

Business and Technical Management of Small-Scale Mineral Producers in Rwanda

Capacity Assessment Report & Training and Skill Transfer Recommendations

For

Rwanda Natural Resources Authority (RNRA) &
Federal Institute for Geosciences and Natural Resources (BGR)

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September 2015



Business and Technical Management of Small-Scale Mineral Producers in Rwanda: Capacity Assessment Report & Skill Transfer Recommendations

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September 2015

Acknowledgements

This report was commissioned by the German Federal Institute for Geosciences and Natural Resources (BGR) within the German support program to the International Conference on the Great Lakes Region (ICGLR). The program is funded by the Federal Ministry for Economic Cooperation and Development (BMZ). BGR's module in Rwanda is implemented in partnership with the Rwanda Natural Resources Authority / Geology and Mines Department (RNRA/GMD). Support by RNRA/GMD, the Ministry of Natural Resources and the Rwanda Mining Association (RMA) during implementation of this assignment is appreciated.

The author of this report wishes to express his deepest gratitude to Mr. Claver Mahungiro for his guidance and support throughout this research. Claver's thorough knowledge of the Rwandan mining sector, gained over decades as a geologist and advisor to mining companies, ensured that this enquiry would uncover practical training options that truly fit the needs of the country's miners.

About this Report

The present report represents an adapted outcome of a consultancy implemented by Projekt-Consult GmbH (a member of GFA Consulting Group) to facilitate skill and knowledge transfer to reinforce management and business planning of small-scale mineral producers in Rwanda. This assignment is integrated into BGR's on-going activities in Rwanda to support formalization of the artisanal and small-scale mining sector in the overall context of the ICGLR Regional Initiative on Natural Resources. The assignment was implemented in cooperation with RNRA/GMD, RMA and BGR.

About the BGR Module of the German Support Program to the ICGLR

BGR and GIZ were jointly commissioned by BMZ to implement a support program to the ICGLR, focusing on the ICGLR secretariat and associated regional bodies as well as national stakeholders in several ICGLR member states including Rwanda. The BGR module runs from 2011-2016 and includes two components, namely introduction of the Analytical Fingerprint method in the Great Lakes Region (Component I) and supporting artisanal mining sector formalization as well as implementation of the Regional Certification Mechanism in Rwanda and Burundi (Component II). This report represents a contribution from Component II in the context of BGR capacity building efforts in partnership with RNRA/GMD. More information on the project can be found at <http://www.bgr.bund.de/mineral-certification>.

Disclaimer

This report does not necessarily represent the views of BGR or its project partners.

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ABBREVIATIONS

\$	US Dollar
3T	Tungsten (W) , Tin (Sn), Tantalum (Ta) ores
ASM	Artisanal and small-scale mining
BGR	<i>Bundesanstalt für Geowissenschaften und Rohstoffe</i> (Federal Institute for Geosciences and Natural Resources)
COPIMAR	<i>Cooperative industrielle minière artisanale</i>
FECOMIRWA	Fédération des coopératives minières au Rwanda
GIZ	<i>Gesellschaft für internationale Zusammenarbeit GmbH</i> (German International Cooperation)
GMD	Geology and Mines Department (of RNRA)
ICGLR	International Conference on the Great Lakes Region
ICP-MS	Inductively coupled plasma mass spectrometry (geochemical analysis method)
IPRC	Integrated polytechnic regional center (Kigali)
IRR	Internal Rate of Return
iTSCi	ITRI Tin Supply Chain Initiative
MINIRENA	Ministry of Natural Resources
NPV	Net present value
PPE	Personal protective equipment
PSF	Private Sector Federation
RDB	Rwanda Development Board
REDEMI	<i>Régie d'Exploitation et de Développement des Mines</i>
RMA	Rwanda Mining Association
RNRA	Rwanda Natural Resources Authority
RRA	Rwanda Revenue Authority
SCBI	Strategic Capacity Building Initiative
SOMIRWA	<i>Société Minière du Rwanda</i>
XRF	X-ray fluorescence (geochemical analysis method)

1 EXECUTIVE SUMMARY

1.1 Background

Combined with a handful of medium-scale producers, artisanal and small-scale (ASM) mineral production has consistently accounted for a significant percentage (~25-35%) of Rwanda's total exports. The Government of Rwanda wants to increase production further to support its ambitious economic development and poverty reduction strategy.

The Government's approach to facilitate sector growth relies on creating an enabling regulatory and capacity building framework for ASM formalization for its 200+ small-scale producers. Sector formalization further forms part of the Regional Initiative on Natural Resources of the International Conference on the Great Lakes Region (ICGLR). The Rwanda Mining Association (RMA) collectively represents the mining sector and thus forms an important organ for the practical implementation of sector policies.

Creating a sustainable national mining sector framework through ASM formalization requires a strategic focus on the longer-term mine business and management perspectives, among others. The German Federal Institute for Geosciences and Natural Resources (BGR), as a technical cooperation partner of Rwanda and the ICGLR, supports this process through facilitating the present study, in partnership with the Government and RMA.

This report assesses the current mine management and business capacity of mine owners and managers as a base to identify what kinds of training are needed to increase the performance and productivity of Rwanda's small scale mining sector. Complementing the capacity assessment, the ability and availability of Rwandan mining professionals to mentor and upgrade the management and planning skills was evaluated, and recommendations were made to adopt a range of training options.

1.2 Capacity Assessment

Since the 1920s, hundreds of coltan, cassiterite and wolframite (3T ores) occurrences in Rwanda have been exploited by license owners who mostly managed operations at arm's length, paying workers by production through a system of managers and subcontractors. Many of the deposits' narrow weathered vein structures typical for 3T mineralization in the region can be mined more effectively by hand than with mechanical equipment. While mineral recovery and mining skills are low, employment from artisanal mining brings considerable disposable income to rural agricultural communities - these benefits can be easily seen, for example, in the relatively high quality of housing in many mining districts. However, in a densely populated country like Rwanda, the available resources amenable to manual mining close to the surface are ultimately finite. Creating the base for more professional semi-mechanized operations (where geologically justified) and improving productivity of ASM activities, therefore, represents an important contribution to sustain longer term sector growth.

By themselves, the mine owners, their managing agents (capitas and subcontractors) and diggers often lack the technical knowledge needed to improve production efficiency. Key areas where improvement would generate significant positive impacts refer to exploration practice, mine planning, mineral processing, and labor (including health and safety) management. Successfully integrating these different areas re-

quires the development of complementary background expertise in terms of business planning and financing, marketing and commercialization of mineral concentrates, as well as communication structures, which also impact on the relationship between mining companies and local communities.

1.3 Training and Skill Transfer Recommendations

Current management and business planning approaches are not aligned with the requirements of more professional, higher capital expenditure mining operations. Mine owners themselves, seeing the mining sector as a risky area of business, are often motivated to generate short-term production increases without sufficient consideration for longer-term strategic investment planning. This is reflected in their primary training interest to receive hands-on advice leading to (temporary) production increases at their mines. While miners need support to better organize, plan and introduce improved mining techniques and the associated business environment, their main training incentives need to be duly considered as well. Therefore, improving business management and planning for artisanal operators should go hand-in-hand with technical mine management. Integrating these two management dimensions has the highest potential to lift the income of both the mine owners and the diggers while also strengthening the overall contribution of the mining sector to national development.

The report recommends a number of options to achieve this objective. Model implementation plans for different scenarios are provided for practical illustration. In presenting these different options, the report builds on the history of capacity building in Rwanda's mining sector, evaluating which approaches are feasible in an ASM context, giving due consideration to the cultural training context. Training should take place both directly at the mine site level (as a one-on-one approach) as well as by other means reflecting the different educational background of mining stakeholders in Rwanda. Both coordination of training measures through an appropriate instrument (e.g., a Steering Committee) as well as implementation support, e.g. through the Rwanda Mining Association, would be important structural elements to ensure the longer-term capacity building effectiveness.

At the mine site level, reference is made to the district-based COPIMAR (*Cooperative industrielle minière artisanale*) training approach employed in the late 1980s and early 1990s. The COPIMAR management structure allowed effective training delivery through a number of national experts. A similar approach, adapted to today's re-privatized sector environment, could make use of the increasing capacity available in Rwanda through graduates of a local mining technician course. Developing a program where these new graduates advise miners on site while, in parallel, receiving further training (e.g., through international trainers) would build both theirs as well as the miners' expertise. A quick-start implementation scenario for this option could rely on experienced Rwandan consulting geologists.

Complementary measures recommended by the report refer to classroom-based business training and technical short-courses, among others. The classroom approach could build on similar programs that have already been developed, although it will require adjustments to these programs in order to better reflect practical mining sector questions. Short courses may target various technical topics, in particular the interface between the mining and banking environment.

