

**LEARNING FROM ARTISANAL MINERS: A MODEL FOR DESIGNING TRAINING
PROGRAMS WITH AND FOR THE ARTISANAL MINING SECTOR**

by

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Abstract

Worldwide, approximately 30 million people depend directly on artisanal mining of many different minerals to provide for themselves and their families. There has yet to be a successful and concerted effort to tackle the barriers which keep artisanal miners trapped in a cycle of poverty and poor environmental and health practices. The purpose of this thesis is to define how a successful training program for artisanal miners should be designed and how the program can be measured and evaluated. This research posits that for a training program to be successful, it should be designed based on a deep appreciation for the unique context in which the training takes place. Monitoring and evaluation of the program must be conducted thoroughly and consistently.

Qualitative research methods were used to analyze a suite of training programs for artisanal miners to inform the design of a suite of Training Needs Assessment research tools, which were field-tested in Indonesia. This study found that training programs on mitigating environmental impacts of artisanal mining, formalizing artisanal miners, mercury eradication and occupational health and safety have not taken into account the context of the artisanal mining sector. The needs and motivations of the miners are often ignored and therefore, training programs have seen little sustained success. The amount of time and patience it requires for there to be uptake is often overlooked. A six-step framework for training artisanal miners was developed as an output of this thesis and can be used by practitioners so that the design, launch and evaluation of training programs for artisanal miners can be done more thoroughly and consistently.

Lay Summary

This thesis examines the possibilities for improving the design of training programs for the artisanal mining¹ sector. The goals of this study are to critically examine different attempts to train artisanal miners and evaluates of the strengths and weaknesses of different training approaches. This analysis is used as inspiration for the development of a research study on the training needs for tin miners in Indonesia. The thesis finds that, like most adult learners, artisanal miners prefer to be trained in a way that is familiar and convenient for them. Miners need consistent support at their place of work instead of learning in a classroom setting.

This research makes a contribution to the field by offering insight on how to avoid commonly-made errors in the design of a training program for artisanal miners.

¹ Artisanal mining (ASM, artisanal and small-scale mining) is small, medium, informal, legal and illegal mining, using basic methods to extract minerals from secondary and primary ores (Veiga, 1997).

Preface

The design of this research included multiple parts. The first research method, a *diagnostic literature review*, was designed by me, under the guidance of my supervisor, Dr. Marcello M. Veiga. The second research method, a *strengths, weaknesses, opportunities and threats* analysis of past and current training programs for artisanal miners, was selected at the suggestion of Dr. Veiga. I carried out the analysis myself, supported by expert interviews for several of the programs detailed in the thesis. The third research method, *case selection*, and the fifth research method, *interviews and focus groups*, were designed and carried out by me. The fourth research method, *data analysis*, was carried out by me. Unless otherwise noted, all photos were taken by me.

This research project required the approval of UBC's Behavioural Research Ethics Board. I received one approval certificate, H14-03045.

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List of Abbreviations

AGM	artisanal gold mining
AM	artisanal mining
ASGM	artisanal and small-scale gold mining
ASM	artisanal and small-scale mining
CIRDI	Canadian International Resources and Development Institute
CSO	civil society organization
DfID	United Kingdom's Department for International Development
DRC	Democratic Republic of Congo
ESEC	Engaging Stakeholders in Environmental Conservation
ESIA	Environmental and Social Impact Assessment
GAC	Global Affairs Canada
GEF	Global Environmental Facility
GMP	Global Mercury Project
HCD	Human Centered Design
ICMM	International Council on Mining and Metals
IDMP	Integrated Diamond Management Program
IM4DC	International Mining for Development Centre
ILO	International Labour Organization
Kg	kilogram
Lao PDR	Lao People's Democratic Republic
LFA	logical framework approach
M&E	monitoring and evaluation

NGO	non-governmental organization
OHS	occupational health and safety
PAC	Partnership Africa Canada
PDA	Peace Diamond Alliance
PPE	personal protective equipment
PRA	participatory rural appraisal
SAM	Sustainable Artisanal Mining
SDC	Swiss Agency for Development and Cooperation
SMART	specific, measurable, assignable, realistic and time-related
SWOT	strengths, weaknesses, opportunities and threats
TDU	transportable demonstration unit
ToT	training-of-trainers
UN	United Nations
UNDP	United Nations Development Program
UNEP	United Nations Environmental Programme
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
USDoS	United States Department of State
UBC	University of British Columbia

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This thesis is dedicated to the artisanal miners of the world: I hope that in some small way, this research will be of benefit.

This thesis is also dedicated to my dad, Dr. Paul T. Weinberg, my mentor and friend.

Chapter 1: Introduction

1.1 Statement of the Problem

Artisanal mining (also known as artisanal and small-scale mining) is small, medium, informal,² legal and illegal mining, using rudimentary methods to extract minerals from secondary and primary ores (Veiga, 1997). Worldwide, as many as 30 million people depend directly on artisanal mining of thirty different minerals to provide for themselves and their families. Of those 30 million people, over 100 million people are directly or indirectly involved in artisanal gold mining (AGM), producing between 380 and 450 tonnes per year (Seccatore et al., 2014). Between 17 and 20% of the world's gold production is believed to come from artisanal mining, using rudimentary processes to extract and process their ore (Seccatore et al., 2014).

The environmental and health impacts of artisanal mining are staggering. Artisanal mining takes place in over 70 developing countries and artisanal gold mining is the largest anthropogenic emitter of mercury into the atmosphere. Mercury produces substantial environmental and human health impacts, particularly a reduction in air quality and mercury poisoning, among others (UNEP, 2013). Mercury poisoning impacts individuals involved in mining, as well as people living downstream of mining areas. Other environmental impacts from the artisanal mining of other minerals are also significant, including soil abrasion, deforestation,

² The International Labour Organization defines informality as: Low entry barriers to entrepreneurship in terms of skills and capital requirements; family ownership of enterprises; small-scale operation; intensive production with outdated technology; and unregulated and competitive markets." This definition is applicable to the artisanal mining sector with one additional defining variable, namely that the government either tolerates, does not tolerate or has no legal framework for these types of mining activities (International Labour Organization, n.d.).

siltation and pollution of water sources, deforestation, poor sanitation, improper waste disposal and others (Hentschel et al., 2002). The health impacts of artisanal mining are also significant, including, but not limited to, dust and heat exposure, overexertion, accidents, injuries or fatalities caused by rock falls, lack of ventilation, landslides and the misuse of explosives and tropical and sexually transmitted diseases (Mayala et al., 2015).

Artisanal miners rarely realize the true potential of their efforts, in large part because they lack awareness of the proper methods or geological information. Informal miners are often left with little choice but to sell their product to unscrupulous buyers who offer them a fraction of what their ore is worth (Hilson & Ackah-Baidoo, 2011). Artisanal mining is backbreaking work that shortens the lives of the people involved, with very little compensation in return.

The environmental and health impacts of artisanal mining could be mitigated with simple and effective changes in behaviour, taught through a context- and culturally-appropriate training program. Training provides artisanal miners with techniques to realize a myriad of benefits, including a higher yield, lower environmental footprint, reduced health and safety impacts. Training also reduces the barriers for formalization. Thousands of artisanal miners die every year as a result of rock falls, landslides, flooding and tunnel collapses. (Gunson & Jian, 2001; Hentschel et al., 2002). If consistent training were in place, lives could be saved and miners could reduce the environmental footprint of their operations.

There are other approaches to reform the artisanal mining sector, such as poverty reduction programs or even an overhaul of the mining code to reflect the realities of the artisanal mining sector. However, these efforts are time-consuming and require a significant amount of

structural change. These approaches could take a decade or more. A training program, on the other hand, involves a pragmatic approach with less of a time commitment, and is therefore the focus of this thesis.

There has yet to be a successful and concerted effort to tackle the most pressing issues keeping artisanal miners trapped in a cycle of poverty and dire environmental and health practices, despite it having been a pressing issue in the international development community for more than three decades. Programs to improve artisanal mining have consistently failed to take account of the local context and unique attributes of each artisanal mining sector being targeted, which in turn makes the programs too broad to address the needs and motivations of artisanal miners.

1.2 Purpose and Hypothesis

The purpose of this thesis is to define, in a pragmatic and succinct way, how a successful training program for artisanal miners can be launched and how the program should be measured and evaluated. An output of this research is a framework for artisanal mining training programs. The framework was developed following an extensive diagnostic literature review of past attempts to train artisanal miners and triangulated with the field experience of the author in Colombia, the Democratic Republic of Congo, Tanzania and West Africa. These activities culminated in expert interviews and primary research with a nascent artisanal mining training program in Indonesia.

A successful training program for artisanal miners more broadly means that the environmental footprint, health impacts or profitability of the mining operation has changed in a measurable way. An example of success is a training program that responds to the variability in

types of training and training contexts and results in a change in artisanal miners' knowledge, attitudes, practices and bargaining position vis-à-vis actors higher on the supply chain.

The hypothesis driving this research is, *when a training program for artisanal miners is launched and carried out in a measureable way, it is a vehicle for positive behavioural change, such as improved occupational health and safety or production. Knowledge-transfer is a sustainable way to improve the artisanal mining sector.*

1.3 Justification for this Research

This doctoral research fills a gap in the study of the artisanal mining sector by examining, through a systematic review of 130 published works, the development of training programs for artisanal miners, compiling lessons learned from other attempts to train miners and applying those lessons to the design of a training program for artisanal miners in the Indonesian artisanal tin mining sector. The thesis is intended as a be hands-on and pragmatic written work and one that it is accessible to practitioners in the field. As such, the writing style tends more toward a report, particularly in Chapter 6, the Framework for Training Artisanal Miners.

This research results in the following academic and practical contributions:

- A diagnostic literature review of training interventions in artisanal mining on several continents, to identify: (1) The barriers for improvement in the artisanal mining sector; (2) The attributes of a successful approach to training artisanal miners; and (3) A categorization of the different types of training programs, including a succinct analysis of their strengths weaknesses, opportunities and threats (SWOT).

- A framework that takes into consideration site selection for the training process as well as monitoring and evaluation of the relative success of a training program. The research posits measurable indicators to use in the site selection, monitoring and evaluation of a training program.
- A distillation of the author's field observations in a number of different country contexts where training programs were being considered by development and industry practitioners, including, among others, Colombia, the Democratic Republic of Congo, Tanzania and West Africa.³
- Strategic planning to establish a training center for artisanal miners, using Indonesia as a primary case study, including field-testing Training Needs Assessment research tools developed by the researcher, with the support of partners at Pact, an international organization. This activity also included a discussion with key stakeholders in Indonesia as well as artisanal mining experts of the potential scope, structure, scale, success indicators and curriculum for a training program in Indonesia.

This research presents the following opportunities:

- Provides technical and strategic support to a nascent artisanal miner training program in Indonesia.

³ The name of the country cannot be mentioned for confidentiality reasons.

- The Framework for Training Artisanal Miners developed as part of this research is applicable to other countries where organizations are developing training programs. This framework helps other practitioners conceptualize the key indicators to measure in a given artisanal mining sector. Further, the framework provides guidance on how to measure marked change in those indicators.

1.4 Research Questions

The research questions this study aims to answer are:

1. What are the barriers for behavioural change in the artisanal mining sector?
2. What of the attributes of a successful training program?
3. What are some of the strengths, weaknesses, opportunities and threats of past and current training programs for artisanal miners?
4. How can a successful training program for artisanal miners be designed and evaluated?

1.5 Research Objectives

The objectives of this thesis are as follows:

Objective 1- Summarize the existing literature on training programs for artisanal miners and identify gaps in the present state of knowledge.

Objective 2- Carry out a strengths, weaknesses, opportunities and threats (SWOT) analysis of different categories of training programs for artisanal miners in Africa, Asia and Latin America.

Objective 3- Carry out interviews and focus groups with artisanal mining experts and Indonesian mining leaders on the most suitable training model for Indonesia's tin mining sector. Field test a mine site observation guide at several artisanal mine sites in Indonesia.

Objective 4- Develop a Framework for Training Artisanal Miners for practitioners to implement when they develop a training program for artisanal miners in other countries.

Objective 5- Conduct a Training Needs Assessment of the mining actors in an artisanal tin mining community in Bangka-Belitung, Indonesia, and recommend how to implement a training program for artisanal tin miners. The research tools developed for this study are evaluated in the Results section.

1.6 Industry Significance

This research makes a unique contribution to the study of the artisanal mining sector by testing qualitative Training Needs Assessment research tools in Indonesia's artisanal tin mining sector. In Indonesia, the research will contribute to the design of a nascent training program on occupational health and safety (OHS) and mining efficiency in the Bangka-Belitung Province. This OHS and efficiency training program is sponsored by the Tin Working Group, which is composed of electronics brands, concerned NGOs and representatives from the tin industry.⁴ The Tin Working Group was formed to address the social, environmental and health impacts of

⁴ See <https://www.idhsustainabletrade.com/sectors/mining-minerals/> for more information.

Bangka-Belitung's artisanal mining sector and a training program for artisanal mining actors is being considered as one possible response.

This research will also assist practitioners working in the training space for artisanal miners to assess the appropriate scale, scope, content, potential sources of funding and key partners for a training program. In turn, the data gathered during the field study phase in Bangka-Belitung informs a more general Framework for Training Artisanal Miners.

This Framework is also useful for the conventional mining sector, namely, legal large-scale, and industrial mining companies, as the sector copes with the increasing presence of artisanal miners in concessions. A suggested measure is the coexistence of artisanal and conventional miners, but this scenario must be predicated by training and organization of the artisanal miners. If conventional miners engage with artisanal miners early and consistently, such as through training, they can avoid conflicts stemming from miscommunication and ongoing tensions that generally arise between the two types of miners. Coexistence can act not only as a measure for keeping the peace in the field, but it also helps companies preserve a positive reputation globally.

1.7 Academic Significance

This academic research is significant because it involves a largely objective analysis of training programs for artisanal miners globally. Since the thesis makes use of qualitative methodological research tools, which draw from the subjective points of view of individuals and groups, it is not an entirely objective analysis. To the author's knowledge, there has not been a comprehensive or systematic review of past attempts to train artisanal miners on the wide range of health,

environmental and safety issues surrounding the sector. Dr. Shefa Siegel surveyed artisanal gold mining training programs up until 2007, and recommended a prescriptive policy framework for future interventions in the artisanal gold mining sector based on formalization, education and capitalization for future training interventions (Siegel, 2007). However, Siegel does not explore other artisanally-mined minerals, nor does he address how to monitor the progress of training programs.

This research expands upon Siegel's assessment to include programs in the past decade and incorporates site selection, monitoring and evaluation considerations into the design of artisanal mining training programs globally.

1.8 Dissertation Chapters

I. Introduction

The Introduction provides a statement of the problem, a brief background on the artisanal mining sector and its severe impacts to human and environmental health. What follows is a discussion of the research questions, purpose and objectives of the thesis. The introduction concludes with a brief discussion of the academic and applied contribution of the research.

II. Review of the Literature

The literature review chapter discusses the significant prior knowledge on the topic of training artisanal miners. It is important to note that there are several primary authors who concentrate on the topic of training artisanal miners. As such, the bibliography may appear to focus on the works of Drs. Veiga and Hilson, but this is more a reflection of the state of the literature than on author

bias. The chapter delves into the broader issues surrounding artisanal mining, including a working definition, key trends and a brief overview of the key environmental, health and economic impacts of the sector. A discussion follows of the primary barriers for both artisanal miners and practitioners to produce substantive positive change in the sector. The section explores possible explanations for why artisanal miners are slow to change their mining and processing practices, despite significant outreach by the international development community. The next section includes a discussion of the key attributes of informality in artisanal mining. The chapter then discusses several attributes of a successful training program's design, implementation and monitoring and evaluation. The section then provides an overview of the key components for developing a training program project document. The chapter concludes with a list of the gaps identified in the literature.

III. Methodology

The Methodology chapter details the conceptual framework of the research, which is based on a combination of Mental Models and Human Centered Design. Following the conceptual framework is an introduction to the primary case study, Indonesia, and discusses how the researcher conducted a Training Needs Assessment for a potential training program in Bangka-Belitung Province. This section is followed by an overview of the research methods, as well as a justification for their employment. The methods include a diagnostic literature review, strengths, weaknesses, opportunities and threats analysis of several prominent training programs and models, case selection, interviews and focus groups and data analysis.

IV. Strengths, Weaknesses, Opportunities and Threats of Training Programs for Artisanal Miners

In Chapter Four, the author provides an evaluation of several past training programs and intervention models with artisanal miners and discusses their strengths, weaknesses, opportunities and threats. The reasons for the programs' relative success or lack thereof are assessed. The findings from this chapter contribute to the design of a Framework for Training Artisanal Miners, as well as the design of the research protocol for the Indonesian Training Needs Assessment.

V. Results

This chapter summarizes the observations from the researcher's field experience in Colombia, Democratic Republic of Congo, a West African Country and Tanzania as well as a primary case study in Indonesia. The chapter then details the results of the interviews with artisanal mining experts as well as interviews and focus groups with decision makers and thought leaders in the Indonesian artisanal mining sector. The chapter analyzes the strengths and weaknesses of the Training Needs Assessment research tools piloted in Indonesia as well as the key themes identified in the expert interviews.

VI. Framework for Training Artisanal Miners

The author presents a Framework for Training Artisanal Miners. The chapter details, step by step, how to define a training program goal, select a suitable site for a training program, carry out

a Training Needs Assessment, launch a training-of-trainers campaign and monitor the program's success.

VII. Discussion

In the Discussion chapter, the findings from the literature review is discussed in the context of the field results. There is a discussion of both the barriers and the attributes of success of training artisanal miners, the original contribution of this thesis and the implications of this thesis for future research in this field.

VIII. Conclusion

This chapter describes the significance of the research and provides recommendations for the research agenda. Conclusions are in bullet form and cover the researcher's major findings from the field and literature.

Chapter 2: Review of the Literature

A series of articles from Veiga and co-authors have stressed that the positive behaviour change in artisanal mining communities must be a ground-up affair and is only possible when the following conditions are met: (1) Miners and their leaders must be included in the discussion of the subjects and methods they want to learn (Veiga & Meech, 1999; Veiga et al., 2006); (2) Trainers of artisanal miners must understand the needs, skills and motivations of miners in order to learn about better practices (Marshall & Veiga, 2017); (3) Any measures to improve the health, wealth or environmental impact of artisanal mining activities must be simple, economically beneficial and expedient (Veiga & Hinton, 2002); (4) Training should be context-specific and delivered by trainers who are influential in a mining sector (Veiga, 1997; Veiga et al., 2006); (5) There must be clear support from a host government (McDaniels et al, 2010); (6) Trainers should be present for the duration of the program (Veiga et al, 2014b); (7) Training-of-trainers participants should be able to provide effective instruction to miners (Veiga et al, 2014b); and (8) Training involves presence, patience and persistence to create a good rapport with artisanal miners and communities (Veiga & Tucker, 2015).

The body of literature on artisanal mining, and particularly of training programs for artisanal miners, largely focuses on why training programs have failed. That being said, this section takes the reader through the key themes in this sector builds a foundation for a more constructive perspective on training program design.

2.1 Definitions of Artisanal Mining

Although artisanal mining has taken place for centuries, and has, more in recent decades, come to the public eye, its definition has been met with little agreement. There are several lines positions in the literature, each of which has a different definition for artisanal mining. In the late 1990s, the working definition of artisanal mining was “*operations, independent of size, that use rudimentary techniques to prospect, mine and process ... ore*” (Veiga, 1997, p. 2). In the early 2000s, the definition of artisanal mining came to consider more aspects like low levels of recovery, health and safety risks and impacts, remote geographical locations, high labour inputs, environmental impacts and informality (Hentschel et al., 2002). In more recent years, the definition of the sector is related to the degree of the activity's formality, rather than its size. As Veiga et al. (2014a) state, “*there is a wide variety of miners that can be classified as 'artisanal,' ranging from those processing 5000 tonnes of ore per day to those panning 20kg of gravel per day;*” what they share is their lack of legal recognition (p. 353).

It is important to distinguish between the different types of artisanal versus small-scale miners. There is little agreement in the literature as to the precise definition of artisanal and small-scale mining. The lack of an agreed-upon definition for artisanal and small-scale mining has created confusion in the literature and in policy, which has resulted in poorly designed laws and interventions. During some periods, the terms 'artisanal' and 'small-scale' were used interchangeably, but, according to Veiga et al. (2014b) they are not the same thing. According to Veiga et al. (2014b), the difference between artisanal, or unconventional and conventional miners is linked to their respective levels of formality, not their scale. The authors distinguish the lowest

rung of artisanal miners, calling them micro-miners.⁵ These are groups of workers who pan for gold or engage in other mining activities that require hardly any equipment; they are also the groups that often are the targets of international training or capacity building programs due to their conspicuous and impoverished nature. However, as Veiga et al. (2014b) argue, it is rather the middlemen—who play different roles, depending on the geography of the artisanal mining sector—who should be the focus of training programs, not the micro-miners.⁶

2.2 Key Trends in Artisanal Mining Globally

2.2.1 Numbers and Methods

It is difficult to determine precisely how many artisanal miners are operating in the approximately globally, not least because the sector operates outside of the formal sphere so census data is very limited. Estimates point to approximately 30 million miners, including 16 million gold miners (Seccatore et al., 2014). There are many miners who transition between mining and other livelihoods, depending on the season. Much of the mining takes place in remote regions that are difficult for the government to access (Hentschel et al., 2002). Each country has different methods of artisanal mining, depending on the level of skills and technology applied (Seccatore et al., 2014). Many materials are mined artisanally, including precious and semi-precious metals like gold and silver and stones like diamonds and rubies, metallic minerals like copper and tin and construction materials like clays and gravel (Collins &

⁵ From this point forward, unless otherwise indicated, the terms ‘micro-miners’ and ‘artisanal miners’ will be used interchangeably.

⁶ See the Barriers section for more discussion.

Lawson, 2014). The International Council on Mining and Metals (ICMM) (2009) provides a useful framework of the types of artisanal mining by splitting the sector up into the following categories:

- **Traditional:** Mining activities have taken place for generations, usually consisting of family units. Mining activities play a similar role in the community as agriculture.
- **Seasonal:** Mining activities serve as a secondary livelihood in addition to other more traditional livelihoods like agriculture. This type of mining involves family units who usually work in proximity to farming land.
- **Permanent co-habitation:** Artisanal mining has taken place for a long time, usually involving workers from neighbouring areas. The mining takes place at abandoned industrial mine sites or tailings areas.
- **Shock:** Mining occurs in reaction to shocks such as conflict, displacement, climate change, commodity price fluctuations and others. Miners can be former industrial mine workers.
- **Influx:** Opportunistic in-migration when a new deposit is discovered. Numbers of miners can reach the thousands. Influx mining activities are usually less permanent than the previous types, with miners migrating and living in camps. There are rarely family groupings of workers; instead, miners form random teams working for one buyer or they work on an individual basis (p. 7).

The above types notwithstanding, in more recent years, artisanal mining in many parts of the world has taken on more mechanized methods.





Figure 2.1 Photos of Artisanal Miners (Above: Indonesia; Below: West Africa)

2.2.2 Informality

Informality is one of the most systemic problems associated with the artisanal mining sector (Hilson et al., 2017; Aspinall, 2001; Sousa et al., 2010; Veiga et al., 2014a; Veiga, 1997).

According to the International Labour Organization (ILO, cited in Buxton, 2013), informality is defined by, “*low entry barriers to entrepreneurship in terms of skills and capital requirements; family ownership of enterprises; small-scale of operation; intensive production with outdated technology; and unregulated and competitive markets* (p. 7).” Chen (2001) argues that informal workers should be incorporated into formal economies through sound policy design. Informal workers play an essential role in all capitalist societies and the trend is unlikely to disappear.

De Soto (2000) further discusses the difference between legal and extra-legal economies. De Soto (2000) argues that governments of many developing countries make it virtually impossible for people to be integrated into the legal realm. In essence, citizens “*do not so much as break the law as the law breaks them*” (De Soto, 2000, p. 21). Siegel (2007) states that De Soto’s position it is an especially useful way of framing artisanal mining because it explains that there are rarely legal frameworks to accommodate the artisanal mining sector. It is important to recognize that informality takes on a number of forms in different countries. Informality can be a result of:

- Reluctance of artisanal miners to obtain a licence due to prohibitive costs, bureaucratic or logistical barriers.
- Unwillingness of governments to differentiate between conventional and artisanal mining in the mining code, thereby rendering it unfeasible for artisanal miners to fulfil the legal requirements for environmental assessments and reclamation, among others.
- Government’s inability to design realistic and people-centred artisanal mining policies.
- An overlap or conflict in legislation around property rights and land title renders artisanal miners semi-legal; or, legal on one level of government, but illegal on another.

- Governments attempt to formalize artisanal miners for the wrong reasons. For example, according to Veiga et al. (2014a), many country governments take the ill-advised approach of forcing formalization on the artisanal mining sector. In Peru, for example, *“out of the 80,000 to 150,000 Peruvian [artisanal gold miners-AGM] in 2012, only 1000 have been formally formalized. In Colombia, of 200,000 AGM, only 9196 are formalized”* (p. 543).

The informal nature of the global artisanal mining sector is often seen as the leading cause of the poor environmental and health practices (Veiga et al., 2014a; Veiga & Meech, 1999; Sippl & Selin, 2012; Hilson & Van der Worst, 2002). This is because, as outsiders to the formal sector, artisanal miners do not follow specific health, safety and environmental guidelines. Matters made worse when a large proportion of the artisanal mining workforce is composed of migrants, poor people, women, children and other vulnerable groups who do not have capital or training at their disposal. Female miners are particularly negatively impacted by the informality of the sector. At the mine site and in the value chain more generally, female miners are generally placed lower on the hierarchy than men; as such, avenues for collective bargaining, wage increases or decision-making are generally closed off for female miners even more than for males (Hinton et al., 2003).

Not all artisanal miners belong to the informal sector by choice. There are a number of barriers to obtain a license. One notable barrier is that in many places in the world, governments have created a bureaucratically and logistically challenging licensing process (Hilson et al., 2017). For example, in Peru, miners have a five-step application process for a mining title

(*Tiempo Minero*, 2012, in Veiga et al., 2014a). In Liberia, obtaining an artisanal diamond mining license is expensive and involves traveling to the capital city of Monrovia to present the application in person (Van Bockstael et al., 2011). By occupying the informal sector, artisanal miners are vulnerable to the abuse of their right to work and provide for their families (Buxton, 2013; SAM, 2016).

Siegel (2007) argues that the first step to mitigating the enormous emissions of mercury by artisanal gold miners is to formalize them. Other authors writing at this time (Veiga & Beinhoff, 1997; Hinton, 2005), concur. However, as of this writing, formalization may not be the first necessary step. Indeed, as Hilson (2008) argues, *“there is growing evidence that efforts to formalize activities have further marginalized miners, specifically through inappropriate licensing schemes, regulations, technologies and support services that discourage, rather than encourage, regularization”* (p. 392). Veiga et al. (2014b) likewise argue that training artisanal mining stakeholders is a necessary first step; if miners are not sensitized to better practices first, then their formalization will entail the formalization of poor techniques.

Indeed, formalization is a process that must move alongside the training of miners. There are a number of types of artisanal miners but increasingly, laws try to accommodate every type, when in reality artisanal miners change their level of mechanization and geography. In essence, artisanal miners go where the minerals are, and, especially with the fluctuation of the price of gold, more and more miners are moving further from their homes to find more viable deposits (Marshall & Veiga, 2017). It confuses the legal situation for miners because they do not fit within one definition outlined in the law. Laws regulating the artisanal mining sector should be

based upon how much is processed and not what type of miner they are. Marshall & Veiga (2017) recommend a framework that would target two of the underlying motivations for formalizing the artisanal mining sector: (1) Formalization enables the government to reap more taxes from artisanal miners; and (2) If miners have to pay taxes according to their level of production, it is in their best interests to mine more efficiently, which is correlated with greater environmental stewardship.

2.2.3 Push and Pull Factors in the Artisanal Mining Sector

Artisanal mining draws in millions of people for many reasons. There are several explanations for why people are drawn to the artisanal mining sector, including poverty, low up-front investment and a lack of alternative livelihoods.

Low Up-Front Investment

Artisanal mining is frequently (but not always) a poverty-driven activity. The simple mining activities require very little up-front investment—investment that is usually covered in large part by a supporter, or 'middleman', such as a trader or mine site leader. Each digger is in turn obliged to sell his or her product to a supporter, for whatever price the latter demands. The system is rigged for the diggers from the start (Hoadley & Limpitlaw, 2004; Siegel & Veiga, 2010).

Alternative Livelihoods

Many authors assert that artisanal mining is common in developing countries because alternative livelihoods like agriculture or fishing have become less economically viable, in part due to land loss from climate shocks, conflict or land grabs (Hoadley & Limpitlaw, 2004; Hilson, 2009). One

issue that Siegel & Veiga (2010) raise, however, is that the so-called alternatives are less lucrative than artisanal mining. Therefore, the argument that providing artisanal miners with an alternative source of income would lead to a decline of participation in the sector is based on a misconception. Sousa & Veiga (2010) explain that artisanal mining, while lucrative in very rare instances, generally *is* the alternative livelihood, not the other way around. In another argument, Tschakert (2009) demonstrates that artisanal miners will not pursue alternative livelihoods as long as there is the prospect of earning an income from mining. Instead of obliging miners to participate in alternative livelihood programs, programs for artisanal miners should rather work on making the sector legal and sustainable.

2.3 Impacts

The environmental, health and social impacts of artisanal mining are substantial and far-reaching. Indeed, according to a global report on artisanal mining, the environmental impacts per output are higher than industrial scale mining (Hentschel et al, 2002). According to that same report, some of the more serious environmental impacts of artisanal mining include:

- Mercury pollution
- Cyanide pollution
- Direct dumping of tailings and effluents into rivers
- Improperly constructed tailings dams
- Acid rock drainage
- Improper or rushed closure
- River damage and siltation

- Erosion damage
- Deforestation
- Landscape destruction
- Garbage and solid waste
- Lack of sanitation
- Activities in protected areas.





Figure 2.2 Environmental impacts of artisanal mining activities in Gabon (above) and DRC (below)

Sousa et al. (2010) summarize the types and severity of impacts associated with artisanal gold mining, but some of them, such as vegetation removal, water supply, excavation with hydraulic monitors, are only applicable to open pit mining operations. It is worth noting that much of the

literature on artisanal mining delves into the health and environmental impacts of artisanal gold mining in great detail, but a closer examination of other minerals and gemstones remains an outstanding gap (Smith et al., 2016; de Oliveira & Ali, 2011). Veiga (2009) states that, worldwide 30 million people are directly involved in artisanal mining of at least 30 different minerals, but gold likely encompasses 50% of this contingent of rudimentary miners.

Human health impacts range from injuries due to pit collapses, cave-ins and drowning. Other health impacts include over-exertion, exposure to extreme noise, dust inhalation and silicosis, mercury intoxication and exposure to other dangerous chemicals like cyanide and arsenic. Miners are also susceptible to typical tropical diseases like tuberculosis, dengue fever and malaria, which are commonplace in mining areas (Hayes, 2008; Hilson, 2009). Hilson (2002) adds that, *“many operators of small-scale mines are willing to accept a higher degree of personal risk in order to maximize profits, and relatively high wages and a general unavailability of alternative employment are sufficient reasons for miners to ignore such risks”* (p. 8). There are also indirect health and social impacts of artisanal mining activities which include psychological stress, sexually transmitted diseases, gender discrimination, sex trafficking and stigmatization from surrounding communities and the government (Hayes, 2008).

The social and economic impacts of artisanal mining are more difficult to quantify. That being said, anecdotal evidence points to the continued economic marginalization of artisanal miners, primarily because they are supported by traders, to whom they must sell their ore, thereby eliminating their bargaining position. Particularly in rush mining situations, miners may migrate from other areas to the area where a vein or deposit has been discovered. This migration

distances miners from their families and support network and can also break up the social fabric of the community to which they migrate (Hayes, 2008).

Not all of the impacts of artisanal mining are negative. Indeed, a sole focus on the negative impacts of the sector create policies and interventions that stigmatize, rather than engage with artisanal miners in a constructive manner. Hinton et al. (2006) offer a succinct — though by no means exhaustive—summary of the positive contributions of artisanal mining. The positive impacts of artisanal mining include job creation, both within the artisanal mining sector and dependent sectors, a reduction of rural to urban migration, infrastructure creation, an increase in foreign exchange earnings and increased economic growth (Hinton, 2006). While artisanal mining is disempowering and marginalizing in many contexts, some activities can be a source of pride, particularly for the actors furthest upstream on the supply chain.

