

**Addressing Labour Shortages in the Mining Sector:
Policy Options to Increase Employer Engagement with
BC's Apprenticeship System**

by

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Abstract

This study assesses the ability of British Columbia's apprenticeship system to engage BC's mining and smelter companies to generate more apprenticeship positions. Supplemented by a literature review, ten semi-structured interviews are conducted with apprenticeship stakeholder groups. Industry and union representatives are consulted to determine relevant factors affecting apprenticeship positions as well as ways to increase industry participation. Interviews are also used to evaluate policy options. Industry participants do not cite significant barriers to increasing apprenticeship numbers; the positions are closely tied to economic conditions in the industry. Improving aspects of in-class technical training could improve industry "confidence" and increase investment in the system. The study recommends reducing tax credits to large businesses and diverting the savings to finance the expansion of Industry Training Authority (ITA) level exams to improve the relevancy, standardization and quality of technical training.

Keywords: Skilled trades; apprenticeship; mining; British Columbia; skills shortages; public policy

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Table of Contents

Approval.....	Error! Bookmark not defined.
Partial Copyright Licence	iii
Abstract.....	iv
Acknowledgements	v
Table of Contents.....	vi
List of Tables.....	ix
List of Figures.....	x
List of Acronyms.....	xi
Glossary.....	xii
Executive Summary	xiv
1. Introduction	1
2. Mining and Mineral Production in British Columbia	4
2.1. Industry Scope	4
2.2. Production Values of Mining in BC	5
2.3. Revenues for the Government of BC.....	7
2.4. Firm Size	8
2.5. Labour Market Characteristics.....	9
2.5.1. Aging workforce	10
2.5.2. Typical earnings.....	11
2.5.3. Unionization	12
2.5.4. Industry unemployment rates	13
2.5.5. Skilled trades occupations in mining and mineral production.....	14
3. Apprenticeship System in Canada.....	15
3.1. Basic Features of Apprenticeship Training	15
3.2. Jurisdictional Responsibility.....	15
3.3. Federal Involvement in Apprenticeship Training	16
3.4. Apprenticeship in British Columbia	17
3.4.1. Organizational framework	17
3.4.2. Certification and programming framework.....	18
3.4.3. Provincial tax credits	20
3.5. Data and Characteristics of Employer Sponsors.....	21
4. Evidence and Rationale for the Policy Problem	24
4.1. Projected Growth in Mining.....	24
4.2. Current Labour Market Conditions in the Skilled Trades.....	25
4.3. Future Labour Market Conditions in the Skilled Trades	27
4.4. Labour Market Outcomes for Apprenticeship Graduates	31
4.5. Summary of Evidence and Rationale for Policy Problem	34

5.	Study Methodology	36
6.	Literature Review: Issues in Employer Sponsorship.....	39
6.1.	Human Capital Theory.....	39
6.2.	Economic Justification for Apprentice Sponsorship.....	40
6.2.1.	Reduced wages	40
6.2.2.	Informational asymmetry.....	41
6.3.	Specific Issues in Employer Sponsorship	42
6.3.1.	General employer benefits from sponsorship	42
6.3.2.	Costs and benefits: Return on Investment (ROI)	43
6.3.3.	Economic conditions	45
6.3.4.	Poaching.....	46
6.3.5.	Lack of information.....	47
6.3.6.	Structure of apprenticeship	47
6.3.7.	Unionization	48
6.3.8.	Administrative requirements.....	48
6.4.	Summary of Literature Review Findings	49
7.	Interview Findings: Issues in Employer Sponsorship	50
7.1.	Economic Conditions.....	51
7.2.	Maintaining Operational Output	52
7.3.	Retirements and Employee Turnover	52
7.4.	Why Hire Apprentices at All?	53
7.5.	Poaching	54
7.6.	Supervision Capacity	55
7.7.	Unionization	55
7.8.	Structure of Apprenticeships.....	56
7.9.	Lack of Information	57
7.10.	Administrative Requirements.....	57
7.11.	Lack of Confidence in Technical Training	58
7.11.1.	Relevancy	58
7.11.2.	Standardization and quality	59
7.11.3.	Implications.....	60
7.11.4.	Is poor technical training a barrier to increased sponsorship?	60
7.11.5.	Apprenticeship Student Outcomes (APPSO) survey results.....	61
7.12.	Impact of Tax Credits	62
7.13.	Summary of Interview Findings.....	63
8.	Policy Options	66
8.1.	Apprentice-Sharing Program (ASP).....	66
8.2.	Targeted Tax Credit (TTC) Program.....	67
8.3.	Expand ITA Level Exams	68
9.	Evaluation Framework	70
9.1.	Effectiveness.....	71
9.2.	Stakeholder Acceptability	71
9.3.	Cost.....	72
9.4.	Excluded Criteria	72

10. Policy Analysis	73
10.1. Apprenticeship-Sharing Program (ASP)	73
10.1.1. Effectiveness.....	73
10.1.2. Stakeholder acceptability	74
10.1.3. Cost	75
10.1.4. Other considerations.....	76
10.2. Targeted Tax Credit (TTC) Program	76
10.2.1. Effectiveness.....	76
10.2.2. Stakeholder acceptability	78
10.2.3. Cost	78
10.3. Expand ITA Level Exams	79
10.3.1. Effectiveness.....	79
10.3.2. Stakeholder acceptability	79
10.3.3. Cost	79
11. Recommendations	81
12. Conclusion.....	83
References.....	85
Appendices.....	91
Appendix A. Mining and Smelter Related NAICS Codes	92
Appendix B. BC Mining HR Task Force: Methodology and Findings	93
Appendix C. New Institutionalism and the Logic of Appropriateness.....	95
Appendix D. Apprenticeship Grants and Tax Credits	98

List of Tables

Table 1: Value of mineral production in BC: 1996 to 2011 (\$'000)	6
Table 2: Value of Copper in BC: 2002 to 2006 (\$'000)	7
Table 3: Provincial revenues from mining in BC: 1995/96 to 2010/11 (\$'000)	8
Table 4: Total employment by industry in mining and smelting (BC): 1997 to 2011	10
Table 5: Unemployment rates of APPSO programs and comparable age cohort in BC: 2011	32
Table 6: Interview participants	37
Table 7: Summary of issues per methodology	50
Table 8: APPSO responses on technical training	62
Table 9: Summary of interview findings	64
Table 10: Summary of TTC program	68
Table 11: Evaluation framework	70
Table 12: Policy evaluation matrix	73

List of Figures

Figure 1: Employment by establishment size (BC): 2008	9
Figure 2: Average hourly earnings by industry (Canada): 2001 to 2011 (monthly data)	11
Figure 3: Union coverage by industry (BC): 2001 to 2011	12
Figure 4: Unemployment rate by industry (Canada): 1996 to 2011	13
Figure 5: Stylized apprenticeship certification pathway for industrial mechanics.....	19
Figure 6: Skilled trades unemployment rate (BC): 2002 to 2012.....	26
Figure 7: Employment growth in the skilled trades (BC): 2002 to 2012.....	27
Figure 8: Projected supply and demand for machinery and transportation equipment mechanics (NOC 731) (BC): 2013 to 2020	29
Figure 9: Projected unemployment rates in the skilled trades (BC): 2013 to 2020	30
Figure 10: Unemployment and employment rates by education level for ages 15 to 24 (BC): 2011	33

List of Acronyms

AJCTC	Apprenticeship Job Creation Tax Credit
APPSTO	Apprenticeship Student Outcomes Survey
ATTC	Apprenticeship Training Tax Credit
BC LMO	British Columbia Labour Market Outlook: 2010 – 2020
CAF	Canadian Apprenticeship Forum
GTA	Group Training Australia
GTO	Group Training Organization
ITA	Industry Training Authority
ITO	Industry Training Organization
JGTP	Joint Group Training Program
MAP	Mining Apprenticeship Program
NOC	National Occupation Classification
RTO	Resource Training Organization
SATCC	Saskatchewan Apprenticeship & Trade Certification Commission

Glossary¹

Apprentice	A person who registers with the Industry Training Authority and pursues an industry training program—combining work-based training with technical or institution-based training—with the intent of obtaining an industry training credential.
Canadian Apprenticeship Forum (CAF)	CAF is a not-for-profit organization that conducts research and engages with stakeholders on Canadian apprenticeship issues. It is funded in part by the Government of Canada’s Sector Council Program (CAF, 2011)
Challenge / Challenge Process	Individuals who have not participated in a formal apprenticeship program in Canada, but have been assessed and approved to undergo final certification assessment requirements based on their prior experience and existing skills.
ITA Level Exams	Examinations developed by ITA for standardized use by training providers in determining successful completion of a specific level of a multi-year apprenticeship program.
Credential / Certification	Recognition that an individual has met the requirements of an industry training program either through participation in a formal apprenticeship program or through a challenge process. In B.C., credentials take the form of provincial Certificates of Qualification (often issued with inter-provincial or Red Seal endorsements), Certificates of Apprenticeship, and Certificates of Completion (Foundation programs).
Foundation Programs	Pre-apprenticeship and primarily school-based programs (including those formerly known as Entry Level Trades Training Programs) directly aligned with apprenticeship programs, and providing an entry point by which participants can earn credit for level 1 technical training without the need for a sponsor.
Industry Training Organization (ITO)	An industry-directed, not-for-profit legal entity with responsibility for developing and managing industry training programs province-wide within a particular economic sector (e.g. horticulture, automotive repair, transportation, ICI Construction).
Journey person	A person who hold a credential in one or more trades.
Red Seal	A national program providing a standardized endorsement for specific occupations/trades and allowing for greater labour mobility across provincial/territorial boundaries. Upon successful completion of a Red Seal exam, a Red Seal endorsement is added to the provincial credential.

¹ Unless otherwise indicated, glossary definitions are direct quotations from ITA (2012b).

Sponsor	A qualified individual or other legal entity (usually an employer) that commits to ensuring that an apprentice receives work-based training relevant to his or her industry training program, and under the direction of one or more qualified individuals.
Technical Training	The institution-based (in-class or distance education) component of an industry training program that provides a combination of theoretical knowledge and practical skills to complement work-based training.

Executive Summary

The Government of British Columbia (BC), through its 2012 BC Jobs Plan, has prioritized the expansion of mining activities throughout the province. Mining and mineral production generates significant revenue for the Provincial Government. Approximately 40% of the industry's workforce is categorized as "trades, transportation and equipment operators," which includes most skilled trades occupations.

Apprenticeships are the primary means of developing skilled tradespeople in BC. The Industry Training Authority (ITA) is the Crown Corporation responsible for governing apprenticeships in BC. Within this organizational framework are Industry Training Organizations (ITOs) that work with industry to recommend reforms of program standards to the ITA. The Resource Training Organization (RTO) is the ITO responsible for trades in the resource sector, including mining.

The problem addressed in this study is that too few mining and smelter employers are sponsoring apprentices. Four pieces of evidence inform this policy problem. First, some economic indicators suggest that labour market conditions in the skilled trades are "tighter" than for the rest of the economy. Second, tight conditions are expected to continue in the medium-term future. Third, these conditions could be exacerbated since occupational projection models have not accounted for the potential of increased mining operations in the province. Finally, even if labour market conditions do not tighten or if the industry does not grow as expected, an apprenticeship provides significant labour market benefits to individuals who receive this training. Therefore, promoting apprenticeships is a worthwhile policy objective in itself. This study examines factors that lead to the sponsorship of apprentices, as well as developing an understanding of ways to increase industry participation.

This study employs two methodologies: a literature review and ten semi-structured interviews with key stakeholders from mining and smelter companies, the ITA and the RTO. Human capital theory provides the theoretical framework for understanding employer decision-making in apprentice sponsorship. From this standpoint, specific examples and industry participation dynamics are highlighted from

the literature. Industry participants are consulted to determine barriers to increased apprenticeship participation. Given the high rate of unionization in mining, union representatives are consulted to provide a rounded view of apprenticeship sponsorship issues. A wide variety of issues are discussed with the RTO, including background information, perception of industry barriers, and policy options. Finally, the ITA is consulted to evaluate policy options proposed in this study.

Interview findings mainly corroborate those from other studies, in particular that the number of apprenticeships offered is closely tied to economic conditions. Employers offer apprenticeships to address retirements and occupational turnover, but will not compromise the operational output of the site by hiring too many apprentices. Large mining and smelter companies consulted in this study do not cite specific barriers to increasing participation. Rather, participants indicate that apprenticeships are offered when the company has a “need” (e.g. new work projects, retirements, turnover, etc.).

Some participants indicate that industry has low confidence in the ability of the educational system to deliver relevant, high-quality technical training to apprentices. Course curriculums are owned by instructors, which can result in uneven standards across the province. Improving the educational content and standards in technical training could boost confidence and participation in the apprenticeship system.

Three policy directions are proposed:

- An Apprenticeship-Sharing Program (ASP) in which the RTO would act as a central indenturing agency and participating firms could employ apprentices on shorter-term, flexible contracts
- A Targeted Tax Credit (TTC) program that would reduce current tax credits to large businesses to pre-2009 levels. Revenues generated through this policy could be used by the ITA to support a variety of initiatives, such as increased funding for technical training
- Expanding ITA level exams, which involves developing standardized exams for all trade programs and apprenticeship levels and increasing the weight of these exams from their current level of 20%

Each policy is formally evaluated according to three criteria: effectiveness (i.e. the likelihood of increasing industry sponsorship levels), cost (i.e. implementation cost and operational feasibility), and stakeholder acceptability (i.e. the likelihood of gaining

support from industry and unions). Overall, expanding ITA level exams receives the highest score, followed by the TTC program, and the ASP. Expanding ITA level exams is expected to be most effective at increasing industry participation. Conversely, the TTC program ranks low on effectiveness, but also has the lowest cost and actually generates revenue for the Province and the ITA.

This study recommends implementing the TTC program and expanding ITA level exams. Expanding ITA level exams is recommended due to its high stakeholder acceptability and anticipated effectiveness. While it is unknown whether this policy option will immediately increase employer participation, it should increase employer confidence in technical training. Based on interview findings, improving employer confidence in the educational system could be a key policy lever for the ITA and the Government of BC to increase industry sponsorship participation. While the TTC program will not immediately increase employer participation, it will generate money for the Province and the ITA by reducing outlays to large businesses. These funds should be used to finance the expansion of ITA level exams.

1. Introduction

In 2012, the Government of British Columbia released its economic plan, “Canada Starts Here: The BC Jobs Plan.” Among the strategies outlined, BC aims to leverage its competitive strength in mining to drive economic and job growth in the province. Rising global demand, particularly in China and India, for coal, metals and industrial minerals presents an economic opportunity for BC given its large deposits of these resources. To meet global demand, the BC Jobs Plan calls for the development of eight new mines by 2015, as well as expanding the capacity of existing mines.

Apprenticeship is the most common method of developing workers in the skilled trades. In BC, the Industry Training Authority (ITA), a Crown Corporation, oversees the apprenticeship system. Among other objectives, the organization identifies the importance of industry engagement, encouragement of employer sponsorship and increasing of the value of apprenticeships to industry (ITA, 2012a). However, the ITA did not achieve its stated number of employer sponsors last year. In 2011/12, the ITA’s stated goal for all industries was 10,600 “total registered sponsors,” but only 9,412 registered sponsors participated in apprenticeship (ITA, 2012b).² While this drop is attributed to poor economic conditions, the ITA also acknowledges a need to improve knowledge of the factors associated with employer sponsorship (ITA, 2012b).

The policy problem that frames this research is that too few apprenticeships are being offered by mining and smelter companies in BC. Specifically, I focus on two occupations—industrial mechanics (millwrights) and heavy-duty equipment mechanics—that are typically developed through the apprenticeship system and are important to a mining operation.

² 2010/11 also saw a drop in the number of employer sponsors (ITA, 2012b). A registered sponsor may sponsor more than one apprentice.

To justify the policy problem, I provide four distinct, but complementary, lines of evidence. First, current economic indicators suggest that some skilled trades in BC are experiencing “tighter” labour market conditions in which supply is not meeting demand. Second, these tighter conditions are projected to continue throughout the decade. Tight labour markets have the potential to constrain industry growth and may warrant increasing the supply of workers in occupations that fall short of the demand. Third, potentially exacerbating these conditions is the expansion of mining as envisaged by the BC Jobs Plan. Finally, given that two of these three rationales involve future projections that are inherently uncertain, I offer a fourth reason to increase apprenticeship positions. That is, the labour market outcomes of recent graduates in the industrial mechanic and heavy-duty equipment mechanic programs in BC show a positive and marked benefit to individuals in those trades even if they are employed by industries besides mining.

Through two methodologies, this study examines why mining and smelter companies offer apprenticeships and the barriers to increasing the number of apprenticeship positions. Human capital theory, developed by economist Gary Becker, provides the theoretical framework to model a firm’s decision of whether to sponsor an apprentice. After surveying the literature based on this theoretical framework, I test these findings through ten semi-structured interviews with key stakeholders. I formulate and evaluate alternative approaches of delivering apprenticeships that could effectively engage BC mining and smelter employers to make a stronger investment in training skilled labour. Finally, while not the explicit focus of this study, I conclude with a brief discussion of the roles and responsibilities of industry, the Government of BC and the ITA to develop skilled tradespeople.

Section 2 provides basic background information about the mining and mineral production sector in BC. Section 3 outlines the apprenticeship system in BC, as well as data on sponsorship characteristics per industry and by firm size. Following these background sections, the four lines of evidence that support the policy problem of this study are discussed in Section 4. Section 5 details the two methodologies of this study. The findings of the first and second methodologies are then discussed in section 6 and section 7 respectively. Section 8 outlines this study’s proposed policy options. In section 9, a framework for the formal evaluation of these policies is described. Following this in section 10, each policy option is analyzed according to the criteria laid out in section 9.

Finally, the study offers recommendations in section 11 and a listing of study limitations, future directions and conclusions in section 12.

2. Mining and Mineral Production in British Columbia

Following an initial discussion that defines the scope of this study, this section addresses: the production values of mining and mineral products, government revenues, information on the size of firms and various labour market characteristics of the industry in BC.

2.1. Industry Scope

Mining involves the extraction of natural, solid minerals (e.g. coal and ores), as well as metals (e.g. copper, molybdenum, gold, silver, and zinc) (BC Stats, 2010). Several sectors within mining correspond to distinct phases of the mining process: geoscience, exploration, discovery, development, production, and reclamation (BC Ministry of Energy and Mines, n.d.-b). This study addresses the production phase of mining.

In Canada, industries are designated under the North American Industry Classification System (NAICS). NAICS codes systematically divide economic activity across the economy into groups based on similar methods of producing a given good or service. The system is organized hierarchically. The NAICS structure contains 20 sectors which each contain varying numbers of sub-sectors, industry groups and industries—at each level referring to more specific categories of economic activity (Statistics Canada, 2012).

Relevant to mining, the highest level of aggregation in the system is NAICS 21 (Mining, quarry, and oil and gas production), which contains (in hierarchical order): five sub-sectors, 19 industry groups, ten industries and 29 Canadian industries. This study operates at the sub-sector level and is not concerned with the more specific industry groupings. Specifically, the sub-sector NAICS 212 (mining and quarry, except oil and

gas extraction) will be the focus of this study.³ This subsector includes establishments involved in the extraction and initial preparation of minerals and coal for further processing and refinement (Statistics Canada, 2012). Hence, the distinction between extracting coal versus copper is not relevant to distinguishing industry groupings in the NAICS system as both activities fall within NAICS 212.

This study also highlights apprenticeship participation at smelter facilities. Smelting is a chemical process that extracts metal from ore. Designated within the manufacturing sector (NAICS 31), smelter plants are specifically found in the primary and metal manufacturing sub-sector (NAICS 331). Smelting plants can be closely associated with primary resource extraction activities (such mining) since they help refine the raw materials extracted from the mining site (BC Stats, 2010). Further, in BC, many of the products that undergo smelting are also extracted in BC, emphasizing how smelting and mineral extraction are linked.

In summary, there are six phases to a mining project. My primary focus is the production phase. Due to the interconnectedness of primary extraction (e.g. mining) and processing activities (e.g. smelting), I examine both mining and smelter companies. The participation in apprenticeship programs for this sector of economic activity, which considered together, can be labelled “mining and mineral products,” constitutes the industry scope of this study (BC Stats, 2010).

2.2. Production Values of Mining in BC

Mining can refer to a wide range of materials. These materials can be broadly divided into three categories: metallic minerals, non-metallic minerals and coal. Copper and gold are the two most valuable metallic minerals in BC, but the province also produces silver, lead and zinc. Among non-metallic minerals, BC produces sand and gravel, stone and sulfur (Natural Resources Canada, 2012). Finally, coal, as shown below, has recently seen a dramatic rise in value.

³ Other sub-sectors such as NAICS 213 (support activities for mining and oil and gas extraction) are closely related to NAICS 212, but do not constitute the specific focus of this project. See Appendix A for a description of mining-related NAICS codes.