2 JUSTIFICATION AND OBJECTIVE

Chapter 2 contextualizes the current study within the history of mining in Rwanda and mining's importance to economic well-being of the Rwandan people. Both historically as well as more recently, mining has evolved mainly artisanally in Rwanda, similar to many developing countries in the world. While mineral exports have grown significantly, concomitant growth of both management and technical skills within the sector has not been sufficient to enable sustained increases in production and productivity. The latter is needed to help the country achieving its longer-term economic development and poverty reduction goals.

2.1 Antecedents and Justification

Mining of electronics industry minerals (tin, tungsten and tantalum, or “3Ts”) is one of the most important elements of the Rwandan economy, accounting for 35% ¹ of the foreign revenue earnings in 2014 ². The Government of Rwanda has high hopes for the sector and has set the goal of increasing exports to \$ 400 million by 2017. Rwanda envisions that mining can help achieve its 2017 poverty reduction target of 30% (from 45% in 2012) by increasing the number of miners from 34,000 (early 2014) to 60,000, increasing the mining sector's contribution to Gross Domestic Product from 1.6% (2012) to 5.3%, increasing Foreign Direct Investment in the mining sector from \$150 million (2012) to \$500 million, and increasing mineral tax revenues to \$30 million (World Bank, 2014).

Achievement of these ambitious growth targets is limited by the Rwandan geological environment in which, with few notable exceptions, known mineral deposits are small and widely distributed. The country's small-scale artisanal mines (defined for the purposes of this report as producing less than 10 tons, often much less, of mineral concentrate/month on average³) reflect these geological constraints by using low capital cost manual mining and mineral recovery methods⁴ which are inefficient and partly environmentally problematic, but which provide considerable income for the rural agricultural population. Even if individual ASM operations are basic and small-scale, they collectively represent more than 50% of the total Rwandan 3T mineral production.

Cook & Mitchell (2014) analyzed mining revenue streams in Rwanda. In this context, they made a range of recommendations on sector development opportunities. One of their findings suggested that the business and mine management capacity of Rwan-

² In 2014, the volume of 3T exports increased by 9% from 2013, but lower market prices lowered the total export value to \$203 million from \$226 million (2013).

³ Revenues vary according to the grade of the mineral exported and the international market price. At the time of writing, 12 tons (half a container load) of cassiterite concentrate (60-65% Sn) is worth about US\$120,000 at export; 12 tons of wolframite concentrate (50-60% WO₃) is worth about US\$ 130,000; and 12 tons of coltan concentrate (25% Ta₂O₅) currently fetches about US\$ 520,000. The profit distribution between miners, mining companies and exporters is discussed in Cook and Mitchell (2014).

⁴ Virtually all of Rwanda's small-scale mines are un-mechanized, employing labor-intensive artisanal mining techniques such as digging with shovel, hammer and chisel, transporting ore manually, and concentrating ore with inefficient ground sluices.

da's small-scale mines significantly limits the sector's long-term growth perspectives, and noted that well-informed mine business planning is either non-existent or sporadic. Many observers of the industry in Rwanda agree, including government mines inspectors, iTSCi stakeholders (ITRI Tin Supply Chain Initiative), international consultants and donors, as well as Rwandan banking executives.

Despite the geological and technical challenges, the government has set the goal that many of Rwanda's small-scale mines shall evolve into medium scale producers as the owners (most of whom enter the sector with little or no mining experience) gain knowledge and competency in mine management and business practice. As management improves and as the extent of a concession's mineral resources are geologically inferred, it is believed that mine owners will be able to progressively increase production. This includes the need to attract financing and commercial loans to fund purchases of more efficient, environmentally-friendly mining and mineral processing equipment. In the longer-term, both improving mineral recovery and targeting deeper-seated mineralization shall progressively increase in importance to sustain the sector's growth perspectives. The government supports this longer-term target through complementary activities to improve geological knowledge of Rwanda, e.g., through state-funded greenfield mineral exploration and geological mapping efforts.

In the meantime, the Government of Rwanda's short term strategy to increase the country's mineral production has encouraged an expansion in the number of artisanal and small scale license holders using "traditional" mining techniques. At the time of writing, there are 223 "active" mining licenses in Rwanda, plus an additional 200 "inactive" licenses. Additionally, about 200-300 license applications have been put on hold as the government implements new and more robust licensing requirements associated with the new Mining Code of 2014. The present report aims to contribute to improving the performance of these mining operators and, thus, should help reconciling the short- and longer-term sector development perspectives. The assignment forms part of BGR's broader technical cooperation partnership with the RNRA and is further embedded into the regional context of supporting ASM formalization and mineral certification in the Great Lakes Region.

2.2 Historical Evolution of Mining in Rwanda

Geological exploration conducted by the Belgians in the early 20th century led to the development of the Gatumba cassiterite-coltan mine in 1926. Other discoveries and developments followed, notably the cassiterite mines at Rutongo, Rwinkavu and Nemba, and the wolframite mines at Gifurwe, Bugarama and Nyakabingo. The mines were developed by the Belgians and initially focused on (semi-) mechanized operations with appropriate investment. In addition to these larger mines, numerous artisanal and small scale mines were discovered and exploited by individual colonists.

Exploration favored the western half of the country where high rainfall and erosion of the steep terrain expose the host pegmatites and mineralized quartz veins. Hydraulic monitors were commonly used to mine surface pits and conventional mining methods followed the veins underground.

In the 1950s--1960s, management challenges and lack of sustained investment at many of the larger mining operations led to a slow change from a mining focus towards a "subcontractor model" whereby small teams of artisanal miners (drawn from nearby rural populations) were paid by production. In this model, concession holders increasingly limited their role to mineral trading, providing little technical support or

equipment and taking no direct responsibility for the mineworkers' wellbeing (Perks 2013, Cook & Mitchell 2014). The creation of the state company, the *Société Minière du Rwanda* (SOMIRWA) in 1973, a joint venture between the Rwandan state and Belgian investors, was meant to counter this development but did not prove successful in the end. After bankruptcy of SOMIRWA in 1985, a new organizational structure was introduced in 1988 with the state-owned *Régie d'Exploitation et de Développement des Mines* (REDEMI) and COPIMAR models⁵. Finally, starting in the early 2000s, mining and mineral trade in Rwanda were progressively liberalized and (re-)privatization efforts were essentially completed from 2007-2010 (Cook and Mitchell 2014).

Management of many mining operations today reflects the historical development starting more than 50 years ago. Mine owners in Rwanda continue to function largely as traders, leaving their mines to be operated by subcontractors or managed at arms' length by a network of experienced miners called "capitas" who pay miners on a production basis. Few artisanal mine owners reinvest profits in their concessions, preferring instead to transfer their profits to parallel business in more stable sectors such as real estate and construction. Mineral exploration is neither systematic nor professional but rather a "by-product" of artisanal exploitation. Mineral resources and the life of individual mines are hence not known. Mine development is chaotic and mineral recovery efficiency is low. Future resources are sterilized by indiscriminately mining zones of surface enrichment. Work conditions are relatively advanced compared to the ASM sector in neighboring countries, but still far below international standards.

In contrast, medium to large-scale mining operations around the world utilize mine and business management techniques that ensure a reasonable level of best-practice in the domains of safety, environment (water and waste management), post operational and social impact. International non-artisanal mines are characterized by a high degree of planning which assures investors of profitability and banks of repayment of loans. At the same time however, the mechanization implicit at high-efficiency medium to large-scale mines accelerates the depletion of the reserves (and, thus, a lower life of mine) and lowers the rate of local employment.⁶

While artisanal mines in Rwanda contribute strongly to the national economy through export revenues and rural job creation, the high degree of informality of the sector (weak business and mine management skills) limits access to capital as well as state revenues from the sector.

Unfortunately, there is very limited access to technical knowledge in Rwanda that can improve mining and mineral processing methods or ensure protection of workers and the environment. There are currently less than 20 competent geologists and mining engineers in the country⁷ (limiting also national capacity to regulate the sector). Poor understanding of the site geology prevents delineation of resources, and artisanal operators have limited knowledge of the relevant regulatory frameworks, leading to

⁵ REDEMI focused on the established larger mines whereas COPIMAR managed the artisanal small-scale mines; see the detailed description of this model in the report section on skill transfer.

⁶ mechanization brings higher skill levels, but only to a limited number of workers

⁷ "competent" refers to persons who have an appropriate university degree and professional experience to act as geologists or mining engineers; note that geographers, environmental and economic experts all have their value and play an important role, but they cannot replace the above core categories when discussing geological knowledge and mining sector development.

an overall low level of compliance in many areas. The finite higher-grade mineral resources close to the surface have been mined extensively; in order to sustain the mining sector's long-term output, increased mineral exploration efforts, adapted to the ASM context, are urgently needed to expand the national mineral resource base.

The sector cannot overcome the challenges it faces overnight. It is widely considered best to pursue progress stepwise, little by little. For artisanal miners, business planning, exploration, mine development, equipment and waste management solutions should be low-cost and funded in as much as possible by internal profits. Also, due consideration must be given to the impacts of sector development: Investments in equipment such as excavators or bulldozers at artisanal operations in Rwanda can increase the level of environmental degradation while reducing employment levels. In scenarios where miners adopt mechanization without planning, operating expenses quickly outpace production increases and the operator loses money.

