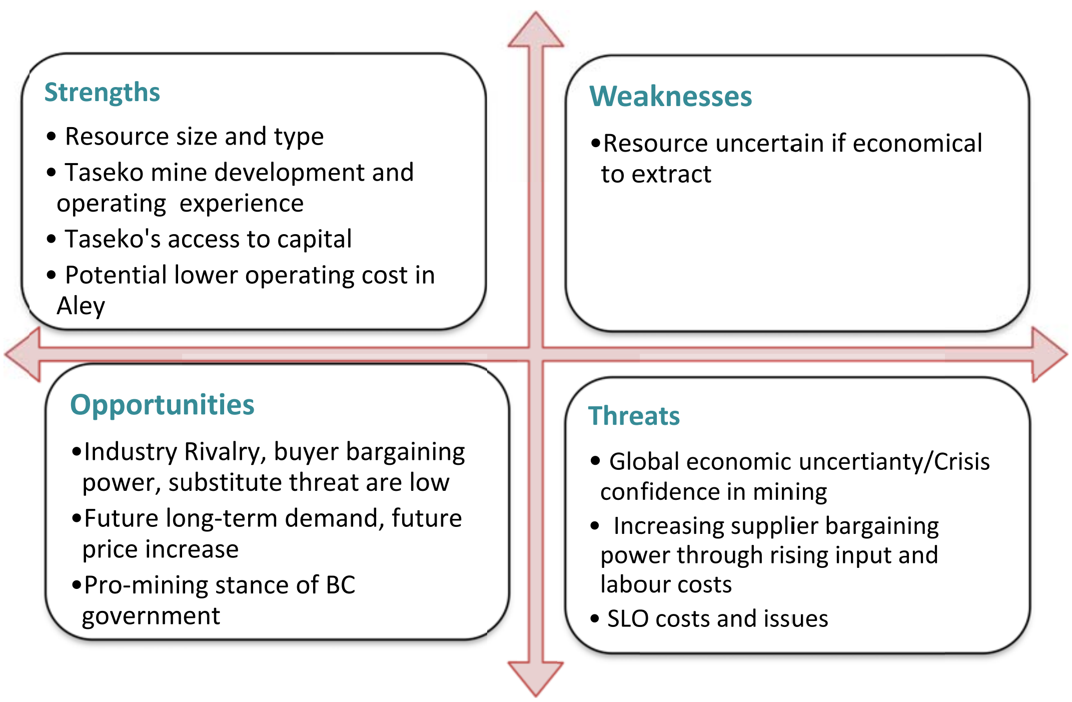
This paper concludes the following findings support Taseko's assumptions about the attractiveness of the FeNb industry and its entry into the industry:

- Demand analysis concluded that there is a foreseeable demand growth for the FeNb industry due to the demand drivers.
- Competitive structure analysis demonstrated that all three incumbents are gearing up to increase their FeNb production capacities to meet the forecasted demand growth. The analysis concluded that forecasted demand is estimated to outstrip production capacity in 2017.
- The FeNb price is steadily increasing.
- With low competitive intensities in four out of the five forces, the FeNb industry appears to be a very attractive industry.
- Only supplier bargaining power was high.

- The P.E.S.T. analysis resulted in the conclusion that rivalry within the FeNb industry is decreasing. The threat of entry, bargaining power of buyers, and the threat of substitutes all remain constant. The bargaining power of suppliers is decreasing for companies such as Taseko/Aley, which operate in jurisdictions with government support. This makes Taseko's entry into the niobium industry more attractive.
- Sources of advantage analysis led to the following conclusions: Aley is an attractive niobium project that can potentially generate a return on investment. Taseko has the sources of advantage to explore and develop Aley. Taseko can be successful in operating Aley since it could potentially have a cost advantage over Niobec and realize a better operating margin.