While the value of mining products tends to fluctuate over time, recent years in BC have seen an increase in production value, as well as a longer-term rise in value. Table 1 shows the aggregate values of mining production in five-year intervals between 1996 and 2011. The value of the industry was \$8.9 billion in 2011, up from \$5.9 billion five years earlier in 2006. This growth is almost entirely due to coal, which rose from \$2.1 billion in 2006 to over \$6 billion in 2011. Coal now constitutes more than half of the province's mineral production revenue (Natural Resources Canada, 2012). Non-metallic mineral value has risen relatively stably, but its overall share remains small compared to coal and metallic minerals.

Table 1: Value of mineral production in BC: 1996 to 2011 (\$'000)

	1996	2001	2006	2011
Metallic minerals (e.g. copper, gold)	\$1,537,248	\$1,394,462	\$3,248,375	\$2,130,530
Non-metallic minerals (e.g. sand and gravel, stone)	\$440,296	\$513,037	\$636,940	\$778,328
Coal	\$1,026,580	\$959,292	\$2,105,270	\$6,072,674
Grand Total	\$4,339,930*	\$8,623,308**	\$5,990,584	\$8,981,532

*Includes: natural gas (\$816 million), natural gas by-products (\$78 million) and crude oil (\$441 million).

**Includes: natural gas (\$4.8 billion). Adapted from: Natural Resources Canada, 2012

While the overall value of mining has increased over the longer term (i.e. 1996-2011), it can be susceptible to short-term fluctuations. One reason for this volatility is that mineral products in BC tend to be exported and are therefore susceptible to fluctuations in exchange rates and economic conditions in other countries (BC Stats, 2010). In the preceding table, metallic mineral production highlights this issue as its value in 2011 was more than \$1 billion less than in 2006, but was approximately \$600 million higher than in 1996. Examining a shorter time horizon clarifies this volatility. Table 2 shows year-to-year fluctuations in the value of copper in BC. This reference period is chosen because it is relatively recent and does not overlap with the 2008 recession. Copper is selected because it is BC's most valuable metallic mineral.

Table 2: Value of Copper in BC: 2002 to 2006 (\$'000)

	2002	2003	2004	2005	2006
Copper	\$612,114	\$589,956	\$910,379	\$1,289,345	\$2,191,742

Adapted from: Natural Resources Canada, 2012

After dropping \$23 million between 2002 and 2003, the value of copper increased \$321 million the following year in 2004. This volatility has important implications for industry projections in the future, and notably for the BC Jobs Plan, which seeks to capitalize on rising values mineral and coal prices. The assumption that coal and mineral values will continue to see strong growth in the future may be misleading. The mining industry can experience short-term fluctuations and historical trends do not necessarily create reliable future projections. While this capstone acknowledges these two issues, it is beyond the scope to directly address them.

2.3. Revenues for the Government of BC

Mining production adds revenue to the provincial treasury. As per the *Mineral Tax Act*, and the *Mineral Land Tax Act*, BC receives revenue from mining activity through Mineral Taxes and the Mineral Land Tax respectively (BC Ministry of Finance, n.d.-b).⁴ Similar to the value of mining, provincial revenues from the industry have also increased over the past 15 years (see Table 3 below). In 2010/11, the total revenue from both tax schemes equaled \$368 million dollars. Contrasting this amount with the \$69 million collected in 1995/96, sees an increase of nearly \$300 million over the past 15 years. Table 3 also highlights the revenue that the Government of BC has derived from increased value of coal over the past five years. In 2005/06, mineral taxes for metals actually exceeded those for coal. But, five years later in 2010/11, government revenue

⁴ Effective since 1990, the *Mineral Tax Act* consolidated a series of coal and mineral royalties and tax schemes. For example, coal mines previously paid royalties under the *Coal Act's Royalty Regulation*, and a profit-based tax under the *Mining Tax Act*. Metallic mineral mines previously paid taxes under the *Mineral Resource Tax Act*. The Mineral Land Tax applies to owners of non-Crown lands (i.e. freehold mineral rights) in BC as per the *Mineral Land Tax Act* (BC Ministry of Finance, 2009).

from coal more than tripled and accounted for more than 75% of mineral revenues (BC Ministry of Finance, 2012c).

Table 3: Provincial revenues from mining in BC: 1995/96 to 2010/11 (\$'000)

	1995/96	2000/01	2005/06	2010/11
Mineral Land Tax	\$4,203	\$4,152	\$568	\$601
Mineral Tax (Metals)	\$53,093	\$27,745	\$136,538	\$75,090
Mineral Tax (Coal)	\$10,051	\$17,920	\$92,205	\$288,821
Total*	\$69,820	\$52,056	\$231,800	\$368,080

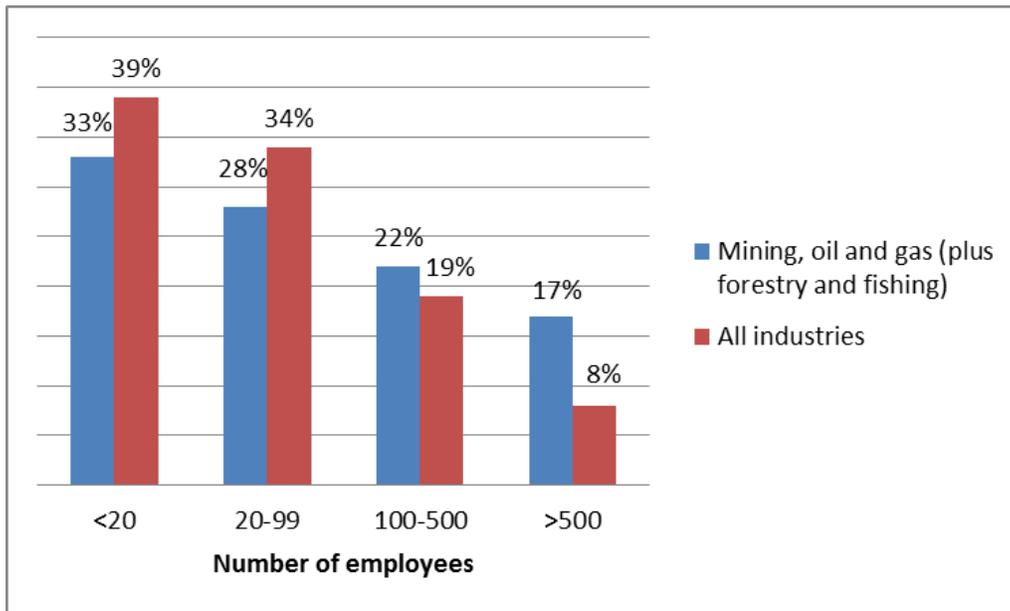
Adapted from: BC Ministry of Finance, 2012c. *Total includes "Mine Health and Safety" revenue

Expansion in mining activities as part of the BC Jobs Plan is projected to generate \$1.6 billion per year once all mining developments are fully operational. The BC government expects to collect \$150 million annually from this expansion (BC Ministry of Energy and Mines, n.d.-a). But this amount is merely a projection; real growth could be lower than this estimate.

2.4. Firm Size

Relative to other industries, mining companies tend to be larger businesses. In 2008, 17% of businesses in the mining, oil and gas industry (including forestry and fishing industries) had more than 500 employees (Industry Canada's definition of large employers) compared to only 8% in all other industries (see Figure 1 below) (BC Stats, 2010).

Figure 1: Employment by establishment size (BC): 2008



Adapted from: BC Stats, 2010

Secondly, across Canada, more than 50% of mining employees worked at large businesses in 2011 (Industry Canada, 2012). Consequently, this study focuses on larger firms given their predominance in the industry. Compared to smaller companies, larger firms are also more likely to provide apprenticeship positions, a point on which I elaborate in section 3.5.

2.5. Labour Market Characteristics

Below, Table 4 shows total employment for mining and smelting industries between 1997 and 2011 in two-year increments. Both industries can be susceptible to short-term fluctuations in workforce size. For example in mining, employment dropped over 2,000 positions between 1997 and 1999 and employment in primary metal manufacturing increased over 1,000 positions between 2005 and 2007. Within the mining and quarry sub-sector, coal mining operations employed over 4,000 workers and metal mining employed over 3,200 workers in 2010 (BC Ministry of Energy and Mines, 2011).

Table 4: Total employment by industry in mining and smelting (BC): 1997 to 2011

	1997	1999	2001	2003	2005	2007	2009	2011
Mining and quarry (NAICS 212)	9,342	7,034	7,010	6,955	7,267	8,164	8,198	8,857
Primary metal manufacturing (smelting) (NAICS 331)	5,670	6,227	5,420	5,765	5,808	7,055	4,706	5,496

Adapted from: Statistics Canada, 2013f⁵

Notable from Table 4, however, is that despite the overall rise in mineral values over the past 15 years (mainly attributable to coal), total employment has remained relatively stable. Employment in these capital-intensive industries does not necessarily tightly correlate with industry value (or even tonnage of minerals extracted) (BC Stats, 2010). Overall, labour productivity in mining, oil and gas extraction tends to be higher than in the rest of the economy (BC Stats, 2010). Further, the extraction of different mineral products can have different technological requirements and therefore differential impacts on employment. These complex and subtle issues are not fully explored in this study.

2.5.1. Aging workforce

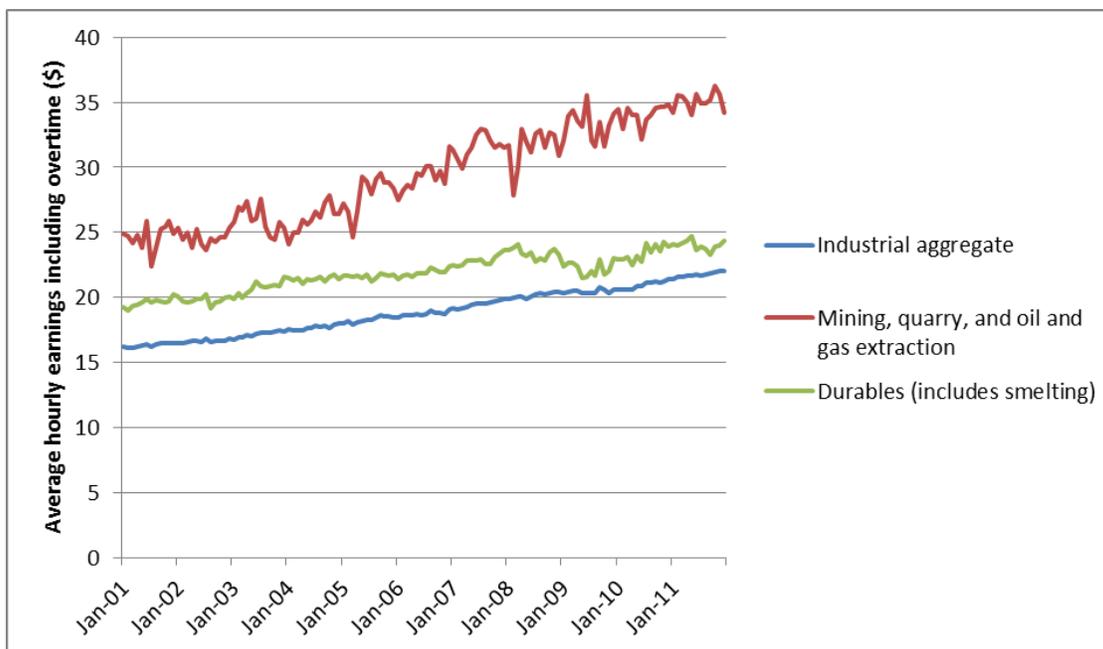
Similar to British Columbia's overall population, the mining industry's workforce is aging. According to the 2006 Census, 19.4% of employed workers in BC's mining, oil, and gas extraction industry are 55 years or older—7 percentage points higher than in the rest of Canada (Statistics Canada, 2009). The Mining Industry Human Resources Council (2012) also predicts that the annual retirement rate will increase from 2.4% in 2012 to 3.0% in 2022. An aging workforce necessitates training new entrants to fill positions vacated by retiring workers.

⁵ Labour Force Survey data is not used because it does not provide industry data more detailed than at the level of NAICS 21 (mining, quarry, oil and gas extraction), making it difficult to separate the size of mining and quarry activities from the oil and gas subsector. Instead, this table shows data from the Survey of Employment, Payroll and Hours.

2.5.2. Typical earnings

Jobs in these industries tend to be well paid. Figure 2 shows average hourly earnings by industry between 2001 and 2011.⁶ Consistently over the decade, hourly earnings have remained above the “industrial aggregate.”⁷ For example, the overall average hourly wage in mining was \$29.45 compared to the industrial aggregate average of \$18.87. Similarly, wages in the durable goods sector (which includes, but is not limited to, smelting (NAICS 331)) averaged \$21.90 over the same period (Statistics Canada, 2013). Similar to the goods sector as a whole, the vast majority of workers in mining, oil and gas extraction are employed full-time (96.1% relative to 91.5% in the goods sector and 79.9% in the overall economy) (BC Stats, 2010).

Figure 2: Average hourly earnings by industry (Canada): 2001 to 2011 (monthly data)



Adapted from: Statistics Canada, 2013g

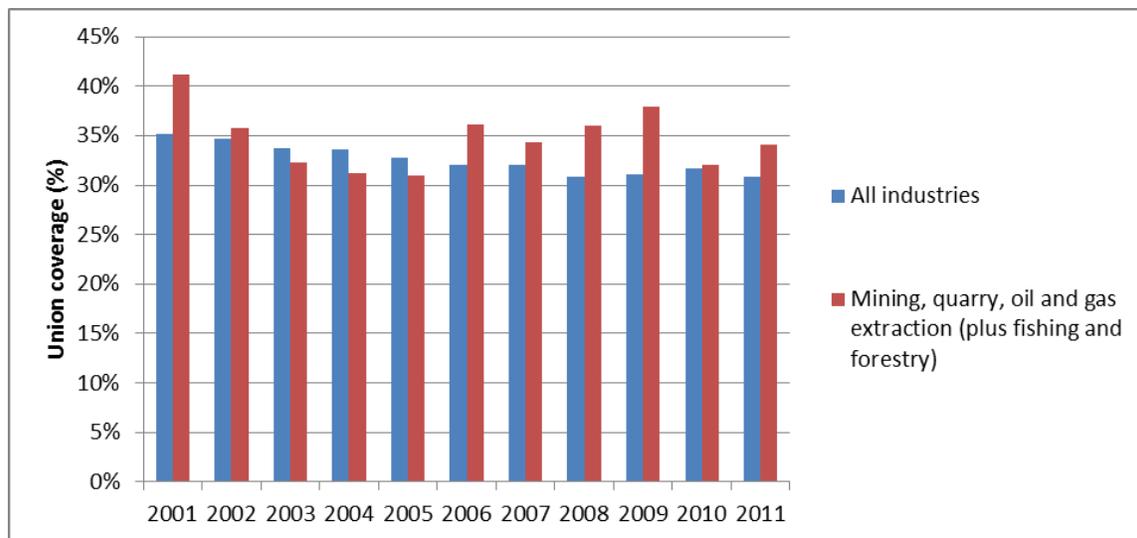
⁶ Data are available only for Canada as a whole, not by province.

⁷ Industrial aggregate covers all sectors except those primarily involved in agriculture, fishing and trapping, private household services, religious organisations and the military personnel of the defence services.

2.5.3. Unionization

One reason for higher wages in the mining, oil and gas industry could be higher union coverage relative to the rest of the economy. In a unionized workplace, wages are collectively bargained between the union and the employer. Statistics Canada aggregates mining, quarry, and oil and gas extraction with the fishing and forestry industries for union coverage in BC.⁸ Figure 3 shows the percentage of workers covered in a union. On average, union coverage in this industry grouping has remained higher than the rest of the economy. Between 2001 and 2011, the average unionization rate in mining, and oil and gas was just under 35%, while in the rest of the economy, union coverage was 32.5%. While this is not a large difference, unionization rates seem to have declined more in mining, oil and gas extraction. Comparing 2001 and 2011 directly, unionization has decreased over 15% in these sectors compared with a decline of 12% in all industries.⁹ Regardless, unions play an important role in BC's apprenticeship system and the mining industry, which will be discussed later in more detail.

Figure 3: Union coverage by industry (BC): 2001 to 2011



Adapted from: Statistics Canada, 2013h

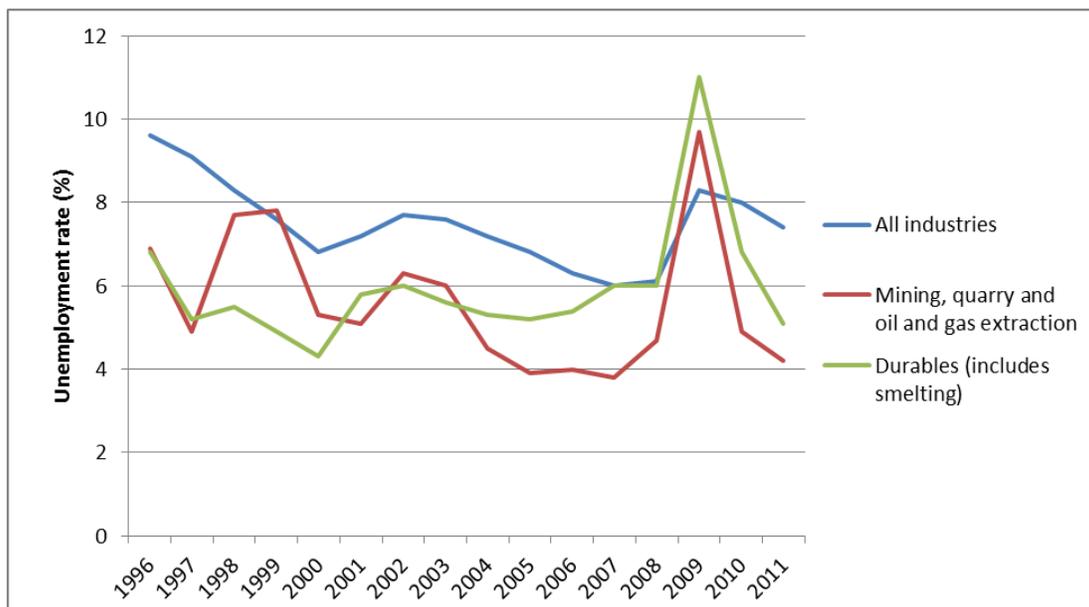
⁸ This aggregation of mining with the oil and gas sector and fishing and forestry industries does distort a more specific examination of unionization in mining. While not a representative sample, all industry participants in this study worked in a unionized environment and indicated this was common for most mining sites throughout the province.

⁹ Calculation: $[(2011 \text{ union} - 2001 \text{ union}) / 2001 \text{ union}] = \text{union growth between 2001 and 2011}$

2.5.4. Industry unemployment rates

Mining and mineral product industries tend to see low unemployment rates. Below, Figure 4 shows unemployment rates for three industry categories between 1996 and 2011 in Canada: 1) all industries (i.e. overall unemployment), 2) the mining, oil and gas extraction sector (NAICS 21), and 3) the durables sub-sector.¹⁰ Excluding the late 1990s and 2009, unemployment rates in mining, oil and gas extraction have consistently remained lower than the Canadian economy as a whole. Similarly, the durables sub-sector has seen lower unemployment rates than the overall economy (except for 2009 when the unemployment rate spiked to over 10%). However, over the past 15 years, the average unemployment rates in the mining and durable goods subsectors were 5.6% and 5.9% respectively—both lower than the overall economy average of 7.5% between 1996 and 2011.

Figure 4: Unemployment rate by industry (Canada): 1996 to 2011



Adapted from: Statistics Canada, 2013d

¹⁰ Statistics Canada suppresses unemployment rates for NAICS 21 in BC. Additionally, unemployment rates for the NAICS 212 (mining and quarry) sub-sector are not available for BC or Canada.

2.5.5. Skilled trades occupations in mining and mineral production

To this point I have described aggregate industry labour market statistics. I now provide more detail on specific skilled trades within mining and mineral production. Mining sites utilize large, mobile heavy equipment; consequently, a large percentage of the workforce is required to operate and maintain this machinery (Participant 1). In 2006, the total size of the labour force in mining, and oil and gas extraction was 20,020.¹¹ Of these workers, 32% (i.e. 6,440) were in occupations classified under the “trades, transportation and equipment operators and related occupations” category (National Occupation Classification (NOC) 7). This group employed 1,320 mechanics, which includes, but is not limited to, heavy equipment technicians (NOC 7312) and industrial mechanics (millwrights) (NOC 7311).¹² These occupations are particularly important to the regular operation and functioning of a mining site and smelter plant (Participant 1) and consequently form the focus of this study.