2.3 Objectives of the Assignment

The original objectives of this assignment followed up on a recommendation by Cook and Mitchell (2014) to facilitate knowledge and skill transfer in Rwanda, based on technical and management capacities selectively available within the mining sector. The following objectives were originally defined in the Terms of Reference of this assignment:

1. Conduct a systematic assessment of the mine management and business planning capacity of selected representative small-scale mineral producers in Rwanda;
2. Identify and recruit suitable national companies and individuals in order to establish a pool of experts with advanced practical knowledge of and experience in the mine management and business planning domain who can act as mentors/trainers for smaller companies/cooperatives in Rwanda;
3. Develop and consult a skill and knowledge transfer concept linking capacity gaps with available capacities;
4. Develop and consult an implementation plan for the above concept.

This approach then evolved during implementation of the assignment in response to feedback from the involved stakeholders in Rwanda. The focus of the capacity assessment was expanded to additionally include technical aspects beyond the mine management and business planning domain. A suitable recruitment mechanism to establish an in-country pool of experts could not be developed in detail, hence the consultancy focused on outlining the available in-country capacities more generally. High-level ideas, recommendations and practical suggestions on facilitating a skill and knowledge transfer concept to strengthen ASM sector capacities were put forward and consulted with sector stakeholders in Rwanda. – These will require more consultations in terms of clarifying priorities, roles and responsibilities, and resources prior to implementation.

3 METHODOLOGY

Chapter 3 describes the methodology of the assignment's capacity assessment which, in turn, provides the base for recommendations on training and skill transfer. A desktop study combined the findings of published and unpublished literature with the extensive knowledge of the assessment's author. Five mines were visited to absorb the current on-the-ground situation. Structured (questionnaire-based) and unstructured interviews were held face-to-face in Rwanda as well as through telephone and e-mail surveys. Two feedback workshops with mining sector stakeholders were organized in Kigali to calibrate the assessment findings and recommendations presented below.

The best efforts were made to collect reliable data. Artisanal mining, however, is a milieu well known around the world for its lack of transparency and the reticence of owners and managers to freely share the details of their business and mining activities. Furthermore, while biases may have been introduced in the delivery of questions during interviews, these possible biases are considered to be relatively slight. The author is confident that the data collected is as reliable as possible, and that the recommendations that follow are appropriate solutions to the knowledge and capacity gaps encountered in the sector in Rwanda.

3.1 Previous Knowledge of Artisanal Mining in Rwanda

At the outset, the research relied on the knowledge of the principal author who is well acquainted with the challenges facing artisanal mining in Rwanda.

Stephen Metcalf's knowledge of the ASM sector in Rwanda was acquired during a 3-year position as an on-site manager of a German mining and trading company. During this time he conducted an extensive needs assessment and developed engineered options to improve artisanal waste management and mineral recovery efficiency, and developed a program to improve mine safety through better mine planning and business management.

This experience⁸, together with input from the Rwandan partners (RNRA and the RMA) and BGR informed the choice of mine site visits, stakeholder and miner interviews, as well as the design and analysis of the capacity assessment outlined below.

⁸ Mr. Metcalf's research in Rwanda was supported by Mr. Claver Mahungiro, a geologist who has worked in Rwanda for 40 years, serving from 1976 to 1992 as Director General of Mines and Quarries and Director General of Mines and Geology at the Ministry of Mines. Mr. Mahungiro organized the country's artisanal miners under the umbrella COPIMAR which provided comprehensive local management and technical support in the main regions where artisanal mining takes place.

3.2 Record and Data Review and Analysis

Prior to and during the field work the research reviewed the following documents; note that public documents included in the reference list are not repeated in the list below:

- Regulatory Review on Labor & Employment and Health & Safety in the Mining Sector (unpublished private sector report);
- Law n° 13/2014 of 20/05/2014 on mining and quarry operations;
- Strategic Plan of the Rwanda Geology and Mining Authority (2010-2013);
- GMD mine inspection manuals and inspection summaries, monthly company production reports, mineral license applications and associated business plans (5 current applications from GMD), Mine Sites Data base 2014;
- Analysis of Mine Production Data, MINIRENA 2015;
- Economic analysis by GMD's Support Services in Mining Investment and Business Development;
- Interview notes of owners and miners visit reports as well as selected Rwanda Revenue Authority data (internal documents from Cook and Mitchell 2014);
- MINIRENA forms and guidance: Mineral and Quarry License Application; Reporting templates for Mineral License Holders;
- Company-internal Environmental, mineral processing, safety reports;
- National Bank of Rwanda, List of Mineral Exports 1998-2015;
- Wilson I. (2013): Environmental, Social and Economic Dimensions to Consider in the Development of the Mining Industry in Rwanda, UNECA.

Company records:

Access to additional internal company planning, operational and financial records was very limited. The assessment was not an official audit and the research team was not able to require that mining companies disclose their internal records.⁹ Mining is a private sector activity in Rwanda and the lack of transparency encountered during the research is a normal characteristic of independent enterprises throughout the world. In addition, it is anticipated that companies operating in an ASM environment often simply do not cultivate proper record keeping systems (see assessment below) and may generally lack adequate documentation procedures. To compensate for this lack of first-hand information, the research team relied on site visits and structured interviews of mine owners and managers, cross referencing findings with personal experience and non-structured interviews with sector experts and stakeholders.

3.3 Site Visits and Mine Owner Interviews

Five mines were selected for site visits. Selection criteria included location (at least one mine in each province), organizational structure (private or cooperative member of FECOMIRWA, the *Fédération des coopératives minières au Rwanda*), volume of mineral production, and degree of mechanization.

⁹ Documents which are commonly referred to by mine owners when describing their management practice (e.g., the Business Plans, Geological Studies and EIAs that are part of the license application, and accounting records (e.g. statements of profit and loss) were not accessible.

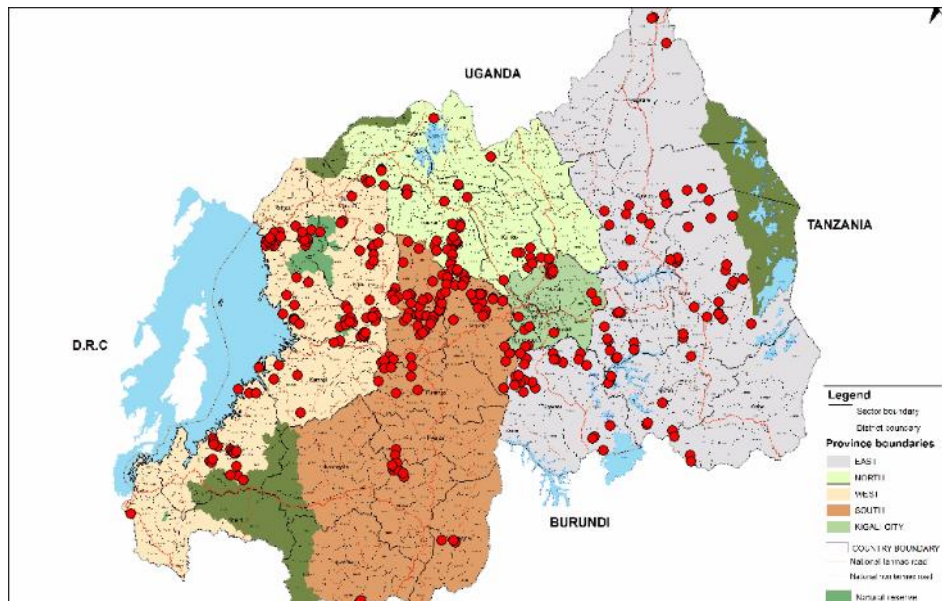


Figure 1: Location of mines visited (yellow stars) in relation to distribution of mines in Rwanda (red dots) (Map OECD/UN GoE Field trip, Kigali 2013)

Table 1: Mineral production at the studied small-scale artisanal mines

	Mine 1	Mine 2	Mine 3	Mine 4	Mine 5
Mineral	Coltan + SnO ₂	SnO ₂ + Coltan	SnO ₂ + Coltan + WO ₃	Coltan	SnO ₂
Years in business	Since 2001	Since 2009	Since 2004	More than 15 years	--
Typical Production	500 kg/ month	700 kg/ month	5000 kg/ month	2000 kg/ month	1250 kg/ month

In advance of the field visits, 87 questions were compiled querying the linked issues of business (38 questions) and mine management (49 questions). Brief mine site inspections were followed by structured interviews of the mine owners according to the questionnaire format. The questionnaire focused on the following themes:

Business

- Mine management and business planning
- Marketing/commercialization
- Record keeping and finance
- Community relations
- Office technology
- Written Policies

Technology

- Exploration
- Mine planning, mining and mineral processing
- Safety, health and security
- Labor management and work conditions
- Environment

The field visit team included Mr. Mahungiro and, variably, representatives of the BGR, the Geology and Mines Department (GMD) of RNRA and the Rwanda Mining Association. Travel distances limited the time spent on site to 2 to 3 hours each.