The S.W.O.T. Analysis in Figure 26 summarizes the implications of these findings:

Figure 26: S.W.O.T. Analysis



Based on the S.W.O.T. analysis, the Aley Project's primary strength is its resource size relative to other niobium exploration projects as well as potentially lower operating costs as determined in the sources of advantage analysis. In addition, Taseko's mining expertise and access to capital are also strengths since exploration projects need both knowledge and financial muscle to advance through the stages of exploration.

The main weakness of Aley is the need for further work to determine potential for the resources to become economically mineable reserves. Further exploration and engineering studies need to be undertaken to determine the capital and operating costs to progress to the feasibility, environmental and permitting stage.

The opportunities presented above support Taseko's entry into the FeNb industry through the Aley Project. The FeNb industry is a very attractive industry with low rivalry, low buyer bargaining power and low threat of substitutes. Moreover, with FeNb stable but rising prices and long-term demand growth coupled with potential low operating costs, there is an opportunity for Taseko to realize a decent margin on the Aley Project. In addition, the BC government's pro-mining policies provide a good political environment to advance Aley further along the mining life cycle.

The increasing power of suppliers and continuing global economic uncertainty, are the biggest threats to Taseko's entry into the niobium industry. The increasing power of suppliers drives higher input, labour and capital costs, which will affect the attractiveness of Aley. The global economic uncertainty that continues to shake the confidence in the mining industry will threaten the outlook for the demand for niobium and make it hard for Taseko to attract potential investors to invest in Aley. In addition, the increasing reputational impact and costs of SLO initiatives may also be roadblocks to the advancement of Aley. These threats increase the barriers to Taseko's entry into the niobium industry.

As mentioned above, the biggest weakness of the Aley project is the uncertainty of the economic viability of its niobium resources. Upgrading the status of the resources to economically mineable reserves followed by a feasibility study will address this weakness. Undertaking this initiative will require financial resources. Taseko does not currently have an estimate of the cost of bringing Aley to the feasibility stage. IAMGOLD's budget for the Niobec's expansion feasibility study can give a context of the potential cost. In fiscal 2012, IAMGOLD spent $9.6 million for the feasibility study. For fiscal 2013, it budgeted $49 million with the goal of completing the feasibility study in Q3 2013 (IAMGOLD, 2013).

Taseko must therefore evaluate its options for funding the Aley Project. This paper will discuss the options that are available in the next section.

5: FINANCING OPTIONS

Taseko has the following options for funding the Aley Project:

- Option #1: Use Cash flow from Operations;
- Option #2: Issue Flow-Through Shares; and
- Option #3: Establish a Joint Venture with a Partner.

This section will discuss each option as well as measure its desirability using an option evaluation method.

5.1 Option #1: Use Cash Flow from Operations

As stated in Taseko's strategy in section 2.2.1, the Company will use free cash flows generated by Gibraltar to fund further development of its project pipeline. Option #1 relies on the successful ramp up of GDP3 and its generation of free cash flows going forward. Per the Company's Q2 2013 Management Discussion and Analysis, Taseko already generated $28 million in operating cash flows in Q2 2013 with the commencement of GDP3. These free cash flows could be budgeted for the advancement of the Aley Project. However, Taseko could use the free cash flow for other purposes, such as:

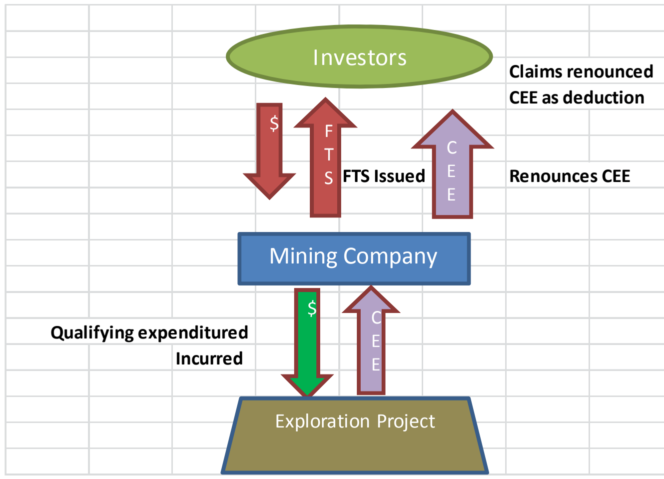
- New Prosperity Project initiatives;
- Pay dividends;
- Draw down debt. Taseko has the option to redeem some or all of the USD$200 million senior debt prior to its maturity on 2019; or
- Invest in other growth opportunities such as acquiring new projects. Due to the downturn in valuations in the mining industry, there could be attractive projects that are available at a discount.