Apprenticeship programs produce workers in the two occupations cited above. Industrial mechanics (millwrights) and heavy equipment technicians are closely related occupations. Essentially both occupations involve maintaining, troubleshooting, installing and repairing machinery and mechanical equipment (Human Resources and Skills Development Canada, 2013a). While the skill sets are similar, heavy-duty mechanics tend to work on larger pieces of mobile equipment, though this distinction is not always relevant in practice (Human Resources and Skills Development Canada, 2013b). I now turn to describing BC’s apprenticeship system.

¹¹ This figure is higher than total employment cited in section 2.5 because it is at a higher sector level (NAICS 21), not the three-digit sub-sector level cited earlier.

¹² These two occupations are classified, along with other similar trades, at the 3-digit level as NOC 731 “machinery and transportation equipment mechanics.”

3. Apprenticeship System in Canada

In this section I outline the fundamental features, jurisdictional responsibility and institutional framework of apprenticeship in Canada and BC. I also discuss the organizational structure of BC's apprenticeship system through the example of the industrial mechanic (millwright) trade. Finally, I end with a brief review of other relevant issues and trends in employer sponsorship.

3.1. Basic Features of Apprenticeship Training

Apprenticeship is a specific form of learning that, at its most basic level, involves a contract between an apprentice and an employer where the apprentice exchanges his or her labour for on-the-job training and a reduced wage from the employer. Among the skilled trades, apprenticeship is the principal method of training workers (Ménard, Chan, and Walker, 2008). Apprentices will typically find their own employer “sponsors” to provide workplace training, though employers can also seek out apprentices from their current staff, job advertisements, union “hiring halls,” or in some cases, apprenticeship authorities. An apprenticeship typically lasts four years, but this can vary depending on the program. Apprenticeships also involve classroom technical training to supplement on-the-job learning; these “academic releases” are in blocks of approximately two months per year. Completion of an apprenticeship program requires passing a certification exam, though the standards vary depending on the program and province (Sharpe and Gibson, 2005). When an apprentice is certified, he or she is commonly referred to as a “journey person” (ITA, 2012b).

3.2. Jurisdictional Responsibility

According to Section 93 of Canada's *Constitution Act, 1867*, education lies within the jurisdiction of the provinces. However, in the case of labour market policy—of which

apprenticeship and adult training is part—provincial and federal governments have both been active throughout the twentieth century. For example, following World War II, the 1967 *Adult Occupational Act* and the subsequent *National Training Act* of 1982 increased the federal government's role in funding adult education and training. Since 1996, with the *Employment Insurance Act* and the signing of a series of bilateral Labour Market Development Agreements (LMDAs) between the federal government and the provinces (Ontario being the exception), the federal government ceded more authority to the provinces over adult skills training (Sharpe and Gibson, 2005).

3.3. Federal Involvement in Apprenticeship Training

The Federal Government continues to participate in labour market policy and skilled trades training. For example, in the mid-1950s the federal, provincial and territorial governments created the Interprovincial Standards Red Seal Program, which harmonized training and certification requirements across the country. Red Seal certification signals high standards of occupational skill to employers and also helps facilitate labour mobility for skilled tradespeople.¹³ Currently Canada has over 50 Red Seal trades. Provincial apprenticeship authorities technically administer the Red Seal program. However, the Canadian Council of Directors of Apprenticeship—an organization of provincial apprenticeship authorities and representatives from Human Resources and Skills Development Canada—develop each occupational standard (Red Seal Program, 2012).

The Federal Government also provides financial support to employer sponsors and apprentices through three broad means. First, since 2006, the Apprenticeship Job Creation Tax Credit (AJCTC) provides employers up to \$2,000 per year (or 10%) in tax credits for wages or salaries of each apprentice. The AJCTC applies only to sponsors of

¹³ Labour mobility continues to be an important issue in Canada's labour market strategy. Chapter Seven, Article 701 in the *Agreement on Internal Trade*, which addresses inter-provincial labour mobility, stipulates that steps be taken to “eliminate or reduce measures adopted or maintained by the Parties that restrict or impair labour mobility in Canada and, in particular, to enable any worker certified for an occupation by a regulatory authority of one Party to be recognized as qualified for that occupation by all other Parties” (Canadian First Ministers, 2012, p. 87).

apprentices in their first or second year (or “level” equivalent) in a Red Seal trade (Canada Revenue Agency, 2012). Second, Service Canada offers two grants to apprentices in Red Seal trades—the Apprenticeship Incentive Grant and the Apprenticeship Completion Grant.¹⁴ Finally, Employment Insurance Part I benefits are extended to eligible apprentices while they attend in-class technical training and are not earning a wage from their employer sponsor (Service Canada, 2012). Despite these three programs, provincial governments primarily run apprenticeships.

3.4. Apprenticeship in British Columbia

BC’s apprenticeship system under the Industry Training Authority (ITA) involves the coordination of a large number of stakeholders: the ITA, six Industry Training Organizations (ITOs), the Government of BC, industry, community colleges and training institutes, unions, and apprentices themselves.

In 2003, the BC government instituted the *Industry Training Authority Act*, producing widespread changes to apprenticeship training in the province, including the creation of the ITA. The ITA is a Crown Corporation responsible for governing and managing apprenticeships in BC, which involves: issuing credentials, developing and managing apprenticeship programs, maintaining program standards, and providing information and assistance to sponsors and apprentices. In 2011/12, the ITA budget was approximately \$108 million, with over \$102 million coming from the Province, \$192,000 from the Federal Government, and \$5.3 million from other sources (ITA, 2013). The following sections outline the current organizational and programming structure of BC’s apprenticeship system under the ITA.

3.4.1. Organizational framework

The core purpose of the 2003 reforms was to make BC’s apprenticeship system more responsive to industry needs. As part of this mandate, ITOs were created for apprenticeship training in specific sectors of the economy. ITOs are not-for-profit

¹⁴ See Appendix D for more details on tax credits and grants.

organizations, established by industry, but co-funded by industry and the ITA (ITA, 2005). Generally, ITOs are responsible for: developing and monitoring training program standards; developing training plans based on labour market information; and engaging in promotional activities to encourage new entrants into the skilled trades (RTO, n.d.). ITOs do not directly administer apprenticeship training, but work with employers as well as the educational institutions that offer the in-class training portions of apprenticeship programs. Currently BC has six ITOs. One ITO, the Resource Training Organization (RTO), is responsible for a variety of natural resource sectors including mining and smelting. As of March 2012, over 4,600 apprenticeships were registered with the RTO, making it the second largest ITO (ITA, 2012b).

3.4.2. Certification and programming framework

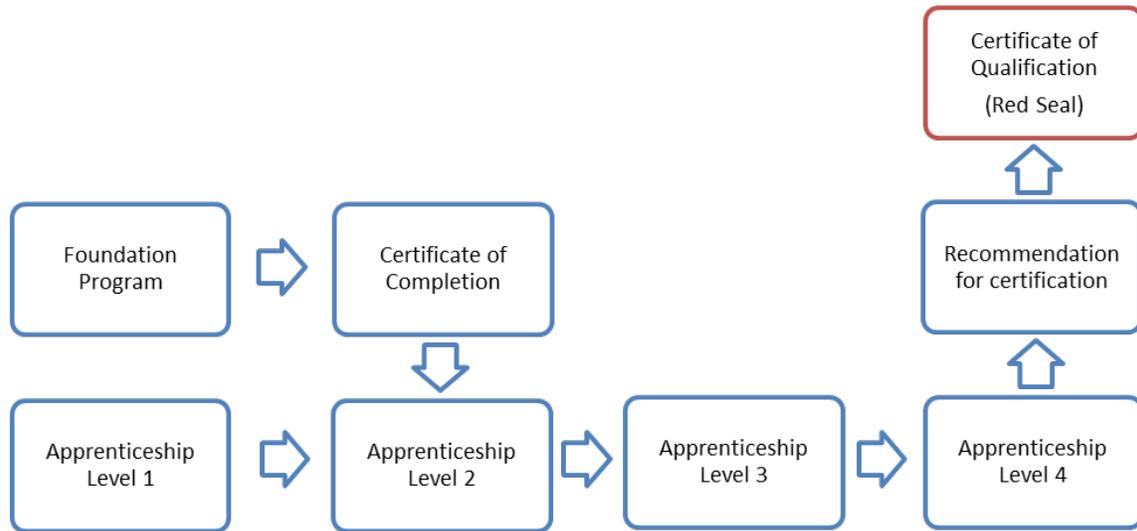
Certification pathways for apprentices and programming frameworks changed due to reforms in the *Industry Training Authority Act*. To achieve certification in a trade, an individual can choose one of two routes: either enrolling in an apprenticeship or “challenging” certification. Below I describe the apprenticeship route, as it is the focus of this study.¹⁵

Figure 5 is a simplified example of the apprenticeship pathway for the industrial mechanic (millwright) program. The specific content of apprenticeship programs differ depending on the trade, but most follow the basic structure shown in Figure 5.¹⁶

¹⁵ The alternative to the apprenticeship system is called “challenging.” Applicants must demonstrate at least 9,900 hours of relevant workplace experience in an occupation to be eligible to “challenge” a trade program. Challengers must score at least 70% on the Interprovincial Red Seal exam to attain a Certificate of Qualification.

¹⁶ For example, not all programs will have four “levels,” and some require a different number of on-the-job training hours at each level.

Figure 5: Stylized apprenticeship certification pathway for industrial mechanics



Adapted from: ITA, 2012c

Figure 5 shows two points of entry into an apprenticeship program. First, individuals, once they have found an employer sponsor and have registered with the ITA, enter the apprenticeship system at level 1. Alternatively, individuals can enroll in a Foundation program, which on completion, grants a Certificate of Completion. The Foundation program is a pre-apprenticeship technical training course that provides students with basic theoretical and technical skills relevant to the trade program they are entering. With a Certificate of Completion, students in the industrial mechanic program (once they secure an employer sponsor) can enter the apprenticeship program at level 2 (ITA, 2012c).¹⁷

Assuming the apprentice has not entered through the Foundation program, an apprentice must complete four levels within the industrial mechanic program. Typically it takes four years for an apprentice to attain his or her full certification. With the industrial mechanic program, an apprentice will be released for 210 hours (or 7 weeks) of

¹⁷ In 2011/12, 45% of Foundation program graduates continued to an apprenticeship program (ITA, 2012e).

technical training at an ITA-approved educational institution at each level.¹⁸ While most colleges are publically funded, the ITA does allow private institutions, or industry itself, to conduct technical training. In such cases, the training organization must be approved by a designation process to ensure that its standards meet ITA guidelines (Participant 9).

The content and structure of technical training courses belong to individual course instructors (Participant 9). Within each technical training session, 80% of the mark is allocated to the instructor's unique examinations, while the other 20% is determined by a standardized ITA level exam. A score of at least 70% on the ITA exam is required to pass that apprenticeship level and progress to the next level. Following successful completion of a technical training course, the apprentice will typically return to his or her employer and continue working until they attend the next in-class training session at their new level (usually the following year). Overall, industrial mechanic apprentices must complete a minimum of 6,600 total hours of on-the-job training, which usually equates to four years.

To achieve a Certificate of Qualification, an apprentice must also score at least 70% on their final exam, be recommended and be approved for certification by his or her sponsor. Since an industrial mechanic is a Red Seal trade, these apprentices must also take the Interprovincial Red Seal exam in addition to being recommended by their employer (ITA, 2012c). The Red Seal exam is cumulative in that it assesses all levels and theories of an apprenticeship. Only after completing four levels of an apprenticeship can an industrial mechanic apprentice apply to take the Red Seal exam.

3.4.3. Provincial tax credits

Currently, the BC Government offers refundable tax credits to employer sponsors in registered ITA trades. Effective from 2007 to 2014, there are three forms of the BC Training Tax Credit for employers. First, designed for sponsors of apprentices in non-

¹⁸ Technical training can also be delivered through online courses or on a part-time basis. In addition, apprentices may also have the option to challenge a level to receive advanced placement in their apprenticeship program. Millwright apprentices can challenge levels 1 and 2. This is different to the challenge pathway since it results in advanced placement within the apprenticeship route, not a Certificate of Qualification.

Red Seal programs, the Basic Tax Credit provides employers with 20% of the apprentice's salary or wages up to a maximum credit of \$4,000.¹⁹ Apprentices must be in the first or second level of their program to be eligible. Second, the Completion Tax Credit supports employer sponsors of apprentices in level 3, 4 or 5. It covers 15% of wages or salary up to a \$2,500 (level 3), or a \$3,000 maximum credit (level 4 and 5), and apprentices may be enrolled in either Red Seal or non-Red Seal programs (BC Ministry of Finance, 2012a). Sponsors of industrial mechanic (millwright) apprentices are therefore not eligible for the Basic Tax Credit because it is a Red Seal trade, but can still collect the Federal Government's AJCTC. Third, BC's Enhanced Tax Credit, aimed at employer sponsors of First Nations apprentices or persons with disabilities, increases the credit amount provided by the Basic and Completion Tax Credits. Specifically, it raises Basic Tax Credit coverage to 30% of wages (up to \$6,000) and Completion Tax Credit to 22.5% of wages (up to \$3,750 at level 3 and \$4,500 at levels 4 and 5) (BC Ministry of Finance, n.d.-a).

3.5. Data and Characteristics of Employer Sponsors

Limited data are available that measure current levels of apprenticeship sponsorship for BC.²⁰ The Canadian Apprenticeship Forum (CAF) (2011) surveyed Canadian employers for attitudes about, and participation in, apprenticeships. From a representative sample (by industry and geographic region in Canada) of 9,568 businesses that employ tradespeople, 1,051 employers responded.²¹ Employers from the mining and manufacturing industries comprised 324 of the responses, and 160 responses were from the BC/North region.²²

¹⁹ Prior to 2009, the Basic Tax Credit covered 10% of wages up to a maximum credit of \$2,000 (BC Ministry of Finance, 2012a).

²⁰ For example, the ITA does not collect data on: sponsorship by sector; trade program sponsorship by sector; or sponsorship by size of business.

²¹ Industry sectors for CAF's (2011) study were defined using Standard industrial Classification (SIC) codes at the 2-digit level, not NAICS codes.

²² The margin of error (at the 95% confidence interval) was +/- 5.4% and +/- 7.7% for mining and manufacturing sector employers and BC/North employers, respectively. CAF's study combined responses from mining and manufacturing companies; hence it is not possible to disaggregate their responses.

Between 2006 and 2011, overall employer participation in apprenticeships has remained relatively stable (CAF, 2006; CAF, 2011). However, some indicators suggest an increased interest from mining and manufacturing employers. Overall in 2011, the rate of participation was 19%, up slightly from 17.6% in 2006. Conversely, participation was higher in manufacturing and mining at 23% in 2011. The average number of apprentices per firm has also increased since 2006, with mining and manufacturing jumping from 1.7 to 7 apprentices per employer. This increase, which was larger than the average increase across all industries (2.9 to 5 apprentices per employer) may suggest that employer familiarity with apprenticeships encourages further participation (CAF, 2011). However, given that less than one-quarter of mining and manufacturing employers sponsor apprentices, there is likely room to increase sponsorship participation. Further, this increase in the number of apprentices per firm may also reflect that larger companies are taking on more apprentices as a small company with 10 employees for example, is unlikely to employ 7 apprentices. Rather, this trend would seem to suggest that more large firms were hiring more apprentices, increasing the average per firm.

While the ITA does not collect data on sponsorship by size of firm, other evidence supports the proposition that larger firms are more likely to sponsor apprentices (see Beckmann, 2002; CAF, 2004). Beckmann (2002) finds a positive and strong relationship between firm size and likelihood of sponsorship. For example, he reports that the probability of firms with fewer than 20 employees training an apprentice is less than 35%, while in firms with more than 100 employees, the probability of training an apprentice is at least 73.4%. At the largest firms with more than 2,000 employees, the probability of training rises to 96.4% (Beckmann, 2002).

Larger employers are also more likely to provide additional disbursements and benefits to apprentices. CAF (2006) finds that larger employers are more likely than smaller firms to provide larger cash disbursements. This includes continuing to pay wages while the apprentice is attending technical training. Additionally, apprenticeship completion rates in Australia have been reported as higher in larger firms (Apprenticeships for the 21st century Expert Panel, 2011). The preceding examples suggest that targeting apprenticeship growth in larger firms is not only likely to be more effective since larger firms already have higher rates of sponsorship, but also more

desirable because they tend to provide additional benefits to apprentices. Given this evidence, my focus in this study is on large mining and smelter firms.

4. Evidence and Rationale for the Policy Problem

The policy problem addressed by this study is that too few apprenticeship positions are being offered by mining and smelter companies in BC. I now discuss four complementary lines of evidence that inform the purpose of this study. First, I outline potential growth in the mining sector and the implications of mining expansion under the BC Jobs Plan. Second, I highlight that current labour market conditions in some skilled trades are experiencing “tightening” labour market conditions. Particular attention is given to industrial mechanics and heavy equipment mechanics. Third, these conditions are projected to continue until 2020. Tight labour markets in the skilled trades may constrain the ability of the mining sector to grow. Finally, even if mining sector and labour market projections do not materialize as expected, I provide evidence for the inherent labour market benefits to individuals of providing apprenticeship training.

4.1. Projected Growth in Mining

As discussed earlier, the BC Jobs Plan prioritizes expansion in mining activity throughout the province (Government of BC, 2012). By the middle of the decade, the Province hopes to see eight new mines opened and increased operating capacity at existing sites. While rising production values of minerals and coal do not perfectly translate into increased employment, increasing the number of mining sites and operating capacity should require additional workers to build sites and operate mines. However, these potential policy developments are not captured in the Province’s labour market forecast (see section 4.3), which means that estimates of future demand could be low, and labour markets could be tighter than anticipated. It is beyond the scope of this study to critically assess the likelihood of mining sector expansion in BC. Instead it simply represents an additional risk factor that could exacerbate already tight current and future labour market conditions in the skilled trades. However, even if anticipated

expansion under the BC Jobs Plan does not occur, rationales for increasing apprenticeships in the province still arise in the following three lines of evidence.

4.2. Current Labour Market Conditions in the Skilled Trades

Occupational unemployment rates are one of several indicators used to measure gaps between supply and demand for labour. Lower unemployment rates tend to point toward tighter conditions (i.e. labour shortages), while higher unemployment rates tend to indicate “looser” conditions (i.e. labour surpluses).²³ As unemployment rates decrease, it becomes more difficult for employers to find workers, and demand begins to exceed supply. Figure 6 below shows the unemployment rates over the past ten years in BC for two groups: “all occupations” and “skilled trade occupations” (NOC 72-74). Skilled trades occupations include industrial mechanics and heavy-equipment mechanics.²⁴ But direct inference about the conditions of these two occupations should be exercised with some caution because they are not disaggregated from other skilled trades occupations.

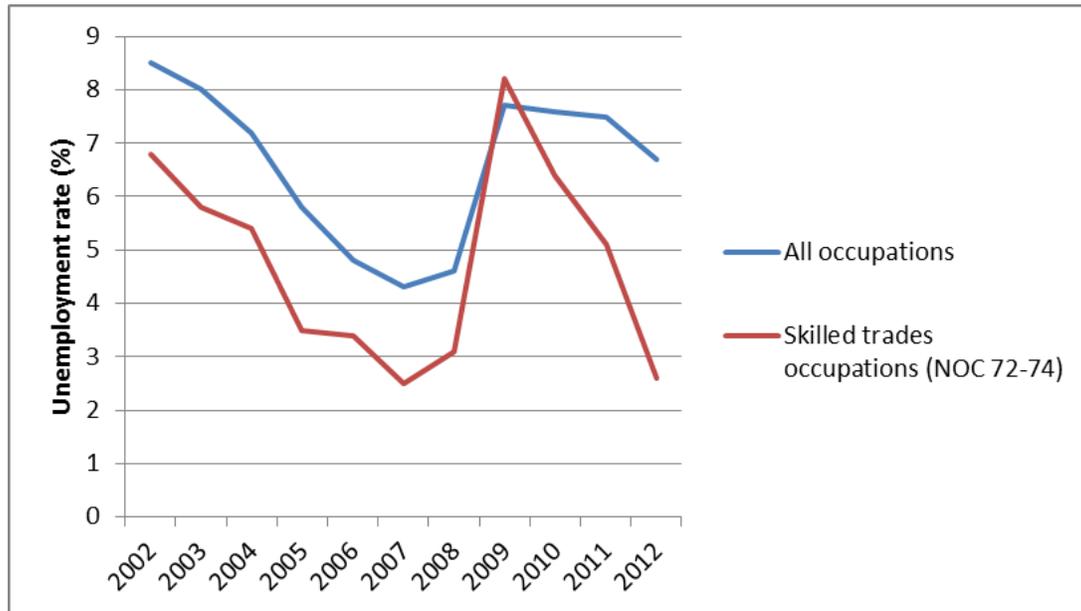
Two main observations arise from this figure, both of which point to currently tighter labour market conditions in the skilled trades. First, between 2002 and 2012, the average unemployment rate for the skilled trades was 4.8%, nearly two percentage points lower than the overall average. Except in 2009, the unemployment rate for skilled trades occupations has remained below the overall average indicating tight labour markets. Second, since 2009, unemployment rates in the skilled trades have declined more rapidly than the rest of the economy. A direct comparison between 2009 and 2012

²³ Examining wage growth over time can also indicate labour market tightness. Using wage data for this purpose assumes that wages respond to free market conditions whereby wages rise when labour demand exceeds supply, and wages fall (or stagnate) when supply exceeds demand. However, this method is not valid when unionization rates are high since unions collectively bargain wages. As a result, I do not examine wage growth as an indicator of labour market tightness.