In an attempt to balance any bias that might accord the limited number (five) of mines visited, three additional structured interviews were held with experts in Kigali who are well acquainted with Rwanda's artisanal mine operation and management practice. Each interviewee was asked 87 questions.

3.4 Unstructured Interviews

In addition to the 8 structured interviews indicated above, the author met with 55 stakeholders and sector experts in Kigali. A list of interviewed stakeholders is included in Annex 8.2.

3.5 Follow up Surveys

Following the mine visits and expert interviews (which focused equally on business and mine operation practice) the research sharpened its focus on the ability of Rwanda's miners to successfully:

- Plan and finance mine development
- Manage company finances (bookkeeping, accounting and financial reporting)
- Manage human resources and company communications
- Meet legal requirements including taxation.

Email questionnaire:

A follow up questionnaire of 54 questions was emailed to owners of the 5 mines visited. Questions focused on:

- Choice of mine site
- Choice of mining tools and equipment
- Mine planning process
- Investment process
- Exploration process
- Staffing structures
- Record keeping
- External influences and investment risks
- Perceptions of strengths and weaknesses

Telephone questionnaires:

Because 5 mine visits are too few to constitute a representative sample (even with the additional 3 expert observers) three telephone surveys were made of 39 randomly selected mines operating in the Southern Province:

1. Mine Owners – *Business financing and training needs (7 questions)*
2. Mine Owners – *Business structure and planning practice (11 questions)*

3. Mine Managers and Subcontractors – *Mine site operational organizational structure, planning and financing (9 questions and 4 calibration site visits)*

Two cycles of short telephone interviews with 39 owners and their respective subcontractors, managers and capitas were conducted to supplement the data collected in the first two surveys. A GMD accredited business expert, Claude Gasita Mutorero of Wand Mining Consultancy Company, who is familiar with mine operations in the Southern Province¹⁰ was engaged to conduct the survey in Kinyarwanda. In this survey, simple yes or no questions provided an index of the general business health of the company and its degree of regulatory conformity. And because mine owners in Rwanda are often guarded and non-transparent, other questions were open-ended.

Because some participants required suggestions of possible answers to the open-ended questions, a degree of bias may have been introduced. In as much as possible, the analysis of the survey data has filtered for any biases due to prompting during the delivery of the questions. The credibility of the findings is also assured (if only partially) by “triangulating” with the findings of the other surveys, the information given by stakeholders in unstructured interviews, stakeholder feedback at the assignment’s two workshops, and direct experience in the Rwandan mining sector. The credibility of the survey is further supported by the responses of similar questions asked of the owners and the subcontractors, managers and capita – findings of education level, existence of contracts, bank and accountant-use match reasonably well.

3.6 Feedback Workshops, Analysis of Field Data and Concept Development

Data from the desktop studies, interviews and site visits was interpreted qualitatively, leading to the identification of skill and knowledge gaps and the development of a set of recommended learning themes. Concepts and recommendations presented as part of this assignment were developed through on-going feedback from and reflections on discussions with stakeholders in Rwanda and the associated analysis of findings.

The validity of the overall capacity assessment was discussed and calibrated at two feedback workshops organized in Kigali on June 22 and July 3, 2015. The workshops featured 25 and 22 Rwandan participants, respectively, assembling representatives from the private sector (mining, banks, and service providers) and Government mining authorities.

¹⁰ It is known through personal experience that the mines in the Southern Province are representative of mines throughout Rwanda.

4 CAPACITY ASSESSMENT

Business planning and technical management responsibilities are shared among different persons in the typical small-scale mining company or cooperative in Rwanda. Mine owners, managers, “capitas” (miner team leaders) and subcontractors fulfill complementary tasks; owners are responsible to organize investment and long-term strategy while short-term planning and day-to-day management is almost completely delegated to the other actors. This system worked reasonably well while mining companies essentially acted as low capital expenditure traders purchasing minerals from subcontracted artisanal miners working on their concessions. However, the same management approach has limits when larger investment into mining equipment is considered in order to increase production and improve productivity as required for sustained mining sector growth.

The present research assignment analyzed the impact of the above management framework for a range of relevant subtopics and provided additional suggestions for learning themes that could be considered for planning a larger-scale sector capacity building program. The latter should recognize that the persons currently involved in the sector’s management have a significant range of educational background and business / mining management training and experience. At the same time, they seem mostly concerned with short-term production increases and seek advice to improve their technical capacities in this regard. Business management capacity building strategies will have to take this into account by building technical as well as business capacity and clarifying the linkages between the two.

At the outset, while submitting a mine plan and documenting exploration efforts are required through several license types, mine planning is often not systematically informing the mining practice. Likewise, in some cases investment decisions are not based on a clear business plan thus increasing the relative investment risk. This, in turn, impacts on the ability of mining companies to secure loans from Rwandan banks. While some miners are successful to obtain loans from commercial banks, these loans are often secured through other business or private property of the owner, rather than through the mining company’s performance with regards to exploration results and erected mining infrastructure.

Progressive improvement in terms of business and technical management of small-scale mines would seem feasible if owners and managers more often received proper advice from qualified third parties such as consultants or Government mine inspectors (see Chapter 6 for details). Relatively simple improvements in terms of sampling procedures and mineral processing could improve productivity while more substantial capacity building in exploration (adjusted to ASM context feasibility) and associated mine planning could provide the base for longer-term production, where geologically justified. Complementary efforts should improve health and safety management or company communication channels with local communities and regulators.

4.1 Structure of Mine Management in Rwanda

Organization of mining companies in Rwanda is complex and variable. Mines may be private companies owned by individuals, or “cooperatives” owned by at least 10 “members” who hold equal shares¹¹. In both of these structures the owner holds the mining license but usually does not operate the mines themselves, preferring instead to operate at arm’s length through site managers or „chief capita¹²“. The latter are responsible for the day to day operations at the mine, leaving the owner to function as a trader, buying minerals from the mining teams and selling at a profit to mineral exporters in Kigali.

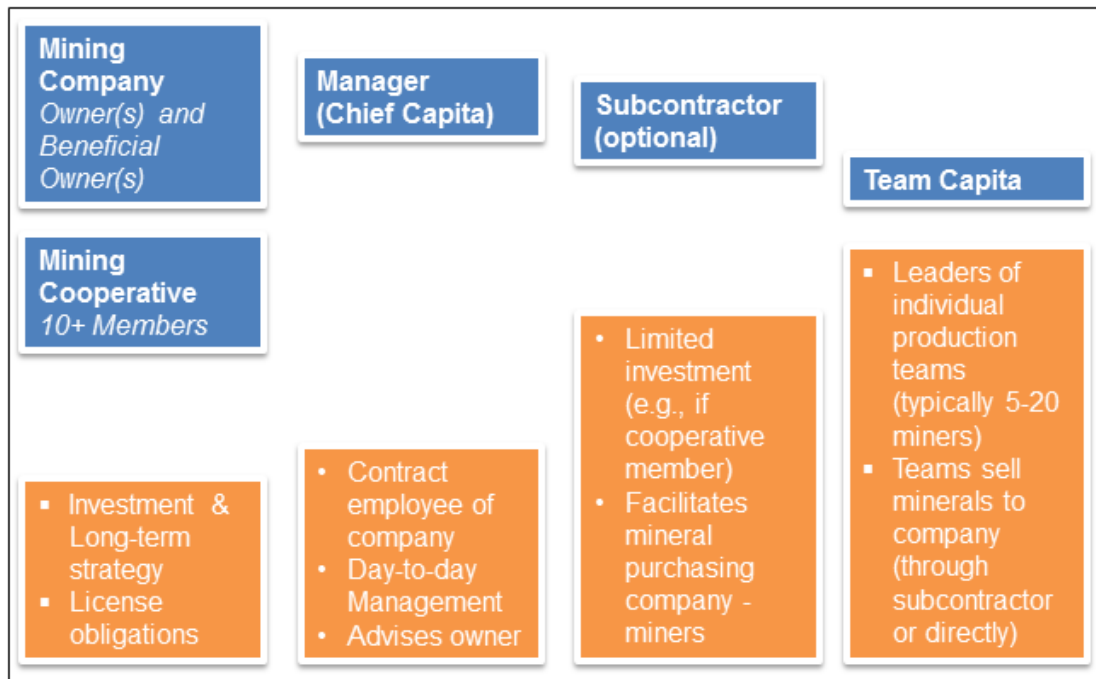


Figure 2: Illustration of typical mine management structure in Rwanda

On site, mining operations are organized through different models of subcontracting and control. At about 20% of mines in Rwanda, site management is contracted to “subcontractors” who in turn engage “capitas” to manage individual teams of several miners. Subcontractors are monitored by the owner’s managers. Other mines operate without the subcontractor management level. Generally, short-term planning at the mines is done by managers and capas whereas long-term planning responsibility rests with the owner (supported by their staff)¹³. Managing staff (mangers, sub-contractors and capita) often have a contract with the mine owners but in few cases don’t, e.g., due to uncertainty about the life of mine.