Mercury Emissions in Artisanal Gold Mining

Mercury emissions are one of the largest impacts resulting from the artisanal mining sector. According to a United Nations Environmental Programme (UNEP- 2013) assessment, artisanal gold mining is the world's largest anthropogenic emitter of mercury into the atmosphere, with the latest figures at 720 tonnes per annum. The countries where mercury use in artisanal gold mining is most prevalent are China (200-250 tonnes per annum), Indonesia (100-150 tonnes per annum) and Brazil, Bolivia, Colombia, Peru, Philippines, Venezuela and Zimbabwe emit between 10-30 tonnes per annum each (Veiga et al., 2006). Veiga et al. (2014a) have noted, however, that where the price of mercury is high, miners are more willing to consider alternative methods for processing their ore.



Figure 2.3. Top: Crushing ore with mercury, Zimbabwe; Bottom: Amalgam

While mercury emissions are a significant concern, this issue has been the focus of the literature and interventions on artisanal mining, often at the expense of other pressing issues. For instance, Siegel (2007) finds that the majority of artisanal mining project funds are devoted to the monitoring and assessment of mercury emissions in artisanal gold mining sectors, rather than

fieldwork where researchers could meet with the miners and come to a better understanding of their needs, concerns and motivations. Spiegel et al., (2014) likewise urge practitioners and governments implementing Article 7 of the Minamata Convention⁷ to consider the interrelated issues, particularly poverty, which contribute to mercury emissions.

Clifford (2014) also argues that the implementation of the Minamata Convention in signatory countries will encounter a lack of acceptance from artisanal gold miners, who have been subject to numerous failed attempts to eliminate their consumption of mercury. He urges the policy community to take a more humanistic approach to working with artisanal gold miners on their processing practices. The author recommends that nascent programs take account of the social and economic drivers of each individual artisanal mining sector. Moreover, if we are going to try to eliminate miners' use of mercury, we have to start gradually and give them the knowledge, tools and means to change their behaviour.

Veiga et al. (2014b) have argued that programs in the artisanal mining sector must begin with a deep contextual knowledge of the artisanal mining sector in question, then education, organization and finally formalization. Other cultural, economic, supply chain and political economy issues contribute to the prevalence of mercury in an artisanal mining sector, and it cannot be addressed in isolation (Veiga et al., 2014b; Hinton & Veiga, 2003).

⁷ The United Nations Environmental Programme's Minamata Convention on Mercury is a "global treaty to protect human health and the environment from the adverse effects of mercury." Article 7 of the Convention addresses the role of artisanal gold mining in mercury emissions into the atmosphere, and encourages governments to create National Action Plans to reduce, and eventually eliminate this anthropogenic source of the toxic chemical's emission (UN Environment, 2017).

Impacts of Mercury Emissions

Mercury can be released into the environment through the soil, air and water. As a persistent ecological pollutant, mercury biomagnifies as it travels up the food chain. Whole ore amalgamation of gold releases mercury fumes into the atmosphere, where it is then transported into rivers and other waterways. Mercury-contaminated tailings are dumped directly into waterways, where mercury can be oxidized and form complexes with organic acids to be biologically transformed into methylmercury, which is rapidly bioaccumulated (Meech et al., 1997).

One trend increasing mercury emissions in artisanal gold mining areas is the proliferation of processing centers. Processing centers are centralized facilities where artisanal miners bring their ore to be processed using both mercury amalgamation and cyanidation. The processing center owners provide the crushing, grinding, concentration and amalgamation of gold services for free or for a nominal fee, with the condition that the miner must leave the tailings in their facilities. After receiving the amalgam with approximately 50% gold and silver and 50% mercury, the miners burn it at the center's facilities or at home where the mercury is evaporated the gold is obtained. The amount of gold recovered by amalgamation rarely exceeds 30% of the total gold in the ore. Then the owners of the processing centers retain the mercury-contaminated tailings and leach it with cyanide to extract the residual 70% of gold left in the tailings (Veiga et al., 2014a). Of particular concern in the literature is the bioaccumulation of mercury when it is mixed with cyanide (Drace et al., 2016). Mercury poisoning is a potentially fatal condition in humans, presenting with "*muscular atrophy, seizures and mental disturbances*"(Hinton & Veiga,

2003, p. 11). Pregnant women are especially vulnerable to mercury poisoning, which they can then transfer to their foetus.

Mercury Abatement Programs

Sousa, et al. (2011) argue that poverty and lack of education are the primary drivers for the poor environmental management prevalent in the artisanal mining sector. As such, conventional environmental and social impact assessments⁸ are inappropriate since they require a certain degree of financial means, time and expertise. Rather, a more appropriate way to measure environmental impacts from artisanal mining activities is to interact with artisanal miners in a comprehensible way and one in which they can participate. For instance, Velasquez-Lopez et al. (2011) describe a demonstration session to artisanal miners in the Portovelo-Zaruma area of Ecuador on the risks associated with mixing mercury-contaminated tailings with cyanide. This participatory research protocol enabled the authors to witness exactly how the miners and owners of processing centers in the region were using mercury and cyanide. As a result, Velasquez-Lopez et al. (2011) could pinpoint the most problematic behaviour and then raise awareness on alternative methods. Likewise, Sousa et al. (2010) explain that Brazilian miners in the Tapajos River Basin of Brazil use gravity concentration in followed by cyanidation in a ball mill because it avoids mercury amalgamation altogether.

⁸ According to the International Finance Corporation (IFC, n.d.), an environmental and social impact assessment is a methodology that “*identiffies], predict[s] and assess[es] the type and scale of potential biodiversity impacts, and opportunities to benefit conservation, associated with any business activities or projects* (p.1).

Cyanidation, when properly implemented and managed, can process fine particle gold extremely efficiently and quickly (in 24 hours, as opposed to traditional cyanidation methods, which take up to 20 days). Cyanidation could be a viable alternative to mercury, provided the ore is made up of fine gold particles, but miners need to be taught appropriate handling of cyanide to avoid any accidents (Sousa et al., 2010). Veiga et al. (2009) describe a method to replace mercury in the treatment of the gravity concentrates. The intensive cyanidation process is conducted in the same ball mills the miners in many countries use for amalgamation of whole ore. Cyanide and a strong oxidant, such as peroxide or the detergents used to remove stains from clothes, are added to the process to speed up the reaction. A cartridge of activated carbon is then added to adsorb the gold in the cyanide solution. The gold is removed from activated carbon using a simple elution process (Veiga et al., 2009). The main challenge to make this simple technology sustainable, as observed in other interventions, is the need for consistent training in the area to provide technical assistance when a problem occurs. This was also observed by Jónsson et al. (2009) when the authors introduced retorts in an artisanal mining area in Tanzania.

2.4 Barriers

Prior to designing an effective training program, which could, for example, improve the working conditions, health or environmental impacts of artisanal mining activities, it is essential to understand the barriers for the program's success. The literature offers a number of explanations as to why it is so challenging to change the conditions of the artisanal mining sector. These barriers can be framed in terms of those affecting the practitioners who lead programs for artisanal miners and those that affect the ability or willingness of artisanal miners to participate.

The barriers, in order of most frequently cited in the literature, include: (1) Programs for artisanal miners do not take account of a particular mining context, and connected to that, there is a lack of quantifiable census and other baseline data on artisanal miners (Hilson, 2005, 2007; Hilson & Maponga, 2004; Hayes, 2008; Marshall & Veiga, 2017; Veiga et al., 2014b; Clifford, 2014); (2) Persistence of so-called 'middlemen' (Hayes, 2008; Siegel, 2007; Hilson & Ackah-Baidoo, 2010; Spiegel, 2012; Veiga et al., 2014a); (3) Artisanal miners are poverty-driven, and they are a transient group (Hayes, 2008; Hentschel et al., 2002; Sousa et al., 2011); (4) There are a lack of available areas for artisanal miners to work (Veiga, 1997; Hilson, 2017; Spiegel, 2016; Dwyer, 2016) and (5) It is difficult for artisanal miners to stop using mercury (Veiga et al., 2014b; Clifford, 2014; Spiegel et al., 2015; Hilson & Vieira, 2007).

This section is divided into two sub-sections of barriers: barriers for practitioners and barriers for artisanal miners. The reasons that training programs have encountered many challenges are two-sided: practitioners and artisanal miners face different barriers and it is important to understand how these barriers exacerbate one another.

2.4.1 Barriers for Practitioners

Programs are not Context-Specific

One of the principal barriers for successful behaviour change⁹ of artisanal miners is that training and capacity-building programs are not designed with a clear view of the local context and the

⁹ Change in behaviour means a miner's successful adoption of health and safety, production or environmental stewardship practices following the training programs, among other factors.

participation of the recipients, the miners and other influential mining actors like mineral traders and financial supporters for the miners.



Figure 2.4 Examples of Retorts (Veiga, 2003)¹⁰

¹⁰ Left: Kitchen bowl retort, Asia; Right: Galvanized steel, Africa.

A key example of this theme was the introduction of the mercury retort¹¹ in the early 2000s. As the authors in this body of literature argue, while the mercury retort has the potential to reduce the amount of mercury being emitted into the atmosphere during the decomposition of amalgam, the majority of programs in which the retort was introduced to artisanal gold mining sectors have failed. This failure partly because the programs did not take into account the needs, preferences, motivations and cultural dynamics of the miners themselves. In other words, practitioners have consistently failed to consult the miners they sought to train in a constructive or adequate manner (Jönsson et al., 2009; Veiga et al., 2014b; Hilson, 2005; Clifford, 2014). As a result, the uptake of artisanal miners using retorts once the program is completed has been low. As Hilson (2005) states, *“the models that have been introduced thus far — mainly those designed and manufactured in the West — have often been viewed with scepticism by illiterate miners, who likely perceive the equipment as intrusive”* (pp.146-147). Jönsson et al. (2013) survey some of the recent mercury reduction efforts in artisanal gold mining communities. The authors find that artisanal miners have not continued to use the retorts given to them during these efforts, mainly because this technology was introduced by outsiders without sufficient instruction on their importance or how to use them properly. When the miners encounter a problem, they typically return to the previous practices, the polluting method to burn amalgams in an open pan or shovel.

¹¹ A piece of equipment that condenses and recycles evaporated mercury while amalgam is being heated, thereby reducing the amount of vapour entering the air. Retorts can be made from steel, iron, glass and even household items like a bowl (pictured above). Retorts range in cost from US \$3 to \$500.

Indeed, since the Minamata Convention on Mercury¹² came into force in August, 2017, some authors have cautioned against the treaty turning into yet another mercury-eradication measure that has little bearing on artisanal mining sectors on the ground. In a similar vein, Spiegel et al. (2015) discuss the implications of the Minamata Convention on artisanal gold miners, with a focus on two case studies in Zimbabwe and Tanzania. Spiegel et al. (2015) urge policy makers not to use the Convention as means to vilify the artisanal mining sector; rather, the Convention should be an impetus for the international community to better understand and respond to the legal, technical and social challenges facing artisanal miners. The authors encourage a greater emphasis on community-based approaches for addressing this critical environmental, policy and health issue.

This suggestion, however, was not fully heard by authorities and recently Ecuador and Colombia came with decree prohibiting the use of mercury in artisanal mining and arresting miners when they use it (Marshall & Veiga, 2017). Many practitioners recommend “*scaling down*” existing technologies used by the conventional mining companies or using the same techniques that worked in another region of the world as a way to replace mercury amalgamation. New technologies, in the view of the miners, imply expensive pieces of equipment or knowledge that is inaccessible to them (Veiga et al., 2003; Spiegel et al., 2017).

¹² An internationally binding treaty where government signatories commit to eliminating mercury emissions from their countries.

Lack of Data on Artisanal Miners

The example of the retort being introduced with little prior consultation of local stakeholders is emblematic of a larger issue concerning programs in the artisanal mining sector, namely, that there is a lack of quantifiable data on the sector as a whole. There is little to no census or baseline data on artisanal miners and their practices because host countries or donors do not generally fund these activities. According to Hilson (2007), the main shortcoming of artisanal mining support programs funded by the World Bank and DfID and other international donors arises from a lack of knowledge of the complexities of artisanal mining sectors. In addition, international agencies rely too much on consultants to carry out and design the majority of artisanal mining projects. These consultants may not always design their approach based on the reality on the ground; rather, they stick to their own ideas of what kinds of projects should be implemented, with the intention of increasing their own project load.

As a result, few stakeholders have a clear picture of the demographic make-up and migratory patterns of miners; the locations, geology or lifespan of artisanally mined deposits, or many other aspects that would contribute to a well-designed training program. Indeed, Hilson & Maponga (2004) argue that even if policy makers wanted to improve programs in the artisanal mining sector, it would be difficult to do so with the current lack of primary data on the sector. Hilson & Maponga (2004) further assert that there are affordable ways to conduct such studies, such as through small grant schemes (e.g. via the Minamata Convention's National Action Plans for signatory countries).

In an attempt to rectify the issue of a lack of clear data on the artisanal mining sector, Heemskerk (2005) advocates for an inclusive method of collecting baseline data on artisanal miners. The methods of data collection and monitoring should include trust building with local mining communities, with a concentration on including diverse perspectives and continuity—all topics stemming from a focus on sustainable livelihoods. Heemskerk (2005) recommends that programs collect data on household income, expenditures and investment and savings. Hilson (2005) further recommends that data collected should include the locations of mine sites, ethnic and educational background of the miners and migratory patterns.

2.4.2 Barriers for Artisanal Mining Stakeholders

Poverty

Perhaps the greatest driver for individuals to join the artisanal mining sector is poverty. The literature has covered this trend for decades, explaining that artisanal mining is often a coping mechanism for individuals who may have lost their land, escaped protracted conflict, or for individuals who reject the strict structures of agriculture or other traditional livelihoods (Hilson, 2002). According to Hentschel et al. (2002), artisanal mining will persist for as long as poverty drives it. Likewise, Siegel & Veiga (2010) argue that artisanal mining programs should not consider alternative livelihoods to be a silver bullet. Rather, artisanal mining, particularly of gold, will be an attractive income-generating activity for poor people for which there is no match. As stated by Veiga & Marshall (2016), *“unfortunately, poverty in rural regions around the world is still increasing and artisanal mining is a preferred way of living for those with no employment opportunities, especially when a gram of gold sells for US \$38”* (p. 359).

Poverty also contributes to the persistence of poor mining practices. As Sousa et al. (2011) argue, poverty and a lack of education are the primary drivers for the poor environmental management that plagues the artisanal mining sector. An appropriate way to measure environmental impacts from artisanal mining activities is to use a model that artisanal miners can understand and in which they can participate. Article 7 of the Minamata Convention, which aims to have governments create national action plans to eliminate the use of mercury in artisanal gold mining sectors, may be a step forward. However, according to Spiegel et al. (2015), if national action plans are not based on tangible baseline evidence from and consultation with the very artisanal mining sectors working with mercury, the key problems will not really be addressed. Spiegel et al. (2015) advocate for interventions to focus on more bottom-up engagement with the artisanal gold sector.

It is important to note, however, that bottom-up engagement with the artisanal mining sector—regardless of the mineral being mined—is challenging. As discussed earlier in this section, micro-miners are often the target of many international programs in this sphere, but this group has very little agency to change its behaviour (Veiga et al., 2014b). The reasons for this lack of agency are numerous and the challenge of training this group continues to vex practitioners. Micro-miners are generally in a tenuous legal position; it is difficult to work with them over an extended period of time because they migrate to different areas and their trust of foreigners is usually low, particularly because they are vulnerable to reprimand or eviction by authorities. Micro-miners usually are panners who work in small family groups to complement their household income, producing very little product per day, such as gold, diamond, gemstones, cassiterite, columbite-tantalite, scheelite and other minerals. (Veiga et al., 2014b). They represent

the majority of the artisanal miners but not the majority of the mineral production from artisanal mining. Programs designed for this group of miners usually produce poor results since the miners are dispersed and involved in multiple livelihood activities.

Other types of more consistent artisanal miners who work in small, medium or large operations, are more interested in evolving and improving their practices. They are not concerned with environmental or health impacts and most notably, in the case of gold mining, they work with mercury. This group of miners also process their mercury-contaminated tailings in a cyanidation plant or dig dangerous shafts and pits. These miners are usually instructed by their bosses¹³ to use these methods. It is therefore recommended that the target of any training program be the bosses who have more agency over the supply chain (Veiga et al., 2014b). Once the bosses or other trusted and influential community members have been trained, they can in turn educate other miners to change their behaviour.

These aspects raise an important first question for any program in the artisanal mining sector: what are the needs, skills and motivations of the miners? Sirolli (2009 and 2012) stresses that any assistance to individuals must start by establishing whether they have asked for assistance and what are their strengths. The author argues vehemently in his publications and speeches: “*we cannot help those who don’t want to be helped.*” The barriers for improvement of artisanal mining operations cannot be removed if miners do not see that they need new techniques to produce more and cleaner.

¹³ Such as sponsors of the operation, pit leaders or immediate traders.

Another interesting point by Priester (1999) is that “*an artisanal miner will not pay out a dollar for a piece of equipment or technique that does not return two dollars*” (cited in Hinton et al., 2003, p. 102). In fact, the majority of the artisanal miners carry out this economic activity to alleviate poverty and, therefore, the arguments on environmental, health and social impacts are insufficient to convince them to adopt safer and cleaner methods. Any innovation must be simple, affordable, acceptable and more efficient than the previous method used by the miners (Hinton et al., 2003).

Importance of Middlemen

Perhaps the most striking barrier for the improvement of the artisanal mining sector is the presence of middlemen who have the influence to promote poor (or positive) mining practices than the miners themselves. Artisanal mining attracts individuals who want to escape poverty; they are not individuals who generally have a lot of capital, and as a result, miners become dependent on actors higher in the supply chain who can support them with equipment, meals or payment of access fees to the mine site (Siegel, 2007; Hilson & Ackah-Baidoo, 2010; Spiegel, 2012). Described below are some of the different types of middlemen, depending on the type of artisanal mining and the geographical area.

- **Traders:** Traders are those who buy the mining products from the miners and provide supplies, including mercury, cyanide, equipment, etc. They also provide loans to miners to start their activities and they buy the mineral products at a lower price than the market (Spiegel et al., 2006). In Central Africa, as Hayes (2008) explains, traders are the benefactors for many artisanal miners: they provide the miner with financing for her

work and in return, the miner is obliged to sell her ore to the trader, often at a discount, to account for interest.

- **Processing center owners:** These are individuals with the funds more skills to implement rudimentary processing plants that provide services for gold miners. The owners then retain the tailings to be processed with more efficient methods, such as cyanidation. For example, in Ecuador, Veiga et al. (2014a) find that, as a whole, gold processing centers cheat artisanal miners by providing them with equipment that produces a 20-30% gold recovery. Ultimately, the majority of economic benefits go to the owners of the plants who reprocess the tailings.
- **Authorities:** This category includes those in charge of, regulating, legislating and enforcing laws in the artisanal mining sector. For example, in Indonesia, middlemen can be members of local government or even the police, collecting pay-offs or ore from miners in exchange for security from a raid—a promise often broken with demands of higher bribes (Stocklin-Weinberg et al., 2013).

Indeed, in artisanal mining sectors all over the world, the division of labour is unbalanced and generally the individuals who take the highest physical and health risks are the ones who see the lowest economic return. Not only is power imbalance a problem from a human rights perspective, but it also exacerbates a poverty trap in which artisanal miners so often find themselves (Spiegel, 2012).

One telling example of the challenges linked to trying to disrupt the existing relationships between artisanal miners and middlemen is Partnership Africa Canada's (PAC) conflict-free gold

project in the Orientale Province of eastern Democratic Republic of Congo, called *Just Gold*. The *Just Gold* project was discontinued in 2014 (Partnership Africa Canada, n.d.). The purpose of this pilot was to incentivize traders (called *negociants*) into a conflict-free pilot mine site. The program invited smaller *negociants* to provide pre-financing to the miners working at the pilot site and also larger *negociants* who would purchase from the small *negociants* and then sell the ore to an exporter (called a *comptoir*) (Blore, 2015). All of the participants agreed to take a 2% cut on the price of gold, with the understanding that the miner yield would be higher, so it was supposed to balance out (Blore, 2015). While the pilot could boast a miner's yield increase of about 25%, the project had to grapple with some notable challenges, including:

- The miners sold their ore to the *petits negociants* and the *petits negociants* sold the ore to larger-scale *negociants*, but this is where the legal supply chain broke up.
- The larger *negociants* sold their product to informal *comptoirs* because they paid 2% higher than the *comptoirs* that were part of PAC's supply chain (Blore, 2015).

According to Levin & Cook (2015) the incentives for the traders were lacking in this system. Blore (2015) states that the traders involved in the PAC project were reticent to wait for a larger pay-out; they preferred to be immediately, even if it was a lower amount. For Blore (2015), the probability that the attitudes of these *negociants* will change in the future is very low. As such, despite the promised long-term economic benefits of participating in PAC's *Just Gold* model supply chain, the middlemen felt they were better served by the pre-existing informal trading arrangements.

Another flawed attempt to eliminate the middlemen is the Integrated Diamond Management Program (IDMP) and the Peace Diamond Alliance (PDA) in Sierra Leone. Funded with a multi-million-dollar grant from the United States Agency for International Development (USAID) in the early 2000s, the purpose of the program was threefold: formalization and rationalization of the artisanal diamond mining sector and an increase of benefits at the local level (Levin & Turay, 2008). The implementing consultancy had the participating miners form cooperatives. The program operated from the assumption that cooperatives would bring artisanal diamond miners the following benefits:

- The program would be able to gather more information about the miners and provide customized training to cooperative members.
- Cooperatives would sell their products directly to international buyers, thereby avoiding the middlemen, who were, according to Levin & Turay (2008), likely engaged in smuggling and linked to criminal or terrorist organizations.
- Greater profits from the diamonds would remain with the miners themselves.

The project lasted for two mining seasons, after which point the project intended for the participating cooperatives to have become self-sufficient. In reality, the funding set aside to support the cooperatives proved to be insufficient. Private investors stepped in to supplement some of that funding, but in the end, only five of the 35 participating cooperatives were funded and the investors saw few economic returns (Levin & Turay, 2008).

According to Levin & Turay (2008), there were several factors preventing the IDMP and PDA's ultimate success. Most notably, the project's belief that replacing the existing miner support system with a foreign one would ultimately be successful was misplaced. Indeed, according Levin & Turay (2008), *“the greatest similarity [between the original supporter scheme and the direct marketing scheme that USAID was proposing] was the obligation to re-pay the investor with diamonds rather than money. The scheme only transferred the miners' obligations from a supporter they knew to one they did not”* (p.5).

Moreover, the cooperatives themselves operated more like businesses and not cooperatives and there was a clear hierarchy between members. Unlike conventional businesses, however, the cooperatives lacked basic management capacity or financial literacy. The so-called members did not trust one another and many were unwilling to contribute membership dues.

In summary, the IDMP and PDA example illustrates that it is difficult, if not impossible, to change the financial and material structure of support that has been in place for years and that serves a function for its participants—both the miners and their supporters and other middlemen. Moreover, the project attempted to impose a cooperative structure on groups of miners who were unaccustomed to entering into a relationship built on trust.

Availability of Areas for Artisanal Miners

One of the most significant barriers for the formalization of artisanal miners is the availability of the mineral titles in an ore deposit, which, in many cases, the miners themselves discovered.

Veiga (1997) argues that most of the 2000 gold deposits in the Brazilian Amazon were discovered by the artisanal miners, *garimpeiros* and now are in the hands of conventional mining

companies or local entrepreneurs who have the capacity and funding to go through the bureaucratic process of formalization. Through the author's own observation, mining companies identify the sites where *garimpeiros* are working using satellite images and claim the mineral titles for themselves—often relying on the national army to then evict the miners.

A criticism of this trend is raised by Dwyer (2015), who stresses that formalization is the privilege of large companies. Spiegel (2016) concurs with this viewpoint and depicts a map of the mineral titles conceded to companies in Cambodia to highlight that there are no available areas for the artisanal miners. Indeed, when miners do discover new deposits, they are classified as *illegal miners*. Hilson (2017), too, argues that in sub-Saharan African countries, the law favours the large companies to the detriment of artisanal miners. The author has observed few cases of cooperation or agreement between large companies and artisanal miners in Ghana.

This topic deserves more attention from local and international authorities since it is one of the main issues that sparks conflict between the conventional and artisanal mining actors. The Governments usually do not have solutions for this impasse and treat the problem with a rigid approach, using the legislation to support their actions. In the field, the companies must deal with the problem of thousands of artisanal miners on a concession, and when all arguments to remove the “*invaders*” end, the armed force come to play a role, as observed in Antioquia, Colombia. It is certainly the case that the coexistence of artisanal miners and large-scale mining companies is a feasible solution, but governments, companies and miners must be educated on of the benefits for each party.

Inability of Miners to Stop Using Mercury

A significant barrier to the reform of the artisanal mining sector is the persistence of mercury emissions in the artisanal gold mining sector, despite the concentration of international efforts to eradicate it and introduce alternative methods. Veiga et al. (2014b) discuss the problem in depth, attributing mercury's prevalence in the artisanal gold mining sector to a number of factors, including the inability of governments to provide sustained training and funds to miners to change their behaviour. In addition, NGOs and other institutions receive large amounts of funding to implement unsustainable techniques or to eliminate mercury in operations producing insignificant amounts of gold.

There are many reasons why artisanal miners continue to use mercury. Part of mercury's persistence in the artisanal gold mining sector is due to the high turnover rates of individual miners. In a confidential West African country, for example, Weinberg (2012) found that the high proportion of the artisanal gold miners working in and around an industrial mining concession came from neighbouring countries. The high turnover rate of miners, combined with the large proportion of migrants coming from countries with an established artisanal gold mining sector introducing and maintaining mercury amalgamation as the common practice, made it very difficult for external interventions to try to reduce mercury emissions. Indeed, Blacksmith Institute,¹⁴ (2007), had carried out a training program for artisanal mining communities in the

¹⁴ Now called Pure Earth.

same region of this West African country, but the retorts distributed during this program were all but forgotten only five years later (Weinberg, 2012).

Another issue that has been discussed in the literature is the lack of awareness of artisanal mining stakeholders to the health and environmental risks of mercury. According to Clifford (2014), there have been so many failed attempts to sensitize artisanal gold miners to the health risks of mercury use that, to this day, the vast majority of the sector is unaware of how to reduce exposure and pathways into the environment.

Observed evidence from the author's own previous fieldwork in Indonesia and West Africa points to miners receiving mercury from their supporters as part of their start-up and operating costs. The supporters, in this sense, are the actors who promote mercury use, and the miners themselves do not necessarily have the agency to give up this practice. Indeed, according to Spiegel et al. (2015), *“switching to a mercury-free gold extraction method requires not only significant investment and training, but may also pose a radical departure from existing labour arrangements”* (p.774). Spiegel and others concur with this explanation in multiple academic publications, and urge the policy community to view mercury use in artisanal gold mining as the complex problem that it is. The explanations for mercury's persistence are not black and white and nor should the proposed solutions. Indeed, according to Hilson (2006), the research to date has not taken account of the reasons for the persistence of mercury contamination in artisanal gold mining worldwide. The author urges governments and donors to dedicate resources to researching the socio-economic dimensions of artisanal mining communities. In this way, mercury eradication measures can be tailored to the situation on the ground.

Still another reason why the use of mercury persists in the artisanal gold mining sector is the legacy of programs that introduced improper or inefficient gold processing alternatives, claiming to have found the panacea to replace mercury and cyanide. This is the case with the Borax Method promoted by Appel et al. (2012 and 2013). Based on a field study with artisanal miners in the Philippines, Appel & Na-Oy (2012) find that the borax method to be a "*safe substitute*" for mercury (p. 5). The authors compare the borax method to the standard method of processing gold with mercury and urge the academic community to conduct further research on the pros and cons of using borax in artisanal gold mining. The borax method uses an ancient technique of adding borax when melting a very rich gold concentrate. To avoid losses of gold to the slag, the concentrate must be extremely rich in gold. However, when the miners increase the grade of gold in the concentrate, they lose more gold to the tailings. As stated by Veiga et al. (2014b), "*the process seems useful for a narrow range of artisanal miners and types of ores (e.g. those without sulphides). It may be useful for micro-miners producing very small amounts of gold per day and working with alluvial ores in water streams*" (p. 357).

2.5 Attributes of a Successful Artisanal Mining Program

2.5.1 Criteria for Successful Artisanal Mining Training Programs

Hinton et al. (2003), Hilson (2007), Siegel (2010), Spiegel (2012), Veiga et al. (2014b), Marshall & Veiga (2017), Hayes (2008) and other authors argue that in order for a training program in the artisanal mining sector to be successful, the following criteria must be met: (1) The training curriculum and program in general must be designed with context-specific information; (2) Miners and leaders must be previously selected and included in program design; (3) Trainers

should be community leaders with teaching skills; (4) Measures to improve production or reduce negative impacts must be simple, affordable and profitable; (5) Government support is crucial; and (6) Training takes persistence, long-term presence and patience. Many of the above points are connected. It is important to note that the majority of the literature engaged in this section deals with artisanal gold mining, but some the lessons around behaviour change and building trust with local communities can apply to other mineral and precious stones sectors. The following section brings these six criteria into practice with practical examples.

1. The Training Curriculum and Program in General Must be Designed with Context-Specific Information

There is no one-size-fits-all approach for training artisanal miners. The dynamics, attributes and impacts of different artisanal mining sectors vary widely depending on geography and the type of mineral or stone being mined. As such, while it is possible to have a broadly-themed training curriculum from which to draw inspiration, the actual content and delivery of that curriculum *must* be constructed based on a comprehensive understanding of the target sector or region. This research should collect data on economic indicators, such as investments and income (Siegel, 2007). Moreover, there needs to be tailored learning solutions for disparate artisanal mining sectors. People learn in different ways and there are often barriers for the successful uptake of the information they receive. Indeed, according to Hilson et al. (2007) “*the heterogeneity of small scale gold mining in terms of skill levels, literacy, operating conditions and geology makes the application of generic solutions inappropriate*” (p.277).

Examples of context tailored delivery mechanisms for new practices include demonstrations onsite, mobile training units, radio broadcasts of or social media, central processing facilities and even vocational classrooms and model mine sites where miners can participate in the best practices available for their type of ore (Stocklin-Weinberg et al., 2015).

2. Miners and Leaders Must be Previously Selected and Included in Programs

Training involves a relationship of trust and rapport between the program and its intended beneficiaries. One important way to build trust is to make the design of the training program a participatory process so that stakeholders can provide input on how their needs, the power dynamics of the community in question, the type of ore being mined and many other factors impact their ability or desire to adopt new techniques. Indeed, according to Veiga et al. (2014b), every mining community is different in terms of their level of organization and gaps in knowledge, so solutions will need to be tailored to their unique situation.

The issue at play here is that if recipients of a training program do not feel any ownership of the design process itself, they will not see its usefulness to their lives and work and will be unlikely to participate. Training recipients should be involved in the design of the program from the offset in order to build trust and ownership (Spiegel & Veiga, 2010). Indeed, Spiegel & Veiga (2010) argue that top-down policies toward mercury reduction in artisanal gold mining sectors are ineffective. Rather, it is important for policy makers to understand the economies and ecologies of scale in these mining environments.

The incorporation and inclusion of mining stakeholders was something that the GEF/UNDP/UNIDO Global Mercury Project (GMP) did well. According to Sousa & Veiga

(2009), the training curriculum was based upon deep consultation with the mining community and it spoke to their particular knowledge gaps. As a result, in the Brazilian chapter of the GMP, Sousa & Veiga (2009) found that 120 days after the educational campaign, the amount of mercury being emitted into the environment in this region had reduced by 10%.

In Tanzania, Jönsson et al. (2007) carried out a retort distribution campaign with Tanzanian artisanal gold miners and other artisanal mining stakeholders. The researchers introduced retorts and studied the miners' receptivity to using the equipment. The findings included an uptake in the use of 18 retorts over a five-month period and a resulting 20 kg of mercury being recycled. The miners involved in the activity saved money and the environmental footprint of their activities were reduced. Jönsson et al. (2007) argue that if the measure is properly introduced, artisanal miners will be willing to use retorts.

3. Trainers Should be Leaders with a Personal Stake in the Community

The stakeholders selected as training recipients must be part of a group with influence over miners. In Zimbabwe and Tanzania, as well as many countries in Latin America and Southeast Asia, artisanal gold miners bring their ore to be processed at central facilities (Spiegel & Veiga, 2005). One example of such an influential stakeholder group is the owners of gold processing centers. Indeed, according to Veiga et al. (2014b), *“interventions to deal with the owners of the Processing Centres ... are badly needed, but are unfortunately rare... Mercury emissions cannot be reduced if these individuals do not change their poor practices of amalgamation followed by cyanidation”* (p. 353). If processing center owners could be convinced to not only teach miners better practices, but also to equalize the division of profits at the centers, the environmental

impacts and economic position of miners would be greatly improved. Such an ask of these stakeholders is a tall order, however, and there will likely be an uphill battle to engage the vested interests in most artisanal mining supply chains. This hypothesis has yet to be proven, in large part because the funding for training programs typically does not match the significant timeframe it would take for this behavioural change to take place.