5.2 Option #2: Issue Flow-Through Shares

Taseko could take advantage of the BC government's Mining Flow-Through Share ("FTS") program. The BC government established this program to promote investment in exploration projects in BC. Under the program, the individual agrees to pay for the shares, and the corporation agrees to transfer or "flow-through" certain mining expenditures to the individual.

The individual can use the "flowed-through" expenditures as a tax credit against his/her personal taxable income. Figure 27 illustrates the mechanics of a flow-through share structure:

Figure 27: Flow-Through Share Illustration



Step #1: Investor buys FTS of the corporation under a FTS Subscription Agreement.

Step#2: The mining company uses proceeds from FTS issuance to fund "qualifying expenditures." Qualifying expenditures are expenses incurred to determine the existence, location, extent or quality of a mineral resource in BC including in the course of prospecting, drilling, trenching, digging test pits or sampling and geological/geophysical/geochemical surveying. As such, Taseko can issue Taseko FTS for the purposes of advancing Aley. The Company records the qualifying expenditures in the Canadian Exploration Expenditure ("CEE") or Canadian Development Expenses ("CDE") pools of the company. The Company can use these tax pools as a deduction from future taxable income

Step#3: Since most companies in the exploration stage do not have taxable income, the company renounces the CEE/CDE deductions and "flows-through" the deduction to the investor. The BC mining flow-through share tax credit allows the investor to claim a non-refundable tax credit equal to 20% of their BC flow-through mining expenditures. The Aley Corporation, a Taseko subsidiary, holds the Aley claims. Since Aley Corporation does not have revenues or taxable income, it can renounce is CEE/CDE tax pools to FTS investors.

Assuming Taseko wholly finances Aley through the issuance of FTS, Taseko will be able to allocate free cash flows from Gibraltar to other initiatives. However, issuing FTS has the following consequences:

- Share dilution; and
- Loss of CEE/CDE tax pools for future deductions when the Aley Projects goes into production.

5.3 Option #3: Establish a Joint Venture with a Partner

Taseko could attract other parties to co-fund the exploration expenditures for Aley through establishing a joint venture ("JV") similar to the one established for Gibraltar with Cariboo Copper Corporation. The JV partner will buy into earn a percentage stake in the Aley Project through the purchase of Aley Corporation Shares. Thereafter, both Taseko and the JV partner can jointly fund exploration expenditures based on their percentage ownership of the Aley Project.

The following companies could be potential JV partners:

- Incumbent Niobium Miners: Since IAMGOLD is also a Canadian mining company, it might be the most suitable incumbent niobium miner to be a JV Partner due to geographical proximity and business culture. In addition, Taseko can leverage IAMGOLD's expertise in developing and operating a niobium mine.
- FeNb Buyers: Potential FeNb buyers could be another potential JV partner as evidenced by the 30% stake held by Japanese and Chinese steel mill consortiums in CBMM. Sojitz Corporation, the majority shareholder in Cariboo Copper Corporation, which is Taseko's 25% JV partner for the Gibraltar Mine, could be the most suitable JV partner in this category. Taseko is already familiar with working with Sojitz since the formation of the Gibraltar Joint Venture in 2010. It is worth noting that Sojitz is part of the Japanese consortium, which has a stake in CBMM.