¹¹ Mining cooperatives in Rwanda are no longer “cooperatives” in the international sense where all workers are equal members. Rwandan cooperatives are more like a small company which is owned equally by a small number of equal shareholders. This is similar to the situation in the ASM sector of Burundi and the eastern Democratic Republic of Congo. Necessary caution should hence be applied when discussing ASM formalization success just based on the number of registered mining cooperatives.

¹² At about 80% of mines in Rwanda, site management is delegated to experienced miners called “chief capas” who are usually direct employees of the company or cooperative.

¹³ External consultants are only rarely involved in planning; they prepare documents for the license application, but these documents are currently not much in use as operational guidance (see below).

In practice, for example, one cooperative visited puts its mine site at the disposal of a subcontractor whom the cooperative provides the means of production such as the water supply (e.g., water races), expropriation funds, etc. The cooperative also provides personal protective equipment (PPE) (although the subcontractor must eventually reimburse these costs). The work of the subcontractor is monitored through the appointed manager.

Profit distribution between companies/cooperatives and subcontractors is variable. One scenario includes a subcontractor who is not a member of the cooperative; in this case, the subcontractor pays a fee of 12% of mineral production at sites where investments by cooperative are required, and 7% of production at sites where no investment is necessary. When the subcontractor is a member of the cooperative, the subcontractor fee is reduced (10% when the cooperative makes investments, and 5% when the cooperative doesn't invest). In all cases, the subcontractor agrees to sell all production under his supervision to FECOMIRWA, and provide the workers with small tools (e.g., hammers, chisels, shovels and timbers for underground support). Cooperative dividends in this arrangement are limited to a maximum of 6% of the profits.

At one private company known to the researchers, a subcontractor receives a fixed price per kg of concentrate based on negotiations reflecting the relative investments. Subcontractors are monitored by the company's manager who is a permanent employee of the company and who receives a fixed salary. Capitas, Managers or Subcontractors pay individual artisanal miners their part in production revenues, either in cash, through Savings and Credits Cooperatives, or through banks. For a more general review of mineral price structures in Rwanda resulting from the above framework see Cook and Mitchell (2014). The following table gives an overview on variable management arrangements as reported by mine owners in the phone survey.

Table 2: Numbers of subcontractors, managers and capitas (telephone survey in Southern Province)

Mine number	Subcontractors	Managers	Capitas
1	Not applicable—not in production		
2		1	1
3	8	1	4
4		1	2
5			3
6	Did not answer telephone		
7		2	20
8		1	
9	2	2	5
10		1	1
11			
12	2		4
13	Did not answer telephone		
14	1	1	1
15	Did not answer telephone		
16			3
17		1	4

Mine number	Subcontractors	Managers	Capitas
18			1
19		1	2
20		1	5
21		1	1
22	Did not answer telephone		
23	Did not answer telephone		
24		1	4
25	Not applicable—not in production		
26		1	2
27		1	10
28			1
29	Not applicable—not in production		
30	Not applicable—not in production		
31	1	1	2
32	Did not answer telephone		
33	1	5	18
34		1	5
35		1	2
36			4
37		1	4
38		10	10 (+10 secretaries)
39		2	6

The individual responsibilities by the different groups, based on the phone survey among miners in the Southern Province, are (self-) reported as follows¹⁴.

Table 3: Management responsibilities of subcontractors, managers and capitas in Percent (%)

Responsibility	Manager	Capita	Subcontractor
Human Resources	33	20	20
Logistics	37	40	20
Record keeping	30	40	20
Worker supervision	7	43	20
General management	27	0	20
Inventory control	3	17	20
Taxes	20	20	20
Finance	3	3	

¹⁴ It seems likely that the interviewed persons did not all have the same understanding of the individual items asked, hence the data in the table should only be regarded as qualitative indicators of relative work focus.

4.2 Business Planning and Financing

Prospective mines in Rwanda are often identified based on existing artisanal operations. Companies/cooperatives qualitatively assess their production potential and then decide to apply for a license. Mining methods applied in a given operation often remain the same, continuing from former informal operations. Mine owners follow the advice of the miners onsite. This usually implies low-investment artisanal methods (using hammers, chisels and shovels) irrespective of actual license documents and requirements. Existing documents (required for license application) such as mine plans, resource estimates or environmental impact assessments are not often referred to for operational guidance.

As the amounts invested in artisanal mining operations increase, planning becomes necessary to manage and reduce risk. Currently, however, the capital at stake at Rwanda's artisanal and small scale mines is still limited to hand tools and small pumps. Furthermore there is limited ongoing obligation to the workers – when grade or volume of ore diminishes workers spontaneously seek work elsewhere; when mine conditions improve there is invariably a ready supply of unemployed miners.

Now however, some mines are transitioning to higher capital expenditure levels, but investment decisions are still made on criteria developed in the previous low risk environment. At one mine visited, for example, the easily exploitable weathered pegmatite ore has been consumed, creating the need for more mechanization to access the underlying unweathered ore zones. The decision to purchase or rent an excavator under these circumstances should be made in the light of a mine plan based on geological evidence and calculations of net present value, rather than on intuitive strategies practiced when the investment risk was lower.

Consequently, occasional investment into heavy equipment (rental or purchase; often for excavators) is made without a verifiable business plan and investment strategy. The relatively low level of education and/or lack of specific mining expertise of many mine owners makes it difficult for them to plan activities, especially when mathematical calculations are required. Usually mine owners delegate these activities to more educated or experienced people, where available¹⁵. Indeed, few in the mining sector know what Net Present Value (NPV) or Internal Rate of Return (IRR) calculations are, or how they benefit planning¹⁶.

The impacts from the above planning deficits are reflected, for instance, in situations where purchase and use of heavy equipment has not led to verifiable long-term increases in production. Additionally, forecasting income from mining is difficult in the changeable 3T metals market. Even so, it would be beneficial if mines made short term forecasts reflecting estimates of best-, mid-, and worst-case mineral price scenarios, and plan implications for mining activities. Currently, miners sometimes stockpile minerals during price declines, but this depends on the availability of cash.

¹⁵ FECOMIRWA members among cooperatives may receive financial and technical advice from this organization.

¹⁶ NPV and IRR refer to model calculations analyzing discounted cash flow over a certain time period. These methods are commonly used in professional mining projects in order to optimize capital investment decisions, e.g., deciding whether to rent or buy certain types of mining equipment.

Most miners believe they have a working mine plan – the document that accompanied their mine permit application. These, however, are actually rather “action plans” that stipulate production and spending milestones, and give little guidance on operational matters. The Rwandan consultants (accredited experts) producing these reports would benefit from workshops to upgrade their skills and lead to higher quality reports. Such workshops could be based on high-quality example mine plans and feasibility studies. Unfortunately, miners are not able and/or willing to spend the money necessary to make a mine plan document containing sufficient detail that would provide any in-depth operational guidance¹⁷. Changing this mind set will be slow and will require constant demonstration of real benefits to show that increased production and increased recovery can come from proper mine planning.

Loan Evaluation Criteria

A practical training recommendation would be to build the miners' ability to generate the portfolio of documents which demonstrate the management strength and geological potential that banks (and investors) require for financing. While commercial banks currently perceive the mining sector as too risky for financing, loan evaluation criteria are a good index of business management capacity. Typical evaluation criteria include:

- ✓What collateral is available?
- ✓How long has the business operated? What is the credit history? Is the company reinvesting profits in its operations?
- ✓What is the riskiness of the sector?
- ✓Is there a business plan? What is its scope and quality?
- ✓Is there a market study (not only for mining, but also for the market to downstream consumers)? Who are the downstream customers of the company?
- ✓Is there competition? Are other suppliers better located? Can they produce minerals for less?
- ✓Is there a unique selling point over the competition (e.g., CTC or other certification)?
- ✓What is the competence of the management?
- ✓Does the company earn enough money to pay interest and repayment of the loans in the future (based on the business plan and the last two balance sheets)?
- ✓Are there at least two people in the top management level? How old are they and are they reliable? Is the (age-related) succession adequately ensured? Who runs the company in case it happens something to the persons in the top management level? Is the company still capable of taking action?
- ✓Are there enough professionals in this sector available to hire?
- ✓Is there a geological evaluation/reserve estimate? Does the company have enough mines / mineral rights? Do they have an exploration program? What is the quality of the evaluation?
- ✓Does the bank already have other borrowers in this industry? (Is there a concentration of risk?)
- ✓Does the company have all the insurance it needs? Is there a risk which is not covered yet? Are there any environmental or tax liabilities? What is the relationship with the local communities? Local Government? What is the CSR program?