²⁴ Provincial occupational unemployment rates below the two-digit NOC level are not available. As a result, this skilled trades grouping is not as specific as it could be. In addition, Statistics Canada publishes occupational statistics under the National Occupational Classification for Statistics (NOC-S) system. NOC-S codes of H2-H5 are converted into to the NOC system codes of 72-74, but there is some divergence in the specific occupations covered under both systems. That is, some occupations which are found in NOC-S H2-H5 are not found in NOC 72-74, and visa versa.

shows that the overall unemployment rate dropped 13%, while the unemployment rate for skilled trades dropped 68%.²⁵ This dramatic reduction in unemployment also points toward tightening conditions for skilled trades workers in BC.

Figure 6: Skilled trades unemployment rate (BC): 2002 to 2012



Adapted from: Statistics Canada, 2013e

Total employment in the skilled trades has also grown since 2002 (see Figure 7 below). Comparing employment in 2012 to 2002 produces a change of 26%, which is substantially higher than growth in all occupations (18.4%) over the same period.²⁶ Furthermore, the average annual growth rate of skilled trades occupations was 2.12%, which is higher than the overall growth rate (1.55%).²⁷ While employment growth alone is an insufficient barometer of labour market tightness, when combined with dropping unemployment rates, it adds evidence to the notion that markets are tightening in the skilled trades in BC.

²⁵ Calculation: $[(2012 \text{ unemployment rate} - 2009 \text{ unemployment rate}) / 2009 \text{ unemployment rate}] = \text{change in unemployment rate between 2009 and 2012}$

²⁶ Calculation $[(2012 \text{ employment} - 2009 \text{ employment}) / 2009 \text{ employment}] = \text{change in employment between 2009 and 2012}$

²⁷ Calculation: $[(2012 \text{ employment} / 2002 \text{ employment})^{(1/11 \text{ (years)})} - 1] = \text{average annual growth rate}$

Figure 7: Employment growth in the skilled trades (BC): 2002 to 2012



Adapted from: Statistics Canada, 2013d

Considered together, low and rapidly declining occupational unemployment rates and higher than average occupational employment growth suggest that current labour market conditions in BC in the skilled trades are tighter than in the rest of the economy. Increasing the supply of tradespeople by generating more apprenticeships could help match supply and demand and also provide individuals with employment opportunities in these occupations.

4.3. Future Labour Market Conditions in the Skilled Trades

In this section I outline findings from the BC Labour Market Outlook (BC LMO) occupational projection model.²⁸ The findings suggest that the overall supply of skilled

²⁸ For the purposes of this study, data that are used in the BC LMO are accessed and downloaded from the WorkBC website. For simplicity, they are cited as “WorkBC, n.d.” The original data sources used by the BC LMO include Statistics Canada’s Labour Force Survey (BC Ministry of Jobs, Tourism and Innovation, 2011a).

tradespeople and the supply of industrial mechanics and heavy-equipment mechanics may not match demand over the next decade.²⁹

In 2010, the province's supply of all skilled tradespeople exceeded demand by 4,990 positions. However, by 2020, the BC LMO estimates that demand will outnumber supply by 2,340 positions, with aggregate demand exceeding supply near the middle of the decade. Stated in terms of growth rates, annual average demand growth between 2010 and 2020 in the skilled trades will be 1.2%, while the requisite annual average labour supply growth is forecast at 0.9% (BC Ministry of Jobs, Tourism and Innovation, 2011b). Even before demand exceeds supply, the market could tighten on account of some mismatch between specific skills demanded and supplied as well as regional divergences in where workers live and where they are needed.

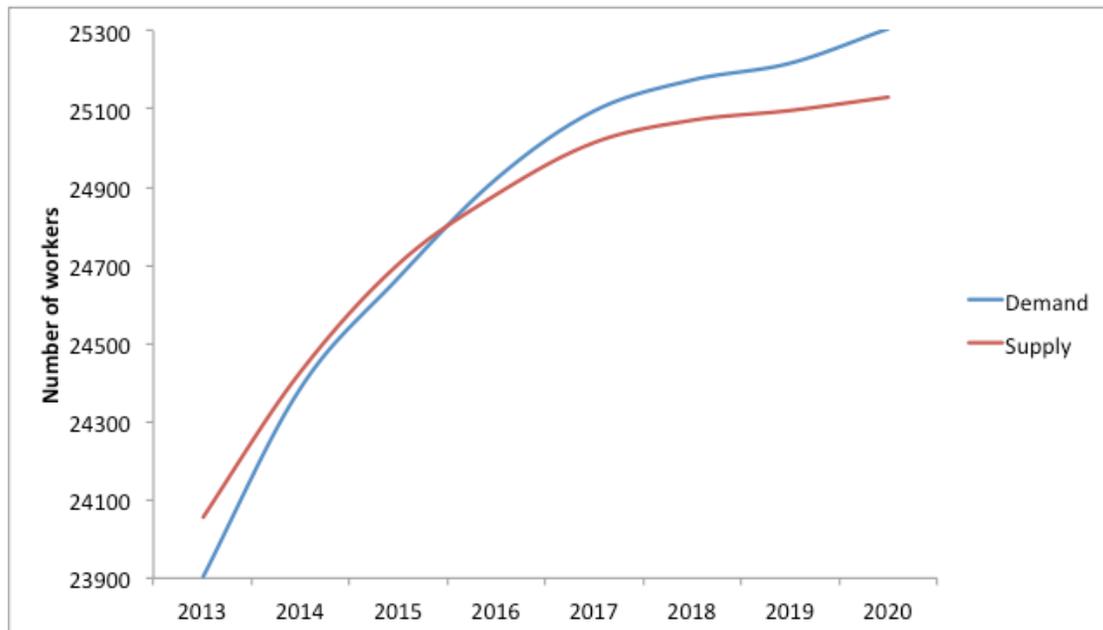
Machinery and transportation equipment mechanics (except motor vehicles) (NOC 731), are projected to see annual average growth of 1.1% between 2010 and 2020 (BC Ministry of Jobs, Tourism and Innovation, 2011b).³⁰ Industrial mechanics and heavy equipment mechanics are within this occupational grouping. Figure 8 compares levels of supply and demand for machinery and transportation equipment mechanics.³¹

²⁹ A summary of the findings from the BC Mining HR Task Force's report on future labour market conditions in BC's mining industry can be found in Appendix B.

³⁰ NOC 731 is the 3-digit occupation category that contains specific occupations such as industrial mechanics (NOC 7311) and heavy-duty equipment mechanics (NOC 7312).

³¹ The BC LMO defines "supply" as the number of individuals in a given occupation working or looking for work, and "demand" as the number of workers required to fill positions.

Figure 8: Projected supply and demand for machinery and transportation equipment mechanics (NOC 731) (BC): 2013 to 2020

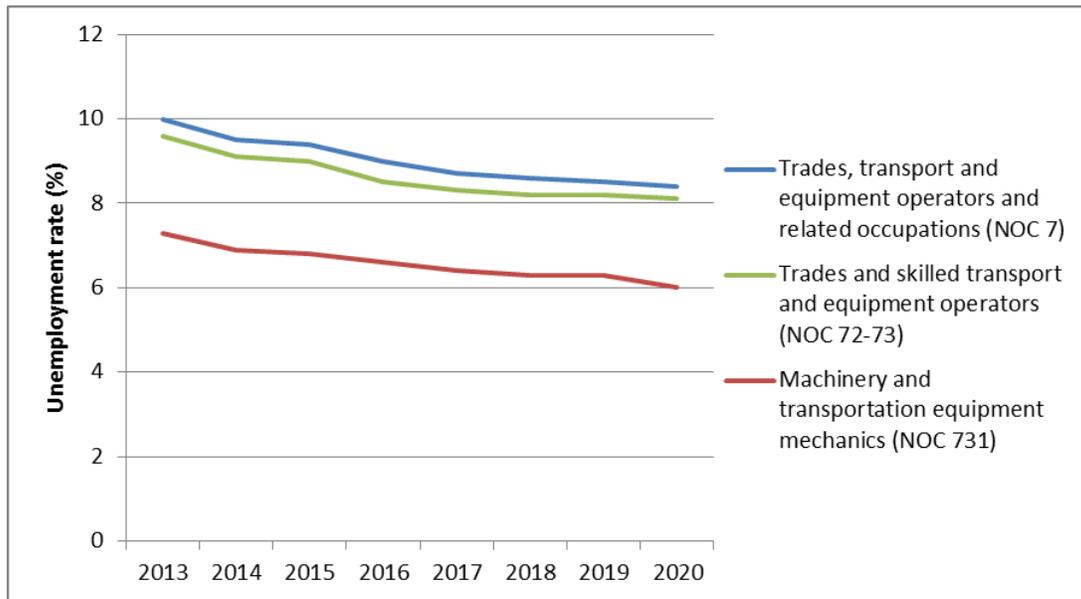


Adapted from: WorkBC, n.d.

Prior to 2016, supply is expected to exceed demand. But in 2016, demand is projected to exceed supply. This trend is expected to continue until the end of the decade. As with the discussion on current market conditions, excess demand is indicative to tighter labour market conditions and may necessitate entry of new workers into the occupation to fill vacancies.

Unemployment rates in the future can also be used to indicate future labour market conditions. Figure 9 shows projected unemployment rates for three occupational groups. Trades, transport and equipment operators (NOC 7) is the highest level of aggregation, followed by trades and skilled transport and equipment operators (NOC 72-73), which include the majority of “skilled trades” occupations. Finally, the third group is machinery and transportation equipment mechanics described in the previous paragraph.

Figure 9: Projected unemployment rates in the skilled trades (BC): 2013 to 2020



Adapted from: WorkBC, n.d.

While all three levels are expected to see reductions in unemployment, machinery and transportation equipment mechanics will see rates approximately two percentage points lower than the broader category of skilled trades occupations over the reference period. By 2020, the unemployment rate for machinery and transportation equipment mechanics will be 6%, compared to 8.1% for all skilled trades occupations. These declining unemployment rates suggest that, even within the skilled trades, industrial mechanics and heavy-equipment mechanics may experience tighter labour market conditions over the decade.

As stated earlier, these preceding examples, calculated in 2010, are based on historical trends and population projections, and do not account for recent policy developments from the Province that have called for the expedited development of mining projects. Therefore, demand projections could be underestimated, and labour market conditions could tighten faster than indicated above. Alternatively, markets may not tighten as individuals alter their behaviour in response to potential shortage conditions and enter these occupations more than was anticipated. The mining industry is also inherently volatile and can be susceptible to employment fluctuations, further emphasizing the uncertainty around occupational projections.

It is beyond the scope of this project to critically assess the accuracy of labour market projections. I assume that conditions will indeed tighten for industrial mechanics and heavy-equipment mechanics across the province. However, in the following section I outline evidence which suggests that individuals entering an apprenticeship benefit from high employment rates following certification. These data provide an alternative justification for increasing apprenticeship positions even if the labour market for the skilled trades does not tighten.

4.4. Labour Market Outcomes for Apprenticeship Graduates

The 2011 Apprenticeship Student Outcomes (APPSO) Survey provides key statistics on the labour market performance of recent graduates of apprenticeship programs in BC.³² Two programs—industrial mechanics and maintenance program and the medium/heavy duty mechanic program—develop workers in the specific occupations considered in this study. Graduates from the industrial mechanics and maintenance program reported a 2% provincial unemployment rate and medium/heavy duty mechanics reported an unemployment rate of 3% (BC Stats, 2011).³³ APPSO statistics cannot be used to indicate labour market tightness because they cover only recent apprenticeship graduates who are not a representative sample of the labour market. However, they do show that there are employment benefits for individuals who enter the trades.

Another way to highlight the benefits of apprenticeship is to compare the labour market experience of recent graduates against an equivalent age sample. Comparing the unemployment rates of recent graduates in these programs to the unemployment rates of similar age cohorts provides an indication of the benefits to apprenticeship. The majority of students in the 2011 APPSO were under 30. The median age of graduates from the industrial mechanics and maintenance program, and medium/heavy duty

³² The 2011 APPSO survey covered students enrolled in a BC apprenticeship program who graduated between July 1, 2009 and June 30, 2010.

³³ The average unemployment rate on this survey was 11%. BC's overall unemployment rate in 2011 was 7.5% (BC Stats, 2012).

mechanic programs were 35 and 27 respectively (BC Stats, 2011).³⁴ Table 5 highlights this age-based comparison. It shows that apprenticeship graduates in industrial mechanic and medium/heavy duty mechanic programs saw dramatically lower unemployment rates and higher employment rates than their similar age cohort in BC in 2011. For example, the APPSO unemployment rate for the industrial mechanics program had unemployment and employment rates of 2% and 97%, respectively. Compared to all 25 to 44 year olds in BC, these labour market outcomes are particularly strong. A similar story applies to graduates from the medium/heavy duty mechanics program, relative to their comparison group of 25 to 29 year olds.

Table 5: Unemployment rates of APPSO programs and comparable age cohort in BC: 2011

APPSO program and median age	APPSO: Unemployment rate	APPSO: Employment rate	BC: Age cohort	BC: Unemployment rate	BC: Employment rate
APPSO: Industrial mechanics and maintenance Median age 35	2%	97%	25 to 44 year olds	6.5%	81%
APPSO: Medium/heavy duty mechanics Median age 27	3%	97%	25 to 29 year olds	7.8%	78.4%

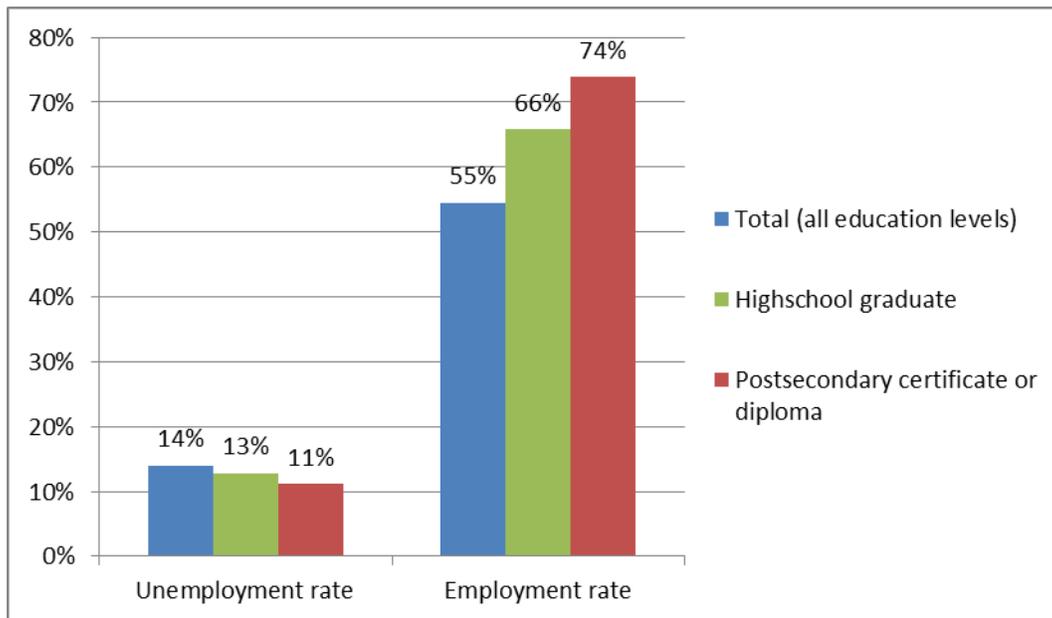
Adapted from: Statistics Canada, 2013b; BC Stats, 2011

Apprenticeship training could also be viewed as a strategy to address the issue of youth unemployment. Younger workers (i.e. 15 to 24 years old) tend to have higher unemployment rates than older workers. For example, in 2011 the unemployment rate for this age group in BC was 14%, significantly higher than the overall workforce average (see Figure 10 below). Divided by education level, 15 to 24 year olds with a “postsecondary certificate or diploma” (e.g. apprenticeship programs) do see lower

³⁴ The median age per apprenticeship program was used to compare against a similar age range provided by Statistics Canada.

unemployment rates and higher employment rates than average for their age group.³⁵ In 2011, the unemployment rate for this educational level (and age group) was 11.2%, almost three percentage points lower than the overall average for that age. A more dramatic illustration of the benefit gained by attaining a postsecondary certificate is the higher employment rate, which was 73.9% in 2011, compared to only 54.5% overall.

Figure 10: Unemployment and employment rates by education level for ages 15 to 24 (BC): 2011



Adapted from: Statistics Canada, 2013c *Table 282-0004*

These two sources of evidence provide a rationale for the inherent labour market benefits of completing an apprenticeship program. Labour market outcomes for apprenticeship graduates in the industrial mechanic and medium/heavy duty mechanic programs are positive compared to similar age cohorts. However, they could be even stronger if compared against younger workers, and therefore could serve as one method to reduce youth unemployment.

³⁵ “Postsecondary certificate or diploma” includes: trades certificates and diplomas from an educational institution above the secondary level, but below the university level. For example: community colleges, Collège d’Enseignement Général et Professionnel (CEGEP), and vocational schools, would qualify under this designation.

4.5. Summary of Evidence and Rationale for Policy Problem

Four complementary lines of evidence have been discussed which inform the policy problem addressed in this study. First, despite the volatility in the mining sector, mineral and coal values have generally been increasing over the long-term. While this does not directly translate into new employment positions, expansion of mining activity under the BC Jobs Plan may still produce more employment opportunities in the mining sector than would otherwise exist.

A significant number of these positions will be in the skilled trades. This study focuses on two closely related occupations, industrial mechanics and heavy-duty equipment mechanics, which are important to the regular functioning of a mining site (and smelter plant). Second, economic indicators suggest that these occupations are currently seeing tighter labour market conditions. Third, tight conditions may persist throughout the decade, with aggregate demand outstripping supply by 2016. When labour market conditions are tighter, this provides a rationale for increasing the number of apprenticeship positions.

Finally, individuals who graduate from an industrial mechanic or heavy-duty mechanic apprenticeship programs benefit through stronger labour market performance following certification. Hence, regardless of the degree to which mining activity increases or how market conditions or the skilled trades evolve over the decade, there is still legitimate rationale for increasing apprenticeship positions since they benefit individual participants.

Given these four factors, the policy issue explored by this study is how to increase apprenticeship positions among mining and smelter companies. As with the background sections, focus is given to apprentices in industrial mechanic and heavy-duty mechanic programs. Increasing the number of apprenticeship positions has two primary objectives. First, supplying the labour market with more workers trained in these occupations may help ease projected labour market challenges in mining and mineral production sectors. Second, the strong labour market outcomes of apprenticeship graduates in industrial mechanic and heavy equipment mechanic programs suggest this may be an effective strategy to promote labour force attachment among individuals,

perhaps even youth. The following section outlines this study's methodology for addressing the policy problem articulated above.

5. Study Methodology

A variety of alternatives exist to address the overarching problem of increasing the number of apprenticeships in BC. Within the apprenticeship system, two main analytical approaches exist. One approach would be to encourage more young people to enter apprenticeship programs. However, simply increasing the supply of individuals interested in the skilled trades will not be effective at generating more tradespeople unless employers are willing to provide apprenticeship positions. Consequently, this study focuses on ways to reduce demand-side barriers to increasing apprenticeship positions.

I investigate factors associated with mining and smelter employer participation in apprenticeship training in BC. This question is investigated in two-parts: 1) a literature review and, 2) ten semi-structured interviews with industry representatives (e.g. human resources professionals, industry experts, and site managers), union representatives, and managers from the ITA and RTO. Given that literature on apprentice sponsorship in BC's mining industry is scarce, interviews are necessary to provide a greater level of detail and specificity. Table 6 provides some detail on the interview participants, including their position and the date of the interview.

Table 6: Interview participants

Participant Number	Position	Date	Stakeholder
Participant 1	BC Mining HR Task Force	December 7, 2012	Industry
Participant 2	Manager	December 7, 2012	RTO
Participant 3	Retired Senior VP of Human Resources at a large BC mining company	December 20, 2012	Industry
Participant 4	Superintendent of Industrial and Personal Relations at BC mining company	January 15, 2013	Industry
Participant 5	Local union President at mining site; also served on RTO Board	January 16, 2013	Union
Participant 6	Senior Labour Relations Coordinator at a smelter plant in BC	January 17, 2013	Industry
Participant 7	Human Resources Manager at BC mining company	January 18, 2013	Industry
Participant 8	Union District Representative	January 21, 2013	Union
Participant 9	Manager	January 25, 2013	ITA
Participant 10	Plant Training and Development Leader (smelter plant in BC)	February 8, 2013	Industry

For the literature review, academic, peer-reviewed sources are used to develop a theoretical framework to explain why employers invest in apprenticeships. Second, non-governmental studies (e.g. from the Canadian Apprenticeship Forum (CAF)) and government reports help identify specific considerations and barriers to employer sponsorship. Studies cited in this section come from the broader literature on apprenticeship sponsorship and do not fully reflect the unique characteristics of BC's mining industry.