The JV option will cause less strain on Taseko's free cash flows since a JV partner will share exploration expenditures. In addition, it will not cause the loss of CEE/CDE tax pools caused by the FTS option. However, the Joint Venture option will cause Taseko to lose a percentage of ownership of Aley. The greater the percentage ownership given to the JV partner, the lesser will Taseko be able to solely drive the direction of the Aley Project. In addition, Taseko will have to share the potentials rents on the Aley Project with the JV Partner.

5.4 Option Evaluation Criteria

A set of criteria need to be established in order to evaluate the options presented above. The basis for the criteria is Taseko's goal of "Building Value through Operating and Developing Major Mining Projects." The criteria will evaluate the options based on the "value" the financing option can potentially bring or take away.

The value that Taseko generates is reflected in the Company's market capitalization - its share price multiplied by the number of issued and outstanding shares. Analysts base their estimates of the share price based on the net asset value (NAV) formula illustrated by Table 14 below:

Table 14: Net Asset Value Formula

(+) Gibraltar (NPV)
(+) New Prosperity (NPV)
(+)Aley (NPV)
(+)Harmony (NPV)
Total Projects NPV
(+) Cash
(+) Working capital
(-) Debt
(-) General and Adminstrative Expenses
(-) Taxes
(-) Provisions and Other Obligations
= Net Asset Value (NAV)
Divided by Issued and Outstanding Shares
= Company Share Price

Based on this concept, the following criteria will evaluate the financing options discussed above:

- Effect on the Net Present Value (NPV) of Aley: The NPV of Taseko's mineral properties drive the NAV. It is based on the present value of the estimated LOM free cash flow generated from the project. The analysis allocated a weighting of 50% to this criteria. This criteria carries the most weight since the NPV of Taseko's projects primarily drives the Company's value.

- Effect on Share Dilution: As shown in the formula, the NAV is divided by the issued and outstanding shares of the Company. The more shares issued, the more dilution occurs since it needs to be shared with more shareholders. The analysis allocated a weighting of 25% to this criteria.
- Effect on Taseko's Cash Position – As shown on the NAV formula above, cash is one of the components of the net asset value calculation. The analysis allocated a weighting of 20% to this criteria.
- Financing Cost Associated with the Option: Financing costs are not specifically in the NAV calculation but is an important factor to consider when evaluating financing options. The analysis allocated a weighting of 5% to this criteria

Using the criteria above, the analysis evaluated the funding options as follows:

- Option #1 has the least negative effect on the NPV of Aley. Despite using the free cash flows generated from Gibraltar, it does not have to split the NPV of Aley with the JV Partner since Taseko has to share the future LOM free cash flows generated by Aley with the JV Partner. It also does not have to sacrifice Aley's exploration tax pools under Option #3 since these tax pools increase the NPV of Aley by sheltering a portion of its taxable income.
- Option #1 causes the least dilution to future earnings. Unlike Option #2, it does not need to issue more shares nor share the future earnings from Aley with a JV partner under Option #3.
- Option # 2 has the most positive effect on Taseko's cash balance since funding for the Aley project will come from the FTS shares issued. The other alternatives outlined above can use the free cash flows.
- Option#1 has no associated financing costs. Taseko will have to incur share issuance costs such as legal fees and listing fees under Option #2. Option #3 will incur the most financing costs since there will be substantial legal costs and due diligence cost associated with forming a joint venture.

Based on the above criteria and relative weightings, Table 5 evaluated the options as shown below: (Each option was ranked 1 (least favourable) to 3 (most favourable) :

Table 15: Financing Option Evaluation Ranking Based on Criteria

Criteria	Weight	Financing from Cash Flow from Operations	Financing through Raising Flow Through Shares	Financing through Establishing a Joint Venture with a Partner
Least Negative Effect on NPV of Aley	50%	3	2	1
Least Negative Effect of Dilution of Future Earnings	25%	3	1	1
Positive Effect on Cash Balance	20%	1	3	2
Financing Costs	5%	3	2	1
Score	**100%**	**2.6**	**1.95**	**1.2**

Table 15 indicates Option #1 best fits Taseko's criteria of building value for its shareholder. The next section will evaluate the feasibility of each option.