One model that has been piloted in Colombia, Peru and Ecuador, called the Training Center for Artisanal Miners program, employs a training-of-trainers method. Paraphrasing Veiga, Zolkinov (2012) describes the sequence of a training-of-trainers model in the following terms:

- Miners are enlisted to participate in training around safe mercury handling, new mining techniques and environmental preservation. The trainees are taken from artisanal mining sectors that see the poorest practices and environmental and health impacts.
- The trainees are engaged in their mining communities for the long-term and teach other mines in a manner that the miners can grasp.

The training-of-trainers approach has been implemented in the field for several decades. In 1995, for example, Veiga et al. (1995) stated that an ideal way to convey information for the artisanal miners is through skilled people from their own community. More recently, in Colombia, the Training Center for Artisanal Mining project has introduced a training curriculum to the vocational authority in Colombia, which will in turn hire trainers to provide instruction to artisanal gold miners. The wide-ranging curriculum includes different classroom and practical

modules.¹⁵ The curriculum provides a wide breadth of topics, but it is important to note that the trainers are meant to use their discretion and teach miners the topics that are most relevant to their needs.

Part of the reason for selecting trainers who are separate and more influential than the miners themselves can be explained by Spiegel (2009), who argues, “*bad practices arise not because miners are stubborn or socially backward ... but because social capacities are limited*” p.3076). The curriculum therefore needs to be targeted toward stakeholders who can exert influence on the supply chain, particularly traders, financiers, equipment owners and processing center owners—all of whom are above the miners on the value chain.

4. Measures to Improve Productivity and Reduce Environmental Impacts Must be Simple, Affordable and Profitable

Artisanal mining is a poverty-alleviating activity; it can be a source of pride for some and a cause of marginalization for others. But above all, artisanal mining is a business. Therefore, any effort to train artisanal miners needs to include economic incentives interwoven therein. According to many sources in the literature, if artisanal miners cannot be convinced that a new technology will bring them an increase in production or profit, they will be reticent to try it, let alone invest in purchasing or maintaining it.

¹⁵ See Appendix D.

Just as the messaging for the training program has to be tailored to the local context, so too should the equipment or methods being introduced. Indeed, Hayes (2008) advises that any equipment introduced should be locally procured and robust. Moreover, multiple authors argue that the messaging around the introduction of equipment or new mining techniques has to be focused on increased economic returns for miners, and not the reduction of the severity of environmental or health impacts of the mining activities (Veiga, 2016; Hayes, 2008; Siegel, 2007).

One way to reduce mercury use is to train artisanal gold miners in safe principles of cyanidation. Indeed, according to Sousa et al. (2010) “*cyanidation has been a preferred method in the mining industry...[it] has shown to be the most promising reagent to replace mercury*” (p. 1758). However, this practice only works in mining areas where there is already the infrastructure to implement cyanidation. Likewise, the artisanal miners need to have some familiarity with the practice of cyanidation; otherwise, it will require a culture shift away from mercury use, which is not impossible, but would take significant time. Moreover, one of the key errors that miners and processing center owners make is to process mercury-contaminated tailings in cyanidation tanks. This is a very dangerous practice and it creates serious impacts both on human health and the environment.

5. Government Support is Crucial

Jönsson et al. (2007) argue that for a program to be successful, it must be accompanied by government support. The support of the government is crucial, but it must come in the correct form and must also be accompanied by other enabling factors. A correct form would imply

government agents participating in and leading many of the training sessions and government budget allocated toward the training activities. The other important way that governments can provide an enabling environment is to remove many of the (arbitrary) barriers for artisanal miners to legalize their activities.

McDaniels et al. (2010), stressed that the absence or poor presence of the Governments at the artisanal mining sites of the six countries where the Global Mercury Project (GMP) was implemented (Brazil, Indonesia, Laos, Sudan, Tanzania and Zimbabwe) was the project's major weakness. Unfortunately, the project was only temporarily successful in training miners and reducing mercury emissions but not ultimately sustainable. The program's lack of sustainability likely stemmed from the fact that when the technical assistance ended, many miners returned to poor practices to mine and process gold ores. Government agents rarely participated in the GMP demonstrations of better techniques to process gold. The governments could have established simple field offices to make the training and demonstration facilities permanently available to the miners, but the argument was always that they did not have funds and this was not priority for them.

6. Training Takes Persistence, Long-Term Presence and Patience

Training programs for artisanal miners have historically been designed as projects, funded by donor agencies, with a limited timeframe (Siegel, 2007). The Global Mercury Project, cited above, is an example of the time-bound nature of training programs. Indeed, project cycle forms of funding and program design make success difficult for training programs to achieve. For example, Siegel (2007) laments that UN-funded projects typically have a brief timeframe (three

to five years), which makes it difficult to hand over the project to any in-country programs of the government. Veiga et al. (2014b) argue that trust must be built in an artisanal mining community and for this to occur, the permanent presence of trainers is essential. One of the central lessons of the Global Mercury Project is that, were it provided with more time and increased support from the host governments in the implementing countries, it would likely have been more successful (Sipple & Selin, 2012).

Hayes (2008) provides succinct recommendations for a successful program strategy in the artisanal mining sector, namely, that the implementing agency needs to know the cultural and policy context in which it is working. There are many lessons to be learned and capitalized upon from other interventions, including the following: (1) Ensure that interventions are participatory and work within the feasible context for most artisanal miners; (2) Level expectations of program beneficiaries about what the program will and will not accomplish; (3) Communication with policy makers has to be consistent; (4) Technical interventions must take account of what miners can afford and would want to implement; and (5) Traders and other middlemen play an essential role in artisanal mining supply chains. Rather than try to eliminate the middlemen, any successful artisanal mining intervention will attempt to work with them.

2.6 Training Program Design

A useful way to facilitate the design of a training program for artisanal miners is to begin with a project document. Project documents can take on multiple forms, but they usually include the following elements:¹⁶

- **Program scope, components, objectives and theory of change:** This section defines up front the change the program intends to bring about. A theory of change is a helpful starting point, but it should not be set in stone, particularly if the subsequent field-based Training Needs Assessment demonstrates that a different theory of change is more appropriate.
- **Implementation strategy**, including a needs, motivations and skills assessment of the miners, followed by training curriculum development in consultation with
- Expected **outcomes and outputs** (see description below).
- **Logical Framework** (logframe) or **Results Framework**.
- **A monitoring and evaluation plan**, which should include the project's indicators, schedule for baseline and monitoring assessments and independent mid-term and endline project evaluation.

¹⁶ See Appendix B for example project documents.

2.6.1 Logical Framework and Participatory Rural Appraisal Approaches

The logical framework approach (LFA) is a method for project planning, monitoring and evaluation which has the following goals: “*to assist projects in establishing clear and realistic objectives; to promote logical thinking and check the internal logic; to provide a basis for monitoring and evaluation*” (Aune, 2000, p. 687). The logical framework approach has been used in project planning for decades, and has re-emerged as a requirement for many international development agencies, including USAID, the UK’s Department for International Development (DfID), Global Affairs Canada and the Swiss Agency for Development and Cooperation. The LFA has been criticized for some major limitations, including its incompatibility with participatory project planning (Chambers, 1997). That being said, the methodological approach to project planning has evolved to address its critics (Bakewell & Garbutt, 2005).

The most notable alternative approach to the LFA is called the Participatory Rural Appraisal (PRA), which aims to include the points of view of the stakeholders who are impacted by the development project—particularly vulnerable groups like women, children and indigenous peoples—into project planning (Aune, 2000). Aune (2000) argues that there could be a happy medium to combining PRA and LFA, that is, making LFA more accountable to the input of those impacted by the project by conducting participatory studies prior to the selection of project goals; regularly sharing updates with project beneficiaries and, overall, provide some more nuance to the problem(s) the development program is trying to address.

The Logical Framework Approach in Detail

A logical framework (or logframe) assists with the design and subsequent monitoring and evaluation of a program. The purpose of a logframe is to support the development of the program's goal, including how it will achieve that goal and what the expected impacts. A logframe is usually depicted graphically, and it can take on a number of forms, depending on the requirements of the donor. Each logframe, however, should include the program's theory of change, development goal, project components, outcomes, outputs and, where relevant, intermediate outputs.

A **theory of change** generally starts with the context in which the project is working and the change the project will bring about. The theory of change encompasses all the pieces—or **project components**—that must be in place for the desired change to occur.

A **development goal** articulates how the program is going to fulfil its theory of change (USAID, 2010). The Sustainable Artisanal Mining Project in Mongolia (2016) provides an example of a development goal: “*an economically sustainable, environmentally responsible and human rights-based ASM sector in Mongolia benefitting from, and contributing to, global best practice regarding artisanal and small-scale mining.*” If the rest of the project components are designed and implemented correctly, then, the development goal should be achieved. The development goal is measured by ‘impact indicators.’ For example, in a DfID-funded program to improve maternal health in Tanzania (2009) with a development goal to reduce the number of maternal deaths, one impact indicator would be national maternal mortality ratio.

Outputs are measurable results of a project (USAID, 2010). There can also be intermediary outcomes should a more nuanced approach becomes necessary. Outputs are measured by ‘output indicators.’ For example, if the output of the maternal health project in Tanzania is to improve women’s access to family planning services, then an output indicator could be the number of service providers trained (DfID, 2009).

Outcomes are effects obtained by following through with the components of the project. Each of the **project components** help achieve the development goal. For example, if the goal is to reduce mercury and improve production, the components could include: (1) The introduction of alternative methods for processing ore; (2) Training and onsite instruction on the new techniques; and (3) Visits on a quarterly basis to monitor the uptake of new techniques. Outcomes are measured by ‘outcome indicators.’ Returning to the same project of maternal health in Tanzania, if the project outcome is “*to increase women’s use of family planning through rural outreach,*” an outcome indicator could be “*couple years of protection delivered by project*” (DfID, 2009, p.1).

A Logframe incorporates **critical assumptions**, or risks—factors that are external to the program but which either must be in place for the theory of change to be actualized, or which might impede that actualization (USAID, 2010). Another way of describing a critical assumption is “*external factors which the evaluators believe may positively or negatively influence the events described...including any external phenomena beyond the project/programme manager's control*” (Better Evaluation, n.d.). Critical assumptions could be related to the willingness of the host country government to engage or coordinate with the project; whether peace and security is

maintained in the region of implementation; or the funding from the donor remains the same (USAID, n.d.).

The logframe is essentially the blueprint for a project. The structure of a logframe can differ, depending on the preferences of the donor, but usually it is created using a Microsoft Excel document, with columns for all the above key components, as well as a description of the regular (e.g. quarterly or annual) targets for each of the indicators and the actual levels achieved at each milestone period (DfID, 2009).

Monitoring and Evaluation

Not all monitoring and evaluation (M&E) models work for every type of program. It is important to consider the goals, scope and resources of the proposed training program before embarking on a specific model of M&E. Whilst the logical framework model of M&E is the one being presented in this chapter, other models, such as Outcome Mapping, could be more appropriate for some training programs.¹⁷

The success of a training program obviously depends on the practicality and feasibility of the program's objectives. **Indicators** help to measure the program's progress over time. Indicators are, then, measurable results that are simple, feasible, reliable and traceable. The way that programs establishes indicators can vary: one way is for the indicators to be established by the donor and or program staff before the program launches. This manner of planning ensures

¹⁷ See, for example, <https://usaidlearninglab.org/sites/default/files/resource/files/ODI-Outcome%20Mapping%20for%20ME-%20OCT2009.pdf>.

that the priorities of the program are going to be tracked as the program progresses. Another way to establish program indicators is to compare the priorities of the program and donor to the goals and priorities of stakeholders who are to be recipients of the training. The latter method, while more time-consuming, is more participatory and sets the program up well to mediate both the priorities of the donor and the needs of the recipient communities themselves.

2.7 Key Gaps in the Literature

Veiga et al. (2015) describe a project sponsored by the United States Department of State and implemented by the University of British Columbia (UBC) in the north of Peru, south of Ecuador that established a small demonstration center to train mining bosses. From 2010 to 2013, 46 Peruvian, 50 Colombian and 115 Ecuadorian artisanal miners and processors were given training on methods to reduce and eliminate mercury increasing gold recovery by gravity concentration, flotation and cyanidation. Despite the small number of people trained, the program had a significant impact on the bosses, who went on to implement more than 40 processing centers in their countries. The Governments of Ecuador and Peru barely participated in the project and did not maintain the demonstration facility.

In another example, Garcia et al. (2015) describe the UNIDO Colombia Mercury Project, which was conducted in five municipalities of the Department of Antioquia, Colombia. In 2010, the five municipalities were releasing 73 to 110 tonnes of mercury to the air, soil and water. The project convinced the police to collaborate with the technical team to demonstrate to the processing center owners and gold shops—the main mercury emitters in the urban area—how to reduce the mercury emissions. In 2013, the project assessed that mercury losses had been

reduced by 63%, resulting in 46 to 70 tonnes per annum less mercury entering the environment. It was clear that the technical interventions would not be so effective without the participation of the police (who were already trained) to force the polluters to stop or change their operations. Unfortunately, the Government administration changed, the UNDO personnel left and no indicators are available to assess the sustainability of the anti-pollution measures implemented in three years of the project

It is clear that the literature focuses on monitoring the impacts of artisanal mining operations and in almost the totality of the articles, no suggestion is provided on how the impacts can be reduced. The major gap in the literature and indeed the training space for artisanal miners, is that there has yet to be a successful training program for artisanal miners. While small victories should always be celebrated, it is also essential to aim higher—especially since this is a sector that has a great many thinkers making much of what is wrong with artisanal mining, but not a great deal about what it would require to bring about positive changes. Some of the key gaps in the literature on training programs in the artisanal mining sector include:

- The impacts of artisanal mining of resources besides gold are not covered extensively in the literature, which makes programming around these artisanal mining sectors difficult to develop.
- There is an over-emphasis in the literature on mercury reduction, at the expense of other pressing topics like gender discrimination and occupational health and safety.
- The monitoring and evaluation of past programs is lacking. It is therefore very difficult to assess the extent to which a program was successful in achieving its goals.

- Much of the intellectual capital in the training space is considered by many practitioners to be proprietary, which has resulted in a lot of unpublished or grey literature. The author attempted to fill this gap by examining grey literature like consultancy or NGO reports as well as by interviewing some of the key experts working in this space.

The gaps in the literature will be addressed in more detail in the Discussion section.

Chapter 3: Methods of Approach

3.1 Conceptual Framework

A conceptual framework provides the skeleton from which the research questions—and therefore the methodological approach to answer the questions—are drawn. The methodology for this study is rooted in two conceptual frameworks: Mental Models and Human Centered Design (HCD). Both frameworks focus on arriving at an understanding of the needs, knowledge and motivations of the potential recipients of a program. The inclusive and participatory nature of these two conceptual approaches is appropriate, given that training programs have to date largely overlooked the context of the artisanal mining sectors they have meant to serve.

It was previously discussed that the primary barriers for behaviour change in the artisanal mining sector, are: (1) Training programs do not take into account of a particular artisanal mining context, and connected to that, there is a lack of quantifiable census and other baseline data on artisanal miners; (2) Persistence of so-called middlemen, supply chain actors who are likely more responsible for maintaining the status quo of informality and dire social and environmental impacts than the miners themselves; (3) The majority of artisanal miners use mining to alleviate poverty and they do not have the skills or desire to become small-scale miners or adopt new techniques; (4) Authorities rarely support artisanal miners on the adoption of cleaner and safer techniques; and (5) Artisanal miners do not have access to funds to improve their techniques or invest in better equipment.

These issues are covered extensively in the literature, but there is little offered by way of solutions. As such, this study turns to other bodies of literature to capture lessons or methodological approaches that can be used to better understand and mitigate these barriers in the artisanal mining sector. The researcher elected to use a combination of a Mental Models framework and Human Centered Design to conceptualize the tools used for a field-based Training Needs Assessment. Complementing the guidance on consulting artisanal miners, is a framework on the best practices for designing and launching a training program for artisanal miners. The two approaches make the program design – in this case, a training program for artisanal miners—responsive to the current gaps in user knowledge. The field data gathered reflects the types of contextual information that should be gathered prior to initiating any type of training program.

3.1.1 Mental Models Approach

The body of Mental Models literature argues that in order to communicate effectively with a population about the risks associated with their behaviour, it is essential to first assess what the target group knows, where there are gaps in the group's knowledge and which of those gaps need to be filled in order to change the group's behaviour in a positive way (Bostrom et al., 1994). Bostrom et al., (1994) argue that a successful risk communication design should include:

- Information, the content of which must be tailored to the knowledge and knowledge gaps of the user group, taking into account the barriers that might impede the group's ability to apply what they learn in the program.
- Active participation from the target group involved in the program.

Effective participation in the program's design also increases its credibility with the public (Bostrom & Fischhoff, 2001). The authors do caution that positive behavioural change resulting from effective risk communication will only occur if the actors have the agency and resources to change their behaviour, a point that is particularly relevant for the artisanal mining sector (Bostrom & Fischhoff, 2001).

Some key aspects of the Mental Models literature are applicable to the development of Training Needs Assessment research tools. The following is a list of the key steps in the development of a Mental Models-based methodological framework:

- **Step 1:** Develop a list of expert priorities by “[reviewing] *current scientific knowledge about the ...nature and magnitude of the risk*” (Morgan et al., 2001, p. 20). Define the key hazards and problems that need to be addressed with training.
- **Step 2:** Mental Models interviews. Open-ended, in order to get “*people's beliefs about the hazard*” (Morgan et al., 2001, p.20).
- **Step 3:** Through structured interviews, ascertain whether expert beliefs line up with a larger group.

It is important to note, however, that to be truly responsive to the needs of the future program users, it would be more appropriate to begin the gap assessment with the users themselves and then cross-check those key findings against the points of view of the experts.¹⁸

¹⁸ This approach was not followed in this research project, but is recommend in future similar studies.

3.1.2 Human Centered Design (HCD) Approach

According to IDEO (n.d.), Human-centered design is “*a process that starts with the people [you are] designing for and ends with new solutions that are tailor made to suit their needs.*” HCD helps the researcher develop stakeholder consultation tools to cultivate deep empathy for the program design recipients and leads to data collection that is sourced from a wide variety of key informants. Human Centered Design was selected as a conceptual underpinning to the design of a framework for training artisanal miners because this approach is specifically designed to help researchers conduct a participatory needs assessment.

The HCD approach consists of three phases, two of which the researcher followed –the third was modified to be more suited for validating the research findings with key informants. In the first phase, called the Inspiration Phase, or research phase, the researcher learns from the users of the future program. The purpose of this phase is paint a clear picture of the current circumstances of the users and take note of their needs. The next phase is called the Ideation Phase, or the analysis phase. In this phase, the researcher processes what was learned from the research phase and identifies key findings, recommendations for the design of the program and a prototype of how the program might look. In the final phase, which is called the Implementation Phase, the researcher presents recommendations to the users and seeks their input and suggestions on the program prototype.

3.2 Methodological Tools

In this thesis research, five methods to conduct research were used, including: 1) Diagnostic literature review; 2) Strengths, weaknesses, opportunities and threats analysis; 3) Case selection;

4) Interviews and focus groups; and 5) Data analysis. Below there is a deeper description of each method.

3.2.1 Research Method 1: Diagnostic Literature Review

Research Questions Approached

- *What are the barriers for behavioural change for the artisanal mining sector?*
- *What are the attributes of a successful training program?*

The purpose of the literature review is to provide a comprehensive account of the history of training programs in the artisanal mining sector in order to posit how a successful program might be designed. Before beginning the field research, the researcher conducted a comprehensive literature review of 130 published and unpublished works on the following themes:

- Definitions, key trends and a background of the artisanal mining sector.
- Examples of training and capacity development programs and other initiatives to educate or build the capacity of artisanal miners.
- Lessons learned from several notable past and current training programs for artisanal miners.
- Barriers to formalization and the key attributes of informal sectors as a whole; and
- Key attributes of a successful training program.

The literature review was initiated with a keyword search in Google Scholar and the University of British Columbia's Library website, including the following words:

- Artisanal mining
- Artisanal and small-scale mining
- Artisanal gold mining
- Artisanal mining Indonesia
- Formalization and informality
- Global Mercury Project
- Training artisanal mining.

The researcher then imported the articles in the reading list into NVivo, a qualitative research software program. The program has built-in features, which help the researcher to carry out an open coding process, wherein key concepts in each published work were identified and categorized without pre-determined categories or concepts (Bhattacharjee, 2012). This method of coding was chosen for the diagnostic literature review because it structured the findings according to key themes, gaps and recommendations from the literature. In particular, open coding helped the researcher identify the crosscutting themes that would then form the basis of the Framework for Training Artisanal Miners. The list of codes was then categorized into a concept tree, which provided a visual depiction of the relationships between each of the key

themes. The concept tree resulted in a list of critical issues and questions that were then examined and validated through expert and field-based interviews in Indonesia.

3.2.2 Research Method 2: Strengths, Weaknesses, Opportunities and Threats Analysis

Research Question Approached

- *What are the strengths, weaknesses, opportunities and threats of select past and current training programs for artisanal miners?*

The strengths, weaknesses, opportunities and threats (SWOT) methodology was chosen for its pragmatic distillation of key findings. SWOT is not without its limitations; indeed, according to Panagiotou (2003), the method is too simplistic to accommodate the complexity and nuance that most organizations possess. Likewise, Helms & Nixon (2010) stress that SWOT is most useful when it is combined with other forms of analysis. SWOT was selected for this thesis because it provides a simple and succinct way of distilling the key elements and operating context of a program. The SWOT tables in the following chapter also provide indicators which serve useful for the Framework for Training Artisanal Miners. As an extension to the literature review, the SWOT analysis chapter provides additional context on what has been attempted thus far in the training programs space. The SWOT tables, therefore, are not intended as the last word on training programs, but rather a method that is combined with other research methods, including a more extensive literature review and field observations from several countries.

In the SWOT analysis, the author reviewed training programs—both ones for which the author has collected primary data already, including the Fairtrade Gold Centres of Excellence

Program in East Africa (Stocklin-Weinberg et al., 2015), and several past programs located on other continents, including the Global Mercury Project (GMP), and the Mongolian Sustainable Artisanal Mining Programme projects. The author chose to profile training cases located in multiple regions. It is important to note, however, that the SWOT profiles are by no means a generalization on the experience of training programs all over the world. Rather, profiling training programs in multiple regions provides context for the Framework for Training Artisanal Miners.

3.2.3 Research Method 3: Case Selection

Research Questions Approached

- *What are the barriers for behavioural change for the artisanal mining sector?*
- *What are the attributes of a successful training program?*

The third research method chosen was case selection, which helped generate a theory about the success factors and challenges involved in training artisanal miners. According to Bhattacharjee (2012), “*case research can help derive a richer, more contextualized, and more authentic interpretation of the phenomenon of interest than other research methods by virtue of its ability to capture a rich array of contextual data*” (p. 93). Indonesia was chosen as the country where the Training Needs Assessment were field tested.

Indonesia is the second largest producer of cassiterite in the world. Tin metal ore, which is extracted from cassiterite, is an important component in the electronics industry. The majority of the cassiterite mined in Indonesia’s Bangka-Belitung Province is mined artisanally. In 2012,

Friends of the Earth released an exposé on the sustainability issues surrounding the mining practices, most notably the sector's health and safety and environmental impacts (FoE, 2012). The report implicated several major electronics brands, including Apple and Samsung, for sourcing tin from a country where the work practices were so poor. As a response, the Sustainable Trade Initiative (IDH) convened a working group of electronics brands, the tin industry association, ITRI, the Electronic Industry Citizenship Coalition and Friends of the Earth. In 2016, the Tin Working Group decided to explore the opportunities for implementing a training program on occupational health and safety in the artisanal cassiterite mining sector.

Indonesia was chosen because the author has existing research links in-country and international relationships with an international organization called Pact. Indonesia is a challenging and unique place to work because it is an island archipelago with diverse types of artisanal mining practices. As such, if a Training Needs Assessment could be launched successfully in such a challenging artisanal mining sector, there is a high likelihood that it would be received readily by artisanal mining stakeholders in other countries.

Pact commissioned the author to carry out a Training Needs Assessment in Bangka-Belitung. The performance of the research tools, including informant reactions, surprises, successes and challenges encountered when using these tools are evaluated in the Field Results. The findings from the primary case study were complemented by the author's near decade of field experience on all the continents where artisanal mining takes place, including one or more field missions to:

- Colombia (four sites over one week in 2016)
- Democratic Republic of Congo (four sites over one month in 2014)
- Ecuador (one site over one week in 2013)
- Gabon (three sites over two weeks in 2011)
- Indonesia (six visits to Indonesia between 2013 and 2017, each averaging a duration of two to three weeks; a dozen sites visited)
- Mongolia (one site visited over one week in 2015)
- West Africa (one site visited over two weeks in 2012)
- Tanzania (four sites visited over two weeks in 2015)
- Zimbabwe (one site visited over one week in 2017).

These field missions provided the researcher with insights from discussions with artisanal miners, local authorities and companies about a myriad of topics, including the methods that should be implemented to train miners. This experience was brought to bear in the design of the Framework for Training Artisanal Miners.

3.2.4 Research Method 4: Interviews and Focus Groups

Research Questions Approached

- *What are the barriers for behaviour change in the artisanal mining sector?*
- *What are the attributes of a successful training program?*

The field research methods were based on the qualitative approaches of semi-structured interviews, expert interviews, focus groups and direct observation because these methods are

natural extensions of case research (Bhattacharjee, 2012). Furthermore, much of the information being gathered does not exist in the written literature.

Expert Interviews - Pre-field Mission

The purpose of the expert interviews was to gather the key themes to be examined in the field as well as capture the state of expert knowledge on training programs for artisanal miners on the global scale. The artisanal mining experts consulted in this study came from different sectors, including academia, consultancies, NGOs, practitioners and donor organizations:

- Saleem Ali, Professor, University of Delaware; Centre for Social Responsibility in Mining
- Atlanbagana Bayarsaikhan, Mongolian Sustainable Artisanal Mining project
- Paul Cordy, Artisanal Gold Mining Expert
- Kenneth Davis, Artisanal Gold Mining Expert, United Nations Environmental Programme
- Gavin Hilson, Professor, University of Surrey
- Thomas Hentschel, Artisanal Mining Expert; Managing Director, Projekt Consult
- Jennifer Hinton, Artisanal Mining Expert; Adjunct Professor, Carleton University
- Felix Hruschka, Artisanal Mining Expert
- Kirsten Hund, Senior Mining Expert, The World Bank
- Susan Keane, Deputy Director, Health, Natural Resources Defence Council
- Lynda Lawson, PhD Candidate, Centre for Social Responsibility in Mining, University of Queensland

- Estelle Levin-Nally, Artisanal Mining Expert; Director, Levin Sources
- Ian Satchwell, Adjunct Professor, University of Queensland
- Marcello Veiga, Professor, University of British Columbia
- Cristina M. Villegas, Artisanal Mining Expert, Program Manager, Pact's Mines to Market Program.

The key issues identified in the expert interviews—particularly the barriers and attributes of success themes—contributed to the design of the Training Needs Assessment, which was piloted in Indonesia.

Indonesia Field Mission Research Tools

The researcher developed the Training Needs Assessment research tools in collaboration with a multi-disciplinary team for *Pact's Occupational Health and Safety (OHS) Training Needs Assessment in Bangka-Belitung's Artisanal Tin Mining Sector* project. The researcher conducted interviews and focus groups with stakeholders implicated in or concerned with the Indonesian artisanal tin mining supply chain. These research tools were focused on the following topics: (1) Training methods; (2) Needs, skills and motivations of artisanal tin mining stakeholders; (3) Suitability and format of a potential training program in Indonesia; and (4) The key stakeholders who should be involved in or consulted on a training program, among other topics that were raised by the informants in an organic fashion. For the purposes of this research, the interview, focus group and observation guides played an instrumental role in the process of establishing a training program. Moreover, the tools were field-tested to assess their field readiness and utility for the Training Needs Assessment phase in general.

Expert Interviews in Indonesia

The purpose of the expert interviews in Indonesia was to develop a context-specific framework of key OHS training priorities in the artisanal tin mining sector in Indonesia. The expert framework, or priority issue list, was then validated with users on the ground, that is, artisanal miners and their team leaders, tin collectors, local authorities and mining companies. Some of the informants were consulted to become potential trainers for artisanal miners when the training program moved forward.

In-Depth Semi-Structured Interviews

The purpose of the in-depth semi-structured interview guides was to gather information from non-expert informants. The interview guides were developed as a long list of questions organized by topic. Each topic had several questions marked as "*must answer*" questions, which were highlighted on each interview guide.¹⁹

Each guide was designed to gather information about the priorities and knowledge of the participants, including their awareness of the health and safety issues involved; any barriers that would prevent them from participating in a training program and to gauge their knowledge of the short- and long-term health impacts of their work. In addition, the question guides helped the researcher identify potential training participants and priority topics. The same guides were used

¹⁹ See Appendix B.

for men and women, enabling the researcher to identify any differences by gender in perceived or real health and safety impacts, as well as gender-differentiated training priorities.

Focus Groups

The focus group guides were designed specifically for male and female miners to build consensus on health and safety training priorities and obtain information on common health practices and how they differ between men and women. The focus groups helped triangulate the findings from the in-depth interviews. Each focus group included an interactive card prioritization exercise, with health and safety issues listed separately on cards. The issues listed on each card were taken from a list of expert priorities developed out of the structured interviews and pre-field literature review. Participants were asked to prioritize the cards by: 1) Issues they felt were significant for artisanal miners in general; 2) Issues they felt were a small problem; and 3) Issues they had never encountered. Then the participants were asked to divide the cards according to the issues most prevalent for male mining populations, issues most prevalent with female miners and the issues that affected the health and safety of all miners. The focus groups supported participants to make their own recommendations on the subject areas they felt training should prioritize. The priority issues articulated by the participants in the focus groups then formed the basis the training curriculum.



Figure 3.1 Focus Group in Belitung (Villegas, 2016)

Mine Site Observation Survey

The mine site observation survey drew from the researcher's observations at other artisanal mine sites, combined with existing surveys and guidelines on OHS and other issues present at mine sites from the International Labour Organization (2001) and the International Council on Mining and Metals (n.d.). The survey included questions that the researcher could answer through observation, including the presence of fumes, high ledges to pits and ergonomic hazards. The survey also employed questions of perception, which needed to be posed to miners, including potential work-related psychological stressors and common practices when there is an injury, accident or fatality.

Selection Criteria and Sample Size

The researcher, in collaboration with a local partner NGO, identified expert informants based on two factors: 1) Their level of influence and knowledge of the artisanal tin sector in Indonesia; and 2) Their potential to be a training program 'champion' or 'spoiler'—that is, an individual who could hinder or completely block the training program. In total, the researcher conducted 18 Indonesian key informant interviews with the following key actors:

- Five central, provincial district level government authorities
- Three academics and researchers
- Three NGOs/CSOs
- Six health workers
- One independent smelter.

For the in-depth interviews, the researcher used 'extreme-case' sampling to identify 'ideal' artisanal tin miners and bosses (i.e. 'high-performers') and those on the opposite extreme (i.e. 'low performers') using the following selection criteria:

- Mining actors that are '**high-performers**' (e.g. they follow higher than normal standards and are amenable to change).
- '**Low-performers**' (e.g. they are resistant to change or exhibit the most problematic behaviours).

The extreme sampling procedure allowed the researcher to determine which mining activities included best and worst practices. The sampling method ensured that the researcher would know

where their starting point was in terms of mining practices on both extremes, so that the training program could be developed to ensure that the actors most capable of change were being targeted.

The researcher chose mine bosses, community leaders and low and medium-level tin collectors²⁰ for in-depth interviews from each of the three selected mine sites. Finally, two focus group discussions—one group for men and one group for women—were conducted at the nearest village to each of the three mine sites. The researcher consulted the following number of key informants, including:

- **12** semi-structured interviews with mine bosses (over three mine sites)
- **12** semi-structured interviews with community leaders and collectors
- **18** semi-structured interviews with male miners (3x 'high-performers' and 3x 'low-performers', distributed over three mine sites)
- **18** semi-structured interviews with female miners (3x 'high-performers' and 3x 'low-performers', distributed over three mine sites)
- **4** group discussions (2 x 2 mine sites) with both male and female miners, separately.