Industry participants represent large mining and smelter companies with operations in BC. All companies employ apprentices and indicate they have a history of engagement with the apprenticeship process in BC. Through recommendations from early scoping interviews, smelter companies were included in the sample. Occupational needs for skilled trades in smelter companies are similar to mining sites. For example,

industrial mechanics are commonly employed in both smelter plants and mining sites since both operations require the upkeep and maintenance of large machinery. Additionally, some large mining companies in BC also own and operate smelting facilities. Small- and medium-sized enterprises (SMEs) are not directly consulted in this study. SMEs are considered less relevant because mining and smelter companies tend to be larger establishments and are more likely to operate apprenticeship programs than smaller companies.

Interviews are chosen as the second methodology to verify and supplement the more general findings from the literature. They consist of two parts. The main portion is based on the literature review to determine barriers to increasing sponsorship. The latter portion assesses the policy evaluation framework proposed in this study. Interviews are semi-structured and take place in-person, over telephone and via email. Only relevant questions, based on the participant's anticipated area of experience and expertise, are posed to participants. For example, industry participants are not asked questions about the cost of policy options. Other than the interview with one participant from the ITA, interview schedules follow roughly the same topics, though some questions are added to subsequent interviews in order to follow-up on ideas raised in previous interviews. Union participants are also asked additional questions to uncover their perspectives on apprenticeship training.

6. Literature Review: Issues in Employer Sponsorship

I draw on economics and human capital theory to outline a theoretical framework of employer participation in apprenticeships.³⁶ Following a description of this literature, I highlight specific issues and challenges for firms in sponsoring apprentices.

6.1. Human Capital Theory

Economist Gary Becker's (1964) work on human capital theory is a useful lens to consider the training investments of employers. To explain firm behaviour regarding investments in worker training, he differentiates between on-the-job training that generates "general" and "specific" skills. General training raises the marginal productivity of a worker at any firm equally, while specific training increases the productivity of the worker principally at the firm that provided the training. Consequently, Becker argues that firms have an incentive to invest only in specific training.

In a perfectly competitive labour market, the implications for workers' and employers' training investments are different. Workers are responsible for general training since they benefit from higher wages in the future, regardless of the firm where they work. Employers will not invest in general training since they cannot guarantee full recoupment of their investment (i.e. the future productivity of the worker). Instead, firms will supply general training only to "the point where the marginal cost to the firm is equal to the price that trainees will pay" in the form of lower wages (Stevens, 1994, p. 556).

Stated differently, firms will not invest in general skills due to the possibility that another firm could hire the well-trained workers from the training firm.³⁷ The hiring firm

³⁶ In Appendix C, I outline ideas from the literature on New Institutionalism to provide an alternative framing of firm decision-making relative to human capital theory.

would therefore gain all the benefits of the training firm's investment in the worker, while paying none of the costs of the training investment. Becker argues that firms will be unwilling to supply general training for fear that the fully trained worker will leave to go to another firm. Becker's human capital model and the poaching externality are predicated on perfectly competitive markets. Apprenticeship training, which develops general skills (as well as specific skills), and provincially (or nationally) recognized occupational credentials, could therefore present a challenge to employers since the training firm is not guaranteed to fully recoup its training investment.

6.2. Economic Justification for Apprentice Sponsorship

Despite the theoretical case against employer participation in general skills training, many employers sponsor apprentices. This section reviews the conditions that could explain this kind of behaviour. Employers must demonstrate that the benefits of sponsorship outweigh the costs of training.

6.2.1. *Reduced wages*

To reduce the costs of sponsorship, apprentices are paid a training wage. Becker (1964) demonstrates this case by showing that the wage of a "trainee" is derived from their marginal production minus their cost of training. In BC, an apprentice's wage is negotiated on a case-by-case basis, and often through collective bargaining between the union and employer. In a later section I describe different costs that employers calculate when deciding to hire an apprentice. For now it is sufficient to state that, in a general sense, a reduced training wage helps compensate for the lower productivity of the apprentice relative to other employees. Paying a lower wage also helps reduce the risk of the employer's investment in general skills training.

³⁷ Theoretically, in a perfectly competitive market, there would actually be no incentive for workers (who received on-the-job general training) to leave the training firm because their wage would be the same in the open market (Becker, 1964). This theoretical case does not necessarily hold for BC's mining sector for three reasons. First, the presence of unions distorts wage rates. Second, as was indicated by some industry participants, larger firms tend to pay higher wages than smaller firms. Finally, informational asymmetry limits other firms' information about a potential hire from another company, limiting worker mobility.

6.2.2. Informational asymmetry

Katz and Ziderman (1990) show that despite the predictions of Becker's model, firms fund workers' general skills training in some circumstances.³⁸ They suggest that recruiting (i.e. "poaching") firms often do not possess sufficient information about the general skills of workers trained at another company. The value of the worker's general training is actually greater to the training firm than the outside market and therefore training firms have an incentive to provide general training to their workers.

There will always be some degree of unobservable characteristics in workers such as personality, work ethic, or innate abilities. These traits can have a discernible impact on a worker's productivity and value to a company. Training firms have a much greater sense of this information than the outside market, since they can observe these attributes during the apprenticeship training period. Additionally, workers cannot signal these unobserved characteristics effectively to the market because they are not codified in any standardized way.

The content of general on-the-job training also suffers from informational asymmetry. General training that occurs on-the-job tends to be fairly non-standardized and can vary between individual workers. This problem applies to apprenticeship training in BC. The ITA provides general guidelines for employer sponsors, but the specific training content will be different in one company versus another. For example, the relationship between the apprentice and the employer could vary or the specific job tasks and equipment could be different.

General on-the-job training (including apprenticeships) also develops what Katz and Ziderman label the "option value of general training." This refers to the benefit derived from the worker's adaptability to new tasks. However, a worker's option value is not considered the primary or intended outcome of the training; instead it represents additional, unintended, and often unknown benefits. In contrast, general training programs develop skills for a specific and intended purpose (e.g. apprenticeship training for a particular skilled trade). Apprenticeship training, which at least signals more

³⁸ See Acemoglu and Pischke (1998) for a similar discussion in the context of Germany.

information to the market than general training that does not produce a credential, still has an asymmetrical information problem regarding these option value skills. Recruiting firms will have very little knowledge of the trainees' option value because the content of the training program does not, by definition, produce option value for the worker—it remains hidden and therefore less marketable to the worker.

In summary, Katz and Ziderman show that Becker's model relies on perfect (or costless) information about the content of training a worker has received and the skills and competencies of the worker. In reality, information is distributed unequally meaning that workers cannot capture the full benefit of general skills training, and firms have an economic incentive to supply general training such as apprenticeships.

6.3. Specific Issues in Employer Sponsorship

Having established a conceptual framework, I now identify specific issues that employers explicitly or implicitly consider when assessing whether to sponsor apprentices. My findings are derived from the broader literature on apprenticeship sponsorship. Nearly every study on apprenticeship training adopts an economic perspective, assessing the costs of apprenticeship relative to the financial benefits (Wolter, Muhlemann, and Schweri, 2006).

6.3.1. *General employer benefits from sponsorship*

According to Karmel and Rice (2011), employers participate in apprenticeship arrangements for four general reasons. First, apprentices, particularly in upper years of their training, can be productive employees. Second, apprenticeships help develop highly skilled workforces that employers can utilize in the medium- and long-term. Boosting the supply of tradespeople can also lower long-term hiring costs avoiding labour shortage scenarios. Third, in some contexts, employers might be compelled to sponsor apprentices to conform to cultural norms (e.g. Germany's dual system). Fourth, governments will typically provide financial supports to reduce the cost of training and increase employer participation. Others have argued that apprenticeships have the

effect of increasing innovation within a workplace since they promote a culture of workplace learning (Ruth and Deitmer, 2010; quoted in Karmel and Rice, 2011).

CAF (2011) found that the top three reasons for sponsoring an apprentice cited by employers were: “apprenticeship sustains the trade and supply of workers” (20%); “apprenticeship helps meet future workplace needs” (24%); and “apprentices can be trained to own specifications and needs” (23%) (p. 31). Based on CAF’s (2011) findings, apprenticeships are offered to a) meet work demand, b) replace retirements and turnover, and c) develop specific skills. As will be shown in section 7, these findings are largely corroborated by interview participants.

6.3.2. Costs and benefits: Return on Investment (ROI)

To measure the costs and benefits of apprenticeship for employers, most studies focus on the period of the apprenticeship training (Muehlemann, Schweri, Winkelmann, and Wolter, 2007). A variety of contextual factors (e.g. the specific study’s design; the characteristics of the local labour market; and the specific industries considered in the study) make it difficult to directly apply findings from other sources to the context of BC. These studies do, however, highlight a fundamental issue for employers considering sponsoring an apprentice—“return on investment” (ROI). ROI is essentially a calculation of the relative costs and benefits of a particular action. When employers decide to sponsor apprentices, they must estimate direct and indirect costs such as the apprentice’s wage, training fees, supervision costs, administrative costs, and additional maintenance costs and material wastage accruing from the apprentice. Weighed against these costs would be benefits such as government financial incentives (e.g. tax credits), the productive contribution of the apprentice (Karmel and Rice, 2011) and reduced future hiring costs. While employers may count costs and benefits differently, each employer engages in this exercise to some degree.

The nature of costs and benefits is also likely to change over the course of an apprenticeship. For example, supervision costs are likely to be highest in the early years, while wages and training fees are more likely to constitute a larger proportion of costs in later years of training. The total cost of sponsorship tends to be highest in the first year, but remains relatively constant after dropping in year two (Karmel and Rice, 2011).

CAF (2011) also found that employers cited the high cost of training as a significant barrier to sponsorship. Some employers also expressed concern about the amount of supervision and training time required of their full-time workers (CAF, 2011). While these results represent just employers' perceptions, they do indicate that apprenticeships must demonstrate positive ROI.

CAF (2006) reports on a benefit-cost model of apprenticeship sponsorship.³⁹ This model demonstrated positive ROI for apprentice sponsorship in numerous skilled trades—including industrial mechanics (millwrights). Costs included: wages and benefits (e.g. EI, CPP etc.), opportunity costs (i.e. diverted productivity of journeypersons training apprentices), disbursements (e.g. registration fees, wages during school training), and administration costs. The apprentice's productivity and tax credits from government were counted as revenue. For industrial mechanic (millwright) apprentices, total benefits exceeded total costs by a ratio of 1.21 to 1 (1.27 to 1 when tax credits were included). Overall, trade groups generated, on average \$1.38 on every \$1.00 (\$1.44 including tax credits) of training investment. Positive net benefits tended to accrue in the later years of apprenticeship, as training costs decreased and the apprentice's productivity increased (CAF, 2006). This study not only supports the claim that apprenticeship can be a positive investment for employers, but also provides a model of how employers would make their decision to sponsor.

Relatedly, Stevens' (1994) (cited in Brunello, 2009) "investment model" predicts the likelihood of firms hiring apprentices. In this model, the relative costs of fully training an apprentice are weighted against the cost of recruiting skilled labour in the future. The decision to hire an apprentice is not exclusively based on pecuniary costs and the apprentice's lowered productivity during the apprenticeship period, but is weighed against the estimated future cost of recruiting fully trained labour.

³⁹ The benefit-cost model was developed by The Conference Board of Canada and R.A. Malatest & Associates Ltd. 433 employers across 15 trades groups, across the country completed a survey. Participating firms must have hired an apprentice in the past two years. The authors urge caution in generalizing findings from this study to specific employers and specific geographic regions.

The above examples demonstrate a general methodology used by employers to offer apprenticeship positions. If positive ROI cannot be demonstrated either within the apprenticeship period or compared against the future cost of recruitment, it is highly unlikely that sponsorship will occur. In addition to this fundamental issue, other factors can contextualize this basic calculation, which I describe in the following sections.

6.3.3. *Economic conditions*

Macroeconomic conditions structure the incentives for individual employers to not only hire new apprentices, but also continue sponsoring existing apprentices. Brunello (2009) confirms previous findings that sponsorship tends to be “pro-cyclical,” meaning that employers are less likely to hire apprentices in economic downturns, and vice versa. Since apprentices are less productive than fully qualified tradespeople, when a firm must reduce labour costs due to a lack of work resulting from poor economic conditions, it is unlikely that new apprenticeship positions will be offered.

Canadian surveys on apprenticeship support the importance of economic conditions in a firm’s decision to sponsor an apprentice. First, CAF (2011) found that 40% of employers (across all industries) indicated the recent economic downturn negatively impacted their ability to hire apprentices. Second, Ménard, Chan, and Walker (2008) provide some statistics about apprentices’ perceptions of employer sponsorship participation.⁴⁰ Approximately 17% of apprentices reported “having difficulty in finding an employer” (p. 47). Respondents also indicated that of the obstacles faced during their program, one of the main barriers was “inconsistent work or lack of work” (approximately 23.5%). Among individuals who dropped out of their programs, 26% cited inconsistent or lack of work as the reason for their discontinuation (p. 22). A more direct question posed to discontinuers about the main reason for dropping out was “not enough work or income.” Thirteen per cent of discontinuers cited this reason, which was surpassed only by “other reasons,” which mainly included personal factors (p. 23-24). Since availability

⁴⁰ This data comes from the 2007 National Apprenticeship Survey. The sample of apprentices included: “completers” (persons who attained a Certificate of Qualification during the study’s reference period), “long-term continuers” (persons still enrolled in apprenticeship over the course of the study’s reference period) and “discontinuers” (persons who had dropped out of their program during the study’s reference period).

of work is closely linked with economic conditions, these findings indirectly corroborate the notion that employer sponsorship is linked with economic conditions. However, these results should also be interpreted with caution since the perspectives of individual apprentices may not be reflective of overall systemic issues.

Karmel and Rice (2011) also provide some evidence from Australia that apprenticeship non-completion and “commencement” is linked with economic conditions. According to the NCVET “Apprentice and Trainee Destinations Survey,” of the non-completing apprentices in 2010, more than 25% cited the reason, “lost job or made redundant,” up from 8.9% in 2008 before the financial crisis. Data from the same survey also shows that the number of commencements, or new apprentice sponsorships, declined immediately following the recession until quarter 4 of 2009, compared to the reference period immediately preceding the recession.⁴¹ Overall, the impact on apprenticeship commencements of “technician and trades workers” was a decrease of 12.3% over this period (Karmel and Rice, 2011, p. 36-37).

6.3.4. Poaching

As discussed earlier in the context of human capital theory, the threat of poaching can act as a barrier to employers offering apprenticeships. Poaching occurs when a firm recruits a tradesperson who was trained by another firm, capturing that worker’s future productivity, with no investment in his or her training. According to CAF (2011), poaching was cited as one of the top three reasons why employers would not sponsor apprentices. Twenty-two per cent of employers who were not currently employing apprentices cited this reason (p. 32). Additionally, despite the highly regulated character of the German labour market, and the different training ethos displayed by some employers,⁴² Harhoff and Kane (1997) found that German firms were more likely to sponsor apprentices when there was less competition in their sector and therefore a lower possibility of poaching (cited in Muehlemann et al., 2007). These statistics and

⁴¹ The reference period was 2007 quarter 3 to 2008 quarter 2, with the first two quarters counted twice to control for seasonality (Karmel and Rice, 2011, p. 36).

⁴² See literature on New Institutionalism in Appendix C for more details on training ethos in German firms.

findings seem to confirm the general theory, but not the empirical exceptions noted by Katz and Ziderman (1990) and Acemoglu and Pischke (1998).

6.3.5. *Lack of information*

A large proportion of CAF's research (2004; 2006; 2011) has found many employers lack information about apprenticeship programs, government supports, and benefits. In some cases, employers may be unaware of basic information, such as their roles and responsibilities as sponsors, or the regulations and procedures necessary to register an apprentice (CAF, 2004). CAF (2011) reported that employers that do not employ journeypersons were less likely to be aware of apprenticeship opportunities than firms that employ journeypersons.⁴³ As mentioned previously, both the federal and many provincial governments offer financial supports to employers—often in the form of tax credits. However, CAF (2011) identified that approximately 50% of surveyed employers were unaware of existing financial supports. Finally, approximately 40% of employers in the 2011 CAF sample stated that more knowledge of apprenticeship ROI would impact their decision to sponsor apprentices (CAF, 2011). This may indicate that informing employers about the potential financial benefits of apprenticeship investment could boost employer engagement with the system.

6.3.6. *Structure of apprenticeship*

Some employers have expressed concern about the lack of flexibility with traditional apprenticeships. By program “structure,” I refer to the length, supervision, and training commitments of employer sponsors. Most apprenticeship programs take four years to complete, which can become a problem when there is insufficient work for apprentices as employers may be forced to lay them off. Some employers may also be dissuaded from sponsorship since they do not want to risk losing their training investment if there is a good chance of needing to lay off the apprentice. In other cases, employers have expressed concern about their ability to provide enough variety of work to properly train an apprentice to program standards (CAF, 2004).

⁴³ As noted earlier, a journeyperson is an individual who holds a credential in one or more skilled trades.

6.3.7. Unionization

The impact of unions on employer sponsorship levels can be complicated and varied. Generally, unions have been strong advocates of apprenticeship since these programs lead to well-paying jobs for union members. International examples, particularly in Northern European countries and Germany, also seem to indicate that the presence of unions tends to promote stronger apprenticeship programs in that worker turnover tends to be lower overall (Hoffman, 2011).⁴⁴

In Canada, unions may pose some challenges for employers looking to hire apprentices. Here, I specifically refer to firm-based unions that represent the interests of local members. CAF (2004) for example found that some employers are concerned with being forced to pay high wages to apprentices due to collective bargaining agreements with the local union. That is, some employers may be averse to paying a wage that is higher than what they believe the apprentice, given their low level of productivity, should receive. However, this issue may be less pertinent to BC's mining sector since the tradespeople would already be unionized at the site, and the employer is accustomed to paying higher unionized wages. In other cases, some employers can be restricted from hiring their apprentice of choice since unions often promote members for apprenticeship opportunities based on seniority (CAF, 2004). The latter case is relevant to mining sector employers and is confirmed in section 7.

6.3.8. Administrative requirements

CAF (2008) found that some employers have expressed concern about the administrative and paperwork requirements of participating in apprenticeship programs. However, according to a 2012 ITA survey of 471 apprentice sponsors (current and former sponsors), the vast majority of respondents indicated no concerns over administrative requirements of the system. In answering the question: "How satisfied are you that the administrative requirements of sponsoring an apprentice are manageable,"

⁴⁴ Worker turnover also tends to be lower in these countries due to stronger employment protection legislation that protects workers against individual and collective dismissal, and more strictly regulated temporary forms of employment. These factors, closely related to higher rates of unionization, can help incentivize firms to supply apprenticeship training (Hoffman, 2011).

82% indicated they were “satisfied” (ITA, 2012d). This statistic does not cover firms that have never sponsored apprentices, perhaps indicating that administrative requirements could be a perceptual barrier to increased participation.

6.4. Summary of Literature Review Findings

Apprenticeships, as a business expense and investment, are primarily a function of economic conditions, and the ability of the employer to offer sufficient work. General and specific skills are developed during an apprenticeship; sponsors bear the risk that their apprentices will be “poached” by other companies on account of the general skill component. To mitigate these risks, employers pay lower wages or rely on imperfect market conditions in which they possess more information about the apprentice’s skills than the market. Fundamentally, to engage in sponsorship, employers need to be shown that an apprenticeship will produce positive ROI.

Various surveys in Canada have identified specific challenges to sponsorship often faced by employers. In addition to “poaching” and economic conditions, employers have cited a lack of training capacity, lack of information about programs, responsibilities and procedures, the length and inflexibility of apprenticeships, the presence of unions, and administrative requirements as potential barriers to sponsorship. However, these issues do not necessarily reflect the unique characteristics of the mining industry in BC. In the following section I report interview findings that illustrate to what extent these barriers and issues cited in the literature matter in the context of BC mining and smelter companies.