¹⁷ The mine plans, geological studies, and environmental impact assessments that have accompanied license applications at Rwanda's artisanal mines typically cost between \$500 to \$2000 each, less than 10 % of the cost of an actionable comprehensive study

Limited access to financing for investment is often cited as a major constraint to further mining sector growth. Access to financing is limited due to the above deficits in business planning and lack of adequate loan securities. However, it is noteworthy that 4 of the 5 mines visited for this assignment indicate they have some loan arrangement with banks. One loan is substantial and it would be interesting to learn more about the terms of these arrangements. It is understood that the loan is often secured through personal property or other business objects of miners. Virtually all miners have parallel businesses. It is widely understood that mine profits are transferred to support other business. Conversely, there is little profit re-investment into the mines themselves.

All miners included in the telephone survey indicated that they are using bank accounts. The use of banks is required by the Rwanda Revenue Authority (RRA) which uses bank transactions as an index of regulatory compliance, and which establishes a banking relationship and builds a credit history. About 80% of miners (referring to both visited mines and mines participating in the telephone survey) use an accountant for their financial operations¹⁸. Those who do not use an accountant indicate that they expect to do so in the near future. These findings suggest that most of the mines interviewed are (or could be) generating statements of profit and loss, which is a key requirement of the RRA.

Recommended learning themes:

Mine owners need to have more confidence in their management abilities. Training should ensure that owners understand what the basic management tools can do, even if they cannot perform the tasks themselves.

- Business management
 - Management confidence-building of mine owners.
 - Self-evaluation - how to establish criteria for monitoring progress
 - Practical human resource management techniques
- Financing
 - Review of bank loan criteria
 - Partnership / equity funding
- Understand what the basic management tools (double-entry book keeping, Excel, etc.) do, even if mine owners cannot perform the tasks themselves.
- Cost estimation
- Management training that would help RMA members succeed in other business activities.
- How to build a relationship with microfinance and commercial banks, and knowledge of requirements for loan applications.
- Use of spreadsheets to compile and graphically represent changes in production relative to expenses

4.3 Marketing and Commercialization

Mining companies sell their pre-concentrate production (purchased from artisanal miners through subcontractors or capitas) to Kigali-based mineral processors and exporters. The price they are receiving reflects the concentrate grade (metal content)

¹⁸ The accountant may be responsible for the owner's other business ventures as well.

as well as the international benchmark price¹⁹ (Cook and Mitchell 2014). During these transactions, mine owners rarely control the grade of the concentrate they sell; they leave grade analysis to the exporter (who might use an in-house or independent laboratory). In some mines, there are unsystematic and undocumented procedures where a qualitative evaluation of ore grades (feed and tailings) is made by panning. It would be beneficial if more mining companies knew how to sample their concentrate and send for professional analysis²⁰.

Pre-financing refers to an arrangement where a mining company receives a certain amount as advance from an exporter to facilitate their cash flow while producing an agreed amount of minerals to be delivered to this exporter. This arrangement is common in Rwanda²¹, but this limits the miners' ability to negotiate for better prices. If bank financing were available, owners might have more scope in price negotiations with exporters.

Recommended learning themes:

Lacking are understandings of the international metals market and pricing mechanisms, the distribution of profits along the value chain, general certification systems and options, and the importance of certification mechanisms for market access. Therefore, Miners would benefit from learning about the international metals market structures and systems. This could be combined with learning the mechanics of chain of custody systems and options.

Sampling and analysis

- Sampling and weighing techniques
- Basic geochemical analytic methods and interpretation of results

Value chain

- Understanding of the international 3T market and pricing mechanisms
- Distribution of profits along the value chain
- Importance of certification mechanisms for Rwanda's market access
- Certification systems and options.

¹⁹ While metals prices are determined by international benchmark prices, there is a long term potential to earn a "fair trade" premium if such a model were to be developed and implemented Rwanda. As management skills grow, fair trade could be an option for mines performing at a high level. The Certified Trading Chains (CTC) project, jointly run by BGR, RNRA and selected Rwandan mining companies from 2008-2011, already laid the foundation for such an initiative by developing standards and auditing procedures. In order to be effective, the scheme would need more international marketing and buy-in, though.

²⁰ As far as analysis at international laboratories is concerned, the process of organizing the export of samples from Rwanda and assembling the necessary documents is perceived as slow and cumbersome by some private stakeholders. GMD maintains that the processing time for export authorization is one business day, but this depends on the availability of key staff who are familiar with all details of the procedure.

²¹ In turn, mineral exporters may in some instances benefit from pre-financing through an international client or trade partner.

4.4 Record Keeping and Office Skills

Mining companies often do not have adequate offices on site but rather operate a (home) office in Kigali. This is due to most mine owners living in Kigali and not visiting their mines very often. On-site stores used for mineral tagging purposes usually have associated facilities to file tagging documents (filled iTSCi logbook pages) but no further records. The iTSCi records and separate production records (documenting purchases from miners) are thus often the only records kept at the mine site. They contain information on tagged mineral volumes, prices, and non-verified pre-concentrate grade estimates. Key confidential records (e.g., income) will not be kept at mine-site offices.

The RRA requires that businesses have proper accounting systems (book keeping and financial statements showing balance sheet and profit and loss statement). Business must be registered with the Rwanda Development Board (RDB). Currently overall compliance (filing returns, payments, change of address and closure of business) is about 90% for medium and large businesses, but micro- and very small business compliance in Rwanda ranges from 10 to 40% only.

The mines visited appear to have better record keeping than the “average” mine in Rwanda. Record keeping is generally paper based which leads to the loss of documents. While the visited mines had computers on site (or access to them), most mines do not. Record keeping should improve. Payment records are often kept only by the capitas. If a mine owner wants to validate wage deductions to RRA, signed receipts of payment would be required.

Few mines in Rwanda have written policies. Miners need to acquire knowledge of the regulatory framework and priority policy subjects such as employee rights and responsibilities, safety, and chain of custody management. It should be noted, though, that several mining companies claim to have established a system of unwritten policies on some topics such as health and safety, enforced by capitas.

Recommended learning themes:

- Record keeping methods and use of computers to transmit reports
- Basic understanding of common business tools (double entry bookkeeping, Excel, etc.)
- Use of spreadsheets to compile and graphically represent changes in production relative to expenses
- Upgrading of skills to better manage iTSCi requirements
- Acquiring the knowledge about and skills to meet RRA accounting and tax obligations.

4.5 Community Relations

Community interactions and associated questions (e.g., communication strategies, local sourcing, free, prior and informed consent) are key issues for international mining companies. In the Rwandan ASM sector, where large-scale mining-related migration is not common and workers are often sourced from local communities, community relationships are less complex, but still highly relevant.

Communication channels between mining companies and communities are often not efficient. Regular open community meetings with communities are uncommon. Serious discussions with landowners to resolve expropriation issues are sometimes facilitated by District officials. Some observers note that *Umuganda* (community work) is a forum for interaction with communities. However, since many mine owners do not live near the mine they are unlikely to meet with communities during local *Umuganda* activities.

Mine owners say that their communication with workers and communities is very good, but this may be a one-sided perception. Participants of the 1st workshop indicated that mine workers are reluctant to complain about unsafe work conditions for fear of losing their jobs. In a favorable development, the Rwanda Extractive Industry Workers Union²² has recently begun to organize workers at Rwanda's mine sites. It would be interesting and productive for the RMA to poll mine workers to identify unspoken concerns – addressing some of these might increase not just safety consciousness or community concerns but also productivity and reduce theft risks.

Mine owners complain that the local governments request too much support for local projects (infrastructure development, schools, etc.). It would be beneficial if the RMA commissioned a study of the informal taxes and contributions miners are asked to pay, analyzing them relative to size of production, number of workers and/or gross/net income.

Often, mine sites are too widely distributed on license areas to prevent unauthorized access. Local fencing of highwalls and un-reclaimed pits is uncommon and this is a hazard for community members. Children can be injured playing in unsupervised current and abandoned tunnels. While active sites are commonly guarded, old workings are often not, and are thus subject to entry by local unauthorized miners.

Recommended learning themes:

- Community development
- Knowledge of the legal and social responsibilities a mine owner has to the environment and local communities
- Basic water and sanitation courses
- Water source development and protection.
 - Low cost filtration techniques for drinking water.
- Communication skills for managers
- Communication skills for security guards
 - Human rights awareness training for guards

4.6 Exploration

Mineral exploration usually forms the base for planned mining activities. Further, it is key to identify deeper-seated mineralization not easily accessible at the surface. However, mining in Rwanda often unsystematically follows informal (historical) artisanal mining activities. Additionally, the typical geological characteristics of 3T mineralization (small, erratic ore bodies with highly variable grades) as well as the rela-

²² a labor union affiliated with CESTRAR (*Centrale des syndicats des travailleurs du Rwanda*)

tively low total value of small mineral occurrences make it difficult to employ standard exploration approaches.

Findings at the mines visited are more favorable than the views of 3 industry observers' interviewed. While the mines visited appear to know more about the local geology than the "average" mine in Rwanda, they do not understand very well the spatial distribution of their mineralized veins. Exploration activities reported by some mines refer to the limited geological studies associated with the license application process. One mine reports receiving geological advice from a foreign consultant but did not provide any further information by which to assess the quality of advice.