The interview questions were piloted first with several colleagues prior to the fieldwork. This process allowed for a refinement of interview questions prior to arriving in the field. Because many of the questions were likely to change once interviews in the field began, a mix of closed

²⁰ Individuals who purchase tin ore from diggers at the mine site. Larger collectors purchase bigger quantities of ore from the collectors who visit the mine sites.

and open-ended questions were included in the methodology. This way, the design was flexible enough to accommodate the search for key themes, but also allowed the respondents to provide more information where they felt it relevant.

Recruitment and Consent

The study was summarized in a relevant and comprehensible manner to each type of stakeholder prior to the researcher's arrival in the field, so that participants consider whether or not they wanted to participate. The study was summarized again prior to each interview or focus group. In this summary, the researcher provided the following information: 1) Explanation of the research questions and study objectives; 2) Foreseeable risks and benefits to participation; 3) Alternatives to participation, for instance, by participating in a focus group instead of a one-on-one interview or declining participation altogether; 4) The researcher's contact information as well as the contact details for UBC's research ethics complaint line; 5) What the key informant should expect as an output, such as a summary report was translated into the local language; and 6) Assurance that the key informant could choose to end his or her involvement in the study at any time.

Written or verbal informed consent was obtained from all participants. Where participants were illiterate, a recorded assent was obtained. All consent forms were translated into Bahasa Indonesia. Confidentiality was maintained throughout the study. All respondents were informed that participation was completely voluntary and they were given the opportunity to refuse participation or refrain from answering any question at any time throughout an interview, conversation or focus group.

3.2.5 Research Method 5: Data Analysis

Research Questions Approached

- *How should a successful training program for artisanal miners be designed and evaluated?*

Coding of Literature Review and Pre-field Interview Data

The data analysis consisted of coding the literature review notes and pre-field expert interview data into key themes using NVivo. In the NVivo program, a node was created out of each of the interview questions so that the responses were categorized into themes. For example, there was a specific node for Research Question 1, and the answers of all the respondents to Question 1 were coded under that node. For the open-ended responses, new nodes were created as common themes arose. Those nodes were then cross-linked to the closed-ended response nodes, depending on how similar the themes were.

Coding of Field Data

Coding of the field data followed the HCD approach. The analysis of the information was conducted through brainstorming, visualizing ideas through sketches and colour-coded post-it notes.

It is important to note that for the purposes of this thesis research, the field data was analyzed in such a way as to inform the design of a training program, not to report in-depth on how the key informants responded. As such, the observations and conclusions provided in the Results and Discussion chapter pertains to the key observations made by the researcher with

respect to the need for and barriers for this training program. In addition, the researcher responds to the research question on how to design a training program for artisanal miners, rather than what the health and safety training priorities were for artisanal tin mining stakeholders in Indonesia.

3.2.6 Potential Sources of Bias

There were three challenges associated with the research in practice, but these challenges were mitigated by the researcher as far as possible. The first potential source of bias is the researcher's decision to **select a qualitative methodological approach**. Qualitative research findings inherently contain bias because they are based on the subjective realities of the key informants. However, each interview was triangulated with a number of different types of stakeholders until a point of saturation was reached—that is, when multiple stakeholder types reported on the same theme, that theme was categorized as a key finding. Likewise, throughout the course of the literature review, the key themes were extracted through a process of saturation; the themes which were cited by the largest number of authors were chosen for the literature review chapter and discussion.

The second challenge was in the **selection of artisanal mining experts** for key informant interviews. The author selected these key informants based on a personal network and the supervisor's network. While this did not impact the reliability of the findings, it did mean that the expert responses were relatively in agreement with one another. Other types of expert informants might have included end users, such as Fairtrade or Fairmined-certified jewellers or electronics brands, or mid-tier supply chain stakeholders, such as exporters or smelters and refiners. These

types of stakeholders hold a different position from the experts consulted by the author, who are rather observers and commentators on the sector, but who do not actually participate in the artisanal mining supply chain. Traders and end users would have provided a perspective on the barriers they have encountered in their engagement in the artisanal mining supply chain. These barriers might provide insight on what kinds of training efforts their consumers would be willing to support, such as adding a premium to an ethically sourced end product, and if not, why not.

The third potential source of bias was related to the **quality of the translators** employed during the Indonesian field study. Since the author is not a fluent Bahasa Indonesia speaker, translators were hired to assist with the key informant interviews and focus groups. However, the translators hired were unfamiliar with the subject matter and so they struggled to translate the interviews accurately. It was not clear to the researcher whether the key informants always understood what they were being asked, and therefore the responses seemed inaccurate. In order to mitigate this challenge, the researcher hired a new, more professional translator.

Chapter 4: Training Examples in the Artisanal Mining Sector

This chapter provides a succinct evaluation several training programs serving the artisanal mining sector. The selection criteria for this evaluation was as follows:

- Geographical coverage of all continents where there are active artisanal mining sectors, including Africa, Asia and South America.
- Programs covered extensively in the literature review, insights drawn from the author's field experience and conclusions drawn from key informant interviews
- Programs supported by multilateral, bi-lateral or unilateral donors.
- Sources in English or French on which there was sufficient program evaluation literature or expert sources willing to discuss the key lessons learned.

The programs covered in this evaluation included a varying range of geography, objectives, funding streams and duration. As such, these programs are not compared to one another. Instead, they are evaluated against their own stated objectives, using a SWOT—strengths, weaknesses, opportunities and threats—analysis.

SWOT analysis has historically been used in the business community, but it has recently been taken up in community development areas (Center for Community Health and Development, University of Kansas, 2017). SWOT analysis takes account of both internal and external aspects of a program. The strengths and weaknesses pertain to the design and impact of the program, whereas the opportunities and threats pertain to the operating context external to the program. Internal factors could include the program's human resources, physical resources and

current and past activities. External factors could include the economic or political context in which the program takes place; actions of the donor, local legislation and even the physical environment (Center for Community Health and Development, University of Kansas, 2017). Once a SWOT analysis has been performed, the program can begin to strategize on how to *“build on the strengths, eliminate the weaknesses, exploit the opportunities or counter the threats”* (Dyson, 2004, p. 632).

4.1 Types of Training Models

There are several types of training models that the majority of the programs for artisanal miners have adopted over the years. These iconic models, which are described in more detail below, include: processing centers; Transportable Demonstration Unit; model mine; classroom; coexistence between artisanal and large-scale miners; training-of-trainers; and training for regulators.

4.1.1 Processing Centers

A processing center is a facility that processes large quantities of gold ore at a given time with the help of different types of technology and chemicals, depending on the grade of the ore being processed. Processing centers have been used by training programs as a venue for educating artisanal miners and disseminating knowledge to the wider community (Hinton et al., 2003). In other contexts, however, gold processing centers tend to cheat artisanal miners by bringing about a low recovery rate on the first round of processing through whole ore amalgamation (Veiga et al., 2014a). Ultimately, the majority of profits are seized by the owners of these plants who reprocess the tailings. What is more, the methods used at these processing centers—namely,

mercury amalgamation and cyanidation—create extensive pollution resulting from poor management of mercury and cyanide during tailings management, whole ore amalgamation, the decomposition of amalgams and the improper disposal of mercury and other heavy metals-contaminated tailings.



Figure 4.1 Processing plant in Ecuador

An iconic example of a processing center being used as a training facility is the Shamva Processing Center in Zimbabwe, a program that took place in the 1980s. The goal of this program was to create a one-stop shop processing and training center for 40 artisanal gold miners in the region. The plant was initially successful, apparently increasing the miners' gold production by 30% (UNECA, 2002).

However, when other miners started to learn about the milling facilities, they wanted to join and very soon the center was over capacity by 450 people. Consequently, the miners had to wait weeks for their ore to be processed, which they found unacceptable. Hilson (2007) writes of the Shamva Processing Center, “*many operators [reverted] to the faster, unmonitored, environmentally-damaging amalgamation activities practiced previously*” (p.242). The primary challenge of the program was that it did not take into account that other miners may have wanted to join but would be reticent to wait a long time for their gold to be processed. Other drawbacks raised by Veiga et al. (2014a) were that the center had installed an inefficient method for extracting fine gold particles and it was located too far from many of the mines, which led to insecure transport routes. If the program designers had conducted detailed contextual and political economy assessments of the mining sector, this knowledge may have been reflected in the design of the Shamva Processing Center.

A second, more positive example of a processing center being used a training center is the Unit of Gold Extraction and Controlled Amalgamation centers piloted in Venezuela in the late in the 1990’s. The purpose of the Unit of Gold Extraction and Controlled Amalgamation centers, a project proposed by UNIDO for Venezuela, was twofold: (1) To demonstrate mercury free processing methods to miners; and (2) To serve as a venue for other training topics, including basic geological exploration, responsible mine site reclamation and tailings management, business skills and more (Veiga & Beinhoff, 1997). The centers were designed to raise awareness with miners and their communities about the dangers of mercury consumption, while simultaneously demonstrating that there are more efficient ways to process gold ore from mercury-contaminated tailings. Veiga & Beinhoff (1997) point out, however, that the Unit of

Gold Extraction and Controlled Amalgamation center approach should not be copied and pasted indiscriminately. Instead, a training or demonstration center must be preceded by a “*firm commitment from the miners*” and the arrangement for a legal area for miners to work (Veiga & Beinhoff, 1997, p.5).

Table 4.1 summarizes the strengths, weaknesses, opportunities and threats of the processing center training model.

Strengths	Weaknesses
<p>Designed to meet miner needs, such as ore type, geology, etc.</p> <p>Mining can be made more efficient and demonstrated by specialized personnel.</p> <p>Increases gold recovery and cost-efficient for the miners.</p> <p>Processing of ore in a relatively brief timeframe.</p>	<p>Miners may not be able to reach the centre due to the distance.</p> <p>Not all types of ore can be processed using the same technique.</p> <p>Especially damaging to the environment and human health if miners bring ore previously treated with mercury to be processed with cyanidation.</p>
Opportunities	Threats
<p>Reduces need for investment in new equipment.</p> <p>Other services, such as training, can be provided to miners onsite.</p> <p>Potential to reduce mercury emissions by having miners process use alternative methods.</p>	<p>Centers do not have multiple techniques to demonstrate to the miners.</p> <p>Miners can reject the program if the process used does not extract the amount of gold they expect.</p>

Table 4.1 SWOT for Processing Center Design²¹

²¹ Adapted from Stocklin-Weinberg et al., 2015.

The processing center model of training is promising because the training programs offered at the center has the potential to change the behaviour of the wider artisanal mining sector just through word of mouth. However, it is not a model that will see much success in regions most of the mining takes place in remote areas. Likewise, the processing center training model is more successful when the miners already visit processing centers. The center also must be located in a sector that is easy for miners to reach.

4.1.2 Transportable Demonstration Unit (TDU)

Mobile, or transportable demonstration units, are *"a kind of collapsible laboratory staffed by experts traveling from site to site to demonstrate how miners can achieve better results by improving their amalgamation methods"* (Siegel, 2007, p. 158). The novelty of this approach is that it allows remote miners to be trained in situ instead of having to travel to a training center. The TDU model also enables miners and trainers to work with the current methods and materials in place at the sites. The TDU approach was widely used during the UN Global Mercury Project.

Table 4.2 summarizes the strengths, weaknesses, opportunities and threats of the transportable demonstration unit training model.

Strengths	Weaknesses
<p>Brings the training to miners working in remote areas.</p> <p>Improves amalgamation methods, e.g. by introducing gravity concentration.</p> <p>Introduces new methods and demonstrates efficiency of various pieces of equipment.</p>	<p>Low capacity to produce large amounts of concentrate, which is usually regarded as inefficient.</p> <p>Challenging to find a trainer with the right combination of expertise in engineering, economic and public health.</p>
Opportunities	Threats
<p>Potential to introduce techniques miners can use with little to no further investment.</p> <p>Success depends on the expertise and engagement of trainers.</p> <p>Local manufacturers can produce different types of equipment demonstrated to the miners.</p>	<p>Equipment can be stolen while the trainer is moving from mine site to mine site.</p> <p>Miners dislike or are unfamiliar with the demonstrated techniques.</p> <p>If miners do not find local suppliers to provide the demonstrated equipment, the credibility of the TDU can be questioned.</p>

Table 4.2 SWOT for TDU Model

The TDU model for training artisanal miners is convenient for miners working in remote locations, but it is not without its drawbacks. Most notably, it is a labour-intensive training model for the trainer, and the end does not necessarily outweigh the means. In other words, a trainer must travel to remote areas, carrying equipment that could be stolen along the way, only to train small numbers of micro-miners at a time. As such, the threats to this model outweigh the opportunities. One way the TDU model could work is if it were combined with another model, such as the processing center, as a means of checking in with the miners to see whether the training they received at the processing center is being implemented at their own operations.

4.1.3 Demonstration Mine

A **demonstration, or model artisanal mine** consists of a section of an upgraded artisanal mine site segregated from the rest of operations. The program holds live training sessions for visitors to observe and practice sound mining and processing methods (Stocklin-Weinberg et al., 2015).

In 2015, the author carried out a feasibility study for a Centres of Excellence for the Fairtrade Gold pilot in Tanzania. The purpose of the study was to explore the potential scope, scale, funding structure, curriculum and delivery model for a training program to scale up the impact of Fairtrade's capacity building activities with artisanal mining organizations at selected sites in Kenya, Tanzania and Uganda (Stocklin-Weinberg et al., 2015). A demonstration mine was one of the central recommendations for the Fairtrade Gold East Africa pilot as a vehicle to disseminate the techniques that member mining organizations had learned their participation in the Fairtrade Gold Pilot. The Fairtrade-certified artisanal mining organizations could in turn instruct other artisanal mining organizations in the region.

The researcher's qualitative study found that the majority of stakeholders from a diverse range of positions—such as artisanal miners, gold processors, government officials and cooperative members in other Fairtrade product supply chains felt that a Centre of Excellence was too ambitious for the realities of the operating context in East Africa. Instead, the most suitable way to deliver training on new mining, business and rehabilitation techniques to other mining actors outside of the Fairtrade supply chain was to provide a combination of onsite demonstrations and classroom learning. It was recommended that the demonstration mine be upgraded with basic milling equipment and a generator so that the trainers could demonstrate

what best practice techniques with that type of deposit would look like. Initially, the training would be given to the leaders of the artisanal mining organization. Once the leaders felt confident, they would then carry out peer-to-peer demonstration sessions with their colleagues who would come from other mine sites.

Table 4.3 summarizes the strengths, weaknesses, opportunities and threats of the demonstration mine training model.

Strengths	Weaknesses
Builds capacity of one artisanal mining organization. Trainees can observe and participate in best practice mining techniques.	Difficult logistically to transport miners from other sites, to the model mine for training. Training specifically designed for the type of ore found in that site. Difficult to replicate elsewhere.
Opportunities	Threats
Artisanal mining organization where the demo-mine is located provides training to other miners. The mine could be combined with a classroom where theoretical underpinnings of the demonstrated techniques are taught.	It is not guaranteed that the trainees would be willing or able to use the techniques they have learned at the at their own operations. Perception that the artisanal mining organization hosting the demo-mine has been given preferential treatment.

Table 4.3 SWOT for Demonstration Mine Model

The demonstration mine training model is one of the more promising models but it should be complemented by a classroom component. This way, the training recipients are can receive both a practical and theoretical type of training. That being said, the logistical difficulties of transporting miners from their own sites to the demonstration mine should not be overestimated. If the other mines are located very close to the demonstration mine, then this challenge would be mitigated, but if the mine sites are very spaced out, this model will not see much success because miners can rarely afford to leave work to receive training.

4.1.4 Classroom

Training sessions for artisanal miners can be held in a classroom setting. In this context, miners would come to learn the theory behind what they learn at the mine site. A logical partner for a classroom model is an educational institution like a university or vocational school. Educational institutions have the facilities and experts to help design the curriculum and issue diplomas or even degrees (Stocklin-Weinberg et al., 2015). For example, the World Bank funded the establishment of the Institute for Gemology, in Madagascar, where students learn about basic concepts of gemology, lapidary courses and jewelry making (The World Bank, 2012).

Table 4.4 summarizes the strengths, weaknesses, opportunities and threats of the classroom training model.

Strengths	Weaknesses
Complements practical, hands-on training offered at a model mine. Participants receive diplomas or certificates to validate their skills in a formal way. Recruits teachers locally based on their expertise.	Must find the right partners (e.g. an academic institution) to ensure that classes are well-organized and sufficiently funded. Difficult to assess the skills of trainers and ensure they are provided with appropriate training to meet the needs of participants. Reputable institutions must be involved to guarantee the continuity of the training process.
Opportunities	Threats
If well conducted, can be a sustainable process to train artisanal miners. Partnership with vocational colleges or universities an option to make the program more sustainable. Opportunity to show to the miners what is effective in other countries.	Performance of trainers must be evaluated on a regular basis. Salaries for trainers must be paid by a stable institution, not a short-term donor.

Table 4.4 SWOT for Classroom Model

As stated in the previous section, the classroom model should be combined with practice sessions at a demonstration mine. Furthermore, the classroom needs to be accessible to training recipients. Trainees cannot travel a long way to reach their classes and the sessions should be brief so that the trainees are not away from their work for lengthy periods of time.

4.1.5 Artisanal Mining-Large-Scale Mining Coexistence

Large-scale (industrial, or conventional) mining operations frequently overlap with artisanal miners. This overlap can occur for a number of reasons, including, for example:

- An exploration company observes artisanal mining activities in an area and, believing the miners have located a viable deposit, subsequently applies for a license in the same zone to carry out further exploration.
- Artisanal miners encroach on the concession of a company, either with no permission or with the permission of customary authorities like a village chief or landowner, when there are often overlapping mineral rights.
- A combination of the two previous scenarios.

The relationship between large-scale and artisanal miners is often fraught, but is largely outside of the scope of this thesis.²² That being said, mining companies occupy a unique position in that they work in remote areas where the capacity of the state rarely extends. Thus, when companies appeal to the government to address a conflict between artisanal and conventional miners, the

²² See, for example, Kemp, 2010; Kemp et al., 2011; Garvin et al., 2009.

government does not always have the capacity to respond effectively. The government's go-to method is to often deploy the army to evict the miners, such as in Colombia and Peru, to name a few, and this usually only escalates the situation. That being said, companies do need to balance their position as members of the private sector and not a replacement for the government, despite their position in the field (Sagebien et al., 2008; Sagebien & Whellams, 2006).

On the other hand, mining companies working in artisanal mining areas have the opportunity to build a constructive relationship with their artisanal and small-scale counterparts. Coexistence is a model in which the industrial miner provides training, a centralized processing facility and the opportunity for miners to sell their ore to a safe and stable buyer, thereby collecting a higher rate. There are two primary ways that coexistence can occur:

1. The mining company allocates an area of its concession for artisanal miners to work, either supervised or unsupervised. An iconic example of this arrangement is Placer Dome and the *Corporacion Venezolana de Guyana's Los Rojas Small Mining Project* on the Las Cristinas concession in Venezuela in the late 1990s, where a Canadian company established a processing plant for the miners (Wotruba & Davidson, 2005).
2. The company allocates an area of its concession and allows an artisanal or small-scale mining and processing operation. Miners from the surrounding area work at this site and eventually receive technical assistance from the company. The company then purchases the ore from the miners for a fair price.

Hecla's Block B project in the early 2000s is another example of an early attempt at coexistence. The company and the 250 gold miners working on the concession formed an agreement in which

the company allowed the miners to continue their operations and receive technical support from the company on geological, geotechnical, underground mining, ventilation and other health and safety issues. In return, the miners sold their ore to the company. The agreement worked smoothly until 2008 when the company sold its holdings (Veiga et al., 2005).

The strengths, weaknesses, opportunities and threats of the coexistence model for training is summarized in Table 4.5.

Strengths	Weaknesses
<p>Conventional mining companies operate in areas where the state has no reach.</p> <p>Mining companies can share the profits with artisanal miners.</p>	<p>Miner profits may decrease if a company assumes responsibility for the centralized processing center (e.g. from an initial donor).</p> <p>Not all artisanal miners in a region can be involved in the process.</p>
Opportunities	Threats
<p>Mining companies in a unique position to provide training to artisanal miners.</p> <p>Coexistence provides companies with the opportunity to build good faith and mediate a naturally conflict-ridden relationship between artisanal and large-scale miners.</p> <p>Financial incentive for the mining company to engage with artisanal miners in a constructive manner, e.g. via training.</p> <p>Reduces threats of artisanal miner incursions and a subsequent halt in operations.</p> <p>Formalization of the miners can be a result of the coexistence.</p>	<p>Mining companies must undergo a culture shift generally on their negative perception toward the artisanal sector.</p> <p>Prevailing belief that companies have a greater right to be mining than artisanal miners.</p> <p>Questionable whether mining companies can deliver training that artisanal miners will trust.</p>

Table 4.5 SWOT for Coexistence Model

The coexistence model for training artisanal miners is a model that merits further field testing. Though it has not seen a great deal of success thus far—namely because the relationship between conventional and artisanal miners is inherently antagonistic—it also presents an important

opportunity for conventional mining companies to transform how they are perceived by artisanal miners and other affected communities. One of the key barriers for this model is that the company and the community are sometimes already embroiled in conflict. However, if a company were to begin a coexistence plan *upon* launching a project, then it could set a precedent for positive engagement.

4.1.6 Training-of Trainers

The objective of a training-of-trainers (ToT) model is to furnish future trainers of artisanal miners with relevant and context-specific training. Training-of-trainers can be a coaching or mentoring program for stakeholders identified in the artisanal mining sector. Training-of-trainers involves workshops specifically tailored for the needs of the local technical experts. Participants then demonstrate teaching skills and core competencies in technical and health related issues to the miners (Veiga et al., 2006).

One output of the UN Global Mercury Project was a manual for training artisanal gold miners (Veiga et al., 2006). The manual provides detailed instructions on an array of exploration, mining, processing, environmental stewardship and occupational health and safety topics for the artisanal gold mining sector—indeed, it is the first and most comprehensive of its kind. In addition to the training topics, the manual provides instructions on how to be a successful trainer. The instructions include, for example, the insight that it requires a great deal of time and patience to learn from miners about how they want to be taught and the trainer must take measures to ensure that trainees own the process of their own learning. This guidance is perhaps the most useful outcome of the GMP: an instruction guide on how to teach non-traditional and adult

learners. The guidebook sets the stage well for the training-of-trainers model with the components of a successful training program. The advantage of this model is that it ensures that champions within the mining sector are trained, thereby increasing the likelihood that artisanal miners will receive training over the long-term, provided that the trainers are gainfully employed (Veiga et al., 2006).

Between 2003 and 2011, the World Bank and other co-financiers supported the Uganda Sustainable Management of Mineral Resources project, which included a training and small grant program for artisanal salt miners. The goals of the project included: *“sustainable development and poverty reduction, supported mineral resource management by communities, improving artisanal and small scale mining activities through development of information systems and an integrated approach to natural resource management”* (Independent Evaluation Group, 2014). The artisanal mining component of the project consisted of two sub-components: the introduction of a training and outreach program to formalize artisanal miners and the provision of small grants for artisanal mining communities to pilot safer and more efficient mining and processing technologies. According to an independent evaluation (2014), the program successfully launched a training-of-trainers campaign, which trained 180 local trainers, who then went on to train 1,000 miners. The topics of training included efficient mining techniques, legislative issues related to artisanal mining, business skills, occupational health and safety and community development (Independent Evaluation Group, 2014).

The above successes notwithstanding, the project suffered from a lack of coherent and consistent monitoring and evaluation, which made the overall evaluation of the project difficult.

A mid-term review found that the program did not have achievable indicators, which were also inconsistently tracked. Further independent assessments found that these gaps had not been addressed (Independent Evaluation Group, 2014).

In a more recent example of the training-of-trainers model, the Canadian International Resources and Development Institute (CIRDI), which is funded by Global Affairs Canada and hosted on the campus of the University of British Columbia (UBC), is planning to launch a training-of-trainers with the Government of Ecuador's Ministry of Mines agents. The goal of the program is to meld Canadian and Ecuadorian mining knowledge and apply it to the improvement of Ecuador's artisanal gold mining sector. CIRDI's goal is for the program to train 40 government officials, who will in turn train up to 200 miners in the pilot phase (CIRDI, 2017). Since its launch in 2016, the program has carried out an educational needs assessment and sought the support of more than 20 government and community stakeholders. Stakeholder mapping has also featured prominently in the early phase of this program (CIRDI, 2017).

One of the key barriers for the training-of-trainers model's sustainability is that it can involve significant financial resources—to consult the training community on the curriculum, design the curriculum, identify training champions, carry out the training, keep the training facility running and carry out monitoring and evaluation, among other factors. In addition, it is impossible to guarantee that the trainers will stay in the current mining sector forever. When trainers leave, they take with them a valuable technical resource for the miners.

The strengths, weaknesses, opportunities and threats of the training-of-trainers model for training is summarized in Table 4.6.

Strengths	Weaknesses
Trainers are individuals from the mining sector, familiar to the artisanal miners.	Challenging to make this model self-financing, particularly if it is launched with donor funding.
Trainers are available onsite to provide coaching to miners as and when they need it.	Trainers have day jobs and therefore they do not have much time to attend training sessions.
Opportunities	Threats
Training champions have influence over miners to encourage them to change their techniques.	It is not guaranteed that trainers will go on to train artisanal miners when the financial support ends.
Provides local leaders with a job.	If the ToT program does not have a clear monitoring and evaluation plan, it is impossible to evaluate whether it was met with any success.
Can serve as a positive example for other nearby mining communities.	

Table 4.6 SWOT for Training of Trainers Model

The training-of-trainers model is a promising model because it sets up influential mining stakeholders with the capacity they need to ensure that miners learn better practices and techniques over the longer-term. However, the funding model for training-of-trainers programs is a key drawback: it is difficult for ToT programs to become self-sustaining after the donor financing ends. This is a problem because the model relies on trainers to work in mining communities long after the training program ends. One way to mitigate this challenge is for the program to engage with in-country institutions who could continue the program or engage the interest of the private sector. These institutions include relevant government ministries and educational or vocational institutions and conventional mining companies.

4.1.7 Training for Regulators, NGOs and Civil Society

The International Mining for Development Centre (IM4DC; the program closed down in 2015) and other donor organizations such as the United Nations and the World Bank, have supported or carried out training and awareness-building workshops and programs for the stakeholders in

artisanal mining countries who engage directly with artisanal miners. The stakeholders include regulators, who are mandated to ensure that artisanal miners are complying with the mining code and mining safely and legally. The programs also include NGOs and CSOs who raise awareness about the health, social and environmental risks and issues that artisanal miners face on a daily basis. The latter group is often tasked with providing training and sensitization for artisanal miners on a myriad of subjects and often act as whistle blowers for the artisanal mining sector. These training programs usually consist of a workshop format in which attendees listen to speakers and participate in interactive learning exercises. The themes of these workshops are far-reaching, but can include:

- Awareness-raising for government officials and other policy makers who are in the process of ratifying or implementing the Minamata Convention, on how the National Action Plan or National Implementation Plan for the elimination of mercury emissions in their country should be developed.
- Reforming the mining code so that it incorporates the needs and realities of the artisanal mining sector.
- Increasing gender inclusivity in artisanal mining, among others.

The strengths, weaknesses, opportunities and threats of the training for regulators, NGOs and CSOs model is summarized in Table 4.7.

Strengths	Weaknesses
<p>Builds capacity of in-country stakeholders.</p> <p>Contributes to policies that are more responsive to the artisanal mining sector.</p> <p>Contributes to formalization of the artisanal mining sector.</p> <p>Raises awareness with governments of countries about specific issues facing the artisanal mining sector.</p>	<p>Training does not directly target artisanal miners so it is difficult to monitor the results on the ground.</p> <p>Training is frequently theoretical, not practical.</p> <p>Government representatives have little direct experience with the artisanal mining sector.</p>
Opportunities	Threats
<p>Western practitioners can act as conveners of policy makers from different artisanal mining countries to promote exchanging of lessons, sharing of positive examples and South-South learning.</p> <p>Promotes a more regularized and organized artisanal mining sector.</p> <p>Leaves change-making in the hands of actors actually working with artisanal miners for the long-term.</p>	<p>Policy makers may not have the mandate to implement the content of trainings and often create impractical laws.</p> <p>Governments do not always understand the realities of the artisanal mining sector and can be prejudicial toward artisanal miners.</p>

Table 4.7 SWOT for Government Training Model

The training for regulators and other in-country organizations is valuable as a short-term training program, but it is not a way to fundamentally change the behaviour of artisanal mining communities because this stakeholder group is not in direct and regular contact with miners.

4.2 Donor-Supported Training Programs

Donor agencies have historically been the lead proponents in this field of training artisanal miners, although the landscape is starting to change.²³ Since the 1980s, the United Nations, the United Kingdom's Department for International Development (DfID) the United States Department of State (USDoS) and the Swiss Agency for Development and Cooperation (SDC)

²³ The Tin Working Group funded project is a case in point.

are the main donor agencies funding NGO, consultancy or academic-led training programs for artisanal miners. Funding streams can range from the tens of thousands to millions of US dollars—although the amount of funding each project received does not necessarily determine its level of success. The following sections detail two iconic donor-funded programs- the UN Global Mercury Project and the Sustainable Artisanal Mining project. There are other smaller programs with a shorter duration,²⁴ but the literature on these programs is limited.

4.2.1 The Global Mercury Project

The largest-scale effort to raise artisanal miners' awareness about mercury and introduce new processing technology to date was the Global Mercury Project (GMP). The GMP was funded by the United Nations and the Global Environmental Facility (GEF). The United Nations Development Program (UNDP) acted as the implementing agency and the United Nations Industrial Development Organization (UNIDO) carried out project execution (Chouinard & Veiga, 2008). The GMP's objective was to *"improve [the] understanding of the social and biophysical implications of ASM, and [develop] and [test] interventions to foster cleaner mining and improve the lives of operators"* (McDaniels et al., 2010, p. 244). The goal of the GMP was to alter the landscape of each pilot country's regulatory framework, environmental and health impact management and mitigation and, ultimately, introduce technology which would reduce or eliminate mercury use in the participating artisanal gold mining sectors. The GMP took an

²⁴ Including, for example, the USDoS-funded Colombia Mercury Project (led by UBC); DfID-funded Zimbabwe Accountability and Artisanal Mining Program (ZAAMP, led by Pact); the USDoS-funded Mercury Reduction, Formalization and Supply Chain Management in Artisanal Gold Mining (led by the Artisanal Gold Council), United Nations Environmental Programme-funded Mitigating Mercury Emissions from Artisanal and Small Scale Gold Mining in Indonesia (led by YTS Kalimantan and Pure Earth, formerly Blacksmith Institute).

approach of 'learning by doing' with its recipient communities. In Phase 1, from 2002 to 2007, the GMP carried out a global assessment of artisanal mining and then launched field programs in Brazil, Indonesia, Lao People's Democratic Republic (Lao PDR), Sudan, Tanzania and Zimbabwe. The primary activities during this phase included baseline data collection, mercury level monitoring and training and capacity building (Chouinard & Veiga, 2008).

The majority of the literature on the GMP focuses on the positive aspects of the program. That being said, the most comprehensive evaluation of the program was conducted by McDaniels et al. (2010). The paper's main critique of the GMP related to its overall sustainability, namely that the host governments did not take substantial ownership of their mercury issue. Thus, when the GMP's funding ended, progress in this area lagged severely.

Intermediate Objectives²⁵

The intermediate objectives of the GMP were as follows:

- Introducing new techniques to process gold ores.
- Minimizing environmental and health impacts.
- Measuring the scope of pollution caused by mercury at artisanal mining sites.
- Introducing technologies and practices to reduce artisanal gold miners' dependence on mercury.

²⁵ McDaniels et al., 2010

- Capacity building and other means of support for policy makers and regulatory mechanisms in implementing countries to minimize negative impacts of artisanal gold mining.
- Developing, alongside host governments, monitoring mechanisms for mercury emissions.

Activities

The primary activities of the GMP included the following (Veiga et al., 2003; Spiegel & Veiga, 2005; McDaniels et al., 2010):

- Baselines, surveys and diagnostic activities of environmental, health, socio-economic and political context of project sites.
- Development of site-specific training curricula.
- Training and sensitization, including training of health practitioners and a training-of-trainers program with the intention of trainers teaching miners in the future.
- Health education initiatives.
- Local, national and international awareness-raising.
- A host of international workshops on GMP training and awareness-raising campaigns.

Program Outcomes

Tanzania: GMP Tanzania's program, which took place between 2006 and 2007, was the largest scale operation of the GMP pilot countries (Scoble et al., 2007). The program conducted a widespread situational analysis of the mining practices in Rwamsaga and Nyarugusu regions. Linked to the mining assessments, the GMP Tanzania team carried out health assessments and social diagnostic assessments, which found that there were cases of child labour and nursing mothers being exposed to mercury vapours (Chouinard & Veiga, 2008). Many of the thousands of training participants were receptive to the training. As of 2010, 100 retorts were still being used (McDaniels et al., 2010).