7. Interview Findings: Issues in Employer Sponsorship

The following section summarizes the main findings from interviews with industry, unions, and the Resource Training Organization (RTO). Industry perspectives form the primary source of reporting, but views from the RTO and unions are included in some cases. My purpose is to explain both why employers hire apprentices and the barriers to increasing participation. Table 7 summarizes key topic areas discussed in this section (i.e. methodology 2) and the issues identified in the preceding section (methodology 1).⁴⁵

Table 7: Summary of issues per methodology

Methodology 1: Literature Review	Methodology 2: Semi-Structured Interviews
General benefits of sponsorship	Economic conditions
Costs and benefits of sponsorship (i.e. ROI)	*Maintaining operational output
Economic conditions	Retirements and turnover
Poaching	Justification for hiring apprentices
Lack of information	Poaching
Structure of apprenticeships	Supervision capacity
Unionization	Unionization
Administrative requirements	Structure of apprenticeships
	Lack of information
	Administrative requirements
	*Lack of confidence in technical training
	*Tax credits

*Denotes concepts not covered in the literature review, but which arose throughout the interview process.

⁴⁵ See Appendix C for interview findings related to New Institutionalism literature.

As can be seen in Table 7, the labels of topic areas covered in each methodology differ in some cases. Despite this, concepts covered during interviews are primarily derived from the literature review. I have also separated some closely related findings into distinct sections (e.g. “economic conditions,” “maintaining operational output,” and “retirements and turnover”). These three issues could be considered components of “ROI” and “economic conditions” covered in the first methodology. In other cases, I expand on certain issues that were more relevant to interview participants than in the literature. Finally, as permitted by the semi-structured interview design, three issues are discussed that were not identified in the literature and therefore were not included in the original interview schedule. These issues are: “maintaining operational output,” “lack of confidence in technical training” and “tax credits.” Subsequent iterations of the interview schedule included these topics.

7.1. Economic Conditions

Economic conditions translate into the amount of work a company is able to provide. Interview participants from industry, unions, and the RTO corroborated findings from the literature that general economic conditions affect the likelihood of firms sponsoring apprentices. For example, one industry participant described how poor economic conditions in the 1990s directly led to fewer apprenticeship positions being offered by the company (Participant 4). Another industry participant stated that downturns in the economy create a situation for employers where “apprentices are sometimes seen as almost extra” (Participant 1). Apprenticeship placements depend on the employer’s ability to provide work. If there is insufficient work, employers will not hire apprentices.

Economic conditions should also be considered in the global context. One union participant drew attention to rising demand for copper in China, which led to an increase in commodity prices, more extraction and more major resource projects. According to him, “that [demand] has now left a shortage of skilled trades to do the required work to build the projects properly,” justifying more apprenticeship positions (Participant 8). While economic conditions provide the overall framework and structure incentives for

mining companies to increase extraction, it does not explain why an employer chooses to promote apprenticeships or hire externally to address human resource needs.

7.2. Maintaining Operational Output

Apprenticeships will be offered only if the current operational output of the mining site will not be impeded. This issue was raised by interview participants, but was not identified in the literature review. One industry participant stated they were temporarily employing fewer apprentices because they could not maintain their level of operations if they offered more apprenticeships. Typically, the issue for employers is not that apprentices actually reduce operational output, but rather that the cost of employing apprentices could not be justified given the reduced workload and revenues being generated at a site. However, due to the collective bargaining agreement at this site, the company hires all their apprentices from their operations staff.⁴⁶ Therefore, any increase in the number of apprentices means the company must fill operational positions at the mine. Current operations at the mine required a large volume of experienced operational employees, so the company decided to limit the number of new apprenticeship positions until the difficult operational work had been completed (Participant 4). This scenario highlights how apprenticeship positions are tightly linked with the output and operations of a company. As another industry participant stated, the decision to hire an apprentice is “really driven on whether there’s a need there...that’s really solely what it’s driven on” (Participant 6).

7.3. Retirements and Employee Turnover

While maintaining operational output and productivity is a necessary prerequisite for employers to hire an apprentice, it does not explain why employers hire apprentices in the first place. Industry participants consistently emphasized that apprenticeship

⁴⁶ The interview participant indicated the site’s collective bargaining agreement was somewhat unique in the province. While most mining sites are unionized, management typically advertises apprenticeship positions externally in addition to the local union in a fully competitive application process.

positions were offered to address employee turnover and pending retirements. Participants referenced their human resource strategies to anticipate employee turnover and retirements and fill those positions with a mixture of apprentices and tradespeople, while maintaining current operational output levels.⁴⁷ As it was described by one industry participant, the decision to offer an apprenticeship

really [comes] down to what we're seeing in terms of turnover, and what are we able to do to make sure we're maintaining the operation efficiently and looking forward to what we can and can't do in terms of hiring tradesmen across the street (Participant 4).

This calculation not only anticipates retirements and expected level of turnover, but also estimates the company's ability to recruit externally. When external hiring is not possible or is too costly, this company looked to apprenticeships, described by this participant, as "augmenting" external hires" (Participant 4).

Industry participants generally indicated that turnover was not a large issue at their sites, but did emphasize that replacing pending retirements was a prominent concern for management. Low turnover was probably due to the large size of the company and their monopsony status in the local community's labour market. At one site, the average age of their journeypersons was over 50, which they acknowledged required a long-term strategy including apprenticeships (Participant 6).

7.4. Why Hire Apprentices at All?

Some industry participants did, however, acknowledge the inherent value in creating a balance between apprenticeship and external hiring. One participant stated, "[there are] pros and cons to both...which is why we try to do both" (Participant 4). On the one hand, bringing in external tradespeople can introduce new ideas, new techniques and different experiences, providing a "bit of a shot in the arm" (Participant 4). At one site, since apprentices are promoted from the local union, they offer in-house

⁴⁷ Note, in this context, "tradespeople" refers to the external recruitment of fully qualified tradespeople in either Red Seal or non-Red Seal trades.

knowledge about the operation, which “gives them a lot of empathy and understanding of what’s going on from an operator’s perspective...that helps them become better tradespeople” (Participant 4).

The above findings show that apprenticeships develop general and specific skills. Human capital theory argues that the cost of developing specific skills should be borne by an employer, while an individual should be responsible for general skills training. Apprenticeships can be challenging for employers because they must entail mostly general skills. Employers may therefore sponsor apprentices in part to generate specific skills, as the apprentice is trained on the company’s specialized equipment and learns that company’s managerial and operational structure (Participant 1).

7.5. Poaching

Industry participants acknowledged that poaching was a concern, but not a barrier to increased sponsorship. Some industry participants cited competition from the oil sands in Alberta drawing employees away from their companies. However, as one industry participant stated: “We understand it’s a risk, but it’s not going to preclude us from offering apprenticeship programs” (Participant 4). Another participant stated this in slightly different terms saying that poaching “definitely occurs, but we see it as a necessary cost of maintaining a strong apprenticeship program” (Participant 7). Large mining and smelter companies offer apprenticeships primarily based on organizational need and market conditions; they do not appear to be dissuaded because of competition from the oil sands or other companies.

Instead, participants did attribute poaching as a relevant barrier to SME participation in apprenticeships because apprentices might leave to go to larger companies that pay more when they become certified (Participant 3).⁴⁸ This concern may be justified as one industry participant stated his company would probably be accused of poaching apprentices from other smaller companies in the area because

⁴⁸ One industry participant suggested that Northern BC mining sites were also more likely to experience poaching, but this was not corroborated in other interviews (Participant 1).

they offer higher wages (Participant 6). Unlike most SMEs, larger employers can generally offer a wide variety of work experiences, competitive wages and benefits, and are better able to protect themselves from poaching. They also have greater capacity to replace a lost employee through external recruitment, or by hiring new apprentices.

7.6. Supervision Capacity

Another reason that can limit sponsorship participation is the capacity of the company to supervise apprentices (e.g., the number of journeypersons required to train an apprentice). At larger mining and smelter companies, supervision capacity is less of a problem because there are more journeypersons on staff, but it can be a significant barrier for SMEs that may have fewer journeypersons or none at all.

BC does not impose any apprentice-to-journeyperson ratios to which companies must conform.⁴⁹ Non-mandated ratios allow the employer to easily adapt to market conditions and address employee turnover and retirements. One union participant expressed frustration with this situation, suggesting, “we would like to see some sort of apprenticeships...based on the number of tradespeople they already have” (Participant 8). However, he indicated that this was a problem best solved through collective bargaining.

7.7. Unionization

Unions are strong advocates of apprenticeships (Participant 3). All industry participants in this study indicated their sites were unionized. Most collective bargaining agreements do not include specific provisions for the number of apprenticeship positions to be offered, or specify that those places be allocated for union members.

⁴⁹ These ratios exist in some provinces and for some trades (e.g. welding in Alberta) (Alberta Apprenticeship and Industry Training Board, 2009). Generally, they help ensure apprentices receive a high level of training (Gilbert, 2011).

The effect of unionization apprenticeship participation varies and often depends on the specific collective bargaining agreement and the relationship between the union and the employer. One union participant described a typical relationship between unions and employers regarding apprenticeships:

One of our biggest fights is our seniority system. The employer likes to pick and we like to have the selection done by seniority, all else being equal, in the sense that the employee can pass the required exams etc. (Participant 8).

Industry participants corroborated this sentiment, indicating that the union's seniority system can be constraining. For example, most employers would prefer to hire younger apprentices since they can benefit from that person's future productivity for a longer period of time than if they hired a more senior union member. Despite this conflict, industry did not indicate that unions dissuaded them from offering more apprenticeship positions. Therefore, while employers may prefer not to deal with unions, this does not mean that unionization is a barrier to increased participation in apprenticeship programs.

7.8. Structure of Apprenticeships

The structure of apprenticeships involves various aspects: length, assessment process, technical training responsibilities, registration and administration, stakeholder responsibilities, etc. Here, I confine discussion to length of the apprenticeship and core responsibilities of the stakeholders involved in sponsoring an apprentice.

Participant 2 from the RTO emphasized that many employers do not want to make four-year commitments to apprentices (Participant 2). SMEs that lack the financial capital to sustain apprentices when there is little work available are more likely to exhibit this opinion.

Interviews with larger mining and smelter companies revealed that the structure and length of apprenticeships were not significant barriers preventing them from sponsoring more apprentices. One participant stated, "the system is very outdated," suggesting that there should be more flexibility and shorter-term contracts (Participant

6). However, this was not a barrier for the company, as their decision to hire was based on market conditions and organizational need.⁵⁰

7.9. Lack of Information

Lack of information about apprenticeship opportunities and the apprenticeship process has been identified as a barrier to increased participation. Industry participants indicated they were familiar with apprenticeships and had long-established programs to facilitate training. One industry participant indicated that he would be very surprised if a mining company didn't have some level of participation in the system (Participant 1).

One union participant offered a contrary view, suggesting that employers in his experience lacked basic information about how to effectively incorporate and utilize first-year apprentices. He suggested that overcoming this deficiency could lead to more apprenticeship positions since employers often view first-year apprentices as financial drains. Yet this observation is difficult to reconcile with the long track record of apprenticeship participation among mining companies consulted in this study. Instead, as noted in the literature review, it may be a more apt description of companies that have had less experience with apprenticeships in the past.

7.10. Administrative Requirements

Corroborating ITA research noted earlier, participants did not indicate that administrative requirements were a significant factor or concern. Generally, large companies have the organizational capacity to handle the administrative requirements of apprenticeships. At one site for example, the company employs an apprenticeship coordinator who interacts with the ITA and schedules technical training (Participant 6). One participant from the RTO did point out that employers—particularly SMEs—can be

⁵⁰ It should also be re-reiterated that the traditional four-year apprenticeship model is not the only way to attain journey person status in BC. The ITA has introduced the “challenge” system where qualifying (non-apprentice) individuals can take a written test for their Certificate of Qualification, as well as Foundation programs that provide basic in-class training to non-indentured apprentices, allowing individuals to skip level 1.

resistant to getting more paperwork. But, as with unionization, this does not necessarily mean that sponsorship rates would increase if paperwork were reduced.

7.11. Lack of Confidence in Technical Training

Interviews with some employers and union representatives revealed a lack of confidence in the apprenticeship system's ability to produce *relevant, consistent, and high quality* skills training.⁵¹ For example, Participant 4 stated, "There's no confidence by many members of industry, including us, that the time in school is being well spent...It's just a dog's breakfast." Before directly addressing these three interrelated concerns, I contextualize this frustration by reiterating industry's motivations for apprenticeship training. First, employers primarily view the apprenticeship system as a method of producing labour that is relevant to their workplace needs. Second, employers are self-interested entities whose primary motivation is generating revenue and reducing costs.

7.11.1. Relevancy

Some industry participants indicated that the formal educational component of apprenticeship training did not add significant value to the process. Industry wanted assurance that when they send an apprentice to technical training, that person is developing relevant skills that will be useful to their company upon returning.

It's not that industry is adverse to the fact that we'll cough up an apprentice for 10 weeks...In our operation we pay for them while they are away, we pay for their tuition, we pay a lot of money for them to be away, and we get no return on investment from that. But what we want to be assured of is that during that 10 weeks they are in school they are actually meeting the requirements that have been set out either through the province...or the NOCs (Participant 4).

Another industry participant provided a similar example with electrician training. His site employs a large number of industrial electricians, and he has found that the

⁵¹ Some industry participants did express general satisfaction with the quality of the education provided by colleges. However, excluding some participants' criticisms because they may not represent every company could miss important levers to increasing employer engagement.

majority of Red Seal electricians in the province have been trained for the construction sector. In his estimation, working as an industrial electrician requires some additional and specific skills that are not practiced in construction. However, the technical training curriculums for construction and industrial technicians are nearly identical forcing the company to upgrade the skills of newly hired Red Seal electricians (Participant 6). Participant 10 corroborated this finding, suggesting that most electricians in the province were trained in the construction industry.

The problem of training relevancy is particularly salient for companies that are upgrading technological processes and equipment. According to one participant, “the main issue we have is the level of technical training is not sufficient for the new technology that we will have in the plant” (Participant 10). Technological improvements also require training upgrades to current journeypersons. Participant 10 recently developed a 600-hour training program to upgrade the skills of industrial mechanic journeypersons because their skills did not match the technological needs of the site.

7.11.2. *Standardization and quality*

According to industry (and one union) participants, a lack of standardization in technical training across the province leads to training courses of varying quality.

That’s probably one of the single biggest concerns that employers have in offering apprentices, is that they don’t believe there is any value in the process because the technical training is too airy fairy, or unreliable (Participant 4).

In BC, college instructors own the curriculums for apprenticeship programs, which can result in uneven standards. This was emphasized by one industry participant and also echoed by a union representative: “[One of the] fundamental flaws from the perspective of industry...is that the instructors own the curriculum they teach...it’s not the schools and it’s not the Province” (Participant 4).

Lack of standardization is a problem because employers want to send apprentices to technical training when it is most convenient for them during their work cycle. While schools offer a variety of times, there may be cases when the top school’s

courses do not fit with employers' schedules and employers may be forced to send a student to a lower quality course. Furthermore, while all apprentices technically enter a given course with the same prerequisites, their previous training could vary widely, creating a teaching challenge for instructors.

Some industry participants also expressed concern with the quality of education provided by the colleges. When referencing Foundation programs, one participant stated, "I've yet to see that process deliver a good product" (Participant 4). This indictment further supports the notion that industry lacks confidence in the system. Other participants attributed inadequate quality of training to a lack of financial resources in certain colleges resulting in limited and outdated equipment.

When we send them to the schools the frustration is that often what they're doing in school is either outdated, or we as their sponsor are not getting information back about what they're doing, what they're being exposed to (Participant 4).

7.11.3. *Implications*

Both these examples clarify industry's definition of a "skills shortage." By arguing that colleges should deliver relevant training, industry participants are implying that industry-specific (or relevant) skills should be developed during technical training. This raises important questions about how responsibilities in apprenticeship training should be allocated among the ITA, colleges, and industry, which is beyond the scope of this project but an important area for future research. In reference to this issue, Participant 10 was queried whether government should only be expected to supply a "general millwrighting program" and industry should "top up the rest of the training to specific job specs." His response was, "well, it's a big charge you are asking industry to do. It's a big investment actually to do that [supply training]." This reaction seems to indicate an expectation that government should supply relevant and industry-specific skills training.

7.11.4. *Is poor technical training a barrier to increased sponsorship?*

While some industry participants expressed frustration with apprenticeship technical training, it is difficult to say whether improving the quality of training would

increase sponsorship rates. One industry participant suggested that because trust and confidence was so low, industry might consider abandoning “the apprenticeship program, and go [to an] all ‘in-house’ program because we can control what they’re [apprentices] being taught” (Participant 4). However, this statement does not definitively address the issue.

The relationship among the colleges, the ITA, and industry could also be described as a kind of prisoner’s dilemma game. According to Participant 4, industry isn’t supporting the apprenticeship system to the expectations of the Province and the ITA. Industry claims they are not sponsoring more apprentices because of the poor quality of training from the colleges. In turn, the colleges argue industry is inconsistent with their levels of commitment. While this does not directly answer the question of whether improved technical training would increase industry participation, it does point to a general lack of trust, cooperation, and communication among the stakeholders.

When queried on this issue, the ITA participant noted that employers are well within their right to develop their own private institutions or partner with private colleges to generate more specific skills. The ITA allows any firm or organization to teach an ITA-certified course as long as it meets criteria outlined by the ITA (Participant 9).

7.11.5. *Apprenticeship Student Outcomes (APPSO) survey results*

Some contrary evidence on the issue of technical training comes from the 2011 Apprenticeship Student Outcomes (APPSO) Survey which found generally high levels of satisfaction with technical training among apprentices, though with some variation by trade program (BC Stats, 2011, p. 22-25). Table 8 summarizes some of these findings.

Table 8: APPSO responses on technical training

Percentage of apprentices responding "very good" or "good"				
Trade program	Quality of Instruction	Quality of tools and equipment	Relevancy of curriculum	Availability of courses
Industrial mechanics/maintenance	87%	70%	78%	74%
Medium/heavy duty mechanics	77%	60%	62%	55%
Overall average (All trade programs)	84%	77%	77%	67%

Source: (BC Stats, 2011, p.22-25)

APPSO results show that overall student satisfaction in the educational system is relatively high, but also indicate room for improvement. For example, while the overall level of satisfaction in the relevancy of course curriculums is strong at 77%, some trade groups such as medium/heavy duty mechanics indicated only 62% satisfaction on this criterion. Second, opinions on the availability of training courses were variable, with medium/heavy duty mechanic respondents indicating only 55% approval, twelve percentage points less than the overall average. Finally, some caution should be exercised given these perspectives reflect student, and not necessarily employer views.

7.12. Impact of Tax Credits

Tax credits were briefly mentioned in the literature as one of four general reasons why employers participate in apprenticeship training (see Karmel and Rice, 2011). Industry participants were asked to provide opinions about the efficacy of BC's apprenticeship tax credits incentivizing increased sponsorship of apprentices. Given that the purpose of tax credits is to reduce the cost of apprenticeship for employers, it warrants discussion whether this is an effective way to generate increased sponsorship participation.

Most industry participants were aware of the tax credits but were only familiar enough to provide general commentary. For example, in answering whether increasing or adjusting the current set of tax credits would increase his company's sponsorship

levels, Participant 4 stated it “wouldn’t hurt, but it’s not the end all and be all with us.” A common sentiment from industry participants was that increasing the tax credits would not have a direct impact on the number of apprenticeship positions offered. Instead, apprenticeship positions are a function of organizational need and market conditions. Participant 7 articulated this notion:

We never want to turn down tax credits, but the reality is we have to maintain strong apprenticeship programs because contractors are expensive and we will not be able to recruit enough qualified trades in Canada due to our journeyperson demographics and growing industrial demand (Participant 7).

These responses suggest that tax credits are not viewed as a strong incentive for companies to offer apprenticeship opportunities.

7.13. Summary of Interview Findings

Table 9 below summarizes the key interview findings discussed above. It also shows whether a particular issue was relevant to increasing sponsorship participation—the primary goal of this study.

Table 9: Summary of interview findings

Issue	Description	Relevant to increasing sponsorship?
Economic Conditions	Impacts the amount of work a company can provide, and by extension, the number of apprenticeships offered	Yes
Maintaining operational output	Apprenticeships will only be offered if current operational output is not affected	Yes
Retirements and turnover replacement	Sponsorship will partly be a function of the company's estimated need to replace retirees and employee turnover	Yes
Poaching	Not considered a barrier, just accepted as "the cost of doing business"	No (But is a consideration)
Supervision capacity	Not a significant issue for large companies	No (But is a consideration)
Unionization	Unions can present challenges, but do not necessarily prevent mining and smelter companies from sponsoring more apprentices than they need	No (But is a consideration)
Structure of apprenticeships	The structure of apprenticeships was not a relevant issue. While flexible arrangements might be welcomed, they are not a deciding factor for participation	No (But is a consideration)
Lack of information	Lack of information was not considered a barrier. However, some companies may not know how to properly incorporate first year apprentices	No
Administrative requirements	Administrative requirements of the apprenticeship system were not considered a burden or barrier.	No
Impact of tax credits	Tax credits are welcome, but are not deciding factor in the number of apprenticeship positions offered	No (But is a consideration)
Low confidence in Technical training	Addressing the lack of relevant, standardized and high quality technical training might demonstrate more value in apprenticeships to industry, increase confidence in the system, and boost participation	Yes (Likely)

As can be seen from this table, participants indicated that many of these issues are not vital to increasing sponsorship participation. Interviews confirmed findings from the literature that employers make a cost-benefit calculation to determine which human resources strategy (apprenticeship versus hiring fully-qualified tradespeople) produces

the largest benefits at the lowest cost. However, some factors in this ROI calculation are more relevant than others (e.g. economic conditions versus tax credits).