Resources are not estimated because of the lack of geological skill and the cost. A reverse circulation drilling and sample analysis program for ten 150 meter holes would typically cost over \$300,000, but this would only give a loose indication of the morphology of the vein at relatively shallow depth. Grade data would not be reliable (representative) enough to predict reserves because of the heterogeneous nature of the mineralization. Artisanal miners are largely unfamiliar with practical measures – trenching and pitting, and interpolation from geological experience – that could be used to make low-cost resource estimates. The life of mine is therefore not known and investment returns cannot be planned over a reliable time period.

Mines have little of the geological knowledge needed to explore. Miners do not know how to conduct exploration sampling. They need one-on-one demonstrations of how to locate sampling pits and shafts, and how to collect representative samples²³. Short classroom-based geological courses such as given to mine owners for 1 week in 2014 have limited benefit – mine owners and managers are often adverse to classroom training (due for example to lack of time or low education level). On the other hand, one-on-one discussions of specific problems encountered at mine sites with Rwandan consultants or graduates of the Integrated Polytechnic Regional Center (IPRC) mine technician program would engage owners and managers in ongoing discussion and learning.

While submission of geological (ore) samples to professional laboratories is not needed when making rough estimates, Miners should be shown how to obtain chemical (X-ray Fluorescence (XRF) and Inductively Coupled Plasma Mass Spectrometry) analyses of their concentrate at professional labs, and be given some quality control and other guidelines so that they can choose an appropriate laboratory – local laboratories may sometimes be unreliable.

Recommended learning themes:

Training should recognize that low level of education and lack of geological expertise of many mine owners and managers makes it difficult for them to plan activities, especially when mathematical or chemical calculations or geological interpretations are required. When necessary mine owners delegate these activities to individuals with more education/experience. Training should therefore be basic to create a common understanding, with more complex tasks to be performed by contracted experts.

²³ Accuracy can be improved even using the spring scales used for the iTSCi tagging process; these are inaccurate in the 100s of gram range, but they are sufficiently accurate when weighing in the 50 kg range; standard weights of small quantities can be estimated by using commonly known volumes (e.g., a small tomato paste can) once the volume-weight relationships were determined/averaged with a laboratory gram scale.

Basic geology:

- Basic exploration techniques
- Sample collection – methods and limitations
- Sampling and weighing techniques; use of scales
- Basic geochemical analytic methods and interpretation of results
- GPS measurements
- Practical methods to estimate resources at small mines in Rwanda
- Understanding and visualization of geological structures in 3 dimensions

4.7 Mine Planning

Artisanal mining often involves following a mineralized vein underground along strike, without due consideration to systematically establish mine infrastructure. In some cases, historical mine workings (established by the Belgians) are exploited without adequate consideration for safety, e.g., when pillars are robbed, or for future mine development. Mines in Rwanda are only now beginning to understand how to drive safe adits and portals in the fractured near-surface ground encountered at most mines, and many still lack knowledge of how to make appropriately sized traveling ways (main transportation tunnels) or how to secure wide galleries.

Ventilation shafts are rare. This is due to the perception that the cost of digging them is high. However, experience by the author indicates that sinking or raising a ventilation shaft in typical near surface wall rocks in Rwanda (weathered schists) costs only around \$20 to \$40 per meter²⁴. Price aside, the main obstacle to creating ventilation shafts is the inability to predict the intersection of the shaft with the vein and the surface. Miners need access to reasonable cost surveyors. Local experts and IPRC graduates could be trained to do basic underground and surface surveying.

Timbering practice is improving in Rwanda, but there are still many problems, and much hands-on training is necessary. This means that technicians need to visit mines to provide recommendations more often than the once or twice a year cycle of the GMD mine inspections²⁵.

The morphology of 3T mineral deposits is complex and not well understood, even by experienced geologists. What's more, even simple vein systems can be cut off and displaced by faults. Nevertheless, a sense of visualizing veins in three dimensions and basic geological "rules of thumb" would be of great use to miners.

Recommended learning themes:

- Preparing a mine plan (case study)
- Simple surveying techniques
- Graphical methods to calculate distance on surface and underground inclinometer and tape measure; ruler, protractor and grid paper

²⁴ Digging in more competent rock costs more, up to \$200/meter

²⁵ The GMD inspectors make relatively thorough surveys of the mine operations in Rwanda, visiting each mine about once or twice a year. However the inspectors only share a summary of the key points and critical concerns that are noted during the inspection. If the mine owners/managers were taught to understand the technical data contained in the field notes, they could enter into a more productive dialogue with the inspectors and be more committed to making necessary changes.

- Basic knowledge of progressive reclamation techniques (e.g., segregation and "banking" topsoil during mine site development plant propagation, surface water control and backfilling)

4.8 Mineral Processing

Mineral processing at mines in Rwanda is limited almost entirely to ground sluicing. Miners interviewed seem to understand the influence of process water flow rate on recovery in the high flow. However, most miners do not understand that considerable economic minerals may be "un-liberated" in the quartz sand²⁶, even though they check large quartz pebbles for visible mineral content. Miners do not recognize the potential value of the quartz sand which is transported by water with the gangue and lost because of the effective low specific gravity of the quartz-mineral particles.

Mineral recovery varies from mine to mine, depending on the employed "traditional" processing methods and the mineralogy of the deposit. That said, it is understood that the recovery rate is low – commonly 2/3rds or more of the minerals are expected to be lost when waste is disposed in local streams. If miners knew how to sample and analyze the feed and waste, and how analyze the distribution of the minerals according to mineral particle size, they would understand that it is important to improve the recovery methods, and to take measures to store their valuable waste until they have the financial and technical capacity to reprocess it.

Recommended learning themes:

Sampling is a key skill for controlling the planning and day-to-day operations at mines both large and small. Sampling must be representative. This is a basic skill that is not hard to learn and practice, and should be taught to mine managers and staff. Sampling needs to follow protocols however, and would need some follow up supervision to ensure that the practice is understood and is carried out properly. Also, Miners could better manage mineral theft risks if they controlled the grade at the mining face on an ongoing basis, using simple sampling techniques such as panning and volumetric weight estimates.

Because the mineralogy of 3T deposits in Rwanda is relatively comparable from mine to mine, pilot mineral processing designs could be tested by the RMA, enabling transition to more efficient, semi-mechanized mineral processing. Test locations could become learning centers. Mobile processing equipment might be considered as well.

Specific themes:

- Gravity recovery and the concept of grain "liberation"
- Feed and waste analysis (particle size)
- Low cost milling options
- Techniques to securely store waste in Rwanda's steep and heavy rainfall environment
- Basic knowledge of low cost techniques to recycle process water, and methods to keep rainwater from passing through mine workings.

²⁶ Ore particles are inter-grown with quartz grains. The resulting grain aggregates have average physical properties (densities) such that, unlike liberated ore particles, they are not efficiently separated from the gangue.

4.9 Labor Management, Health and Safety

RNRA/GMD has installed a mine inspection unit that has been carrying out regular field inspections at an increasing number of mines in Rwanda (since 2013). While the GMD Mines inspectors have generated much improvement in safety at Rwanda's mines, there is still a long way to go. The Rwanda Mining Association should develop and implement practical programs to promote safety at mines, and deliver a program of safety training to supplement the GMD inspections (which take place only once or twice a year).

The personal protective equipment (PPE) expenditures indicated by the visited mines (ranging from \$3 to about \$90/worker/year) do not seem realistic. Furthermore, the quality of the PPE available in Rwanda is very low (it is difficult to have confidence in cheap Chinese helmets, for example). High quality equipment outlasts low-cost alternatives and is more cost effective. As a solution, the RMA could build institutional credibility by importing containers of helmets, proper mining boots, headlamps and other safety equipment, and sell these items at cost to their members.

First aid equipment is inadequate at mines in Rwanda and its proper usage is unclear. The RMA could offer certified first aid courses through the Rwanda Red Cross²⁷ or by hiring a permanent first aid manager/trainer to deliver capacity in the mining districts. As with distribution of PPE, the RMA could sell first aid equipment at cost to its members. Transportation of injured to the local *Centre de Santé* is usually done by makeshift stretcher, sometimes for long distances when cars are not available. At the minimum, each mine should have locally made basket stretchers available on site.

Mine owners and workers do not have a "safety consciousness". For example, mine owners and workers do not recognize the danger loose stones on the edge of high-walls pose to workers below. There is little understanding that a small effort (e.g., using a scaling rod) can prevent accidents. It is most probable that the only way that safety consciousness can grow in Rwanda is through constant visits to mine sites by inspectors and technicians who have an accident-prevention sensibility. If these visits were primarily directed to improving the productivity/income at the mine, the technicians would have the credibility to enable the needed consciousness shift.