GMP Tanzania's awareness-raising campaign included the distribution of educational booklets, posters, T-shirts and caps, press releases on radio and television and newspapers, and Transportable Demonstration Unit demonstrations that were open to the public (Chouinard & Veiga, 2008). Despite these efforts, GMP Tanzania did not record a significant reduction in mercury emissions (Chouinard & Veiga, 2008). According to Stocklin-Weinberg et al. (2015), even though GMP Tanzania was a large-scale program compared to the other GMP country chapters, the miners observed by the author in 2015 in Rwamsaga did not use retorts or fume hoods.

Brazil: The GMP Brazil program took place between 2002 and 2004 (Chouinard & Veiga, 2008). According to surveys taken three months after training, 90-100% of the participating miners were employing the mercury containment practices they had learned (McDaniels et al., 2010). Other country program outcomes included: analyses on the scope of mercury contamination on

environmental impacts of mercury contamination; the socio-economic, health and environmental context of the mining communities in the project zone; the feasibility of implementing a micro-credit scheme with artisanal miners; and tracing the mercury trading chain. The Brazil program also developed and distributed equipment for the training sessions, including a small pilot plant, biosand filters and retorts (Chouinard & Veiga, 2008).

Sousa et al. (2010) detail a case study in the Tapajos River Basin, Brazil, where miners were using gravity concentration, followed by cyanidation in a ball mill to process their ore. The authors provide an optimistic assessment of the method because it avoids the use of mercury amalgamation. Cyanidation, when properly managed, can process fine particle ore extremely efficiently and quickly (in 24 hours, as opposed to traditional cyanidation methods, which take up to 20 days). Sousa et al. (2010) stress the importance of miners being taught appropriate handling of cyanide to avoid any accidents.

Sousa & Veiga, (2009) describe the chronology of the program and the tools used to evaluate its effectiveness. Using 20 performance indicators, Sousa & Veiga (2009) found that 120 days after the educational campaign, the amount of mercury being emitted into the environment in this region had reduced by 10%. That being said, there has not been ongoing monitoring of the project site to ensure that the mining sector are still implementing the methods they learned during the GMP. The article emphasizes how important it is for a program's goal to be defined and then for the proponents to select manageable performance indicators to measure progress. The current sustainability of the results of the GMP in Brazil is unknown.

Indonesia: During Phase 1 (2003-2004), GMP Indonesia carried out extensive environmental, health assessments and baseline assessments to identify mercury hotspots in artisanal gold

mining areas in the North Sulawesi and Central Kalimantan Provinces (Sulaiman, 2007). The assessments revealed that the artisanal miners working in these regions were severely exposed to mercury, primarily through inhalation and eating contaminated fish (Sulaiman, 2007). The GMP Indonesia team made recommendations to the national and provincial governments regarding the development of legal provisions for miners (Chouinard & Veiga, 2008).

During Phase 2 (2005-2007), GMP Indonesia carried out numerous mercury-awareness raising campaigns and training-of-trainers workshops. The workshops were held via a TDU model, so the program could reach remote mining communities (Sulaiman, 2007). The program also encouraged and assisted several dozen gold shop operators to install mercury capture systems, such as fume hoods, in their shops. Awareness-raising and sensitization activities on the health impacts of mercury exposure and the risks associated with HIV/AIDS were substantial: GMP Indonesia staff distributed pamphlets, gave radio and television interviews and consulted widely with miners (Chouinard & Veiga, 2008). Chouinard & Veiga (2008) estimate that in the gold shops where fume hoods were installed, owners were able to recover 80-90% of the mercury used. This means that in the shops where the GMP distributed fume hoods, approximately 645kg of mercury was not released initially; and in 2008, emissions were reduced by another 900 kg.

Lao PDR: The Lao PDR program took place between 2002 and 2007 (Chouinard & Veiga, 2008). The program focused on identifying the scope of artisanal gold mining in the country (Baker et al., 2007). The program also trained Ministry of Health personnel on different ways to deliver awareness-raising training on mercury risks (Baker et al., 2007). GMP Lao PDR

delivered an awareness-raising campaign nationwide, which included brochures, posters, workshops and demonstrations where retorts, carpet sluices and other safety measures were introduced and engagement with miners at the village level (Baker et al., 2007). Perhaps the most tangible outcome of this country program was that the government subsequently developed mine safety legislation with support from the World Bank. Despite these efforts, GMP Lao PDR was unable to record a quantifiable reduction in mercury emissions (Chouinard & Veiga, 2008). The GMP project summary report for Lao PDR also mentions that the government had low capacity and an insufficient level of rapport with miners to carry the program over once the GMP funding ended (Baker et al., 2007).

Sudan: The GMP Sudan program took place between 2004 and 2007 (Davis & Ibrahim, 2007). The first phase of the GMP Sudan chapter included the assessment of the socio-economic, health and environmental and micro-credit potential in the country (Davis & Ibrahim, 2007). In phase 2, GMP Sudan deployed Transportable Demonstration Units and a training-of-trainers campaign to provide trainings on geological concepts, ore concentration, amalgamation and health and safety issues, among other topics (Davis & Ibrahim, 2007). Trainers were expatriates, but they performed demonstrations using equipment that could be acquired locally. The program also distributed informational materials in schools and via television and radio broadcasts. The closeout report for GMP Sudan (Davis & Ibrahim, 2007) concluded that the team of highly committed trainers could have a great future training miners, but it is unclear whether this training continued after GMP funding ended.

Zimbabwe: GMP Zimbabwe, which took place between 2002 and 2006, carried out a number of assessments of the health impacts of mercury use in the area of implementation (Chouinard & Veiga, 2008). At the time of the GMP's implementation, the country was facing a significant economic crisis with almost 80% of the country unemployed and an inflation rate that reached 79.6 billion percent by November of 2008. A resulting environmental impact assessment showed that mercury in fish near mining areas was two to four times the healthy limit for consumption, but the main problem was miner intoxication from mercury vapours (Metcalf & Spiegel, 2007). Thousands of miners and several dozen trainers were trained on the impacts of mercury, health and safety at the mine site and improved recovery and processing methods (Chouinard & Veiga, 2008). Perhaps the biggest achievement of the GMP Zimbabwe program was its innovative awareness-raising method of community theatre, which reached more than 8,000 people (Metcalf & Veiga, 2012). However, due to a number of political and social factors, this awareness-raising program did little to modify artisanal miners' behaviour.

Critical Lessons from the GMP

Below is an indicative list of the important lessons furnished by the GMP project-wide as well as country programs (Spiegel & Veiga, 2005, Spiegel et al., 2005; Chouinard & Veiga, 2008; Sousa et al., 2009; McDaniels et al., 2010; Spiegel & Veiga, 2010):

- Technical and social training must be based upon exhaustive study of the mining sector's needs and context.
- Transportable demonstration units are effective for miners in remote areas, but local suppliers must produce or sell the demonstrated pieces of equipment.

- Important to demonstrate different techniques and let the miners to decide what is appropriate for them.
- Difficult to change attitudes regarding environmental degradation when impoverished miners have more pressing concerns.
- Miners do not have the patience to use alternative processing methods if they take a longer amount of time the methods they currently employ.
- Miners must see an economic incentive to change their behaviour. They are therefore less receptive to messaging around health impacts.
- The combination of lobbying with governing bodies at the local, regional, national and global level *and* field-based trainings for future trainers and miners was an important and effective methodological approach.
- Governments in implementing countries must have the capacity to monitor uptake in behaviour change on the ground after the program ends.
- Governments must be able to sustain the training process implemented by a project.

Project Indicators

Program-wide, the GMP developed performance indicators based primarily on attendance, such as the number of people attending training sessions or field demonstrations, the number of female participants and the number of health brochures. These indicators, while interesting in themselves, do little to illustrate the overall impact of the GMP's programming on the uptake of

new techniques or practices. For instance, the number of people attending a training-of-trainers session does not speak to what the participants learned or whether any of the participant-related indicators would be better complemented by qualitative indicators such as what people learned; observation of whether other miners who did not participate in the training sessions had begun to adopt new techniques; the number of pits that were backfilled six months after a training session among others. Indeed, according to McDaniels et al. (2010), *“in terms of actual mercury abatement, it remains to be seen over the long term how effective the interventions of the GMP actually were”* (p.250).

Strengths, Weaknesses, Opportunities and Threats (SWOT) of the GMP

Table 4.8 lists the key SWOT factors associated with the GMP. This analysis is drawn from both the literature and the author’s own opinion (McDaniels et al., 2010; Spiegel & Veiga, 2010; 2014).

Strengths	Weaknesses
<p>Drew local interest for its health and safety intervention program.</p> <p>Delivered training in a manner that was logical to miners.</p> <p>Brought training to the miners working in remote areas.</p> <p>Demonstrated to miners that it was possible to produce more gold without using mercury.</p> <p>Responded to official requests from governments of countries with a mercury in artisanal mining issue.</p>	<p>Suffered many bureaucratic challenges.</p> <p>Subsequent visits to GMP program countries reveals limited reduction of mercury use.</p> <p>Program never transitioned past the pilot phase.</p> <p>Did not incorporate effective monitoring and evaluation considerations into programming.</p> <p>Many of the indicators seem to have been defined after implementation.</p>
Opportunities	Threats
<p>Each country program sought implementation partners in relevant government ministries, local authorities, health organizations and miner associations.</p> <p>Governments in almost all of the implementing countries adopted some measure of formalization for their artisanal mining sector. They have since largely lacked the capacity to implement them.</p>	<p>The health and environmental impacts of mercury are difficult to detect immediately.</p> <p>Governments in implementing countries rarely had the capacity, organization, will or resources to continue GMP activities after the donor funding ended.</p> <p>Many of the artisanal miners involved in training were less concerned about the health impacts of using mercury than they were about providing for their families.</p>

Table 4.8 SWOT of the Global Mercury Project

4.2.2 Sustainable Artisanal Mining Program in Mongolia

The Sustainable Artisanal Mining Project (SAM) in Mongolia began in 2005 with funding from the Swiss Agency for Development and Cooperation. The objective of this program is to “develop an economically sustainable, environmentally responsible and human rights-based ASM sector in Mongolia benefiting from, and contributing to, global best practice regarding ASM” (SAM, 2016). Phases 1 and 2 of the SAM project piloted mercury-free processing methods, mainstreamed health and safety into the artisanal gold mining sector and sensitized the Mongolian government and general population on the realities of artisanal mining. Phase 2

specifically supported the Mongolian government to incorporate the artisanal mining sector into its mining code, which was reformed in 2010 (SAM, 2016). Phase 3 focused on assisting artisanal miners to become legal and organized workers, demonstrating best practice in environmental reclamation and occupational health and safety. Phase 3 saw the emergence of artisanal mining-oriented organizations like the National Artisanal Mining Federation (SAM, 2016). As of this writing, SAM is in the middle of Phase 4. The components of this phase are:

- Build human rights-based artisanal mining policy and community mining, which aims to help artisanal miners understand their rights and government actors understand their duty as rights providers to artisanal mining workers.
- Economic strengthening of all formal supply chain actors.
- Knowledge sharing and global artisanal mining policy dialogue (SAM, 2016).

The SAM project coordinates closely with regulators in the Mongolian government (SAM, 2016). SAM works with a sister project called the Engaging Stakeholders in Environmental Conservation (ESEC), which is funded by SDC and implemented by the Asia Foundation.

The SAM project has carried out or supported several types of training activities for artisanal miners. During Phase 3, in particular, SAM supported local capacity-building NGOs to hold training sessions for artisanal miners on the following topics:

- Gender mainstreaming in the artisanal mining sector
- Capacity building for local artisanal mining organizations on how to cooperate, how to manage organizational internal management, financial management, etc.)

- Business development training
- Small Grant Projects for artisanal mining organizations
- Occupational health and safety training
- Artisanal mining organization and formalization training, such as explaining the artisanal mining related aspects of the legal framework in a more comprehensible way.

Also during Phase 3, SAM built and supported three mercury-free processing plants, but was met with a number of challenges, notably over access to land, adherence to environmental standards, logistical difficulties for miners to reach the plants transporting all their ore and, according to Hayes et al. (2013) significant "*political or commercial dynamics at play*" (p. 7). However, as of this writing, two of the plants are still in operation.

Strengths, Weaknesses, Opportunities and Threats of the SAM Project

Table 4.9 lists the key SWOT factors associated with the SAM program. This analysis is drawn from both the literature and the author's own analysis (Hayes et al., 2013; SAM, 2016).

Strengths	Weaknesses
<p>SAM works iteratively with the government, informing policy makers of the project's progress and supporting the government with the design and improvement of its mining code.</p> <p>Operates as a convener with other artisanal mining country NGOs and government to share lessons, best practice and host site visits to artisanal mining operations in Mongolia.</p> <p>Uses a results framework, which has substantially enabled both internal and external stakeholders to monitor progress.</p> <p>Includes gender and human rights considerations in all components of the project.</p> <p>High responsiveness to feedback following external evaluations.</p>	<p>Mongolia has a unique artisanal mining sector with a responsive government, an artisanal mining population willing to follow regulation and a relatively small artisanal mining population. All these enabling factors are not necessarily present in other artisanal mining countries and therefore placing Mongolia as an example to be emulated might set other artisanal mining sectors up for failure.</p> <p>Phase 3 Mid-Term Review found that there was a lack of metrics to evaluate the effectiveness of SAM's OHS training.</p> <p>Evaluates some training programs through evaluation sheets, which is not very effective for measuring the long-term impacts of a training program.</p> <p>One training session is not enough for miners to internalize the information, but sometimes that is the only activity allowed in the budget.</p>
Opportunities	Threats
<p>Project enables South-South learning by hosting miners and policy makers from other artisanal mining countries, including a recent trip for Mongolian miners to the Philippines.</p> <p>Sharing lessons learned from SAM could help propel the positive impacts of the program to other artisanal mining countries.</p> <p>SAM's facilitation of multiple stakeholders in the Mongolian policy realm has supported changes and improvements in the country's artisanal mining legislation.</p> <p>SAM worked with the National Statistics Office to include artisanal mining in its national census. Now there are more concrete numbers on the sector.</p>	<p>The SAM project's main goal—to improve the level of formalization of artisanal miners—is dependent on the Mongolian government's capacity to support artisanal miners. The government seems to be in support of the artisanal mining sector, which is a positive sign.</p> <p>Much of the gold trade still operates underground. It is difficult for SAM to ensure that responsibly mined gold does not enter the grey or black market before or after it leaves Mongolia.</p> <p>Rush mining situations in Mongolia are difficult to manage and can undermine or influence the miners who have been trained in good practices.</p> <p>Many Mongolians—including government stakeholders—view artisanal miners as criminals, which impedes constructive dialogue.</p>

Table 4.9 SWOT of the Sustainable Artisanal Mining Project

4.2.3 Fairtrade Gold

Fairtrade describes itself as “*an alternative approach to conventional trade and is based on a partnership between producers and consumers*” (Fairtrade Labelling Organisation, 2011).

Fairtrade certifies producers who agree to meet minimum standards to manage the social, economic and environmental impacts of their activities (Childs, 2008). The Fairtrade Gold and Precious Metals project serves 16 markets in Latin America and East Africa (Fairtrade Gold, 2014). Fairtrade launched a project in the East African countries of Kenya, Tanzania and Uganda in 2012 with a three-year grant from Comic Relief. The Fairtrade Gold and Precious Metals Standard for Artisanal Mining provides assurances to downstream consumers that the gold was produced and traded transparently and the mining organizations that produced the gold were paid a fair market price (Fairtrade International, 2017).

In an article about the fair trade concept more generally, Hilson (2008) argues that this type of purchasing arrangement between artisanal miners and Western jewelers does little to improve the livelihoods of the former group. This is because the gold mined artisanally is used for foreign exchange, not goods like jewelry. Fair trade arrangements, which have been effective for other commodities like coffee and cocoa, should be adapted to the unique challenges in the artisanal mining sector. Those challenges are numerous and include entrenched middlemen, a largely informal sector and host governments who have very little will or capacity to support the miners. Moreover, a more effective target of these policies is governments in the producer countries, not the miners and the consumers.

The strengths, weaknesses, opportunities and threats of the Fairtrade Gold pilot are summarized in Table 4.10. This analysis is drawn from the literature and the author's own analysis (Childs, 2008; Stocklin-Weinberg et al., 2015).

Strengths	Weaknesses
<p>Raises visibility and profit margins for a selection of artisanal mining organizations or cooperatives.</p> <p>Provides crucial capacity development to Fairtrade artisanal mining organizations and cooperatives, including financial and numeracy training, business skills building, and instruction on topical issues such as environmental reclamation, occupational health and safety and more.</p>	<p>Price offered to miners often lower than market prices.</p> <p>Cannot target miners working under informal conditions or in remote areas because they do not meet the Fairtrade criteria.</p> <p>The certified amount of gold reported by Fairtrade in 2013-2014 was only 60 kg.</p>
Opportunities	Threats
<p>Fairtrade has learned from the South American pilots of Fairtrade Gold and is applying lessons to the East Africa pilot.</p>	<p>The trade arrangement is not really equitable for all the stakeholders involved.</p> <p>Removing middlemen from the trade relationship will fail.</p> <p>Requires constant presence and infrastructure to buy minerals at a better price than the middlemen.</p>

Table 4.10 SWOT of Fairtrade Gold Project

Chapter 5: Results

The results of this thesis address several key gaps in the literature on training artisanal miners. The first gap is related to miner motivations. As stated earlier, training programs to date have largely overlooked the motivations of the mining sectors they intend to serve. It is crucial for practitioners have a clear sense of why individuals are engaged in mining in the first place. A field-based Training Needs Assessment would fill that gap. The second gap relates to the scope of the training activities. For instance, some training programs have focused on classroom learning or workshops, such as the Sustainable Artisanal Mining Program in Mongolia. The limitation to workshops or classes is that miners cannot afford to leave their work for long periods of time. If classroom sessions are incorporated into a training curriculum, their length should be limited to an hour or two and should take place on days when miners would not normally be working. Thirdly, training programs have largely focused on themes around mercury reduction, health and safety and reducing conflict and human rights abuses in the artisanal mining supply chain. While these themes are important, it is also important to bear in mind that artisanal miners are entrepreneurs and they are often interested in earning more. Therefore, the training curriculum should include a component on increasing miner efficiency.

5.1 Field Results

The figure below depicts the development of a framework for training artisanal miners. The scope of Phase One included field observations of artisanal mining communities in Colombia, the Democratic Republic of Congo, West Africa and Tanzania. In Phase Two, the author developed research tools for a Training Needs Assessment based on observations in other

countries. The Training Needs Assessment tools were field-tested in Indonesia. The Training Needs Assessment formed the basis of Phase Three, wherein the author designed the Framework. An overview of the author's process for developing the framework is depicted in Figure 5.1.



Figure 5.1 Development of Framework for Training Artisanal Miners

5.1.1 Colombia

In 2016, the author carried out a Training Needs Assessment of several artisanal gold mining areas, comprising some 6000 miners, working within the concession of a conventional mining company in Antioquia, Colombia. The objective of this mission was to determine whether the miners wanted to undertake a coexistence agreement with the company. The vision was for the

company to provide technical assistance to a group of miners and a small plant for them to process their gold. In exchange, the miners would sell their processed gold to the company.

The author observed that the relationship between the company and the miners was fraught to the point that it was unlikely that coexistence could ever be part of the conversation. The major barriers for the miners to reach any kind of agreement with the company included:

- The author observed that the community leaders were angry at the company for its confrontational approach. In essence, the leaders felt that even when the miners played by the company's rules and sought a Memorandum of Understanding with the company, the community leaders were still treated like criminals. This lack of respect made the miners reluctant to cooperate with the company.
- From the company's side, the author observed that there was a lack of direction on how to manage the escalating situation. In exceptional circumstances, the company could request that the army intervene to deter the expansion of artisanal miners. In the absence of such an extreme course of action, there was no clear precedent guiding the relationship between the company and the miners. Although lower level employees did have close ties with locals, other representatives in higher positions were in open confrontation with the miners. This increased tension and the level of uncertainty.
- The author observed that the company treated the mining villages differently; some of the mining villages were given preference with respect to the company's corporate social responsibility program and one of the mining villages was being

vilified because their leaders were allegedly allowing foreign armed miners into the mining camps. This preferential stance was evidenced in the benefits the company bestowed on some villages and not others. For instance, the company built a community hall in one village but completely excluded another village from the benefits. The company did not seem to comprehend the internal dynamics of each of the villages, which ultimately led to more distrust and animosity.

- The company did not apply its own rules with respect to community engagement consistently. This lack of certainty about the rules of engagement was to the detriment of the miners who made an effort to modify their practices and meet the requirements for formalization. This also contributed to de-legitimize the capacity of the company to commit to work with the miners.

The Colombian case demonstrates the company's inability to view the miners as equals or potential partners. This stance undermined any corporate social responsibility initiatives or attempts at cooperation. In other words, the company's own actions bred distrust. A Training Needs Assessment was too pre-emptive at that stage. There were major conflicts on the horizon between the miners and the company. Indeed, only a year after the field work, six of the company's security forces were killed in an explosion when they were trying to shut down one of the artisanal mining tunnels (Rolfe, 2017).

5.1.2 Democratic Republic of Congo

In 2014, the author carried out a comparative analysis of the international and domestic efforts to reform the Democratic Republic of Congo's (DRC) artisanal mining sector of tin, tantalum and

tungsten (so-called ‘conflict minerals’).²⁶ The author observed that, despite the multitude of efforts to eliminate the presence of human rights violations and fraud in the tin, tantalum and tungsten supply chains, the miners themselves have not seen many improvements in terms of their mining techniques. The author made the following key observations:²⁷

- As of 2014, mineral supply chain due diligence and traceability programs were overly focused on human rights issues but economic prospects for the miners participating in these programs have not improved. In fact, there was anecdotal evidence that miners were receiving less for their product than before the conflict minerals programs came into effect.
- There seemed to be a lack of ownership, especially by miners, of conflict minerals programs. The majority of the miners and traders the author interviewed felt that the due diligence and traceability programs were operating at the behest of the government, but did not take the needs of the miners into account.
- Miners observed by the author in action were using very rudimentary methods and frequently mentioned that they preferred to receive funding to purchase better equipment.

²⁶ Such as the *Organisation for Economic Cooperation and Development’s Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas*. See OECD, 2016.

²⁷ It is important to note that some of these critiques have been heard by the iTSCi program and its most recent phase has focused more extensively on providing artisanal miners with health and safety training. See, for example, Iwundu et al., 2017.

The main insight drawn from the author's DRC observations is that the programs developed to reduce the incidences of human rights violations and fraud in the artisanally-mined tin, tantalum and tungsten supply chains were not based upon the wide range of needs of the mining sector. Instead, the goals of the programs were defined before any artisanal miner needs assessments took place in the DRC. That is not to say that the programs have not been able to achieve their objectives. Indeed, one of the due diligence and traceability programs, called the International Tin Supply Chain Initiative (iTSCi) program recently received a positive independent evaluation (Iwundu et al., 2017). Nonetheless, the conflict minerals interventions were launched because the donors were concerned about eliminating conflict in the DRC, not because members of the DRC's artisanal mining sector had requested that type of assistance.

5.1.3 West Africa

In 2012, the author carried out an artisanal mining sector profile for a gold mining company in the southeastern region of West Africa. The profile was meant to fill a crucial section of the company's Environmental and Social Impact Assessment (ESIA). The ESIA was required by the government before the company was granted expanded exploitation rights on the concession. The company was faced with a challenging situation, because several thousand artisanal gold miners were already working in the area of the concession where the company planned to expand operations. By the time the researcher arrived in the field, the conflict between the company and the artisanal miners had escalated to the point that the miners had blockaded the mine sites from any foreigners. The miners were wise to the fact that the company could not continue its expansion when there were artisanal mining activities taking place. The miners furthermore

knew that if the company could not complete a profile of the artisanal mining sector, the government would consider the ESIA incomplete. The researcher made the following observations during this field mission:

- The artisanal mining was taking place underground and the miners had not learned appropriate timbering methods. The working conditions were extremely dangerous;
- Many of the miners were migrants from neighbouring countries. These groups of miners brought with them processing methods such as using mercury and cyanide, from their more established artisanal mining sectors.
- Foreign miners had taught the local miners how to process their ore with mercury and, in some areas, cyanide. Mercury was being burned openly in public areas with children nearby.
- When the researcher asked if there were alternative livelihoods the miners would consider, the majority of respondents stated that there was nothing as lucrative as mining. All the miners were concerned that if the company resettled them to another area, they no longer be able to provide for their families.

Although the researcher did not inquire specifically if the miners would like to receive training, this context revealed a lot about the need for, but the likely reticence of, miners to receive any kind of technical assistance. This reluctance on the part of the miners was due to two factors: (1) The miners did not feel supported by the government. Likewise, the company was frustrated by the lack of government presence in the field and several employees told the author that the company was left to its own devices to attempt to resolve an issue that they felt was the

government's responsibility; (2) The miners were composed of locals and migrants. Their position in the area was tenuous because the company was putting plans in place to resettle the miners; and (3) The relationship between the company and the miners was extremely fraught, leading to a poor context for training. A training program would have made little progress in such a hostile and uncertain environment.

5.1.4 Tanzania

In 2015, the author carried out a Training Needs Assessment for several artisanal gold mining operations in Tanzania's Geita region for Fairtrade Africa. The author consulted Fairtrade certified and other miners, crushers and bosses and representatives from civil society. The author's key observations of the training needs of these stakeholders were as follows:

- The miners were most concerned about their lack of working capital. Indeed, the leaders stated that, because their turnover was so unpredictable, it was challenging to cover their operating costs on a daily basis. According to one owner, he was not even able to pay his workers regularly. The leaders felt that they could rectify this situation if a bank or another loan facility would be willing to finance the operation. However, no financial institution would provide a loan to the mining organizations because their activities were seen as too risky.
- Many of the miners consulted were more interested in receiving an equipment loan than training. According to the leader of one organization, his operations would be vastly improved if he could purchase a crusher. However, it is risky to loan mining organizations equipment because the miners could easily default on the loan. In

addition, by mechanizing its operations, the mining organization would be taking jobs away from the manual crushers, who are primarily women.

- Many of the miners who were not members of Fairtrade felt that member organizations were being given an advantage that they did not deserve. Fairtrade has strict selection criteria for the mining organizations and cooperatives with which it will work, and the other miners—who in fact make up the majority of the sector—are informal and therefore could not qualify for Fairtrade’s support.

The Tanzania case presented a complicated context for Fairtrade to implement a scalable training program for artisanal miners. The organizations who were already members represented very best of their sector, and even they were struggling to finance their daily operations. There were few options for the organizations to improve their situation aside from upgrading their equipment. That being said, even if Fairtrade provided the equipment, it would only benefit that singular organization and not the wider sector.

5.1.5 Indonesia

The results of the field mission in Bangka-Belitung and Jakarta, Indonesia in November and December, 2016 primarily cover how the Training Needs Assessment research tools were developed and how they performed in the field. The research tools were piloted on different types of informants and there were several unanticipated challenges or successes worth noting.²⁸

²⁸ An abridged and open source version of the Training Needs Assessment research tools is located in Appendix B.

In addition to the pilot of the Training Needs Assessment tools, the researcher made several key observations about the need for and likelihood of a successful training program in this particular artisanal mining sector.

The need for a training program in Indonesia's artisanal tin mining sector is high. The author observed a severe health and safety issues at the mine sites. In addition to health and safety training needs, however, the miners were quick to point out that they would prefer to learn how to improve the efficiency of their operations. The top training needs mentioned by the miners are summarized in the Table 5.1.

Training Need	Description
Prospecting	Prospecting activities are haphazard. Miners must learn how to identify sites with potential cassiterite mineralization.
Landslides	Landslides presented the primary safety risk in Bangka-Belitung. The miners must learn how to construct benches to reduce the overall slope angle. This will greatly reduce the numbers of landslides.
Mine site planning	Artisanal tin mining sites lack a mine site plan. The sites were constructed without information on the geology, location of mineralized zones, the cut-off grades, groundwater conditions, etc.
Safety measures for tin collectors ²⁹	Tin concentrate buyers perform initial processing of the ore before they sell it. Their practice of using dry shaking tables is not only detrimental to their health and the health of their neighbours, but it is inefficient. The collectors need training and demonstrations on how to operate wet shaking table technology.

Table 5.1 Training Needs in Bangka-Belitung

²⁹ Tin collectors are middlemen who collect cassiterite ore from miners and perform initial processing before selling the product to larger collectors.

There was a divergence in points of view on training priorities between experts and miners. Several healthcare workers were concerned about the prevalence of lung cancer in the province, which they believed was the result of miners handling radioactive material or excessive smoke from diesel engines. However, it is impossible to prove that the respiratory conditions were from mining or other lifestyle choices, like smoking. On the other hand, miners were most concerned about aches and pains resulting from their work. This disconnect between the experts' list of priorities and the miners' priorities would need to be rectified before the miners would want to participate in a training program.

In all, there were more barriers than opportunities for a training program's success. Indeed, the author met with several potential training champions, in this case, mine site bosses, but the conditions they set on the scope of the training program were restrictive. For instance, none of the champions wanted to receive training for more than an hour at a time, stating that they could not interrupt their work day. Moreover, many of the champions stated that while they would be happy to receive training, they were not confident that the miners working for them would want to adopt new techniques. The researcher observed the same trend with the tin concentrate buyers consulted: they were set in their ways and did not seem interested in learning about alternatives. Therefore, the likelihood that a training program would be successful in this context is low, in large part because the mining stakeholders are accustomed to working for themselves. Organizing into collaborative associations or cooperatives is a foreign concept.

5.1.6 Field-Testing the Training Needs Assessment Research Tools

The Training Needs Assessment research tools for the Indonesia case study consisted of question sheets for structured key informant interviews, semi-structured key informant interview guides, focus group guides and an OHS observation checklist for artisanal mine sites, adapted to Bangka-Belitung's tin mining sector.³⁰ The interview and focus group guides and observation profile covered the following topics:

- Identification of the common types of unsafe practices, injuries and fatalities at the mines.
- Assessment of the awareness of both regulators and miners of the main issues surrounding mine site safety and the short and long-term health impacts of mining;
- Identification of any gender disaggregation in health impacts on miners.
- Estimation of numbers of miner injuries and fatalities.
- Description of typical practices when there is an accident or fatality at the mine site.
- Observation of the key health and safety issues at the mine site and determination of the types of indicators that could be measured throughout the course of a training program.
- Estimation of mineral recovery rates and processing techniques to determine whether there are simple ways of improving efficiency.

³⁰ An abridged version of the research tools is located in Appendices A and B.

- Identification of key stakeholders' priority issues in terms of occupational health and safety in artisanal tin mining.
- Identification of potential training champions.
- Development of a preliminary implementation plan for a training program, including top level curriculum topics, a list of training participants and partners and a realistic timeline.

Mobilization Mission

The purpose of the mobilization mission, which took place in Jakarta, Bangka and Belitung, Indonesia, in November of 2016, was to make preparations for the field work. The mission included the selection of mine site for the Training Needs Assessment visits, courtesy visits to relevant government and non-governmental stakeholders as well as mine site bosses, potential training champions and other customary authorities. The purpose of these visits was to inform local authorities and mine leaders about the study so that they could arrange for the researcher to meet with miners. The key challenge during the mobilization mission was the **lack of time** allocated for this activity. In any training program development phase, the donor must be aware that **mobilization requires at least a month** of lead time and that it is an essential phase before any research occurs.

Key Informant Interviews, Focus Groups and Mine Site Survey

The **structured key informant interviews** were piloted with Indonesian academics, provincial and local level authorities, several NGOs, two independent smelters and several healthcare professionals in Jakarta, Bangka and Belitung, Indonesia in November and December, 2016. The

primary limitation of the key informant interview guide was that it was too lengthy, especially since the interviews were being translated simultaneously. On the other hand, the length of the question sheets produced a wealth of data once the interviews were completed.

The **semi-structured interviews** were field-tested with several dozen Indonesian miners, mine bosses, tin collectors and traditional authorities in Bangka and Belitung in December of 2016. Some miners felt uncomfortable being approached by a foreign researcher. This had nothing to do with the interview questions per se, but it could have been remedied if more extensive project mobilization had taken place prior to the arrival of non-Indonesian researchers. On the other hand, an equal number of male and female key informants were sampled, which produced a more reliable account of the gender-differentiated health impacts for miners.