The number of apprenticeship positions offered is based mostly on economic conditions, the human resources needs of a company (retirements and turnover) and whether the operational output at the site can be maintained if the apprentice is hired. Government policies to incentivize sponsorship must account for the fact that companies will not invest in an apprentice unless they believe they need to, and that it must produce positive ROI for the company. Some of these issues may present barriers to SMEs, but for the larger companies consulted in this study, factors such as administrative requirements and supervision costs are simply not barriers to increasing sponsorship levels. Finally, some participants indicated that industry confidence in technical training could be increased by improving the relevancy, quality and standardization of technical training courses.

8. Policy Options

The following section outlines three policy options to increase the participation of large mining and smelter companies in apprenticeship arrangements.

8.1. Apprentice-Sharing Program (ASP)

Based on the Group Training Organization (GTO) model in Australia, this policy option seeks to address a variety of issues identified in the literature and interviews. Unlike traditional apprenticeship arrangements where individual firms employ apprentices, GTOs recruit apprentices and supply them to “host” employers under an apprenticeship contract. GTOs are also responsible for the management and operation of the entire process, including wages, paperwork, and off-the-job training (Australian Government, n.d.) Firms can benefit through increased exposure to more apprentices, reduced risk and increased flexibility as the shorter-term contracts can be more responsive to fluctuations in the amount of work at a site.

Funding for Australian GTOs comes from the Joint Group Training Program (JGTP) as well as participating firms. The JGTP supports GTO development and operations throughout the country. As an agreement between states and the Federal Government, specific funding provisions under the JGTP can vary by state (states typically match federal funds for their particular state) (GTA, 2010). For 2012/13, the Federal Government recently announced \$14 million (AUD) for the JGTP.⁵² According to GTA (2010), on average, approximately 5% of GTOs’ funding comes from government. In the Australian Capital Territory (ACT), GTOs receive between \$330 and \$470 (AUD) per apprenticeship commencement (\$353 to \$502 (CAD)); \$305 to \$360

⁵² 14 million in Australian dollars translates into just over \$14.9 million (CAD) (exchange rate: 1 Canadian dollar = 0.93 Australian dollars, April 10, 2013). This is the same exchange rate used for commencement, retention and completion funding per GTO listed below.

(AUD) per 12 and 24 months retention (\$326 to \$385 (CAD)); and \$330 to \$470 (AUD) per completion (\$353 to \$502 (CAD)) (Australian Capital Territory [ACT] Government, 2012). This funding formula illustrates one method of financing an ASP.

Precedent for group training arrangements already exists in BC's mining industry with the Mining Apprenticeship Program (MAP) at College of the Rockies. An Apprentice-Sharing Program (ASP) program in BC could follow this and the GTO model closely. Funding would be supported by the ITA and participating employers. Following the Australian model, approximately 5% of funds could come from the ITA (i.e. the Province). The RTO would act as the central indenturing agency and provide services such as screening and recruitment of applicants, administration, paperwork, and paying wages. Employers would be responsible for supplying on-the-job training as per a traditional apprenticeship arrangement, but would not be the official sponsor.

8.2. Targeted Tax Credit (TTC) Program

This policy option adds a targeting component to the BC Training Tax Credit scheme by reducing tax credits for large businesses. Business size would be based on the definition used by Industry Canada such that a company with more than 500 employees would be considered a large business. The overarching rationale behind the TTC program is that current tax credits are an ineffective use of government money to generate apprenticeship positions, and that this money could be used more effectively in other areas. Savings from the TTC program could be used to support more relevant issues faced by the ITA. For example, revenues could be put towards greater funding of technical training at public post-secondary institutions.

The basic structure of BC's current apprenticeship tax credits would remain unchanged under the TTC program. A summary of the proposed TTC scheme is found in Table 10. SMEs would not see a tax credit reduction under the new plan, and SMEs claiming Completion and Enhanced Tax Credits would see the maximum claim amount for level 3 apprentices increase to \$3,000 and \$4,500 respectively. Conversely, there would be a drop in the percentage and maximum claim amount for large businesses. The Basic Tax Credit (for levels 1 and 2) would be scaled back to pre-2009 levels to

cover 10% of wages up to a maximum credit of \$2,000 rather than current levels of 20% coverage up to \$4,000. The Completion Tax Credit would also be reduced to cover 10% of eligible expenses up to \$2,000. Finally, the Enhanced Tax Credit supplement would be reduced to 25% (maximum \$5,000) for the Basic Tax Credit and 20% (maximum \$3,500) for the Completion Tax Credit.

Table 10: Summary of TTC program

	Large businesses	SMEs	Status-quo tax credits (for reference)
Basic Tax Credit	10% Max \$2,000	20% Max \$4,000	20% Max \$4,000
Enhanced Basic Tax Credit	25% Max \$5,000	30% Max \$6,000	30% Max \$6,000
Completion Tax Credit	10% Max \$2,000 Levels 3, 4, 5	15% Max \$3,000 Levels 3, 4, 5	15% Max \$2,500 level 3 Max \$3,000 levels 4, 5
Enhanced Completion Tax Credit	20% Max \$3,500 Levels 3, 4, 5	22.5% Max \$4,500 Levels 3, 4, 5	22.5% Max \$3,750 level 3 Max \$4,500 levels 4, 5

8.3. Expand ITA Level Exams

This policy option would build on existing work being done by the ITA to implement standardized level exams across all trades. Level exams occur at the end of technical training and test a student’s knowledge of the course content. Currently only some trades have ITA level exams, and where applicable, level exams constitute 20% of a student’s grade. This policy option would also increase the relative weight of these exams. Students would still be required to score at least 70% to pass the course.

Some industry participants expressed a fundamental lack of confidence in the system’s ability to produce relevant, standardized, and high-quality technical training. Standardizing exams would work within the current system of instructor-owned curriculums, but would put greater onus on instructors to meet occupational training

standards set by the ITA.⁵³ It could also provide greater assurance to industry that the content of the training was valuable, increasing confidence in the system. While standardized exams do not guarantee higher quality of skills, they could increase the accountability of instructors and technical training institutions. The ITA will also be able to more easily track student performance across institutions to identify where gaps may exist, providing employers and the ITA valuable information about the quality of training across the province.

⁵³ Other policy options were also considered to address educational issues. One participant indicated that industry had previously proposed provincially standardized curriculums, but said there was significant opposition from colleges and a lack of political will to execute this policy direction. Alberta's apprenticeship system has set curriculums and standardized exams for each level of technical training (Alberta Apprenticeship and Industry Training, n.d.).

9. Evaluation Framework

The following section describes the criteria and measures used to evaluate each policy option. Criteria compare and assess alternative policies, while measures operationalize and assess each criterion. Table 11 provides a summary of criteria and measures used in this study.

Each criterion is qualitatively assessed on a three-point ordinal scale. Unless otherwise noted, the measurement index is: 3 as “high,” 2 as “medium” and 1 as “low.” Participants’ opinions supplement findings from the literature in the assessment of each criterion. Participants are not asked to explicitly rank each criterion, but rather express their opinions in more general terms. Based on their opinions and findings from the literature, I assign a score on each criterion for each policy option.

Table 11: Evaluation framework

Criteria	Description	Measurement Index	Sources
Effectiveness	Impact on a company sponsoring more apprentices	High = 3 Medium = 2 Low = 1	Interviews: ITA, RTO, industry, unions Literature
Stakeholder acceptability	Level of support from industry	High = 3 Medium = 2 Low = 1	Interviews: Industry Literature
	Level of support from unions	High = 3 Medium = 2 Low = 1	Interviews: Unions Literature
Cost	Cost to implement and operate the policy	Low = 3 Medium = 2 High = 1	Interviews: ITA, unions ⁵⁴ Literature

⁵⁴ One union participant, who also sat on the RTO Board, also informed the cost criterion for some policy options.

9.1. Effectiveness

Policy options will be assessed by their effectiveness at addressing the policy problem. This criterion measures to what extent the policy increases the likelihood of a company sponsoring more apprentices. Given that all industry participants indicated their company currently employed apprentices, effectiveness primarily refers to increasing sponsorship at firms that already sponsor apprentices. Interviews with all groups of participants, the ITA, RTO, industry, and unions, are used to evaluate this criterion. A policy that is ranked “high” indicates that it is likely to increase apprentice sponsorship in large mining or smelter firms, while a policy ranked as “low” suggests the policy will have little impact on a company’s sponsorship rates.

9.2. Stakeholder Acceptability

Stakeholder acceptability is divided into two categories to assess the likelihood that a policy will be supported by industry and by unions. Since industry participation is necessary for the success of any apprenticeship arrangement, gaining industry compliance is an important policy dimension. Similarly, because a large proportion of mining companies are unionized, policies should incorporate the perspectives of organized labour.⁵⁵ These dimensions are assessed separately to allow for a difference of perspective from these two stakeholder groups. A ranking of “high” indicates the policy will be well received by the stakeholder, while “low” means that the stakeholder will oppose the policy. To control for the additional dimension on this criterion, both scores are averaged into a single stakeholder acceptability score in the final analysis. Interviews with industry and unions, supplemented by the literature, form the basis of the assessment.

⁵⁵ While educational institutions that provide technical training to apprentices are also an important stakeholder in the apprenticeship system, they were not consulted in this study since they were not identified in the literature review as relevant to increasing employer participation in apprenticeships. Future studies should include this perspective.

9.3. Cost

“Cost” is a single criterion that implicitly refers to two issues—implementation cost and operational feasibility. Implementation cost describes the estimated cost required to set up and implement a policy option. Conversely, operational feasibility assesses the ongoing administrative and financial capacity of the Province, ITA, or RTO to carry out a policy. These two elements are described throughout the analysis, but they are aggregated to a single ranking. The cost criterion is also measured on a three-point scale, but the order is reversed such that “low” receives a score of 3, while “high” receives a score of 1 since low-cost policies are preferable to high-cost policies. Assessment is based on findings from an interview with a participant from the ITA, as well as findings from the literature.

9.4. Excluded Criteria

I do not formally evaluate the criteria of “political feasibility” or “equity.” Political feasibility should not be a relevant factor in assessing the relative merits of different policy directions, as it distances the evaluation from evidence-based decision-making towards political ends that may not reflect the inherent value of the policy. Equity is also not formally assessed. Given the policy problem of increasing the number of apprenticeship positions, it is not relevant (or inequitable) if some employers participate more than others.

10. Policy Analysis

This section assesses each policy option according to each criterion described in the evaluation matrix. A summary of the evaluation scores can be found in Table 12.

Table 12: Policy evaluation matrix

	ASP	TTC Program	Expand ITA level exams
Effectiveness	Low (1)	Low (1)	Medium (2)
Industry acceptability*	Medium (2)	Low (1)	High (3)
Union acceptability*	Low (1)	Low (1)	High (3)
Cost	High (1)	Low (3)	Medium (2)
Total (maximum 9)	3.5	5	7

*Note: Industry acceptability and union acceptability scores are averaged to a single score for stakeholder acceptability.

10.1. Apprenticeship-Sharing Program (ASP)

10.1.1. Effectiveness

The ASP would not be overly effective at increasing apprenticeship positions with large employers and is assigned a ranking of “low.” Industry participants expressed a general level of interest in ASP, but not necessarily for their own companies. For example, one participant stated that he thought it was “a good idea” (Participant 6), while another participant acknowledged that his company could not participate in this program because of their collective bargaining agreement and indicated this could also be a barrier to other large companies. Despite this, he stated, “it’s a pretty exciting opportunity there” (Participant 4). However, his rationale did not indicate that this program would increase the number of apprenticeship positions offered at his company. Instead, he

pointed to benefits such as exposing apprentices to more trade experiences and the opportunity to connect with apprentices with less commitment than a traditional four-year apprenticeship.

Another industry participant indicated that they “have never had a shortage of apprentices,” which is to emphasize an earlier point that apprenticeships (especially for larger firms) are offered based on organizational need and market conditions (Participant 6). A large company will not hire an apprentice if one is not needed, and if they need one, they simply fill the position through advertising. Participant 10, who, despite expressing general support for an ASP model, indicated that the potential of losing an apprentice following certification could be an issue for companies. In addition, sharing apprentices between sites would eliminate the informational advantage enjoyed by sponsors about an apprentice’s work ethic and personality. These issues may reduce the potential value of sponsorship, particularly to larger firms that view them as a long-term human resource investment.

A final consideration that may limit the effectiveness of this policy option is that participating companies would still have to pay a membership fee to access ASP services. Economic conditions and company profitability therefore remain mitigating factors, though the overall cost of membership could still be lower than traditional sponsorship.

10.1.2. Stakeholder acceptability

Industry participants were generally supportive of the idea of an ASP for a variety of reasons; however, it was not considered a high priority and therefore this criterion is assessed as “medium” (2). One participant expressed support for the program because it could connect previously unknown pools of workers with companies more effectively (and visa versa). He emphasized that exposing apprentices to a variety of work settings and trade experiences could also improve the quality of apprentices produced. Another participant thought it was a good idea in concept, saying that his company had talked about sharing apprentices between sites (and within the same company), which is not equivalent to sharing apprentices between companies.

Union participants were not necessarily adverse to an ASP, though their opposition would be highly dependent on the effects to their local membership. Given that many large mining sites are unionized, any policy that decreases the likelihood of local members receiving apprenticeship positions will be negatively perceived. This policy has the potential to introduce flexible, non-unionized workers into companies, which might dissuade employers from looking at their own staff for apprenticeship positions. While there is likely to be variability in union support, the logical implications of this policy suggest that union support will likely be low.

10.1.3. Cost

A Group Training Australia (GTA) study found that larger companies might be more cost-effective partners even though the vast majority of participating firms in GTOs are SMEs. However, the consulted ITA participant suggested that ITOs (e.g. RTO) do not have the infrastructure to operate such a program. Implementation would require substantial financial investment in the organizational capacity of the RTO. Australian GTOs for example grew only after the Australian government offered financial support in the mid-1980s (NCVER, 2001). One union participant corroborated this issue stating that while the RTO should be the organization to run an ASP, “the government is not willing to invest money for either organization [i.e. ITA] to have the capacity to run a properly run...program....I think it’s a really great idea, but I also think it’s a bit of a pipe dream” (Participant 5).

Operational feasibility, which includes ongoing costs and organizational capacity to run a program, would also be poor for this program. Cooney and Gospel (2008) have shown that GTOs required substantial government investment to remain operational since the 1980s when GTO prevalence in Australia increased dramatically. They state that approximately two-thirds of GTOs’ operational funding comes from government (Cooney and Gospel, 2008). However, as noted earlier, GTA (2010) cites that only 5% of GTOs’ funding comes from government. Regardless, some level of public funding will

likely be required to maintain an ASP.⁵⁶ The ITA participant also doubted the ability of ITOs to properly operate this policy. Due to the current lack of infrastructure, and low operational feasibility, an ASP program was assessed a score of 1 (“high cost”) on this criterion.

10.1.4. Other considerations

Both union and ITA participants highlighted important issues with this policy not captured by the evaluation framework. One union participant suggested that employers would only be interested in hiring upper-level apprentices, which could prevent first year apprentices from gaining the work hours required. The issue of apprentices’ mobility was highlighted by a number of participants. The ITA participant argued that apprentices could not be expected to move around the province, especially on short-term contracts. Organizing an ASP by geographic area could help mitigate this problem, but might stretch operational capacity. The ITA participant also questioned part of the premise for an ASP. She did not believe that apprentices needed to be exposed to a wider scope of trade experiences. She also observed that increasing the number of non-employer sponsored apprentices could risk oversupplying the market with tradespeople because these positions are not directly indexed to employer demand.

10.2. Targeted Tax Credit (TTC) Program

10.2.1. Effectiveness

The purpose of tax credits is to lower the cost of apprenticeship training for employers, thereby increasing sponsorship participation. In addition, tax credits can theoretically distribute training costs more equitably among employers since they should reduce the incentive for poaching (Saskatchewan Apprenticeship and Trade Certification

⁵⁶ If we assume that 5% of funding comes from government, that state governments have matched the Federal Government’s \$14 million (AUD) investment under the JGTP, and that there are 150 GTOs in Australia, each GTO receives \$186,666 (AUD) from government, while its total operating budget is over \$3.7 million (AUD). This gives an indication of the high cost involved in operating an ASP.

Commission [SATCC], 2005). However, despite their widespread use, there is little evidence to suggest that they generate more apprenticeships. In fact, a report by the SATCC (2005) found that:

There are limited empirical data on which to advance cogent arguments for a tax credit approach to encouraging apprenticeship investments. Most of the literature argues for expected outcomes but we could not find a study to substantiate these arguments (p. 7).

The ITA participant also corroborated this finding, questioning whether tax credits actually incentivize employer sponsorship. The TTC program seeks to utilize tax credits in a more efficient way, though it acknowledges that more information about tax credit efficacy is required. The ITA participant was generally supportive of this measure, likening it to a “graduated income tax approach” whereby the size of tax credits would vary by firm size (Participant 9).

Industry participants consistently stated that tax credits were a minor consideration when deciding to hire apprentices. Tax credits do not change the fundamental fact that if there is no organizational need to hire an apprentice, companies will not offer a position. Given the relative low priority of tax credits in hiring, it is unlikely that lowering credit amounts will result in fewer apprenticeships offered by large mining and smelter companies (though some companies on the margins, with less established programs might participate less). At the same time, this policy will clearly not increase employer willingness to sponsor more apprentices in the short-run. However, because the policy actually generates revenue for the Province and the ITA, if this money is used in more effective areas, apprenticeship participation could increase. One example would be to redirect funds to improve technical training. Responding to this proposition, one participant indicated that “measurable proof” of the impact of this additional funding (to technical training) would be needed to demonstrate its value (Participant 10). Because in the short-run firms are unlikely to add additional apprenticeship positions, this policy option is assessed a score of 1 (“low”) on this criterion.

10.2.2. Stakeholder acceptability

This policy was assessed a score of 1 (“low”) on industry and union acceptability. While tax credits do not fundamentally impact the decision to hire an apprentice, reducing government financial support will nevertheless be viewed negatively by the business community. As discussed above, the Province and the ITA should clearly and transparently outline how technical training will be improved through the funds generated by the TTC.

Unions will also be sceptical about this policy since it reduces tax credits for large businesses, which will likely be perceived as disinvestment in apprenticeship training from the Province. However, as with businesses, if the Province and the ITA can effectively redirect those funds to improve technical training, and therefore the employability of apprentices, unions could become more supportive.

10.2.3. Cost

The low cost of this policy is its main advantage relative to the other proposed policies. Costs associated with the TTC would mainly apply to the Provincial Government, which administers tax credits. However, this policy does not create any additional net costs to the Province or the ITA given that it simply redirects funds in the form of tax credits to large businesses to financially support technical training throughout the province. There are unlikely to be substantial implementation costs to the policy since it requires only a minor alteration to the existing tax credit structure for apprenticeships. Operational costs to fund technical training will also be minimal since the ITA would simply be transferring more money to training institutions. Some collaboration between colleges, the ITA and industry would be required to ensure that money is being spent by colleges in a way that provides value for industry and the ITA.

10.3. Expand ITA Level Exams

10.3.1. Effectiveness

Based on interviews with industry participants, improving the relevancy and standardization of technical training in BC could be an important lever to increase industry participation. An industry priority is to ensure that technical training is developing skills relevant to the workplace. Moving towards standardization could signal intent from the ITA that educational reforms are being made. Industry's immediate response is hard to predict. Based on the interviews in this study, education was the single biggest complaint from industry about the apprenticeship system, so a score of 2 ("medium") is assessed on this criterion. Improving industry confidence and participation, may only materialize over the longer-term, so assessment of this policy's effectiveness should be couched in a longer time frame. As stated throughout this report, however, addressing educational issues will not supplant the importance of market factors in creating apprenticeship positions.

10.3.2. Stakeholder acceptability

Based on interviews in this study, any steps to standardize the educational component of apprenticeship training will be received positively by industry. While some may call for more dramatic intervention (e.g. standardized curriculums), this policy is a reasonable step towards improving the quality of education and increasing the accountability of technical training institutions. Unions are also likely to support this policy initiative if they believe it will improve the quality of educational training, and by proxy, the employability of future tradespeople since their skills should be more valued by industry. Due to this anticipated high level of support from industry and unions, this policy option is given a score of 3 ("high") on stakeholder acceptability.