5.5 Feasibility Analysis

The analysis above indicates that Option #1 appears to be the most attractive option for Taseko. This section will assess which option matches Taseko's internal capabilities. Table 16 shows Taseko's management preferences, organization and resources for implementing the options presented above.

Table 16: Financing Option Feasibility Analysis

		Management Preference	Organization	Resources
Option #1: Fund from Cash Flow from Operations	What option requires	Preference to implement business model. Needs to be confident that Taseko will realize free cash flows from Gibraltar. Absence of more promising projects available in the market.	The Gibraltar Mine needs to understand its responsibility and role as the cash source of Taseko's project pipeline. Moreover, investors need to understand Taseko's growth strategy.	To generate the free cash flows, Gibraltar needs to gradually increase production and ramp up towards design capacity.
	Current gaps	None, management is confident on Gibraltar's prospects as well as on Aley's prospects.	None. The Gibraltar Mine understands its role. Investors also do not expect dividends from Taseko in the near term.	Since the commissioning of GDP3, Gibraltar has steadily increased production. However, impact lower of copper prices continue to impact Gibraltar's free cash flow generation.
	Gap-bridging solution	N/A	N/A	Initiate further cost reduction program and increase Gibraltar production towards capacity to realize scale economies.
Option#2:Fund through Raising Flow Through Shares	What option requires	Management needs to be open to share dilution and loss of tax pools	Taseko needs to have the corporate structure to be qualified to issue FTS.	To get the right pricing for the FTS issuance, Taseko needs to be trading at a higher price. In addition, Taseko needs a strong finance department with the experience to facilitate a FTS arrangement.
	Current gaps	Management prefer no dilution and to retain tax pools.	None. Taseko has the adequate corporate structure.	Taseko shares are currently trading at the $2 range. The share price has not recovered due to the lingering uncertainty in the financial markets. In terms of the knowledge resource, Taseko has the finance team to facilitate the FTS financing.
	Gap-bridging solution	Less dilution will occur if FTS issued at a higher price.	N/A	Difficult to bridge the gap since it is driven by macroeconomic factors.
Option #3: Fund through Establishing a Joint Venture with a Partner	What option requires	Management needs to be open to relinquish some of Taseko interest in Aley.	The option requires Taseko corporate structure to be open to form JVs.	Option requires a a strong finance and legal team to facilitate and negotiate the transaction.
	Current gaps	Management's preference is to own Aley a 100%.	None, Taseko already has the JV structure for the Gibraltar Mine.	Taseko's finance and legal team has the experience in JV formations to the Gibraltar Joint Venture.
	Gap-bridging solution	Excellent offer from potential JV partner.	N/A	N/A

Based on the above analysis, Option #1 is the best match for Taseko's internal capabilities. It meets management's preference for utilizing Taseko's growth strategy of using Gibraltar's free cash flows to finance its project pipeline. Option 2 and 3 cannot meet management's preferences to issue the FTS at a better price (issue less shares to minimize share dilution) or receive an offer that makes sense from a potential JV. Taseko does not have the best financing resources available due to the current world economic uncertainty and the depressed mining environment.

6: CONCLUSION

Chapter 4's analysis led to the conclusion that the following factors support Taseko's assumptions about the attractiveness of the FeNb industry and its entry into the industry: a foreseeable demand growth for niobium, a steadily increasing niobium price, and a low intensity competitive environment. It further reached the conclusion that Aley is an attractive niobium project and Taseko can be successful in exploring, developing and operating Aley.

Hence, Taseko should pursue the following recommendations contained in the March 2012 technical report on Aley:

- Additional exploration and engineering work to further define the extent of the niobium mineralization with the purpose of upgrading the resource classification to reserves;
- Follow up on other potential deposit targets on Aley; and
- Continuation of metallurgical test work designed to support a pre-feasibility study.