The scope of the **focus group guides** covered most of the issues contained in the semi-structured key informant interviews. The guides also served as a consensus-building exercise to allow the researcher to triangulate the findings from the individual interviews. One of the drawbacks of the focus groups, however, was their length. Many of the participants were unable to remain for more than an hour, whereas the guides were designed for a two to three-hour session. That being said, the focus groups provided the facilitator with activities to build rapport within the group. This rapport-building made participants feel at ease and happy to share their points of view.

The **mine site observation survey** was piloted at four mine sites in Bangka and Belitung in December of 2016. The primary results of the observation survey are summarized in Table 5.2. The hazards were triangulated with miners and bosses during interviews and focus groups to

ascertain which ones were a priority and therefore merited training. Typical mine site safety hazards included landslides, equipment use, water, sanitation and hygiene and dust inhalation from dry processing.

Problem	Presentation	Risk
<i>High-level hazards: Engineering and work practice controls</i>		
Structural integrity	Landslides Equipment failure Unsecured waste facilities such as slag heaps or tailings dams	Severe injury, such as bone fractures or brain injuries Death
Ventilation	Ill-positioned ventilation intakes resulting in blockages or pumping fuel/exhaust fumes into mines	Chronic bronchitis
Insufficient, incorrect, inappropriate, inconsistent or no use of Personal Protective Equipment (PPE) to protect against physical and chemical hazards PPE is not adapted to women miners or diverse sizes	Dust Noise Heat stress Exposure to chemicals	Without boots, workers face risk of foot injuries Without clean face masks, workers risk dust or chemical-borne diseases Without ear or eye protectors, workers risk hearing or eye injuries Vision loss or eye injuries Minor to severe foot wounds Acute or chronic eye injuries
<i>Physical hazards</i>	Exposure to excessive noise Exposure to intense heat Excessive sun exposure	Vision or hearing loss risks exacerbated Sunstroke and dehydration
<i>Potential safety hazards: Chemical & biological hazards</i>		
Chemical hazards	Exposure to dust, fumes, vapors and gasses	Minor to severe respiratory conditions Skin conditions Silicosis Lung cancer
Biological hazards	No toilets or pit latrines on site Where there are toilets or latrines, they are not segregated by gender	Disease outbreaks that could infect miners and the surrounding and downstream communities
Working with open wounds	Miners working with open cuts and wounds	Minor to severe infections
Environmental risks	Standing water	Water or mosquito borne illnesses, such as malaria or dengue for the region

Table 5.2 Mine Site Risks in Bangka-Belitung, Indonesia³¹

The primary results of Training Needs Assessment pertain to the top occupational health and safety priorities for each of the key informant groups consulted throughout the course of the

³¹ Adapted from (Stocklin-Weinberg et al., 2017a.).

study. It is worth noting that male and female miners felt they were similarly affected by mining-related diseases such as dermatitis and illnesses resulting from a lack of hygiene. However, in terms of hazards, male and female miners face very different issues. As such, for the training curriculum to target the spectrum of miners in Bangka-Belitung, it would be essential that there are customized modules for men and women respectively.

5.2 Expert Interview Results

The expert interviews, which took place in Vancouver from June to August of 2016, highlight seven key themes pertaining to the common design errors of training practitioners and offer recommendations for how a training program should be designed. The first issue raised is that training programs often set unrealistic standards on the miners they are willing to support. Secondly, the evaluation of training programs has historically been overlooked or used as a box-ticking exercise rather than as a suite of activities which provide real insight on the program's level of success. Thirdly, training programs are rarely designed in a context-specific manner. Instead, the programs follow the goals and objectives of the donor without verifying that the miners are in agreement. The fourth key theme pertains to the position of the miners themselves and how challenging it is for them to change their behaviour, in part due to ingrained habits and the conviction that this is the way it has 'always been done.'

The final three themes provide guidance on how a training program should be designed, including: (1) The site selected for a training program must be based on reasonable criteria (e.g. it is not in the middle of a conflict zone); (2) Thorough stakeholder mapping must place before any training activities are launched to ensure that the right people are being engaged at

appropriate intervals; and (3) Every mining sector involves women and men. As such, the training curriculum should account for the different roles played by female and male miners.

5.2.1 Barriers

The artisanal mining experts consulted were concerned about a number of barriers for launching a successful training programs. Their largest priorities, in order of most frequently cited, are detailed in the sections below.

Training Targets the Most Privileged Miners

One of the most significant barriers for both training program practitioners and artisanal miners is the issue of access to training. Given that most donors and host governments only permit training for legal miners, the highest skilled miners are most often selected for training, not the worst performers who most need training. One expert stated, *“we know what best practice could look like and it's usually not possible to reach because of funding barriers... [the poorest miners] are going to be the hardest group to work with, but the ones who need the most help. Who are we really helping? We are advancing the field, but are we advancing the marginalized?”*

According to most experts, the majority of programs (training or otherwise) for the artisanal mining sector target groups who are the highest on the pyramid with respect to capacity, their ability to vocalize their needs, level of organization and legal status. Indeed, one expert states, *“this is happening with most training programs. We address the top of the pyramid but the agents who have the most needs aren't being targeted. [Training programs] are implemented in areas where it is most easy to implement them. Not only because the most demand is coming out*

of the more organized groups of miners. They can explain vocally what they need and they convince donors to support them with training activities. They have better access to training. Those who are not organized, just groups of diggers, women miners, scavenging the tailings, they have no voice. They cannot approach the project and say what kind of training they would need so they are often left behind.” That being said, organizations that deliver training are in a bind because such a high level of capacity of artisanal miners is what the market and donors have come to expect. As such, certification standards like Fairtrade and Fairmined are working within the parameters that their donors demand and therefore have limited influence in changing behaviours.

It is important to select the correct training participants, such as those with influence to change the practices of miners. In this way, the micro-miners with the lowest level of agency might still be reached via their supporters. However, striking a balance between selecting individuals who hold the trust of the miners *and* ensuring that the program is not just entrenching power, is challenging. According to one artisanal mining training expert, *"sometimes trainings can be really well-intentioned but not focused on what will actually advance or the priorities of their constituents and clients (in some cases)."* In order to avoid entrenching power, it is essential that the program have a firm grasp of the political economy of the mining sector before selecting the recipients for training.

The Fairtrade Gold program in East Africa and Latin America has strict core criteria for artisanal mining organizations to become members of the Fairtrade system and in turn receive training, financing and, eventually Fairtrade certification. Artisanal mining organizations

involved in Fairtrade are required to have extensive measures in place, including, but not limited to documented accreditation from the government, a policy for anti-corruption, a conflict minerals and human rights policy, a grievance mechanism, established chain of custody on minerals and others. (Fairtrade International, 2013). These requirements are completely unrealistic for most artisanal miners and essentially act as a barrier for their inclusion in Fairtrade.

Another telling example of a program for artisanal miners that aimed for the most elite of miners is the World Bank's Mineral Resources Governance Project, which ran from 2003-2012. The program had three primary objectives: (1) Strengthening transparency in the mining sector; (2) Institutional reform in the management of mineral resources; and (3) Promotion of private investments to enable value-adds to the minerals sector (The World Bank, 2012). One activity of the program was to set up a vocational program for artisanal gemstone miners at the Madagascar Geological Institute to provide basic training on gemstone processing and pricing. By the program's close-out, 195 miners had been trained (The World Bank, 2012). However, according to one Madagascar gemstone mining expert, *"the problem [prospective students] have is that the institute is too expensive, so it becomes an activity out of the reach of most Malagasy miners unless they can get scholarships."*

Because training programs tend to target the groups of miners who are easiest to work with, it is difficult for practitioners to duplicate their success with other types of miners. According to an artisanal gold mining expert referencing a training program for artisanal gold miners in East Java, Indonesia, for example, *"I think that one weakness is that in this particular*

program, [the NGO] picked the low hanging fruit. There are a few legal mining concessions and the vast majority are grey-market. We were able to work in an area that was easier politically. People were able to speak honestly because they weren't doing anything illegal. It was in an accessible area, not in a remote area. Just because it was successful, doesn't mean it should be cut and pasted in other areas." Another telling example is the wide introduction of the Borax method throughout the artisanal mining sector. Indeed, according to one expert, when Borax was piloted in one region of the Philippines, the government was so enthusiastic about the method that it was mandated all over the country—even in areas where the grade of the gold was unsuitable for that type of processing.

This is a fundamental tension for training practitioners—whether to target the “*lowest hanging fruit*”—the miners who have the means and incentive to improve their behaviour—or the more difficult groups to target, such as the miners who are poor, informal and most marginalized by the structure of the value chain—and most in need of training. A solution posed by some experts is to prioritize trainees such as mine bosses, investors or other authority figures who are not poverty-driven. These stakeholders have the incentive to improve their behaviour because they have already invested capital. They can then encourage their workers to adopt better practices as well.

On the other hand, one expert stated that some training programs go to the opposite extreme and target transient micro-miners, who do not have the agency or will to make changes to the status quo as a result of their training. This expert sums up the problem of targeting inappropriate recipients for training as follows:

- They are not champions who can disseminate new cleaner and more effective techniques to others.
- They work in small family groups dispersed on a large extension of land which makes difficult to access all miners.
- They are usually panners who work with small sluice boxes and have no funds to buy better types of mining and processing equipment.
- Individually, they are not the main polluters as they have very small operations. As many funds from the agencies are dedicated to environmental problems, such as mercury abatement, the micro-miners should not be the main targets.
- They produce very small amounts of gold or other minerals and usually do not mine as their primary economic activity. For instance, they combine mining with agriculture.
- They do not have time or interest in changing their methods or investing in new types of equipment if they are comfortable with the little production complementing their incomes.³²

Some training programs target micro-miners because their activities are the most conspicuous, that is, they are profiled the most in the public eye. However, this group of stakeholders have very little influence over changing the status quo—it is their bosses who hold the power to change miner behaviour. This does not necessarily mean that training programs have institute an

³² Artisanal tin miners in Indonesia are an example of this lack of interest in learning new techniques.

intentionally neglectful strategy. Several experts noted that for the majority of miners, their work is a survival strategy and compelling them to change their techniques to improve their impact on the environment or even their long-term health, is not going to ring true for them. According an expert, *"if, at the end of the day, the priority is to buy bread, pay the chief, then the environment is the last thing on his mind. Training isn't going to have maximum returns in these types of contexts."* Another related issue is access: informal, migrant or transient miners are often dispersed to sites in very remote areas. These sites are extremely difficult to reach, especially for researchers carrying out a Training Needs Assessment.

Training programs either target small numbers of high-performing miners who have no incentive to disseminate what they have learned to other miners, or they target micro-miners who are not really the source of the pollution. In either case, it seems that training programs base their training curriculum not on the actual composition and concentration of influence in that given artisanal mining sector, but rather on preconceived beliefs on ‘what works’ in training. The support of such ineffective programs diverts essential funding from other artisanal mining sectors in need of more support.

Training is not Designed in a Context-Specific Manner

Training programs should be based on the needs of the miners. If a Training Needs Assessment demonstrates that mining stakeholders do not want to receive training, but only new equipment, then it would be a waste of funds and time to launch a program in that mining area. Likewise, if miners have diverging training needs from the donor's priorities, the program must find a compromise. This seems to be common sense in terms of the actual success and failure of the

training process: the donors have their priorities, such as the elimination of mercury, and the miners have their own, such as to improve their gold production. If both parties can find middle ground, then success is likely to be reached. This is not always the case, as the agendas of the donors and the bureaucratic process for monitoring projects are usually very rigid.

If the training curriculum is accepted and deeply incorporated by the miners, the uptake of the cleaner techniques introduced to the miners is much more likely to occur. However, as mentioned before, the constant presence of trainers onsite is necessary to guarantee that miners will not return to the old polluting methods when the trainers leave the site (Veiga et al., 2014b). Moreover, it is helpful for miners to receive on-the-spot instruction. In these cases, governments must participate in the process and establish formal training programs.

Informality of Artisanal Mining Affects Everyone

Expecting uptake from miners is difficult, if not impossible, when they operate outside of the legal realm. Several experts emphasized that the formality issue needs to be addressed before miners receive any education. On the other side, however, authors like Veiga et al. (2014b) argue that if miners are formalized before they have received any training, their polluting behaviour will be formalized. One way to mediate this issue is to run side by side training pilots with a group of formal and a group of informal miners and assess the relative levels of uptake.

The majority of the world's artisanal miners are informal. Their situation is not going to change until they become formal, but the history of international interventions in the artisanal mining sector has shown that this cannot come from external sources. Indeed, according to one expert, *“the challenge is not only changing their mindsets, but also changing the minds of the*

researchers. ... [Artisanal miners] already know what the problems are, but they have no incentive to change... It goes back to informality—these people are confined to the informal space. A lot of my colleagues assume that if you rectify some of the legislative hurdles... that the parasitic actors will go away. But of course, they won't go away... The only way you change things is if you put the miner in the position to change. Empower them. You can't just give them money or a license, because this person owes the shark [a middleman] that money.... They need to change the situation on their own.” The solution to the issue of informality is not just a matter of ensuring that miners apply for a license. Indeed, formalization is a process, not an end. Rather, the key is to support them to learn what their ore is really worth and how to improve their efficiency. Indeed, more than half of the experts interviewed stated that the informality of most artisanal miners makes them reticent to invest in any type of change. Why would they, when their assets could be confiscated and they could be evicted from their place of work at any time?

Another serious problem that create hurdles for the formalization of artisanal miners is the lack of available mineral titles to give to miners once they receive a license. Two experts mentioned the cases of Ghana, Brazil, Colombia, Papua New Guinea, Honduras, Peru and Ecuador, where formalization has not achieved positive results because the mineralized areas, usually found by the artisanal miners, are already permitted out to conventional mining companies.

Habit and Inertia

Several informants pointed out that for artisanal mining sectors that have been active for generations, it is difficult for any program to compel miners to change their techniques because

the miners believe they are effective. This is one reason why it is so difficult to convince artisanal miners to stop using mercury: it has been proven to work, it is accessible and their fathers and grandfathers used it. Indeed, according to an expert, "*[it is challenging to] change behaviours and techniques through training when they have been doing it a certain way for a very long time; it has become engrained in their system, and change can only be accomplished through long-term engagement.*" This was also observed in the field with Indonesian artisanal tin miners and collectors.

This barrier is also a question of optics: miners may not take kindly to researchers or practitioners from other countries flying in and making promises of improvements and profits and then departing when the program funding runs out. It is therefore advisable to work with trusted messengers instead, such as individuals who already have a relationship with miners, existing skills and a financial stake in the sector. In other situations, like in the Brazilian Amazon, artisanal miners are migrants and do not create roots in the area. After the easily extractable mineral, in particular gold, is depleted, they move to another site, leaving behind a significant environmental degradation (Veiga & Hinton, 2002). The transient miners, then, are not ideal training candidates.

Evaluation of Training Programs is not Performed Effectively

Follow-up must be incorporated into the objectives of the training program, but it rarely is. One of the limitations is funding and the lifeline of projects and donor cycles. However, for training delivery to be deemed successful, there needs to be an endline survey and independent evaluation conducted after the training has taken place to determine its impact, successes and

pain points. Even if the program was relatively unsuccessful, the lessons uncovered by an evaluation would help other practitioners avoid the same mistakes.

An expert stressed that often project sponsors do not have a clear profile of the target group before designing and implementing a training program. For example, as most programs target the reduction of mercury in artisanal gold mining, the objective should be to work with the stakeholders who use and release large amounts of mercury per day. In these cases, the processing centers should be the main target, not the small groups of panners producing less than one gram of gold per day. Unfortunately, according to this expert, *“most projects avoid approaching processing centers as they have political influence and the owners are not interested in changing their miners’ exploiting characteristics.”*

It appears that either donors do not want to include monitoring and evaluation (M&E) in their budgets or the program implementers do not embed M&E into their programming. Nearly half of the expert informants stated that for evaluation to be effective, it has to include revisiting the sites that received training to ascertain whether miner behaviour has changed and whether there had been any uptake in new practices.

It is important to take a multi-pronged approach to monitoring the progress of a training program. According to an expert, if one were to ask the miner participants how they enjoyed the training sessions, more often than not they are going to say that they liked it because they hope for further assistance. To gain a more accurate picture of the training’s impact, follow-up visits must be embedded into training, where progress can be tracked, such as through production, such

as the ratio of gold extracted, in the case of artisanal gold miners and sales at equipment shops. Progress has to be observed.

Another expert pointed out that participant evaluations, which are usually given directly following a training session, are the standard method of evaluation. However, this practice alone does not provide much information about how effective the training has been—only long-term evaluation can do that. Anyone can give a positive evaluation, but that does not mean that they are going to put what they learned in the training into practice.

5.2.2 Attributes of Success

Appropriate Site Selection

As discussed in the previous section, the probability of a successful training program for informal of miners is low. It is important to engage early and often with the relevant ministries of government so that this stakeholder group is in support of the training program, involved and, in some cases, an implementing partner. Some of the other considerations for site selection could include the following aspects, some of which are mentioned in Veiga et al. (2006) and Siegel (2007):

- **Is it secure?** There needs to be an extensive security assessment prior to launching preparatory studies for the training program.
- **What is the level of political will?** The level of buy-in from the relevant agencies of government will enable all aspects of the training program.

- **What is the legal status of the miners?** The majority of donors will not fund a project that involves informal miners.
- **Is the site too remote?** If program activities are situated in a remote area, it will be difficult and costly for other miners to participate in training. Uptake will therefore be limited.
- **Is there a crisis occurring in the area?** For instance, if there are floods, conflict or political instability, the miners will not be able to participate in training activities.
- **Is there a mineral rush in the area?** Miners will not pause their activities to adopt better techniques when they are producing reasonably well or when there is a gold or other minerals rush, with thousands of miners at the same site.

Selecting suitable sites for a training program for artisanal miners is one of the keys to the program's success. If the context is unsuitable for the program, it may not make much headway. On the other hand, if the government is involved and in favour of training, the miners are organized and willing to learn, there is a reliable funding stream for start-up and a feasible plan for the self-financing of the program further down the line, then the program is more likely to see more success.

Key Stakeholders Must be Well-understood

According to one expert, *"make sure that the groups who are normally threatened, aren't. For example, you don't want women, who are usually the most marginalized, to be trained within earshot of the chief. You want them to be free to express their ideas freely."* Indeed, it is essential to spend time becoming familiar with the way the artisanal mining sector works; who the key

stakeholders are and what their needs and motivations include. There will inevitably be individuals or stakeholder groups who are threatened by a training program because it could affect their financial stake or influence in a given mining sector. Another expert asserted: "[we have to carry out a training program] in a way that is acceptable to the community at least and to the gate-keepers, who would put up the most resistance to training."

Gender Considerations

Women play various roles in artisanal mining operations that range from labourers to providers of goods and services such as meals, sex trade and small shops at the mine site (Hinton et al., 2003). The Global Mercury Project highlighted the importance of involving women from the artisanal mining sector in the training process since they care more about pollution and child abuse than male miners (McDaniels et al., 2010). Hinton et al. (2006) argue that many training sessions focused only on male artisanal miners and the information usually does not flow to the females involved in the operation.

Chen (n.d.) points out that women tend to be the most unrecognized and vulnerable members of the global informal economy. The artisanal mining sector is no exception. Women usually perform dangerous activities, such as burning amalgam, ignoring the long-term hazards of the activity (Hinton et al., 2006). In many parts of the world, women miners are often barred from the most lucrative mining activities, in part because of prevailing cultural beliefs that they are weaker or they bring bad luck to the mining activities if they work while pregnant or menstruating. (York, 2017). An expert expressed that "*women from artisanal mining communities, if well-trained, have much more power to implement cleaner methods than men,*

who usually do not see the health and environmental consequences of their work for their families and neighbours.”

Training Should Take Place in More than One Session

If the design and investment goes into hosting a one-off training program, held in workshop format, over the course of several days or weeks, it is not likely to bring about any measureable change in miner behaviour. Evidence shows that people need to be able to practice what they have learned for it to stick in their minds (Stocklin-Weinberg et al., 2015). Indeed, according to an expert: *“the next step is to get people to use it in a way that is relevant to them...they have to...make conclusions in their own life about what they've learned.”* This entails returning to the training topics in repetition, and to set the training at the miner’s place of work.

Train Trainers to be Teachers and Coaches before they Train Miners

Potential trainers, or champions, need to learn techniques for teaching and demonstrating new methods. Teaching does not come naturally to all people, so it is important that the trainers are given a foundation from which to launch their training activities. Traditionally, training programs have chosen trainers who are subject experts, but have overlooked whether they have ties to the community or any natural teaching abilities. According to one expert, rather than simply being subject experts, trainers need to know how to adapt the material *“to the audience, taking into account knowledge, skills and attitudes...If a practitioner can't explain a concept in simple terms in a way that someone is going to understand, then the practitioner doesn't understand it themselves.”*

Coaching, Mentoring and Remaining in Touch instead of One-Off Training

There are inexpensive ways for a program to measure any changes as a result of training activities. One way is for the training program to employ mentors and coaches to work at the mine sites who can be on hand for trainees to call upon should they run into difficulties or questions following the training. A mentor's job is to point miners toward the right source of expertise if they should have questions. A coach, on the other hand, is an expert in one area—for example, timbering—who lives in the region and is available to miners if and when they have questions.

Other simple and cost-effective ways to keep in touch with miners after training is to create Whatsapp or Facebook groups. These groups can be used as a forum to announce future training sessions, troubleshoot common miner problems and send out alerts, such as reminders on safety precautions to take once the rainy season begins. This type of monitoring through social media has been effective for Pact's artisanal mining programming in both the Democratic Republic of Congo and Zimbabwe (Pact, 2017).

Begin a Training Session by Building Rapport

The first hour of a classroom session should be spent with the participants and the trainer getting to know one another. Whilst the Training Needs Assessment assists with the development of a training curriculum, each session should open with the trainer receiving a recap from the participants of their training needs. Trust-building exercises and putting the participants at ease is an essential first step. The importance of building rapport with training participants was a key lesson from the Global Mercury Project. Indeed, according to Scoble (2006), one of the key

barriers for training participants, and indeed artisanal miners in general, is that the levels of trust are generally low. It is therefore essential to encourage “*cooperative behaviours*” between training participants, such as through games and other rapport-building exercises, before attempting to demonstrate new techniques (p.1).

Training Sessions Should be Interactive

For artisanal mining stakeholders, the most effective approach is to conduct training onsite using demonstrations with their own equipment. However, there are some concepts—such as the theory behind the new techniques the participants are learning—that do need to be taught in a classroom setting beforehand. In the classroom, it is important to get participants as involved as possible. Training sessions for artisanal miners in a wide array of contexts and multiple countries must be inclusive and interactive. Indeed, according to one expert: “*maximize participation ... and use a diversity of methods... [use case studies, examples, small group work, role plays, group and group assignments... these are] all better than giving a lecture.*”

Make the Training Worth the Participants’ While

If artisanal miners or their bosses participate in a training session, it means that they are losing a day or week’s income; this should be viewed as their in-kind contribution. As such, the training must contain transferrable skills that they can put to use right away. Very often, training sessions offer a small stipend to the miners for their lost day of production. This does not help develop a trustful environment between trainers and miners. According to an expert, in the GMP, for example, “*many miners would attend training sessions just because of the free food, not necessarily because they were interested in the training.*”

Training Involves Presence, Practice and Persistence

The participants of a training program are not going to learn all they need to know in one week or even six. Training should be a longer-term process so that participants can learn from repetition and practice. All learners need to be able to hear or read about a new topic more than once and artisanal miners are no exception. According to an expert, *“people learn by doing. 'I see, I know, I do.' You don't learn until you actually do it.”*

Chapter 6: Framework for Training Artisanal Miners

This chapter presents a framework on the design and evaluation of training programs for artisanal miners more broadly. Sound design is an important building block for a successful training program. Too often training programs are reactive to the specifications of their donor instead of taking the time to design a program that reflects the realities of the context in which the training will take place. Of course, the donor's priorities need to be part of the training program's design, but the donor is not in the field. Therefore, a training program for artisanal miners must be designed based on the country and culture in which it intends to work. This framework includes instructions on how to incorporate cultural sensitivity into every step of the training program. The instructions, then, do not differ per country or culture, but how the program is actually implemented is going to depend on those factors. Approaches of inclusive consultation, respect for culture and protocols, are global; how the programs ensure that those aspects are considered at every step of the training program is what will differ across mining sectors.

The development of the Framework for Training Artisanal Miners incorporates findings from the literature on training programs for artisanal miners, expert findings, acquired through interviews, and local knowledge, acquired through field research. The purpose of this framework is to understand where the perspectives of miners and experts align, whilst also designing indicators that are suitable for regulators, donors and communities (Roberts, 2005). According to Roberts (2005), *“ideally this merging of scientific and local knowledge would produce a set of indicators that would be both readily understood by members of the local community...while at*

the same time meeting the broad technical and legal requirements” (p. 44). It is important to note that this framework provides guidance on *what* to do in a training program, but not *how* to do it. The how-to—such as the goal of the program, the content of the curriculum and the training model employed—should be derived from an in-depth needs assessment and tailored to the individual mining sector and learning preferences of the training recipients.

Appropriate site selection and needs assessments *must* be the first step of any training program. It is important to note that regardless of how a training program for artisanal miners is designed, the results cannot be predicted in a foolproof manner because training involves people, and it is impossible to make failsafe predictions about how people will behave or react. That said, there are some steps that training programs can follow to reduce the risks. The following section outlines the steps to take to prepare for, carry out, monitor and evaluate a training program from artisanal miners.

6.1 Step One: Define Training Program Goal

The program goal articulates how the program is going to fulfil its theory of change (USAID, 2010). There are numerous training program goals.³³ Training program goals could include:

- Improved mineral recovery
- Increased participation of women in the mining sector
- Reduced environmental impacts

³³ See Indicators section.

- Improved sanitation and hygiene
- Better occupational health and safety practices or
- Reduction of mercury and other pollutants.

If the rest of the project components are designed and implemented correctly, then the development goal will be realized.

6.2 Step Two: Map the Key Stakeholders

There are many of different approaches to stakeholder mapping—indeed, there are entire consulting firms dedicated to the exercise. A stakeholder mapping activity need not be exclusively under the purview of experts; it can be done by an individual or team within the project, as long as the team includes people from the implementation country who have clear understanding of the dynamics of the artisanal mining sector.

Taking the example of a program with the goal of reducing occupational health and safety (OHS) risks for artisanal miners, the project team should carry out a brainstorming session on the following stakeholders who are:

- Involved in regulation and management of the sector
- Involved in the mining and processing
- Financing the miners
- Overseeing OHS at the mine site
- Running local clinics
- In charge of OHS-related legislation

- Other experts concerned with or researching key issues in OHS for the artisanal mining sector.

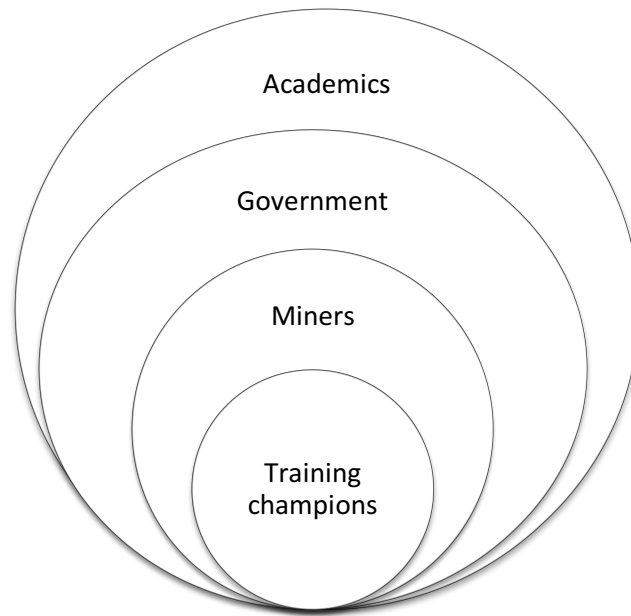


Figure 6.1 Simplified Stakeholder Map

This stakeholder map can be depicted visually, using a circle (Figure 6.1). At the center of the circle the team should write the anticipated recipients of training, then each layer of the circle moving outwards to the edge contain a stakeholder or group. The further from the center, the less influential that stakeholder would be for the training program (IDEO, nod).

6.3 Step Three: Develop a List of Miner Priorities

Figure 6.2 describes the sequence of conducting a gap assessment between what the training recipients currently know and the state of scientific knowledge on a given training theme.

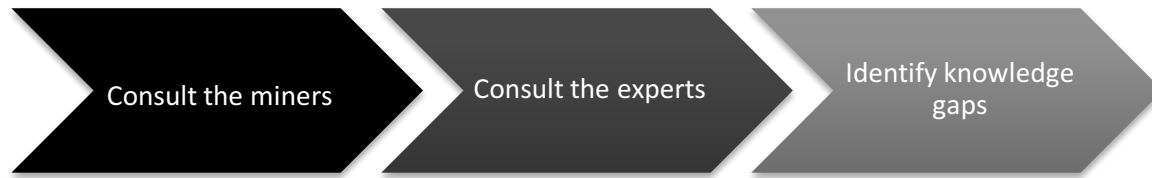


Figure 6.2 Identifying Miner Gaps in Knowledge

The Mental Models approach calls for the program designers to first establish a state of expert knowledge on a given issue. In other words, through expert interviews and a comprehensive literature review of the program's subject area, a list of key priority issues is developed.

According to Morgan (2001), *"the objective [of a list of expert priorities] is to construct a single description, summarizing the pooled knowledge of the community of experts...where there are disagreements and uncertainties, the summary must capture them as well"* (p.22). This list of expert priorities helps the program cross-check the state of scientific knowledge against what the future training recipients know: the gap between the two is where training will likely be most useful. However, in order to make the training program especially responsive to the needs of the users of the program, it is advisable to reverse these steps: begin by gathering the state of knowledge and motivations of the miners and then cross-check the key themes with the experts. The consultation of the miners should be done through a Training Needs Assessment, which is discussed in the next step. It is likely that the priorities of the miners will differ from those of the experts, so consultation and discussion with the miners is an important way to establish gaps. Knowledge gaps are wide-ranging, but are essentially the methods miners employ that are misaligned with established best practice in that area.

The list of expert priorities is not complicated; it is simply a means of capturing the key problems and priorities related to the training program's goal. Returning to the OHS training program example, then, the experts could include health care practitioners, academics in OHS and mining disciplines, representatives from large-scale mining companies who regularly interact with artisanal miners, among others.

6.4 Step Four: Carry Out a Training Needs Assessment

A Training Needs Assessment consists of a suite of activities which lay the foundation for the training curriculum and program itself. The length of time of a Training Needs Assessment varies from program to program, but the amount of time it takes should not be underestimated. The Training Needs Assessment serves a double purpose: it is a crucial way for the program team to make a smooth entrance with key stakeholders and it gives the program team the opportunity to get to know the miners, including their needs, motivations and desire for training, and build trust and goodwill. If this phase is rushed, the program will be unsuccessful. A Training Needs Assessment should take place over several phases, which are detailed in the sections below.

6.4.1 Phase One: Mobilization

Project mobilization is an important first step for the program team to introduce itself to the key stakeholders in the program. If this step is overlooked, it can lead to significant challenges further down the line and potentially even the project's rejection from the country. A project's mobilization mission—particularly its length—varies depending on the country, but more broadly, it should take the following steps:

1. **Prepare external communications.** The project team should mail or hand deliver letters informing the relevant government agencies about the goal, timeline, permit status and donor for the project. Letters should be written in a culturally-appropriate manner. In some countries, it may be necessary to meet with officials in person after they receive a mobilization letter.
2. **Select sites** to determine whether they are adequate to implement a training program, based on the program's selection criteria. The site selection criteria vary from program to program, but it should include at the very least: (1) Sites that are politically stable and not experiencing a rush mining situation; (2) Early contact with the mining sector has shown that there is a willingness to learn; (3) There is government support; and (4) There are potential and willing local partners, such as a vibrant civil society or a university or vocational institution.
3. **Visit sites** to consult people about the project or study, its goal, timeline and, where appropriate, funding. At these visits, it is important to meet with local authorities such as chiefs and mine bosses and answer any of their questions. These stakeholders will help select miners for the research team to consult. The courtesy visits ensure the team has an itinerary for the Training Needs Assessment visit. Naturally, the schedule will likely have to be adjusted during the mission, but it is good to have an initial plan and contingency plans in place before the Training Needs Assessment begins.