10.3.3. Cost

The cost of this policy option is considered to be "medium" (2). As discussed earlier, the ITA has already introduced standardized level exams in some trade programs. Implementing level exams for all trades will require substantial financial

investment and require extensive coordination with technical training institutions, occupational experts, and industry to match exam content to occupational codes and ITA program standards. Increasing the relative weight of these exams from 20% of a student's grade should not require additional financial cost to implement. Ongoing costs will include the ITA having to mark and administer more exams. However, this cost is mitigated because exams are multiple-choice, and the ITA already has the basic infrastructure and knowledge of how to operate this policy. Another ongoing cost will be associated with updating more exams to match occupational standards, which are updated approximately every five years.

11. Recommendations

The preceding analysis has presented three options available to the Province and the ITA as mutually exclusive, but in reality, multiple policy avenues can be pursued. I recommend expanding ITA level exams and implementing the TTC program.

Expanding ITA level exams has the best overall score of the policy options. While the number of apprenticeship positions is mainly determined by market forces, implementing reforms in the educational system could increase the confidence of large businesses in the quality and relevance of technical training, and ultimately increase participation in the apprenticeship system. Based on the potential high level of effectiveness and likely widespread support from unions and industry, I recommend that the ITA adopt this policy option.

Because it scores low on effectiveness and stakeholder acceptability, the TTC program may appear a counter-intuitive option to implement. It acknowledges the limited financial levers available to the Province and ITA to directly influence industry apprenticeship participation. The main benefit of the policy is its low cost to implement and operate as well as its ability to actually generate revenue for the Province and the ITA. These revenues could finance more “valued-added” initiatives from the ITA, such as the first recommendation of expanding ITA level exams. As such, these policy options are highly complementary and should be implemented together.

The ASP option is not recommended because it is unlikely to generate more apprenticeship positions in large businesses, is costly and does not receive overwhelming support from stakeholders. Other considerations not accounted by the evaluation framework also preclude its recommendation. In particular, developing apprentices without employer sponsors could risk oversupplying the market, and unless geographically based ASPs are developed, apprentices may not be able to travel across the province on short-term contracts. Finally, ASP models already exist in BC through union “hiring halls” and even in the mining industry itself, with the MAP program

operated by College of the Rockies. If industry wants to develop ASP systems, the current ITA system allows industry to develop pilot programs similar to the ASP.

12. Conclusion

This study contains some methodological and analytical limitations, which I briefly describe below. I then suggest future research directions that extend beyond the current study and offer some concluding thoughts.

Apprenticeship data collected by the ITA are severely limited. For example, I was unable to describe apprenticeship sponsorship by industry, industry participation per trade program, and sponsorship by employer size. This lack of data meant that the study's problem statement could be erroneous, since it is difficult to determine a baseline measure of mining and smelter companies' apprenticeship participation in BC. Consultation with educational institutions could have also better informed the discussion of technical training raised by some interview participants.

Future research should focus on barriers to SME participation in apprenticeships and determine areas where government supports can be most effective. Tax credits are popular government tools, but more evidence of their efficacy needs to be gathered to justify their use. Most importantly, future studies should explore the validity of claims concerning skills shortage in BC's skilled trades. To this end, research should focus on how skills shortages are measured and attempt to reconcile the often-diverging definitions of government and industry. Research also needs to address where responsibility to increase investment in skills training should fall—should the onus lie more on government or more on industry? Conclusions on these key issues will affect the best directions for policy reform.

This study has attempted to develop options to increase the number of apprenticeship positions offered by mining and smelter companies in BC. Through interviews with industry stakeholders, I learned that participation in apprenticeships primarily depends on economic factors and market conditions. Many large companies have long-established apprenticeship systems, but they ultimately base hiring decisions on organizational need (i.e. turnover and retirements), and maintaining or expanding the

productive output at the site. These findings were reflected in the analysis, which did not assign an effectiveness score greater than “medium” for any policy option.

While the participation of larger companies tends to be mainly determined by economic conditions, interviews also revealed that industry perceives a gap between the skills produced by technical training and actual workplace needs. This “skills shortage” issue was beyond the scope of my study to address directly, but interview participants did indicate that policies designed to improve the relevance and quality of technical training might increase industry confidence in the system and potentially lead to increased participation. Improving coordination and fostering cooperation among all apprenticeship stakeholders—industry, the ITA, ITOs, colleges, unions, the Province, and apprentices—is necessary to outline priorities for future reforms. Without adequate and meaningful collaboration, stakeholders will continue to work inefficiently and sometimes at cross-purposes to each other.

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Appendices

Appendix A.

Mining and Smelter Related NAICS Codes⁵⁷

NAICS 21: Mining, quarrying, and oil and gas extraction

This sector comprises establishments primarily engaged in extracting naturally occurring minerals. These can be solids, such as coal and ores; liquids, such as crude petroleum; and gases, such as natural gas. The term mining is used in the broad sense to include quarrying, well operations, milling (for example, crushing, screening, washing, or flotation) and other preparation customarily done at the mine site, or as a part of mining activity. Establishments engaged in exploration for minerals, development of mineral properties and mining operations are included in this sector. Establishments performing similar activities, on a contract or fee basis, are also included.

NAICS 211: Oil and gas extraction

This subsector comprises establishments primarily engaged in operating oil and gas field properties. Such activities may include exploration for crude petroleum and natural gas; drilling, completing and equipping wells; operating separators, emulsion breakers, desilting equipment and field gathering lines for crude petroleum; and all other activities in the preparation of oil and gas up to the point of shipment from the producing property. This subsector includes the production of oil, the mining and extraction of oil from oil shale and oil sands, and the production of gas and hydrocarbon liquids.

NAICS 212: Mining and quarrying (except oil and gas)

This subsector comprises establishments primarily engaged in mining, beneficiating or otherwise preparing metallic and non-metallic minerals, including coal.

Exclusion: providing support services, on a contract or fee basis, required for the mining and quarrying of minerals

NAICS 213: Support activities for mining, and oil and gas extraction

This subsector comprises establishments primarily engaged in providing support services, on a contract or fee basis, for the mining and quarrying of minerals and for the extraction of oil and gas. Establishments engaged in the exploration for minerals, other than oil or gas, are included. Exploration includes traditional prospecting methods, such as taking ore samples and making geological observations at prospective sites.

NAICS 331: Primary metal manufacturing

This subsector comprises establishments primarily engaged in smelting and refining ferrous and non-ferrous metals from ore, pig or scrap in blast or electric furnaces. Metal alloys are made with the introduction of other chemical elements. The output of smelting and refining, usually in ingot form, is used in rolling and drawing operations to produce sheet, strip, bars, rods and wire, and in molten form to produce castings and other basic metal products.

⁵⁷ The following NAICS sector descriptions are directly cited from: Statistics Canada, 2013a

Appendix B.

BC Mining HR Task Force: Methodology and Findings

Overview of methodology

The Task Force's report compares forecasted "hiring requirements" in BC's mining industry against projections of "available talent" from 2012 through 2022—in essence, it weighs expected labour demand against labour supply. Hiring requirements involves combining two concepts: "net change in employment" and "replacement requirements." Net change in employment calculates not only additional jobs that are created as part of new mining operations, but includes the lost amount of employment over the same time horizon. Replacement requirements include workers retiring, as well as other non-retirement separations such as: changing occupations, returning to school, temporarily leaving the workforce etc. To produce the occupational forecasts, the Task Force's report utilizes historical averages and assumes that rates of change on both the demand and supply sides will remain stable into the future (MiHR, 2012).

The report utilizes data from Statistics Canada's Census and Labour Force Survey, the BC Government and BC Ministry of Energy and Mines.

Findings

The report supports some of the projections from the BC LMO, though it does not provide regional distributions, and also includes occupations, such as truck drivers, that are not produced through the apprenticeship system. Labour market conditions are projected for 66 occupations, as well as the mining industry's projected share of these occupations.⁵⁸ Of the predicted cumulative hiring requirements in mining over the next 10 years, approximately 42% will be occupations in the "trades, transport and equipment operators category" (NOC 7) (MiHR, 2012). Occupations with the largest expected cumulative hiring demand between 2012 and 2022 are:

- Heavy equipment operators (except crane) (NOC 7421)⁵⁹
- Truck drivers (NOC 7411)
- Heavy-duty equipment mechanics (NOC 7312)
- Underground production and development miners (NOC 8231)⁶⁰
- Construction millwrights and industrial mechanics (except textile) (NOC 7311)

Four of the five occupations listed above are classified in the broad occupational category of "trades, transport and equipment operators and related occupations." Three of the five occupations (NOC 7312, 8231, and 7311) typically require college education or trade certification (Skill level B), while the other two (NOC 7421, and 7411) usually require at least a high school diploma (Skill level C). Heavy-duty equipment mechanics and industrial mechanics (millwrights) are produced through apprenticeship programs.

⁵⁸ Some of these occupations are unique to the mining sector, while others are employed in various sectors. For example, "machine operators, mineral and metal processing" (NOC 9411) workers are mostly employed in mining, while carpenters (NOC 7271) are employed throughout the economy, including the mining sector (MiHR, 2012).

⁵⁹ NOC codes used here are from the NOC 2006 list.

⁶⁰ Currently, NOC 8231 is not a certified trade occupation, though some work is underway to develop credentials for "non-maintenance mining occupations" such as this (Participant 1).

In addition to forecasting hiring demand, the Task Force's report also compares, a) the expected cumulative hiring demand versus the predicted available supply of labour per occupation, and b) the proportion of labour per occupation the mining industry is forecasted to require versus the expected share of each occupation the mining industry presently holds (versus the economy as a whole). The following list shows the cumulative gap between 2012 and 2022 of hiring requirements to available supply (based on historical averages per occupation) for the top five occupations in projected hiring demand for the mining sector:

- Heavy equipment operators (except crane) (305 workers)
- Truck drivers (70 workers)
- Heavy-duty equipment mechanics (130 workers)
- Production and development miners (110 workers)
- Construction millwrights and industrial mechanics (145 workers) (MiHR, 2012)

Appendix C.

New Institutionalism and the Logic of Appropriateness

Literature Review

Insights from the New Institutionalism literature provide an alternative form of analysis, in which a firm's decision to invest in training is largely based on firms following certain rules (i.e. norms) and fulfilling identities within those rule structures. The "logic of appropriateness" suggests that rational choice decision-making implied in Becker's model constitutes only one of a variety of decision-making forms (March, 1994).

Numerous streams exist within this school of thought; here I elaborate on the fundamental concept of the logic of appropriateness. The logic of appropriateness means that decisions are made by "establishing identities and matching rules to recognized situations" (March, 1994, p. 58). In contrast, the "logic of consequences" is based on a rational cost-benefit calculation of the decision-maker (March, 1994). Becker's human capital predictions would fall under the logic of consequence since firms' training investments are based on the financial benefits of sponsorship exceeding the costs of training.

Two concepts within the logic of appropriateness warrant discussion: "rules" and "identity." People, firms and organizations form an identity and often act or make decisions in accordance with that identity. An identity is shaped and created through the rules that govern the particular situation. Decision processes are then based on three factors: the actor's recognition of the situation; clarification of personal or organizational, context-derived identity; and the ability to match the appropriate rules to identities and situations (March, 1994).

In essence, the logic of appropriateness recognizes that organizations internalize rules and norms of behaviour appropriate for their organization. Organizational identity then "is a conception of self, organized into rules for matching action to situations." (March, 1994, p.61) That is, organizations draw on the norms and rules of their environment (which they have internalized into their identity) when they make decisions. Identity is co-constructed by actors (e.g. people or organizations) themselves ("individualization") and the social environment in which they operate ("socialization"). In essence, it involves actors *learning* how to act in a way congruent with their identity (March, 1994). To clarify this theoretical discussion, Germany's "dual system" of education is briefly discussed.

Germany's 'dual system' and the logic of appropriateness

Germany's apprenticeship system is often referred to as the "dual system." It is a highly regulated (though not state-operated) and popular alternative education route for young people in which they combine upper-secondary education with on-the-job apprenticeship training⁶¹ (Hoffman, 2011). The system also exhibits a high degree of cooperation between private firms, the state, and organized labour, whereby firms commonly make substantial investments in general training and apprenticeships, sometimes incurring a financial loss (Finegold and Wagner, 2002). As such, institutional and cultural factors need to be considered in conjunction with rational cost-benefit

⁶¹ According to Hoffman (2011), approximately 60% of upper secondary students, and 23% of all companies participate in some form of apprenticeship or on-the-job training in Germany.

calculations to explain the high prevalence of apprenticeship sponsorship and strong employer engagement with the dual system (Finegold and Wagner, 2002).⁶²

For Finegold and Wagner (2002), a number of changes in the German labour market and dual system would suggest that employers would opt out of the system and emphasize more external recruitment (i.e. poaching) of trained employees from other firms. However, despite an “increase in apprenticeship costs, a loss of some of their top trainees to university, an outdated apprenticeship curriculum, and intensified competition,” banking firms have tended not reduce their sponsorship of apprentices (Finegold and Wagner, 2002, p. 675). They argue that the logic of appropriateness is the overarching conceptual framework that most accurately describes the dual system and high employer engagement. They state: “[sharing] a common identity, a common set of values, and a mutual trust, all facets of a logic of appropriateness that are enhanced by their long history of participation in the dual system” (Finegold and Wagner, 2002, p. 681-2). For example, through their interviews with employers, the authors found that some employers offered apprenticeships partly because “it [was] the right thing to do” (p.682). Further, the prevalent, and well-ingrained cultural endorsement of employer training in the private sector means that employers’ participation is closely linked to their external reputation (Finegold and Wagner, 2002).

To explain this occurrence, strong employer buy-in can be partly attributed to providing employers a “voice” in the system (Finegold and Wagner, 2002). Providing a voice to employers is necessary to improve trust and cooperation between employers and increase compliance with the dual system. Some of the voice strategies include: reforming the content of banking apprenticeship programs, and adjusting policies to increase the retention of top trainees who might otherwise move on to university (Finegold and Wagner, 2002). Hoffman (2011) indirectly corroborates this notion by espousing the important role played by “intermediary organizations” that work with employers to develop programming content and qualifications standards, as well as facilitate the connection between employers, apprentices and government.⁶³ Without these intermediary organizations it would be very unlikely that individual employers would exhibit such high rates of training participation (Hoffman, 2011).

In summary, Finegold and Wagner (2002) suggest that the essential qualitative character of the system and Germany’s labour market can be most effectively described as a function of the logic of consequence and the logic of appropriateness. The logic of appropriateness complements the logic of consequence to reinforce the overall system in three ways: by reducing isolation and encouraging firms to view themselves as members of the whole system; by encouraging firms to focus more on long-term decision making, and less on short-term cost/benefit calculations; and finally, by providing firms a legitimate “voice” when problems arise.

Relevance to this study

Finegold and Wagner (2002) correctly point out that without certain institutional and socio-historical features, it may be difficult to establish an apprenticeship system where firms behave according to the logic of appropriateness rather than the logic of consequence. Whether an ethos of the logic of appropriateness exists in BC is a question that should not be disregarded outright simply because BC’s apprenticeship system and labour market are so dissimilar to Germany.⁶⁴

⁶² Finegold and Wagner’s (2002) findings are from the banking sector in Germany, though the dual system of education in Germany involves multiple sectors across the whole economy.

⁶³ The most predominant intermediary organizations in Germany are the Chambers of Industry and Commerce. There are over 80 Chambers that operate regionally, and fulfill a variety of functions, of which VET (vocational education and training) is one.

⁶⁴ In fact, according to the Organization for Economic Co-operation and Development, Canada ranked as the second most unregulated labour market in 2008 (cited in Hoffman, 2011).

The following section reports on this study's interview findings pertaining to the logic of appropriateness in BC mining and smelter companies' participation in apprenticeship training.

Interview Findings

Logic of appropriateness and "voice"

A high degree of cooperation and trust between stakeholders would indicate elements of the logic of appropriateness. Industry would justify their hiring decisions on factors other than a cost-benefit calculation, such as a preference for training versus hiring externally because of some value-based endorsement of apprenticeships. Finally, high levels of "voice" would be indicated if industry expressed it could effectively contribute to the overall functioning and direction of the system.

Generally, industry participants pointed to the importance and value of showing loyalty to employees through apprenticeships, good working conditions and positive working culture. However, these decisions were only predicated on a cost-benefit model of decision making. For example, they observed that developing trust and partnership with their employees tended to attach journeypersons to the company, reducing turnover and poaching.

In one case, due to the site's unique collective bargaining agreement, apprenticeship positions were only offered to union workers. According to the industry participant, the company was initially resistant, but has become extremely satisfied with the arrangement, realizing that the arrangement has engendered loyalty from the staff. "It's nice to give people that work for you internally an opportunity and to grow within one operation" (Participant 4). In a sense, it would seem this arrangement exhibits elements of the logic of appropriateness since the employer and union have developed a more collaborative relationship.

However, despite this company's strategy, ultimately this cooperative relationship is based on contractual obligation, not a sense of cultural affinity for apprenticeship training. Second, its apprenticeship program is fundamentally predicated on reducing turnover, and increasing productivity, since the same company recently had to reduce its apprenticeship numbers because of a difficult "mining sequence" (Participant 4). This company's situation serves as a stark illustration that apprenticeship positions are fundamentally offered for economic reasons and will not be offered unless there is an economic rationale.

Some industry participants were asked about the quality and level of their input into BC's apprenticeships system. Industry participants offered a balance of perspectives. Some expressed a high level of satisfaction, such as Participant 7 who stated it is "good from our perspective. Between...the RTO and other ITOs, we have the opportunity to contribute lots." Others however, such as Participant 1 articulated that "mining companies probably feel that they don't have enough involvement" in developing apprenticeship.

While structures certainly exist (e.g. ITOs) for employers to express their input, given the general lack of cooperation between unions and employers, and primacy of rational economic (i.e. logic of consequence) decision-making, the logic of appropriateness holds little (if any) significance for mining and smelter companies' sponsorship decisions.

Appendix D.

Apprenticeship Grants and Tax Credits

Federal grants for apprentices

The Apprenticeship Incentive Grant is available for apprentices in their first or second year/level of a Red Seal program. It is a taxable cash grant of \$1,000 per year/level, up to \$2,000 per apprentice (Service Canada, 2011a).

The Apprenticeship Completion Grant is a taxable cash grant of \$2,000 for apprentices who complete their apprenticeship training and obtain their Red Seal journeyperson certification (Service Canada, 2011b).

BC tax credits for apprentices

The BC government provides tax credits for apprentices. At levels 1 and 2, apprentices can receive \$1,000 per completed level, \$2,000 for level 3, and \$2,500 at levels 4 and 5. As with the employer Enhanced Tax Credit, apprentices who are members of a First Nation or persons with disabilities qualify for a larger tax credit amount (BC Ministry of Finance, 2012b).

Ontario tax credits for employers

Ontario's Apprenticeship Training Tax Credit (ATTC) is a refundable tax credit for employer sponsors of apprentices. Since 2009, the ATTC allows employers to claim up to either 35% (to a maximum of \$10,000) of eligible expenses related to the sponsorship (small businesses can claim up to 45% to a maximum of \$10,000). This amount is per year, but unlike the BC Training Tax Credit Plans, applies to the first 48 months (the equivalent of levels 1 through 4) of an apprenticeship. Prior to 2009, the ATTC covered 25% (30% for small businesses) to a maximum of \$10,000 per apprentice for the first 36 months (Ontario Ministry of Finance, 2012).

Are apprenticeship tax credits effective?

Tax credits have been widely used to incentivize behaviour. The Canadian Council on Learning (CCL) conducted a systematic literature review of studies and reports on employer tax credits to increase the number of skilled tradespeople. While the CCL found 20 relevant academic, industry and government reports, their synthesis concluded that there is limited empirical research on the effectiveness of tax credits (CCL, Question Scan Summary Report).

A variety of methods have been used to estimate the effects of tax credits (and tax incentives). Methodologies include: surveys, case studies, econometrics, general equilibrium models, and simulations, however all methods suffer serious drawbacks and none have consistently demonstrated conclusive results. One reason common to all factors is that most tax incentives are relatively small compared to the size of the economy in which they are being applied. As a result, it is very difficult to isolate the effects of these programs (Luger and Bae, 2005).

Most studies cover vocational education, not apprenticeships specifically, therefore, the Saskatchewan Apprenticeship & Trade Certification Commission (2005) provides the most relevant example for this study. The Commission conducted a survey of employers to develop an estimated cost of training a four-year apprenticeship. They found that the net cost of a four year apprenticeship was approximately \$40,000, but did confirm findings from other studies that costs

decline over the four year period. The Commission assumed a 12.5% growth in apprentices resulting from a \$5,000 (based on Ontario's Apprenticeship Training Tax Credit amount prior to 2009) tax credit. Based on these assumptions, the cost to the Province would be \$8,437,500 (SATCC, 2005). However, justification for its 12.5% estimate of sponsorship growth is not provided.