After evaluating a number of financing options as well as Taseko's internal capabilities, Taseko should use the free cash flows generated from its operations to finance the above activities.

Appendix A: Biggest Mining Companies in B.C. in 2012 Based on Revenues

Rank '13	Company	Primary business	Assets '12 / (000s)	Net income '12 (000s)	Revenue '12(000s)
1	**Teck**	Copper, coal, zinc and energy	**$34,617,000**	**$870,000**	**$10,343,000**
2	**Goldcorp Inc**	Gold mining	**$311,807,882**	**$17,472,512**	**$54,295,652**
3	**First Quantum Minerals Ltd**	Exploration, development and operating mines	**$75,288,642**	**$18,675,312**	**$29,474,502**
4	**Eldorado Gold Corp**	Gold producer, developer and explorer; iron ore producer	**$792,020,082**	**$3,177,402**	**$11,463,932**
5	**Pan American Silver Corp**	Silver mining	**$33,845,912**	**$874,252**	**$9,276,652**
6	**Silver Wheaton Corp**	Silver streaming company	**$31,861,482**	**$5,854,502**	**$8,487,102**
7	**New Gold Inc**	Gold mining	**$42,794,162**	**$1,988,012**	**$7,905,092**
8	**Nevsun Resources Ltd**	Precious and base metals mining	**$8,736,962**	**$2,464,492**	**$5,654,732**
9	**China Gold International Resources Corp Ltd**	Gold mining in China	**$18,041,942**	**$769,272**	**$3,320,552**
10	**Aura Minerals Inc**	Gold and copper production	**$4,252,572**	**($56,752)**	**$3,071,052**
11	**Capstone Mining Corp**	Metals and mining	**$15,111,972**	**$595,322**	**$3,052,092**
12	**B2Gold Corp**	Gold mining	**$6,757,892**	**$518,552**	**$2,587,922**
13	**Imperial Metals Corp**	Base and precious metals	**$659,732**	**$32,061**	**$257,783**
14	**Taseko Mines Ltd**	Gold, copper and molybdenum mining and development company	**$986,447**	**($19,632)**	**$253,607**
15	**First Majestic Silver Corp**	Silver mining	**$812,218**	**$88,809**	**$246,930**
16	**Silver Standard Resources Inc**	Silver exploration and development	**$13,155,952**	**$548,382**	**$2,408,792**
17	**Silvercorp Metals Inc**	Silver producer with projects located in China and Canada	**$5,748,592**	**$1,011,272**	**$2,377,242**
18	**Copper Mountain Mining Corp**	Copper mining	**$616,014**	**$27,422**	**$229,474**
19	**Aurizon Mines Ltd**	Gold mining	**$449,651**	**$31,807**	**$223,558**
20	**Endeavour Silver Corp**	Silver and gold mining	**$4,770,492**	**$384,482**	**$2,078,712**
21	**Amerigo Resources Ltd**	Copper and molybdenum production	**$2,042,122**	**($8,184)**	**$1,815,792**
22	**Fortuna Silver Mines Inc**	Silver mining in Latin America	**$3,159,472**	**$314,322**	**$1,608,392**
23	**Veris Gold Corp**	Gold mining	**NP**	**NP**	**$1,087,625**
24	**North American Tungsten Corp Ltd**	Tungsten mining	**$80,968**	**($9,843)**	**$107,524**
25	**Turquoise Hill Resources (formerly Ivanhoe Mines Ltd)**	Copper, gold and coal mining	**NP**	**NP**	**$921,415**
					NP = Not Provided

Data source: (Business in Vancouver, 2013)

Reference List:

Anglo American PLC. (2013). *Fact Book 2012/13.* London: Anglo American PLC.