6.4.2 Phase Two: Design the Training Needs Assessment

The content of a Training Needs Assessment varies depending on the goals of the program, but its general purpose is to assess where the miner knowledge or skills gaps lie, which topics most interest the training recipients and generate ideas for how to address them. Depending on the goal of the training program, the stakeholder groups most in need of the training may not even be miners, but rather mine bosses, members of the government or other stakeholders like customary authorities, financiers and so on. It is important that a multi-disciplinary team conduct the Training Needs Assessment so that the social, political, economic engineering, environmental and occupational health and safety aspects of the artisanal mining sector are sufficiently captured. The Training Needs Assessment also results in the nomination of potential trainers who are willing and able to train artisanal miners in the future.³⁴

6.4.3 Phase Three: Select Trainers and Use Context-Appropriate Tools

Trainers can be referred to as training champions. Champions can come from any part of the mining sector. They can be members of government, traditional authorities, mine site bosses, academics, NGOs and others. The criteria for selecting local training champions varies from place to place, but it is important that at a minimum they are charismatic, hail from the area or the country, are trustworthy and committed to improving the lives of artisanal miners. These secondary trainers will act as trainers to support the transformation of the techniques used by the miners.

³⁴ See Appendix B for an abridged version of a Training Needs Assessment research tools.

6.4.4 Phase Four: Develop a Training Curriculum with the Trainers

The training curriculum is the outcome of extensive and ongoing consultation with training champions and miners, both during the Training Needs Assessment and beyond. The curriculum topics should be based on a marriage between the project's goals and the needs, knowledge gaps and training preferences of the miners. Developing the curriculum should include the input of the mining leaders and the individuals who will be receiving the training. The curriculum should accommodate the non-traditional learning styles of adults who may not have received a formal education. The curriculum development phase also serves as a crucial opportunity to consult the training champions on how the training sessions should be structured. Bear in mind that training champions and miners have other jobs and commitments, so the training-of-trainers sessions may need to take place in shorter sessions over a longer period of time. It is also important to include a suitable combination of practical, onsite and theoretical modules, as well as content that is tailored for both male and female miners.

6.4.5 Phase Five: Train the Trainers and Select Finalists

The primary trainers will likely be outsiders and content experts from other parts of the country who will train future training champions. The scope, format and duration of the training-of-trainers sessions will depend entirely on the findings of Phase Four. After the training-of-training program is completed, the top performing graduates of the training program are then recruited as fulltime coaches for the wider mining sector.

6.5 Step Five: Develop and Implement a Monitoring and Evaluation Plan

The artisanal mining sector is a notoriously difficult area in which to set and fulfil development goals. Indeed, it is challenging to develop clear indicators to measure the success of a program because there are a number of factors that cannot be controlled. Some of those challenges have included:

- Low government presence in the mining area and lack of trained mines inspectors to inspect and monitor working conditions, methods and degree of formalization.
- Low enforcement for miners if they work outside of the law.

That being said, there are suggested approaches in the literature on that should be incorporated into an M&E plan for a training program. Those approaches could include (Sousa & Veiga, 2009):

- Develop a **scorecard** to assess the extent to which the training recipients have implemented new techniques. The scorecard exercise should be implemented 120 days after the training session(s).
- **Prioritize indicators:** The indicators that the donor wants to measure should be cross-checked against the indicators that are prioritized by potential training recipients. Each of the indicators should be: (1) Measureable; (2) Directly linked to the program goal; and (3) Ranked in order of their feasibility of achieving them. The United Nations Development Program (UNDP) advocates for development programs to design SMART indicators, that is, indicators which are Specific, Measurable, Attainable, Relevant and Trackable (UNDP, 2009).

Table 6.1 provides some sample indicators that could be used to monitor the progress of training programs with different kinds of goals. The 'questions to ask' column serves as a non-exhaustive list of guiding questions the program can ask as it develops its own indicators. This information was drawn from a literature review and the author's field observations (Sousa et al., 2009; Sousa & Veiga, 2009; Veiga & Baker, 2004).

Goal	Questions to Ask	Indicators	Data Collection Method
Improved recovery	<p>Have miners stated that their recovery has improved since they participated in the training? What kinds of evidence of improvements have they provided?</p> <p>Are there higher yields and evidence in the region of a technology switch?</p> <p>Have training participants implemented any of the technology introduced in the training sessions?</p>	<p>Production has increased by x% (compared to a baseline).</p> <p># of improved equipment being used to concentrate minerals.</p> <p>Types of goods local shops are selling change. Shops become bigger (demonstrates improved purchasing power of miners).</p> <p>Mineral recovery has increased by x%.</p>	<p>Interviews with miners and collectors</p> <p>Observation checklist</p> <p>Visit local shops and interview shop-keepers</p> <p>Onsite tests of recovery and early processing</p>
Participation of women in training	<p>Has the training led to more inclusion of women?</p> <p>Are women playing larger and more lucrative roles in the mining sector?</p>	<p>How many women attended the training.</p> <p>How many times women spoke up and for how long.</p> <p>What kinds of issues they raised.</p> <p>Whether they engaged leaders in a discussion.</p>	<p>Observation</p> <p>Interviews with training participants, both male and female</p>
Formalization of miners	<p>Are miners who attended training registering with the mining authority?</p> <p>Are there more people enrolling in classes or interacting with the government in ways that allow specific agents to fulfil their mandates?</p> <p>Are mines inspectors receiving requests for guidance from miners in</p>	<p># of miners applying for licenses after training.</p>	<p>Interviews and surveys with miners</p> <p>Interviews and surveys with relevant government officials</p>

Goal	Questions to Ask	Indicators	Data Collection Method
	terms of site safety?		
Environmental management	<p>Is there reduced air, soil or water pollution at and around the mine site?</p> <p>How does the extent of land degradation a given period of time after the training, such as 3, 6 or 12 months after the training different than the recorded baseline levels?</p> <p>How many miners who received training have adopted cleaner techniques?</p> <p>How many miners who received training have adhered to proper tailings disposal practices?</p>	<p>Whether miners involved in training implement are refilling old pits.</p> <p># of cleaner techniques adopted 1 year after training; 2 years after training.</p> <p>Miners who participated in training exercise proper disposal of tailings.</p>	<p>Onsite observation check-lists</p> <p>Miner interviews and surveys</p>
Improved mine site sanitation	<p>Are miners taking measures to improve sanitation around their sites? For instance, are latrines properly built?</p> <p>Are malaria prevention measures being employed?</p> <p>Are there water filtration systems in place?</p> <p>Is food being prepared onsite?</p> <p>Where do miners get their drinking water?</p> <p>Where do miners bathe?</p> <p>Where do miners urinate and defecate?</p>	<p>Water filtration system installed.</p> <p>Central garbage disposal system implemented 6 months (or 1 year) after training.</p> <p>Malaria prevention measures taken at x number of sites.</p>	<p>Onsite observation checklists</p> <p>Interviews with health officials</p> <p>Interviews with miners and bosses</p> <p>Surveys</p>
Improved mine site safety	<p>Are miners taking breaks?</p> <p>Are miners involved in heavy lifting?</p> <p>Are there fewer major injuries? Are there fewer deaths? Or more deaths being reported that would have otherwise gone unreported?</p> <p>Are more people wearing PPE onsite and correctly?</p> <p>Are local shop owners reporting that</p>	<p># of miners wearing fume masks 6 months or 1 year after training.</p> <p># of miners wearing personal protective equipment, such as masks, gloves or sun shielding clothing 6 months or 1 year after training.</p> <p>% of pits with slope angle at 45 degrees 6 months after</p>	<p>Observation checklists</p> <p>Interviews with health officials</p> <p>Interviews with miners and bosses</p> <p>Surveys</p>

Goal	Questions to Ask	Indicators	Data Collection Method
	<p>more helmets are being sold?</p> <p>Are miners taking proper measures to prevent dust inhalation?</p> <p>Are miners taking proper measures to prevent fume inhalation?</p> <p>Are slope stability measures being taken?</p>	training.	
Mercury reduction	<p>Was mercury reduced?</p> <p>Level of biota (e.g. in small fish) measured in soil, sediment, water, or air in baseline assessment compared to post-intervention.</p>	# of retorts used 6 months, 1 year and 2 years after training.	<p>Interviews with miners</p> <p>Observation at mine sites and processing facilities</p>

Table 6.1 Examples of Indicators based on Different Training

6.5.1 Monitoring and Evaluation Plan in Detail

Figure 6.3 depicts an example monitoring and evaluation plan from an artisanal mining training program proposal.

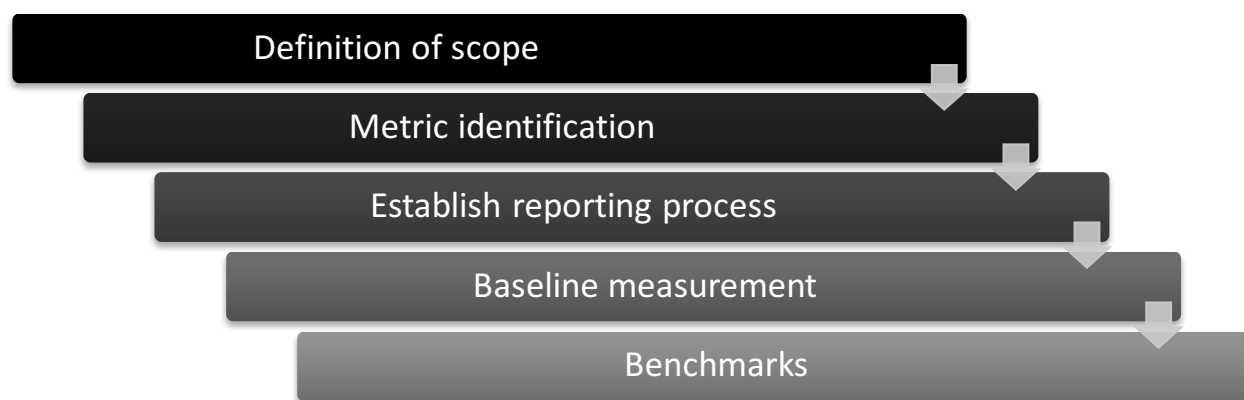


Figure 6.3 Example Monitoring and Evaluation Roadmap

Definition of scope. Define key positions, team authority structure and accountability levels and reporting structure. These activities should take place during an early Training Needs Assessment phase of the program.

Conduct a baseline. Conduct a baseline assessment to develop a manageable list of indicators. Refine an approach for how to collect baseline data, which includes: (1) Identifying the required sample size; (2) Setting a measurement period; (3) Ensuring statistical validity; (4) Planning for data collection; and (5) Defining standard procedures of data collection. Baseline data provides important information to aid in monitoring the benchmark targets for M&E during the project's implementation.

Set Project Indicators. Ensure agreement between all project proponents on which indicators should be measured. Indicators should be SMART, in order to monitor the progress of the project's outcomes, outputs and activities, agreed upon frequency and method of collection, benchmark targets, data collection schedule aligned with project outcomes, outputs and activities and a system for validating data (UNDP, 2009).

Establish reporting process. Quarterly or semi-annual monitoring of performance indicators is recommended. The program should also embed plans to monitor and communicate and validate results as it progresses.

Implementation. During the program's implementation, a local partner should carry out a status mission to measure the progress of project indicators. The purpose of this activity is to compare the target indicators to the actual metrics at that point in time.

Review: A post-situational analysis or independent evaluation should take place following a pilot period. The purpose of this evaluation is to provide an overall assessment of whether the program goal has been met thus far. A significant gap found in the literature on training programs for artisanal miners was the lack of uptake of training programs in terms of a change in miner behaviour. Or, if there was any change in behaviour, those changes were not recorded because the program's funding had ended and there were no budgeted follow-up visits. This is a loss, not only for that particular program, but for new training programs that might repeat past mistakes or reinvent the wheel.

6.6 Step Six: Launch Coaching Program for Miners

Artisanal miners, like most adult learners, will grasp new techniques only through repetition. Therefore, having trainers, or coaches situated nearby to support the miners on a regular basis is more effective than one-off trainings. The frequency of coaching sessions or the actual content of the instruction will depend from program to program, but it is suggested that at a minimum, the following considerations are taken:

- Use language and teaching methods that people understand; do not be condescending.
- Reduce the number of words and increase the number of pictures with examples.
- Provide several options for the mining and processing techniques.
- Make training accessible to everyone. It is important to prepare sessions that can accommodate people who are illiterate as well as sessions that accommodate people

with limited time. If women are participating in training, make sure that childcare is available.

- Introduce equipment that miners can afford and access locally. It is futile to implement training when the miners will not be able to apply what they have learned.

6.7 Applicability to Other Development Issues

While this framework is targeted for a training program for artisanal miners, the steps outlined are useful for development programs more broadly. Indeed, a needs assessment should be the first step for any type of behaviour change program, regardless of the sector. According to Henrich et al. (2011), *“preferences or expectations are affected by group-specific conditions, such as social institutions or cultural fairness norms”* (p. 75). Such information can only be obtained by getting to know the future program recipients.

Scoble (2006) argues that trust is the basis for which actors will improve their performance. With improved trust, individuals will engage with one another more cooperatively, which will in turn reduce the risk of their economic activities. Indeed, according to Scoble (2006): *“in situations where risk exists for both parties, trust is important....serving as a type of coping device...the need for trust becoming increasingly important, as the amount of risk increases”* (p. 54). Building trust is important not only between the individuals who are the targets of the training program, but also between the program and the program’s targets. The first step for building trust with the people on the ground is to be present and understand their needs and motivations. The behaviours of each of the sector being targeted for a training program need

to be examined closely before a program attempts to change them. This is where a Training Needs Assessment comes in. However, above and beyond the Training Needs Assessment, it is essential that the program continue to build that trust on the ground by maintaining a constant presence.

Chapter 7: Discussion

The findings of this study confirm that while the design of a training program for artisanal miners is a challenging endeavour, if it is done thoroughly and in a consultative manner with the individuals the program is going to serve, it can be successful. Thoughtful program design and engagement with local leaders are essential. Artisanal miners are a unique stakeholder group with very different characteristics depending on the geographic location and a training program to address their needs involves a great deal of contextual knowledge, and groundwork, clearly stated goals that line up with the priorities of the program recipients, a long-term plan for engagement and a deeply responsive and adaptive strategy to monitoring and evaluation.

7.1 Revisiting the Hypothesis and Research Questions

The study's hypothesis is, *when a training program for artisanal miners is launched and carried out in a measureable way, it is a vehicle for positive behavioural change, such as improved occupational health and safety or production. Knowledge-transfer is a sustainable way to improve the artisanal mining sector.* This study responds to this hypothesis, but it is important to note that behavioural change in the artisanal mining sector requires a minimum of six months to a year before the outcomes of the training become evident. As such, the results of this thesis focus on the sound design and launch of a training program so that it can be set up for success, rather than the actual observed behavioural change resulting from a training program.

7.1.1 Barriers for Behaviour Change in the Artisanal Mining Sector

The first research question, *what are the barriers for behaviour change in artisanal mining communities*, is not straightforward to answer because there are so many barriers to bringing about real change in the sector. The real issue is how to overcome those barriers. The first barrier raised by the expert interviewees is that current training interventions usually select sites and participants that are the most accessible, skilled and vocal about their needs. Indeed, this was the case in the Indonesian field sites visited. The training program's donors were usually unwilling to work with informal artisanal miners because the government general looks down on it. In Indonesia, for example, it is the informal actors—particularly, in this case, the miners and tin collectors and processors—who are involved in the most unsafe mining and processing practices. This phenomenon, wherein informal miners face the highest risks to their personal safety, is unfortunately present in most artisanal mining countries (Veiga et al., 2014b; Hilson & Van der Worst, 2002). It is a mistake that formal miners are prioritized for training over informal miners because less than 1% of the world's artisanal miners are indeed operating formally (Marshall & Veiga, 2017). Moreover, formalized miners are not necessarily working with best practice methods and even if they do receive training, it is not guaranteed that they will assimilate the new concepts without sustained support.

The second barrier raised in this study's results is the lack of monitoring for ongoing training programs. This issue stems from two sources: one is that donors are happy to fund pilots, but a full-blown training program would take too long and would be too costly for most donors to entertain. Monitoring and evaluation for shorter projects with a limited funding stream is

usually neglected. An example of the challenges some training programs face with M&E lies with the Uganda Sustainable Management of Mineral Resources project. The independent program evaluation pointed to several instances throughout the program's lifespan where the M&E plan was missing a complete logframe or the indicators were not applicable to the project's goals. It is difficult to evaluate the impact of the project, especially in the training arena, without these crucial elements (Independent Evaluation Group, 2014).

The third major barrier revealed through this research is that training programs are not designed in a context-specific manner. The results of the study in Indonesia's tin mining sector make a clear case for the need for preparatory work before a training program is launched. This preparation includes a sufficient amount of time for study mobilization, not least because authorities—both traditional and official—appreciate an in-person introductory meeting before they agree to facilitate a Training Needs Assessment. Likewise, mobilization is a trust-building activity; it is necessary face time that stakeholders in artisanal mining sectors expect. Indeed, as Veiga et al. (2014b) point out, training takes time, presence, persistence and patience. If the program team does not take the time to understand the mining sector's context, miner uptake will be hard to achieve. No one will attend the training if they do not understand why it is beneficial to them or if the curriculum is not based on their own priorities.

The finding that training programs are rarely designed in a context-specific manner is in line with Siegel's conclusions. In essence, Siegel (2007) argues that training programs often misinterpret the needs of miners because they have not first gathered crucial information about the unique mining sector, including their household income, savings and levels of expenditures.

Hilson & Maponga (2004) further argue there is a critical lack of “*anthropological information*” about the artisanal mining sector (p. 30). Consequently, governments and international organizations are unable to address the challenges that artisanal miners face on a daily basis.

The fourth finding on barriers is related to the issue of the artisanal mining sector’s informality. This topic relates back to the tendency of training programs to select the mining populations that are the easiest to work with. However, the miners who need training the most are often overlooked. For example, Stocklin-Weinberg et al. (2015) found that Fairtrade selected artisanal mining organizations that already had some degree of business acumen and organization. Their health and safety and environmental impacts were not as severe as the informal miners working in the same region of Tanzania. Likewise, the researcher found in Indonesia that the illegal mining areas—namely, offshore and in protected forests—were where the most detrimental practices and impacts were taking place.

The fifth finding is that it is very difficult to change miner behaviour due to ‘habit and inertia.’ Some artisanal mining sectors—especially in countries like Ghana or Burkina Faso, where there is a long history of artisanal mining—may be reluctant to change their techniques simply because an international NGO or academic has told them to do so, and especially if the program does not consider the socioeconomic circumstances of that mining sector (Hilson, 2006). This issue is the very heart of the mercury debate in the literature: why, when practitioners have been trying to reduce the emissions of mercury in artisanal gold mining, have so few programs been met with success? One of the principle reasons is that *mercury works*; it is an inexpensive and rapid way for miners to process their ore, which means cash in hand for the

miner (Spiegel et al., 2015). In a similar vein, the researcher found that in Indonesia's tin mining sector, individuals would process their ore using dry shaking tables, which is extremely detrimental to human health as the dust includes heavy metals, because that is the way it has always been done in that sector. Getting ore processors to change that perception requires many demonstrations and positive interactions between trainers and trainees. Likewise, in visits to Tanzania and West Africa—two artisanal mining sectors that were subject to extensive mercury-reduction efforts during the Global Mercury Project in the early 2000's—the author found the use of retorts and fume hoods to be extremely low. Even in the same areas where GMP activities had taken place in West Africa, many miners were unaware of the mercury retort's function (Weinberg et al., 2012).

That being said, habit and inertia can be reversed if the practitioners are patient and focused on building trust with the key mining stakeholders and perform repeated demonstrations of alternative and safer techniques. Small victories are important.

7.1.2 Attributes of a Successful Training Intervention

The second research question, *what are the attributes of a successful training program for artisanal miners*, was answered via the key informant interviews, observation and focus group discussions in the field. That being said, the results of the literature review were aligned with the results of key informant consultant. However, much of the literature on training in the artisanal mining sector is focused on what has gone wrong,³⁵ rather than what techniques contribute to a

³⁵ See, for example, Siegel, 2007; Hilson et al., 2004.

more successful program. Success in a training program—namely, that the program beneficiaries have implemented the techniques they learned in the training, taught others to do the same and there has been a real and positive change in the baseline levels of indicators—cannot be detected for the first several years. Unfortunately, the majority of training programs are usually only funded for a year or two. However, there are methods, or attributes, that set the program up well to see small improvements.

The attributes of a successful training program include:

1. Know the context and the operating area by carrying out a Training Needs Assessment, which includes mapping the key stakeholders and consulting miners and other key stakeholders about their needs, motivations and skills in mining, their relative willingness to change their practices and how they might diversify their activities.
2. Discuss an appropriate curriculum and how it should be implemented with the future training participants.
3. Launch a training program.
4. Monitor the program's progress.

The first attribute of a successful training program is the importance of **understanding the context and training needs** of a given artisanal mining sector **before** launching the program. An evolving stakeholder influence map proved to be instrumental throughout the course of the Training Needs Assessment in Indonesia. In fact, as the landscape of influential stakeholders tends to shift in any artisanal mining sector, especially at the government level, mapping the stakeholders is important, but a political economy assessment is also essential. Likewise, as

Spiegel et al. (2014) argue, in the evolving space following the ratification of the Minamata Convention on Mercury, it is going to be more important than ever for GEF grant recipients to engage at the local level. Mercury emissions will not be decreased until training and capacity development programs for artisanal miners are cognizant of and responsive to the value chain.

Every Training Program should include a Training Needs Assessment. There are various methods for conducting a Training Needs Assessment, but it is important that the study places a heavy emphasis on consulting all stakeholders involved in the supply chain. The key informants list should include, but not be limited to:

- **Government.** Representatives from ministries that engage with the scope of the training program, such as the Ministry of Mining, Health, Environment, Trade and other relevant authorities. Make sure to include members of government at central and local levels.
- **Traditional authorities.** This group could include the mayor, chiefs, mining village heads, mine bosses and religious leaders, among others.
- **Expert informants.** Academics, subject experts, doctors and other clinic staff (if the training program focuses on health and safety), members of NGOs (local and international) and CSOs focusing on the artisanal mining sector.
- **Mining stakeholders.** Large-scale mining companies, artisanal mine site team leaders, artisanal miners, including men and women, ore processors, transporters and service providers.

A dissemination mission is a critical way to gather feedback from the training participants and ensure their participation in the design of the training program. Dissemination—in this instance, meeting with the different key informants one-on-one—makes the recipients of a future programming feel included and respected. Indeed, as Veiga et al. (2006) argue, it is important to build a rapport with the key stakeholders. If that rapport is not built from the outset, the program could receive limited interest on the ground.

The third attribute of success can broadly be grouped as **techniques for launching the training sessions themselves**. Veiga and others advocate a training-of-trainers approach in order to maximize the potential uptake of the training (Veiga et al., 2006; 2014b). The training-of-trainers sessions should include both theoretical and practical components so that when the trainers go to the mine site, they are equipped with well-rounded knowledge. Once the trainers receive training, they then act as coaches for miners on a daily basis. Miners do not have time to stop their activities to participate in training, so trainers need to be present at the mine site, supporting the miners to implement improved practices. The idea of coaching and mentoring was raised several times by both the expert interviews and throughout the course of the fieldwork in Indonesia. Artisanal miners are adult and non-traditional learners, which means that their education in the artisanal mining sector has largely consisted of learning from more experienced miners and by trial-and-error. As such, the training program must tailor the activities to the ways they learn best. Coaching and mentoring mimics the ways in which artisanal miners are accustomed to learning. Indeed, this was the key feedback from the miners and bosses consulted during the dissemination mission in Bangka-Belitung. This group of key informants stated that they would prefer to receive instructions from either someone they know and trust or a foreign

expert. This finding was shared by the artisanal gold miners consulted in Tanzania (Stocklin-Weinberg et al., 2015). Indeed, according to two miners who were not part of the Fairtrade Gold pilot in Tanzania, the idea of learning from more experienced miners was very appealing.

The fourth attribute of a successful training program is the importance of sound monitoring and evaluation (M&E). M&E needs to be incorporated into the original program design. A logframe assists practitioners to identify the goals, anticipated outcomes and indicators to measure the program's progress. An important element of the indicators, however, is whether they are well-defined and relate to the overall program goal, contain SMART elements and paint an accurate picture of the program's impact. If the indicators gathered during a monitoring visit illustrate that the program has not reached its targets, then the plan must be adjusted. Training programs will see unpredictable results and the M&E activities are a way of alerting the program team that some adaptation needs to occur.

7.1.3 Design and Evaluation of a Training Program for Artisanal Miners

The third research question, *how can a successful training program for artisanal miners be designed and evaluated*, can be answered in many ways. There are multiple steps a program can take so that its chances of success are greater. This section details how the researcher proposed to design the training program for artisanal cassiterite miners in Bangka-Belitung, Indonesia, but it should be noted that this design is culturally- and site-specific, and the following discussion is not a replacement for carrying out a Training Needs Assessment in different mining sector.

An extensive stakeholder mapping exercise, including a political economy assessment and Training Needs Assessment, are essential. For the case study in Indonesia, these activities

launched the implementation phase of the training program. This preparatory phase enabled the researcher to modify the program's theory of change, based on the priorities and needs of the future training recipients. The program's theory of change is as follows: *“If an approach, that includes key stakeholders from multiple relevant sectors, is applied and coupled with a program designed to improve both the health and wealth of miners through a practical, affordable and financially beneficial skill building program, **Then** the occupational health and safety of unconventional miners will increase over the long term and strengthen sector oversight”* (Stocklin-Weinberg et al., 2017b, p. 4). This theory of change can be broken down to details the key components of the anticipated training program. Those components include, in the Indonesia case: (1) A contextually-aware program approach, which includes all of the key stakeholders in relevant sectors; (2) A training curriculum with training provided on both occupational health and safety as well as techniques to improve efficiency; and (3) The steady improvement of the health and wealth of Indonesia's artisanal cassiterite miners.

The outcomes of the training program are the 'Then' portion of the theory of change, namely that the health and safety of unconventional cassiterite miners will be improved over the long-term and the Indonesian institutions would be strengthened, particularly in their ability to provide oversight of the sector. Based on the theory of change, the researcher then designed the project components. In this case, the proposed training phase of the program had two components:

1. **Improve the health and wealth of unconventional³⁶ cassiterite miners in Bangka-Belitung** via a training-of-trainers campaign for local training champions at legal mine sites in East Belitung, followed by onsite coaching sessions for miners for a one-year pilot period. The program would then scale up training activities to Bangka Island.
2. **Support the government's efforts to formalize the unconventional mining sector in Bangka-Belitung** via government training sessions and strategic partnerships and ongoing capacity development for the Mines Inspector.

The researcher selected the sites designated for the training program in conjunction with the donor and local government so that all parties were in agreement. The sites are in a designated mining area, so there is no risk of working with informal miners. That being said, the Training Needs Assessment revealed that the miners who are involved in the riskiest behaviour are working in the ocean or remote forests in the province. However, this is where the second component of the program fits in: by providing support to the government's formalization efforts, the research team's hope is that eventually the harder-to-reach miners will be able to join the training.

The training program's outputs, or intermediate results, provided a detailed plan for the program. The outputs included: (1) Mobilization and program start-up; (2) Training curriculum development; (3) Baseline of mine sites; (4) Training-of-trainers pilot in Belitung; (5) Evaluation and stock-taking; (6) Coaching for miners in situ *and simultaneously*, Mobilization and Baseline

³⁶ In Indonesia, artisanal miners are referred to as 'unconventional' miners.

in Bangka; (7) ToT in Bangka (8) Dissemination workshops; and (9) Project close-out and gathering of lessons learned.

7.1.4 Strengths, Weaknesses, Opportunities and Threats of Artisanal Miner Training Programs

Addressing third research question, *what are the strengths, weaknesses, opportunities and threats of past and current artisanal miner training programs*, involved a twofold approach. Firstly, the SWOT exercise of the training programs was carried out through a literature review and expert interviews to fill in the gaps for programs that were not covered extensively in the literature. The researcher developed an initial long list of programs to cover, but then reduced it to a more manageable number by creating several selection criteria. As such, the programs covered are not exhaustive.

Indeed, the process of carrying out a SWOT itself was a reality check and illustrates why there has yet to be a comprehensive analysis of *all* training programs for artisanal miners. The list would be long and it would be challenging to find comparable information on each program. Likewise, there is a significant amount of grey literature and reports about some of the programs that remain confidential to this day. The reason for this secrecy is often cited as ‘intellectual property.’ This is a significant detriment to the field because it means that programs often reinvent the wheel and donors cannot differentiate which training approach might work, and under what circumstances. The findings from the SWOT analysis were instrumental for the design of the Training Needs Assessment tools for the Indonesia field study. Indeed, the research tools and overall program were informed by the key themes, which resulted from the SWOT

analysis. These themes can be divided into three common categories: 1) Monitoring and evaluation of training programs is lacking; 2) Training programs are financially unsustainable; 3) There are specific training methods that see the most success; and 4) It takes time for behaviour change to become evident.

7.1.5 Monitoring and Evaluation of Training Programs is Lacking

A Monitoring and Evaluation Plan must be Established Before the Program Begins

The SWOT analysis of the UN Global Mercury Project and the Sustainable Artisanal Mining Project in Mongolia revealed that, in some cases, improper program performance indicators were selected. Indicators must be able to illustrate the overall impact of a program. For instance, the number of people trained is not an illustrative indicator of how a program is performing.

A results framework is an important tool to monitor the progress of a program, but it should be designed in a flexible manner. A flexible design enables the program to adapt its approach if it encounters unexpected barriers. Thus, it is always important to develop an evolving list of foreseeable risks a Plan B at the ready.

The Indonesian training program developed indicators centred around the program's goals *during the Training Needs Assessment*. This approach enabled the researcher to consult the future training recipients on what practices they wanted to see change over time. As a result of this consultation, the indicators were focused on monitoring the improvement of miners' health and wealth over the course of the training program. For example, one indicator to monitor around health and safety improvements would be the availability of personal protective

equipment at nearby equipment shops. If, after a given period of time following the training program's launch, the shops began to supply and sell PPE that was introduced during the training sessions, then that would reveal that the training was having an impact.

Training Programs Need to be Accountable and Transparent

A lack of monitoring and evaluation and transparent reporting is a widespread problem in the artisanal miner training space. There are a number of examples of training programs for artisanal miners not publishing their findings in the public domain, despite being funded by tax payers. The Canadian International Resources and Development Institute (CIRDI) has been criticized for its lack of transparency about its activities since its launch in 2013 (Munson, 2016). Indeed, the organization's website, though certainly updated and more informative than previous iterations, does not include any publications on any of their artisanal mining programs. Although CIRDI does acknowledge in its mission statement that it "*freely share[s] information about [its] work and welcome[s] dialogue and discussion*" it is difficult to reconcile that statement with the dearth of published work on their program areas (CIRDI, 2017). This lack of transparency is troubling, most notably because CIRDI's programs are funded through Global Affairs Canada, which is ultimately funded by Canadian taxpayers. That being said, CIRDI is not the only government-funded organization that does not make its program findings publicly available.

The United States Agency for International Development (USAID) failed to publish a report the author co-wrote on conflict minerals programs in the DRC and it is doubtful that this was the only case where this occurred. In addition, the Artisanal Gold Council received \$8.8 million from Global Affairs Canada for its *Sustainable Development of Artisanal and Small-*

Scale Gold Mining in Indonesia (2016-2021) project (GAC, 2017). The project description on the Artisanal Gold Council's website is limited to one paragraph and there is no published material on the program (AGC, 2017). Global Affairs Canada's description of the program is slightly more detailed, but it does not include any progress reports (GAC, 2017).

7.1.6 Program Sustainability

One of the key barriers for training programs in general is their dependence on donor funds. All training models face the challenge of retaining funds or adopting a financially self-sustaining model. Indeed, none of the programs surveyed really overcame the barrier of how to become self-sufficient and even income-generating. The UN Global Mercury Program is a case in point. The Program never moved beyond the pilot phase, despite intensive efforts to lobby the host governments to take over the program once the donor funding expired. Governments or educational institutions must have mechanisms in place to sustain the training program in, for example, a school in the area where artisanal mining and other rural activities take place. If this is not the case and the program cannot find a local institution to sponsor it, it is likely to fail. Early and consistent engagement with potential in-country partners are an essential part of developing a training program.

In some countries, keeping the government abreast of the program's progress is crucial; in other countries, the government will be more hands-off. It is important to be familiar with the political context so that the government engagement strategy is correct from the beginning. If the program alienates government stakeholders, it could be removed from the country.

7.1.7 Behaviour Change Takes Time

It is challenging to assess the relative success of short-lived training programs—and many training programs have a short duration—because change in this sector is a gradual process. Even the longer-running programs were only able to report significant outcomes after several years. The unfortunate reality is that the majority of donors are unwilling to fund a program for that length of time. One way to mitigate this issue is to structure the training program around a training-of-trainers model, where the training recipients go on to train the miners. This way the best practices are being disseminated to individuals who have influence over the behaviour of other miners.

7.1.8 Successful Training Methods

There are a number of ways to structure a training program. The actual methods employed need to be based on in-depth consultation with the individuals who will receive the training. One important lesson drawn from the literature as well as the case study in Indonesia is that mining stakeholders need to see an incentive to adopt new techniques. That incentive is usually economic, but the messaging can be tailored around other goals using an economic lens. For example, in the Indonesia training program, increasing miner wealth was seen as more important to the Training Needs Assessment participants than improving their health. However, when the training recipients receive the message that accidents and fatalities and even illnesses at the mine site leads to lost work time—and therefore a loss of income—this gives them an incentive to participate in both efficiency *and* health and safety training.

Another important theme that emerged from the key informant interviews and focus groups in Indonesia is that the curriculum and program design needs to be participatory. The Training Needs Assessment in Indonesia helped to build that contextual knowledge, but it should be followed by an inception phase before the training-of-trainers sessions are launched. This way the program can further ensure that the curriculum is tailored well for the recipients.

7.2 Limitations of the Project

7.2.1 Field Mission

Carrying out fieldwork in an artisanal mining sector under the best of circumstances is logistically difficult, but Indonesia is a uniquely challenging case. The quality of the data collected depended in part on the level of trust the project partners and the researcher have established with the informants. The researcher was reliant upon the existing relationships between the project partners and mining stakeholders. The project partners in the field acted as mediators, or fixers, building a rapport with key informants prior to the researcher's arrival. The timeline for mobilization was compressed for this particular Training Needs Assessment. In order to mitigate this challenge, the researcher went to the field early and worked directly with the local partner to carry out an expedited mobilization.

In the design of the research methodology, the researcher had to think through some mediating measures for asking challenging or sensitive questions of informants surrounding issues of motivations, income, financial and material flows (e.g. where the ore is going, and how much the different supply chain actors earn). The researcher took care to triangulate the findings, both between informants in the field, and against findings from the literature and by asking

project partners or other trusted contacts about the key themes that arose throughout the course of the research.

7.2.2 Aligning Donor Priorities with Miner Priorities

Much of the literature on barriers to improve in the artisanal mining sector comments that donor priorities are often misaligned with the needs and priorities of the training recipients themselves. The training program in Indonesia was no exception. While the donor understandably prioritized health and safety in response to international media reports of deadly mining accidents, the artisanal miners were more focused on economic results. An approach to marry the two—health and safety concerns with economic ones—will be a shrewd choice.

Likewise, in Indonesia, it was challenging to make the case to the miners that health and safety were important things to consider in their daily work. An important insight from this case study is that when carrying out a Training Needs Assessment, it is important for the researcher to discuss health and safety issues with miners around the message that injuries and accidents lead to lost work time, which leads to lower profits—which is a more compelling argument for miners.

7.2.3 Accounting for the Counter-Factual

The hypothesis for this study is that successful training programs for artisanal miners are based on a curriculum that incorporates concepts of efficiency and financial incentives resulting from training, rather than health and safety issues. There is also a counter-factual, namely that behaviour change in artisanal mining communities could have nothing to do with training.

Indeed, it is possible that the artisanal mining sector will only see transformation when governments take responsibility for their citizens, including artisanal miners, and engage in tangible measures to alleviate and eventually eliminate poverty (Siegel, 2007). The argument is a compelling one. However, in this case, the two arguments need not be mutually exclusive. In artisanal mining, there are so many factors that put up barriers for the sector's positive development. Training is certainly not a panacea, but it would not impede any efforts of a government to alleviate poverty. Indeed, training programs for artisanal mines could very well be part of poverty alleviation efforts.

Chapter 8: Conclusion

Artisanal mining provides an important source of income for more than 30 million miners globally, and yet the sector also produces a myriad of negative social, health and environmental impacts for both miners and their communities. This research was conducted in order to better understand why there has been so little advancement in training programs for artisanal miners, despite concerted international efforts in this sphere for some thirty years. The research begins from the premise that training is a key tool for artisanal miners to improve their profitability, and, more importantly, empower them with the means to take more ownership of their position vis-à-vis their financial supporters. However, training programs thus far have rarely seen significant success, in large part because they fail to take the local context into account—or, if they have been successful, the positive lessons they provide have been lost in the minutiae of ineffective program monitoring or a lack of published material. The central question guiding this research, then, was: *why, when there have been so many efforts in the training space for artisanal miners, are there so few examples of success?*

This issue was examined via four research questions:

1. What are the barriers for behavioural change in the artisanal mining sector?
2. What of the attributes of a successful training program?
3. What are some of the strengths, weaknesses, opportunities and threats of training programs for artisanal miners?
4. How can a successful training program for artisanal miners be designed and evaluated?

The main findings of this research as follows:

- **Findings of Objective 1- *Summarize the current literature on training programs for artisanal miners and identify gaps in the present state of knowledge.*** Though there have been significant and important efforts in this space, the literature reviewed over the course of this research revealed that the barriers for improvement in the artisanal mining sector far outweigh the successful examples. The most notable barrier is that training programs often neglect the unique attributes of the artisanal mining sector when they design a curriculum. Indeed, the author's own experience in multiple countries demonstrates that funding cycles and priorities of the donor are often out of sync with the needs and timeframe of the training recipients.
- **Findings of Objective 2- *Carry out a strengths, weaknesses, opportunities and threats analysis of different types of training programs for artisanal miners in Africa, Asia and Latin America.*** There has been very little objective analysis of training programs for artisanal miners. In this light, this thesis evaluated the strengths, weaknesses, opportunities and threats (SWOT) of several prominent training programs in Africa, Asia and Latin America. This SWOT analysis formed the basis for the discovery phase of a training program for artisanal tin miners in the Bangka-Belitung Province of Indonesia. The findings of the SWOT analysis were aligned with the findings of the literature review, namely that training programs have been limited in their efforts to make the curriculum and training program fit for purpose and effectively monitored (e.g. performance indicators often do not measure the progress of the program in meeting its objectives).

- **Findings of *Objective 3- Carry out primary research with artisanal mining experts and Indonesian thought and mining leaders on the most suitable training model for Indonesia's tin mining sector; and Objective 5- Conduct a Training Needs Assessment in Bangka-Belitung's artisanal tin mining sector, to suggest measures for implementing a training program.*** The study in Indonesia—both a Training Needs Assessment and dissemination mission with key informants after the study concluded—contributed to a framework for training artisanal tin mining stakeholders in better mining practices to improve both the safety of their working conditions and the efficiency of their prospecting, extracting and processing practices. The research tools, which were field-tested in Indonesia, serve as a prototype for the practitioners to draw upon in order to gather knowledge of the unique artisanal mining sector in which they plan to work.
- **Findings of *Objective 4- Develop a Framework for Training Artisanal Miners for practitioners to use when they develop a training program for artisanal miners in other country contexts.*** The product of this research, then, is a framework to guide practitioners working in this sector as they design, monitor and evaluate their own training program for artisanal miners. The framework does not instruct practitioners on what the training should cover, but rather how a training program's design can be informed by the needs of that particular mining sector.

8.1 Additional Findings

There were additional insights gathered throughout the course of this research. These findings can broadly be summarized as: (1) The framework presented in this thesis can be used as a guide, but it should not be a replacement for carrying out relationship-building with the artisanal mining population targeted for the training program; (2) The content of the training curriculum should be developed with the training recipients, and therefore it should be based on what they want to learn, and not necessarily what the donor wants them to learn; and (3) Miners must want to receive training.

8.1.1 The Training Curriculum Must be Individually Tailored to the Context

There are many models for providing training to members of the artisanal mining sector. While this thesis presents a framework that can certainly guide training programs seeking to implement a training-of-trainers model, it is important to bear in mind that ToT will not work under all circumstances. Indeed, the purpose of the Training Needs Assessment is to ascertain which training format the miners prefer. In some countries, miners may prefer to be trained in another format, such as in a classroom. This could be the case where there is a higher-educated mining population, such as Mongolia, or, it could also be the case where the artisanal miners were formally trained in the conventional mining sector, such as in Bolivia. Regardless, the author suggests exploring ToT as one potential format in the early phases of engagement with the mining sector. If another format is preferred by the training recipients, then it must be taken into account. The framework presented in this thesis is, therefore, meant to provide guidance, and it

should be populated with the contextual information of the specific mining sector in question. Nothing about the miners' preferences and knowledge gaps should be taken as a given.

8.1.2 The Goal of a Training Program Should be Determined with Miners

The primary case study examined over the course of this research is an occupational health and safety training program for artisanal tin miners. Therefore, many of the research tools for the Training Needs Assessment pertain to that subject area. The development of the curriculum should be drawn extensively from the knowledge gaps and miner preferences uncovered during the Training Needs Assessment. As such, it is not best practice to go into the field assuming that the miners want to learn about occupational health and safety, as an example. The researcher in fact based the Training Needs Assessment on OHS because this was what the donor desired, but by the end of the Training Needs Assessment phase, it was clear that the training champions identified were more interested in learning how to improve their recovery, and therefore profits. As a compromise, the researcher suggested that the training program develop a curriculum that incorporated both components –health and safety *and* improved efficiency. Practitioners should bear in mind that this type of compromise will likely be necessary for their program as well.

8.1.3 Receptivity of Miners to Training

One of the most important aspects of designing a training program for artisanal miners is ensuring that the recipients indeed want to be trained. Some artisanal mining sectors are reticent to take part in a training program because they have low trust of foreigners. This could be in part because there is a legacy of broken commitments by international development practitioners. If it

is clear that the miners in question do not want to be trained, then it is probably best to move on to another area or work instead with other stakeholders who could in turn reach the miners.

8.2 Originality of Thesis

This thesis is an original area of research for four reasons:

1. The thesis takes a critical look at several training programs for artisanal miners using a SWOT analysis. To the author's knowledge, this approach has yet to be used in this context. The SWOT analysis provided some context for the framework for training artisanal miners.
2. The SWOT analysis and the literature review evaluate training programs for artisanal miners of gold, precious stones and metals. To date, there has yet to be a comprehensive evaluation of training programs that addresses other types of artisanal miners besides artisanal gold miners.
3. The framework for training artisanal miners is the first of its kind and is applicable to more than one country context. There are toolkits and guides for training practitioners working on different aspects of the artisanal mining sector (see, for example, the World Bank's guide on gender and artisanal mining (The World Bank, 2012) and the Global Mercury Project's guide for training artisanal gold miners (Veiga et al., 2006) for training programs for artisanal miners. However, this framework goes a step further and provides a pragmatic suite of instructions to guide the site selection, design, development of models of training and techniques for knowledge delivery as well as key principles for monitoring and evaluating a training program.

4. This thesis provides guidance on how to conduct a Training Needs Assessment, including qualitative research tools for an occupational health and safety Training Needs Assessment. These tools are open-source and the general approach to the interview, and focus group guides and mine site survey are adaptable to other training program goals.

8.3 Implications for Further Research

There are three avenues that this study raises which merit further research.

1. **Comprehensive SWOT analysis of past and current training programs:** The SWOT analysis of this program provides a basis for a more substantial course of study on a wider breadth of training programs. It would be advisable to start with a database with key research parameters to gather on each program; then search for relevant literature both in an academic library and grey literature; then identify and fill gaps in the literature through key informant interviews. This analysis could be a thesis in itself or perhaps a study commissioned by a donor agency.
2. **Test the framework for training artisanal miners:** The framework presented in this thesis was developed by the author but it has not been field tested in its entirety. The author strongly encourages other practitioners to use this framework for their own purposes and provide feedback.³⁷
3. **Explore the relevant Adult Education literature that could contribute to the exploration of effective training techniques for artisanal miners:** Artisanal miners are

³⁷ The author's email address is rubymining.ubc@gmail.com.

classified as adult learners and many members of the sector have not received a formal education since childhood, if at all. As such, the training curriculum needs to incorporate unconventional and hands-on ways of learning. There is a body of Adult Education literature that would play a useful role in designing the techniques trainers should use to reach miners and ensure uptake.³⁸

³⁸ Although the literature on adult education for the artisanal mining sector is sparse, there are other bodies of literature to draw from, including, for example: Speiran, 2014; Caffarella & Daffron, 2013; and Diouf et al., 2000.

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Appendices

Appendix A : Expert Interview Question Sheet³⁹

A.1 Artisanal Miner Training Needs Assessment Content Expert Interview Guide

Options of attribution: Full attribution (do you want to review excerpts?) Partial attribution (e.g. stakeholder type). No attribution. Off the record.

Question 1: Do you think training for artisanal mining communities is effective? Why/why not?

Question 2: Please tell me about any artisanal mining training programs that would be instructive in my research.

Question 3: What were the program's strengths? (internal)

Question 4: What were the program's weaknesses? (internal)

Question 5: What were the opportunities the program brought about? (externally)

Question 6: What were the program's threats for success? (externally)

Question 7: What are some of the barriers for behavioural change in artisanal mining communities?

Question 8: How should a training program be designed and what kind of context is most suitable?

³⁹ © R. Stocklin-Weinberg, 2017

Question 9: How can the success of a training program be evaluated?

Question 10: What types of indicators are most appropriate and in which context?

Question 11: What types of techniques and information provided in training programs lead to behaviour change for the mining actors involved in the program?

Questions 12: Can these findings be applied to other country contexts in a standardized way?
How?

Question 13: Are there any theorists who might help me frame this work?

Question 14: Is there anything else you would like to add?

Would you like to be contacted further?

Options of attribution: Full attribution (do you want to review excerpts?) Partial attribution (stakeholder type). No attribution. Off the record.

Appendix B : Indonesian Training Needs Assessment and Situational Analysis Tools⁴⁰

B.1 Expert Structured Interview Questions

The following question list is a high-level version of the kinds of questions researcher asked of expert informants in November and December, 2016 in Bangka-Belitung and Jakarta, Indonesia.

Introduction script for experts

Hello, my name is _____. I am fill in position here. The purpose of this conversation is to gain vital information to inform a pilot training program to improving the health and wealth of Bangka Belitung's artisanal tin mining sector. We are conducting a participatory Training Needs Assessment and Occupational Health & Safety Situational Analysis with key stakeholders in Bangka-Belitung and Jakarta to identify key priority topics to reinforce and monitor technical skills that are customized to local geography and conditions with health, safety and environmental training topics, and develop a training curriculum that encourages artisanal tin miner participation in a pilot Training of Trainers (ToT) program.

[Have them sign the consent form for experts.]

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Authorities (local, regional, national)

Only the informants selected by local partner for their: a) level of influence; b) knowledge of the ASM tin sector; c) potential training champion capacity; d) potential spoiler capacity. If at all possible, invite one regulator to a mine site and observe their situational awareness (per the mine site checklist).

- *Warm up questions*
- *Topic 1: Mine site hazards; areas needing improvement*
- *Topic 2: Barriers*
- *Topic 3: Identification of potential partners*
- *Topic 4 Solutions-building*
- *Other information*

Academics, Experts & NGO/CSOs question sheet

Topic 1: Current best practice

Topic 2: Training experience & vision

Topic 3: Recommendations of informants

Topic 4: Other information

Health authority question sheet

Question 1: What are the national statistics on diseases that often occur at mine sites, including, but not limited to HIV/AIDs, malaria, TB, etc.?

Question 2: Do you have any statistics on the number of mine site fatalities this month? In the last month? How about in the last year?

Question 3: Do you trust these figures? Why/why not?

Question 4: What is supposed to happen by law when a miner is injured or killed onsite?

Question 5: Is there anything else you would like to add/ anyone else I should speak to?

Health workers question sheet:

1-2 hours per interview

Question 1: Do you know how to recognize a mining-related injury, even if your patient does not admit he or she is a miner?

Question 2: What are the most frequent kinds of injuries that people who come to your clinic report?

Question 3: Do you have any statistics relating to occurrences of HIV/AIDs, TB, pneumonia, malaria, etc.? Are there any other diseases that are common with miners? Do you trust these figures? Why/why not?

Question 3: Are there particular diseases that are more common with women miners? How about with men miners?

Question 4: Are there particular injuries that are more common with men miners? How about women miners?

Question 5: What is the procedure when a miner is injured/ sick? Who pays for his/her medical bills? Do you know if there are death payments in the case of fatalities?

Question 6: Do you have or can you point me in the direction of official statistics on the number of mine site fatalities this month? In the last month? How about in the last year? Do you trust these figures? Why/why not?

B.2 Mining Stakeholders Semi-Structured Interview Questions

The following question list is a high-level version of the kinds of questions the researcher asked of mining actor informants in November and December, 2016 in Bangka-Belitung and Jakarta, Indonesia.

Instructions

In the semi-structured interviews with non-experts, including mine bosses, land owners, collectors, village authorities, equipment providers, etc. try to cover as many topics as possible, but responses may come from different sources. *It is important to try to cover the highlighted questions with every informant; the other questions can be asked as time allows, but try to make sure that questions from each topic are covered with each of your informants. It is crucial to take cues from your informant during the interview. Remember that participating in an interview takes these stakeholders away from their work and makes it more difficult for them to earn money at the end of the day.*

Try not to take more than an hour of their time, unless they seem very enthusiastic about answering questions. If the person seems uncomfortable answering a question, quickly move on

to another subject. Likewise, if the informant is eager to leave the interview, try to cover the key topics only.

If the interview is taking place at the mine site, ask the informant to point out examples on the site or even draw out sketches or diagrams.

For each interview and focus group, fill in the following information:

- Interview #
- District
- Site name
- Name of interviewer
- Consent: (y) (n)
- Try to keep track of how many of your informants, both in the focus groups and interviews, as well as during your observation at the mine site are literate and how many are illiterate.
- Take note of the native language spoken by each of your informants and the languages spoken at the mine site more generally.

Introduction script for mining actor informants

Hello, my name is _____. I am fill in position here. Today I am here to ask if you will participate in a discussion about your life, mining and your family that will take 1-2 hours of your time. Any information obtained as a result of your participation in these activities will be

kept confidential by the study staff. Your identify will not be revealed when the information is used. Do you have any questions for me before we get started?

[Have them sign the consent form or record their consent]

Miners and mine bosses

Section 1: Warm-up questions

Question 1: How many days a week have you worked here?

Question 2: For how long they have been mining?

Question 3: Do you have other income generating activities besides mining?

Section 2: Mining practice, recovery; existing specialisms

Question 1: Do mine site bosses organize you and other miners in any way, like, for example, your skills, knowledge or physical abilities?

Question 2: What impacts how successful you are at mining?

Question 3: Can you give some examples of how you or anyone you know has had to improve or change your practices at all? How did you do it?

Question 4: Could you tell me some ways you could improve your mining productivity?

Section 3: Impacts of mining activities

Question 1: What are the impacts of mining on your health?

Question 2: Do you think women miners experience the same health impacts as men? If not, what are the differences?

Section 4: Plans for the future

Question 1: Do you (your community) want to be miners forever?

Section 5: Champions

Question 1: Who are the most knowledgeable people around here?

Question 2: Are they respected by others? Why?

Section 6: Demographics

Question 1: Can the people you work with/ you read and write? What is your level of education?

Question 2: What do women do? What do men typically do? (Show me) What did you do yesterday (at the site)?

Section 7: Other information

Question 1: Is there anything else you would like to add?

Community leaders & religious heads question sheets

Section 1: Warm-up questions

Section 2: Impacts

Question 1: How do you feel mining has affected your community?

Section 3: Champions/ partners identification

Question 1: Can you suggest any local people who are respected in the communities who would be well placed to mobilize and teach miners about any of these priority issues?

Section 4: Solutions-identification

Question 1: Do people in your community want to be trained to mine safer and more efficiently?

Other information

Question 1: Is there anything else you would like to add?

Champions question sheet

Topic 1: Warm-up questions

Topic 2: Skills identification

Question 1: Do you want to learn and then teach miners how to mine in a safer and more efficient way?

Question 2: How many years have you been working in mining? In which area (mining or processing)?

Question 3: Do you think your techniques are good for good production?

Question 4: How can they be improved? Do you know how?

Question 5: Which areas of expertise do you think you bring to the table?

Question 6: How do you learn best?

Topic 3: Capacity

Question 1: Given your current responsibilities, what is the most feasible format for you to learn in? Would it be in a workshop format? Continual site visits? Or In a lecture at a vocational school, for example, etc.?

Topic 4: Other information

Question 1: Is there anything else you would like to add?

B.3 Mine Site Observation Survey

The mine site observation survey should be designed with the specific type of mineral and geography in mind. That being said, some of the high-level occupational health and safety areas for researcher observation could include:

1. High level hazards, like stumbling hazards, lack of slope stability in pits, dangerous equipment, risks of crushing injuries, ventilation concerns;
2. Work practice controls like worker knowledge of equipment, use of protective gear and what types;
3. Safety hazards, including biological, chemical, ergonomic, physical or psychological hazards;
4. Sanitation issues, including food preparation practices, drinking water availability, defecation and urination practices and showering practices;
5. Waste disposal practices; and
6. Living conditions of workers.

B.4 Miner Focus Group Guides

The following question list is a high-level version of the kinds of questions the researcher asked during focus group discussions with male and female miners in November and December, 2016 in Bangka-Belitung and Jakarta, Indonesia.

Focus Group Guide

The purpose of the focus groups is to triangulate/corroborate information in interviews, to brainstorm on top priorities for a training curriculum and to discuss and build consensus on potential long-term solutions to the gravest health and safety impacts in a participatory manner. Focus groups will take place on the last day at each mine site. Groups will be formed of six willing miners; one group of women and one group of men. The focus group should last between two and four hours.

Guidance for the facilitator:

- Number each respondent or identify when there was a group consensus on responses
- Try to make everyone feel welcome and comfortable by asking warm-up questions first
- Do not let one person talk the whole time. If some group members seem to be quiet during the group discussion, try to engage them in a friendly way. If they are unwilling to participate, try to have an informal conversation with them after the group discussion.
- Make sure each participant signs a consent form
- Ensure you address any concerns or questions prior to the discussion.

The focus group should more or less follow this sequence:

Step 1: Start by introducing the goals and agenda for the focus groups (5-10 minutes)

Step 2: Moderated discussion of problems and impacts (30-60 minutes)

You can use the Card Sort exercise here.

Step 3: Recapitulate the problems discussed to gain consensus (perhaps use a flipchart- 20 minutes)

Step 4: Moderated discussion on solution building (30-60 minutes)

Step 5: Recapitulate the solutions discussed to gain consensus, using a flipchart (20 minutes)

Step 6: Wrap up; final thoughts and questions. Reconfirm consent (10-20 minutes)

Topics to be explored during the focus groups:

1. Key areas in occupational health and safety, livelihoods and productivity that need to be improved
2. Solutions building, e.g. forming cooperatives; complementary livelihoods; appetite to learn new practices

Card Sort Prioritization Exercise

Step 1: Make a deck of cards, each with a word written on it (e.g. relating to key OHS themes discussed in previous days onsite. List both risks and impacts.)

Step 2: Ask your group to order the cards by priority

Step 3: Discuss

Appendix C : Example Project Documents

C.1 Sustainable Artisanal Mining Project Document Annotated Outline

Annex

Below is an example annotated Table of Contents from the Project Document for Phase 4 of the Mongolian Sustainable Artisanal Mining Project (SAM, 2015).

1. Context

Overview of context of artisanal mining in the implementation country. Any information of training needs, demography, challenges, etc. Policy environment overview. Any normative standards that could be pertinent to the program. Includes overview of key stakeholders driving the programme and impacted by the program. 6-7 pages.

2. Results and lessons learned thus far

If there are any previous phases of the program or past training programs attempted in the implementing country, describe their outcomes, challenges, opportunities, etc. here. 2-3 pages.

3. Objectives

3.1 Project scope and components

Overview of project scope and components. Should address relevant gaps described in Section 2. 2-3 pages.

3.2 Impact hypothesis and theory of change

There is no set template for writing a theory of change, as it depends very much on the gaps your program is trying to fill. A Theory of Change contains a high-level goal of the program, a hypothesis of how the program plans to fulfil that goal and under what conditions. One paragraph-2 pages.

3.3 Development goal and expected outcomes

Incorporates the program's goal, theory of change and project components into one encompassing sentence. All of the project components combined are supposed to bring about the desired change, or development goal.

The description of each outcome circles back to a particular project component and demonstrates how the project component will lead to that outcome. Each outcome should be accompanied by a paragraph-long description. 2 pages.

3.4 Outputs and activities for each component

Outputs enable the program's outcomes and intermediary outcomes. Each output is accomplished through attendant activities. If the output is, for example, 'legalization and formalization of ASM activities', then some of the activities could include convening workshops and dialogues and lobby relevant government stakeholders; capacity building at different government levels to improve coordination.

The length of this section depends entirely on how many components the program contains.

3.5 Target groups

Should describe the groups of stakeholders that stand to benefit from the program's different components and how. This section needn't be lengthy; 1 page should suffice.

3.6 Levels of intervention

Describes the program's input of engagement at different levels, such as the community level; at the level of regional or local policy-makers and regulators and at the national level. 1 page.

4. Implementing strategy

4.1 Intervention approach

The content of this section entirely depends on the specialisms of the implementing organization(s), the context of the country in question, the goals of donor and the needs expressed by the recipient population. For instance, if the implementing organization works primarily in the policy sphere, then the implementation approach will likely focus on government stakeholders; convening policy dialogues and roundtables, etc. 1 page.

4.2 Partners' roles and responsibilities

Briefly clarifies the role and responsibilities of the program partners. 2 pages, or depending on how many project partners are involved.

4.3 Addressing drivers and restrainers of change (barriers and attributes of success)

A brief description, building on any stakeholder mapping already carried out in the intervention area, of the stakeholders who would be in support of the intervention and those stakeholders who might try to disrupt the program. 1 paragraph.

4.4 Sustainability and exit strategy

High-level plans for phasing out the program. Even if this is a project launch document, it is important to keep the exit strategy at the back of your mind. 1-2 pages.

5. Organization, management and administration

Describes how the project is funded and who staffs it; how the project will coordinate with in-country stakeholders who already engage in the program's area of intervention, such as specific government ministries. The project staffing should be delineated by its steering committee (if relevant) and high-level positions such as management and middle-management, to project officers and consultants. 3 pages.

5.1 Project management -roles, tasks and responsibilities

Scope of work in brief for each of the project management staff members. Length depends on the size of the program's management staff.

6. Resources

High-level description of program's sources of funding and how the funding should be delineated. Length depends on the scope of the program.

7. Risk analysis

This section is the long-form version of the program's log frame, in which every outcome, output and activity takes risks into consideration. Length depends on the scope of the program.

7.1 Assumptions and risks

This section depends entirely on the context of the program. Risks could be in the realm of political instability, the business environment, a history of positive or negative engagement in the ASM sector, etc. The length is also dependent on the number of risks foreseen.

7.2 Risk mitigation strategies

8. Monitoring and evaluation

This section provides an overview of the program's Monitoring and Evaluation plan, but it should be expanded upon in a separate document as well.

8.1 Monitoring and internal project cycle management

Indicators will need to be set according to the activities of the program itself. Those indicators should be based on a baseline assessment at the beginning of the program, so that any change can be monitored as the program progresses. See Section 6.1.3 on indicators for more guidance.

This section can also describe the reporting procedures of the program, both to donors, partners and the communities involved. The length of this section can vary.

8.2 Evaluation and external project cycle management

This section discusses how the program will be evaluated. For instance, the SAM project has elected to hire an independent evaluator for midterm and end-term reviews (SAM, 2015a). Many donors now require an independent evaluation of the program, at least once, and often periodically.⁴¹

⁴¹ The US Department of Labor is a case in point.

C.2 Global Mercury Project: Project Document

The Global Mercury Project's Project Document (2002) is a thirty-page report which lays out the components of the program. While it uses different terminology from the SAM program—primarily because it adheres to a different donor's formatting requirements—much of its content is similar. This section provides an alternate example of a project document for an artisanal mining training program, including feedback on how the UN GMP project document could have been improved.

Section A: Context

A.1: Setting

This section details the context from which the idea for the Global Mercury Project arose. In essence, this section is the justification for the program. The length of this section can vary from 2-10 pages, depending on the scope of the program. In the GMP's project document, this section is lengthy because it was a multi-year and country endeavour.

A.2: Development Objective/ Strategy

This section can be split up into three sections: one to describe the long-term objective of the project—in this case, to protect international waters from mercury pollution from artisanal and small-scale mining—the second to describe the program's broader development objective—in this case, for each of the participating governments to work with their artisanal mining sector to reduce their environmental impact—and the third to describe the global environmental objective—in this case, to support countries as they decrease the amount of mercury pollution on

their waterbodies and wider environment. The section then details the project's objectives in short list form. This section can range from 2-3 pages.

A.3: Project Activities/ Components and Expected Results

This section details each of the project's objectives and the activities that coincide with meeting each objective. Each activity is accompanied by a paragraph-long rationale so that it is clear to the reader how this particular activity will help accomplish the program's objectives. The activities assigned to each objective will require significant brainstorming and planning on the part of the program's designers to ensure that the activities will help the program fulfill its objectives. If, through monitoring activities, it appears that the activities are not meeting their goal, there should be some adaptation to the project document. This section varies in length, depending on the number of program objectives and required activities.

A.4: Risks, Sustainability and Commitments

This section details the potential risks, or critical assumptions, associated with the program. These risks can include issues that could impact the program's long-term as well as short-term success. The UN GMP's Risks, Sustainability and Commitments section is brief—1.5 pages—which is insufficient for a program of this length and scope. A risk assessment in each of the program implementing countries prior to putting together the project document would have been advisable.

A5: Stakeholders Participation and Implementation Arrangements

This section describes how the program will be managed, including key roles at the government, UNIDO, NGO and other partners level. 1-2 pages.

A.6: Incremental Costs and Project Financing

This section details in brief what the human and environmental costs would be if the GMP were not implemented. It would be more appropriate if this section discussed instead how the program was going to be financed at different scales of operation. Length depends on the scope of the program.

Section B: Inputs

B.1-4: Government, GEF/UNDP Financing and Incremental Costs/Project Budget, UNDP Inputs and UNIDO Inputs

This section provides an overview table of the program's financial inputs from different funding sources and details how the implementing agency will provide in-kind contributions. 1-2 pages.

B.5 Monitoring, Evaluation and Dissemination

This section details in two paragraphs how the program will monitor its activities and disseminate results. Two paragraphs are insufficient for this type of program. It would have been more appropriate for the GMP to devote 7-10 pages to developing a more suitable monitoring and evaluation plan, including sections on key performance indicators, a schedule of monitoring

visits and what kinds of information would be collected, the frequency of program evaluations and mitigation strategies for potential challenges.

Annexes

Appendix D : Training-of-Trainers Curriculum Overview

A typical training-of-trainers curriculum might include some of all of the following components.

Socio-economic component

- **Understanding why people are involved in artisanal mining:** Demography, traditions, living conditions, level of education, key causes of conflict between miners and other stakeholders; the supply chain of gold or other miners; pricing and market.
- **Minerals policy and legislation for artisanal miners:** How to mine legally by obtaining a license; gaps in legislation for artisanal miners; issues with definitions of artisanal mining; perceptions of artisanal miners.
- **The main characteristics of artisanal gold mining:** What mining looks like around the world; health and safety issues in mining; common errors made by artisanal miners. Processing Centers; environmental impacts of tailings mismanagement.

Environmental and health component

- **Health and the environment:** Common environmental impacts of artisanal gold mining, including a module on cyanide and mercury; health impacts of artisanal mining.

Technical solutions component

- **Mineralogical characterization and geological exploration:** How to best process a particular type of ore; sampling, definition of grade, gold liberation, grain size analysis and the importance of liberation.

- **Mining methods and safety at work:** Safe operation of heavy equipment, handling explosives, proper ventilation, avoiding rock fall accidents, first-aid and rescue.
- **Physical methods of mineral processing:** Mineral liberation, comminution, processing equipment; gravity concentration and other methods of processing; how to test gold recovery.
- **Chemical methods of gold extraction:** Safe use of cyanide, activated carbon and zinc; different methods of cyanidation; addressing problems with some processing technologies.
- **Tailings management:** Types of tailings dams; dry and wet tailings; prevention of acid rock drainage; preventing accidents; how to liberate gold from tailings.
- **Ancillary methods:** Vehicle maintenance; recycling water; carpentry for underground mining; welding.

Administration in mining component

- **Administration methods:** How to manage a small business; creating a business plan; managing cash flow and operating costs, taxes, procurement, using local manufacturers.
- **Training methods for miners and communities:** Pamphlets, posters, theatre skits, videos; methods of consultation with miners; how to include miners in the development of a training curriculum.

Sustainability component

- **Mine closure planning:** Environmentally responsible mine closure; methods for avoiding erosion or heavy metals seepage; phytoremediation, fertilization.
- **Economic diversification of mining communities:** Aquaculture, jewellery making, tailings materials used for construction, joint ventures, applied research.
- **Designing a small mine and plant:** Examination of case studies in other countries; steps for developing a plant; how to conduct a pre-feasibility study.