Azzarello, S., & Putnam, B. (2012, July 25). *BRIC Country Update: Slowing Growth in the Face of Internal and External Challenges.* Retrieved July 20, 2013, from CME Group Web Site: http://www.cmegroup.com/education/files/ed133-market-insights-bric-2012-8-1.pdf

BC Ministry of Energy and Mines. (2012). *British Columbia's Mineral Exploration and Mining Strategy.* Victoria: BC Ministry of Energy and Mines.

British Geological Survey. (2011). *Niobium-Tantalum.* London: British Geological Survey.

Business in Vancouver. (2013). *Biggest Mining Companies in B.C. in 2012.* Retrieved July 8, 2013, from Business in Vancouver Web Site: http://www.biv.com/article/20130430/BIV050101/130429939/0/BIV0100

CBMM. (2013). *CBMM Images*. Retrieved July 25, 2013, from CBMM Company Web Site: http://www.cbmm.com.br/english/images/fotos_cbmm/mineracao/02.jpg

Clow, G. G., Salmon, B., Lavigne, M., McDonough, B., Pelletier, P., & Vallieres, D. (2011). *Technical Report on Expansion Options at Niobec Mine, Quebec, Canada.* Roscoe Postle Associates Inc.

Crockett, R. N., & Sutphin, D. M. (1993). *International Strategic Minerals Inventory Summary Report.* Denver: U.S. Geological Survey.

Ernst & Young. (2011). *Effective Capital Execution - Mining and Metals.* EYGM Limited.

Ernst & Young. (2012). *Business Risks Facing Mining and Metals.* EYGM Limited.

Eurasia Group. (2012, September). *Global Mining Outlook (Presentation)*. Vancouver, BC, Canada: Eurasia Group.

IAMGOLD. (2012, March 28). *Niobium 101*. Retrieved May 5, 2013, from IAMGOLD Corporation Web Site: http://www.iamgold.com/files/pdf/Niobium%20101%20Final%20March%202012.pdf

IAMGOLD. (2013). *2012 Annual Report.* Toronto: IAMGOLD Corporation.

IAMGOLD. (2013, July). *Niobec Niobium Mine, Québec*. Retrieved July 25, 2013, from IAMGOLD Corporation Web Site: http://www.iamgold.com/English/Operations/Operating-Mines/Niobec-Niobium-Mine/Mining-Processing/default.aspx

IMF. (2013, August). *Data and Statistics*. Retrieved August 3, 2013, from International Monetary Fund Web Site: http://www.imf.org/external/data.htm

Jordan, P. (2012, May 17). *Climbing Costs Make Mining Growth Problematic.* Retrieved July 4, 2013, from Globe and Mail Web Site: http://www.theglobeandmail.com/report-on-business/industry-news/property-report/climbing-costs-make-mining-growth-problematic/article4184840/

KITCO. (2013, August). *Historical Copper Charts*. Retrieved August 2, 2013, from KITCO Base Metals Web Site: http://www.kitcometals.com/charts/copper_historical_large.html#5years

KPMG. (2011). *Business Risks Facing the Mining Industry.* KPMG LLP.

KPMG. (2012). *Competitive Alternatives.* KPMG LLP.

Papp, J. F. (2012). *2011 Minerals Yearbook: Niobium and Tantalum.* U.S. Geological Survey.

Papp, J. F. (2013). *Metal Prices in the United States Through 2010: U.S. Geological Survey Scientific Investigations Report 2012-5188.* U.S. Geological Survey.

Porter, M. (1979, March/April). How Competitive Forces Shape Strategy. *Havard Business Review*.

PwC. (2013). *Mine - A Confidence Crisis.* PwC.

Roskill Consulting Group Ltd. (2011). *Analysis of the Global Niobium Market.* London: Roskill Consulting Group Ltd.

Simpson, R. G. (2012). *Technical Report Aley Carbonatite Niobium Project.* Vancouver: GeoSim Services Inc.

SinoLatin Capital. (2010). *Niobium: A Bridge Between China and Brazil.* Retrieved July 3, 2013, from SinoLatin Capital Web Site: http://www.sinolatincapital.com/Upload/20101013154620.pdf

Sousa, C. A. (n.d.). *The Evolution of FeNb Manufacturing.* Retrieved July 15, 2013, from CBMM Web Site: http://www.cbmm.com.br/portug/sources/techlib/science_techno/table_content/sub_1/images/pdfs/006.pdf

Taseko Mines Limited. (2011). *New Prosperity Project Description.* Vancouver, BC: Taseko Mines Limited.

Taseko Mines Limited. (2013, February 22). *Q4 Earnings Conference Call Presentation*. Vancouver, BC, Canada: Taseko Minies Limited.

Taseko Mines Limited. (2013). *2012 Annual Information Form.* Vancouver, BC: Taseko Mines Limited.

Taseko Mines Limited. (2013). *2012 Year End Management Discussion and Analysis.* Vancouver, BC: Taseko Mines Limited.

Taseko Mines Limited. (2013, April). April 2013 Company Presentation. *Building Value Through Operating and Developing Major Mining Projects*. Vancouver, BC, Canada: Taseko Mines Limited.

Taseko Mines Limited. (2013, February). *February 2013 Investor Relations Presentation.* Retrieved July 08, 2013, from Taseko Mines Limited Web Site: http://www.tasekomines.com/i/media/mce/presentations/Feb_Presentation.pdf

Taseko Mines Limited. (2013). *Q2 2013 Management Discussion and Analysis.* Vancouver, BC: Taseko Mines Limited.

USGS. (2012, October 5). *Historical Statistics for Mineral and Material Commodities in the United States.* Retrieved August 5, 2013, from USGS Web Site: http://minerals.usgs.gov/ds/2005/140/ds140-niobi.pdf

USGS. (2013). *Mineral Commodity Summary.* U.S. Geological Survey.

Volkering , S. (2013, March 29). *Why a Playstation and Mining Technology Have More in Common Than You Think.* Retrieved August 4, 2013, from The Daily Reckoning Web Site: http://www.dailyreckoning.com.au/why-a-playstation-and-mining-technology-have-more-in-common-than-you-think/2013/03/29/

Wikipedia. (2013, August). *High Strength Low Allow Steel*. Retrieved August 4, 2013, from Wikipedia: http://en.wikipedia.org/wiki/Hsla

Wikipedia. (2013, August). *Niobium*. Retrieved August 8, 2013, from Wikipedia: http://en.wikipedia.org/wiki/Niobium

Wikipedia. (2013, August). *Niobium Pentoxide*. Retrieved August 7, 2013, from Wikipedia: http://en.wikipedia.org/wiki/Niobium_pentoxide

Wikipedia. (2013, August). *Resource Nationalism*. Retrieved August 2, 2013, from Wikipedia: http://en.wikipedia.org/wiki/Resource_nationalism

World Steel Association. (2009, September). *Steel by Topic: Construction.* Retrieved August 7, 2013, from World Steel Association Web Site: http://worldsteel.org/dms/internetDocumentList/downloads/steel-by-topic/Steel-advantage_bridges/document/Steel%20advantage_bridges.pdf

World Steel Association. (2013, April 11). *World Steel Short Range Outlook.* Retrieved August 5, 2013, from World Steel Association Web Site: http://www.worldsteel.org/dms/internetDocumentList/press-release-downloads/2013/April-2013-SRO-APU-by-region-and-GDP/document/April%202013%20SRO%20APU%20by%20region%20and%20GDP.pdf

WorldAutoSteel. (2013). *FutureSteelVehicle*. Retrieved July 2013, from WorldAutoSteel Web Site: http://www.worldautosteel.org/projects/future-steel-vehicle/

Yahoo Finance. (2013, August). *Taseko Historical Price Charts*. Retrieved August 9, 2013, from Yahoo Finance Web Site: http://ca.finance.yahoo.com/q/bc?s=TKO.TO