If accidents happen, safety protocols are often unclear²⁸. Throughout the world, mine workers volunteer to be members of the rescue team at their mine. These teams are coordinated regionally to provide inter-mine support in the event of an accident. Mine rescue strategies can be developed through workshops with miners. The team members have special status at their mine and are very proud of their skills and bravery. They compete in practice rescue exercises against nearby mines' teams to build their strength and competence. The RMA could conceptualize a mine rescue program in coordination with the National Army and other relevant authorities.

Access control to underground workings is often inadequate. It is recommended that the RMA trains all mine owners and their managers to adopt the attendance control system used at the Nyakabingo mine. Miners there must surrender their National ID to obtain a headlamp to enter the underground workings. The Shift Boss files the IDs

²⁷ Training takes 4 Sundays for groups of 30 people. Separate courses may also be booked; BGR facilitated a two-day first aid course for selected GMD staff, for example.

²⁸ In a recent accident where a miner died of asphyxiation, the informal search and rescue team was unaware of the danger, resulting in three more fatalities.

according to the team, thus controlling their location in the mine. They must return the lamp at the end of the shift to recover their ID. If the miner does not return his lamp at the end of the shift, he is presumed to be missing underground and a search begins.

Recommended learning themes:

- Basic ground control theory
- Basic PPE for mining
 - How to choose the right equipment
 - Understanding the different manufacturing qualities of boots and helmets.
 - Understanding the limitations of various equipment (when to use, and when not to use)
- Mine ventilation
- Mine rescue techniques
- First Aid
 - Basic (for diggers) and advanced (for managers)
- Transportation (immobilization) of injured workers

4.10 Mine Owners’ Perspectives on Training

The following results were obtained through telephone survey among mine owners, managers and capitas in the southern Province. As explained in the methodology chapter, the findings refer to perception of these stakeholders, rather than to analytical findings by the author. Comparing the two perspectives is meant to allow better calibration of training needs and skill transfer concept development.

28% of mine owners surveyed have only completed primary education, equal to the number who completed secondary school. 46% claim to have a university degree. Training content for mine owners should reflect the significant number of mine owners who have a high level of education (university and secondary school), as well as those with only primary education. Looking at a larger group of mining sector employees (not just owners), the Rwanda Development Board (2012) found that only 10% had a TVET or university degree and 28% attended secondary school. The rest (that is, almost two thirds of the total) only attended primary school or did not attend school at all.

Table 4: Owners’ perception of education levels

Owner education level	%	Frequency
University	46%	18
Secondary school	28%	11
Primary school	26%	10
Total	100%	39

When asked to identify what skills owners need to improve their business, 84% said that they need training in mining business planning. 33% said that they needed general technical skills (including exploration) and 38% expressed interest in an *Akazi*

Kanozi type training²⁹ for miners. With the unclear differentiation of response categories, these results only have indicative value, rather than actual quantitative meaning. Indeed, while the strong expression of interest in mine business planning is encouraging, many mine owners also believe that the cost of in-depth geological research and mining planning (from the author's experience about \$50,000 for a typical artisanal mine) would exceed any possible benefits. Training strategies would need to take this into consideration through a progressive implementation and monitoring approach with a view to facilitating the actual practical application of new skills.

Table 5: Owners' perception of key required skills

Skills needed	%	Frequency of choice
Mine business planning	84%	33
General technical skills	33%	13
<i>Akazi Kanozi</i> training adapted for miners	38%	15
Business Management	10%	4
Exploration	8%	3
Study tour	5%	2
(Total)		(70)

When given a free choice of what kinds of trainings and strategies would be most useful, mine owners prefer technical trainings (49%) and help accessing equipment (44%). Business training is not the highest priority. As before, result categories are unclear and overlap, such that the actual poll data should not be assigned any quantitative meaning. However, the findings qualitatively indicate that mine owners are primarily action-driven; they do not yet reflect on the links between business planning and the associated technical activities aiming for production increases. This implies that capacity building approaches need to consider both technical and business support in their program design, in order to reconcile planning skills development with the perceived need for technical training (and expected productivity improvements).

Table 6: Mine owners' identification of the trainings that they think would be most beneficial to improve the performance of their mines

Key trainings and strategies	%	Frequency of choice
Technical field trainings	49%	19
Access to equipment	44%	17
Strategic partnerships	10%	4
Reserve estimation	10%	4
Study tours	5%	2
Financial partnerships	5%	2
Environmental management	5%	1
Security	3%	1
Business management skills	3%	2

²⁹ *Akazi Kanozi* is a successful and popular job skill and entrepreneurship training directed at Rwanda's youth. As discussed below in the „Skill and Knowledge Transfer chapter, *Akazi Kanozi* could probably be quickly adapted to the mining sector at relatively little cost to establish a common base level of business management skills and attitude.

Key trainings and strategies	%	Frequency of choice
Improved Infrastructure	3%	1
Knowledge of regulations	3%	1
(total)		(54)

General education level does not seem to be a significant influence on preference of strategy. However, it is mainly the group of university graduates who indicated interest in forming strategic and financial partnerships, making reserve estimates, or learning about regulations. A more precise evaluation on the specific academic background (e.g., mining or business administration-related degrees) would be required in order better understand the underlying factors impacting on strategic business decisions of mine owners.

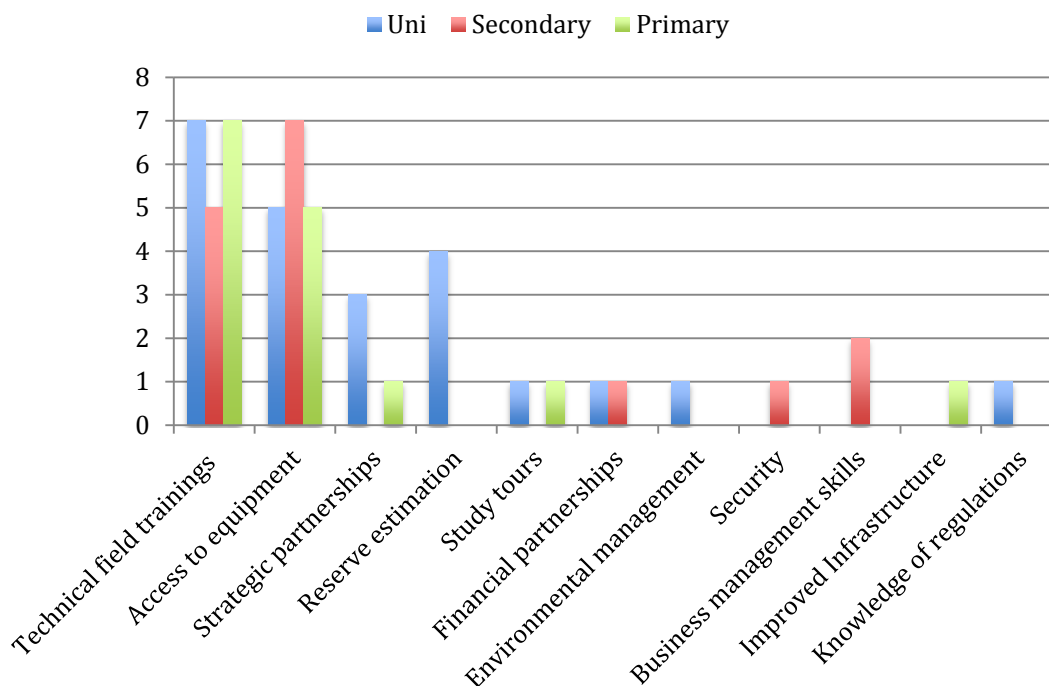


Figure 3: The influence of the education on mine owners' choices of key strategy and training preferences

The owners and managers'/capitas' perceptions of training needs are different: Managers and capas want business management training (such as an *Akazi Kanozi* program adapted for mining) and study tours more than the owners recommended, and they are less enthusiastic about the record keeping, human resource and conflict management training than suggested by the mine owners. This might suggest that the managers and capas have an aversion to record keeping, human resource and conflict management which they believe they already have sufficient competence in these areas, or they simply do not understand what record keeping, human resource and conflict management trainings might entail.

Table 7: Mine owners' perceptions of business training needs

Business management training needs								
	As perceived by mine owners						As perceived by Managers and Capitas	
	Owner		Manager		Capita		Manager + Capita	
	Re-sponse Fre-quency	%	Re-sponse Fre-quency	%	Re-sponse Fre-quency	%	Re-sponse Fre-quency	%
Business Planning	7	12			12	34	2	6
Business Management	25	44	9	20	2	6	7	21
Mining Business Plan-ning	6	11					3	9
Record Keeping	2	4	15	34	7	20	2	6
Human Resources	5	9	11	25	2	6	3	9
Conflict Management			4	9	7	20	1	3
Akazi Kanoze Training	7	12	3	7	3	9	8	24
Taxes and Regulations	2	4	2	5	1	3		
Monitoring and Evalua-tion	1	2						
Study Tours	1	2					7	21
Safety and Security	1	2						
Misc Technical					1	3		
Micro Finance							1	3

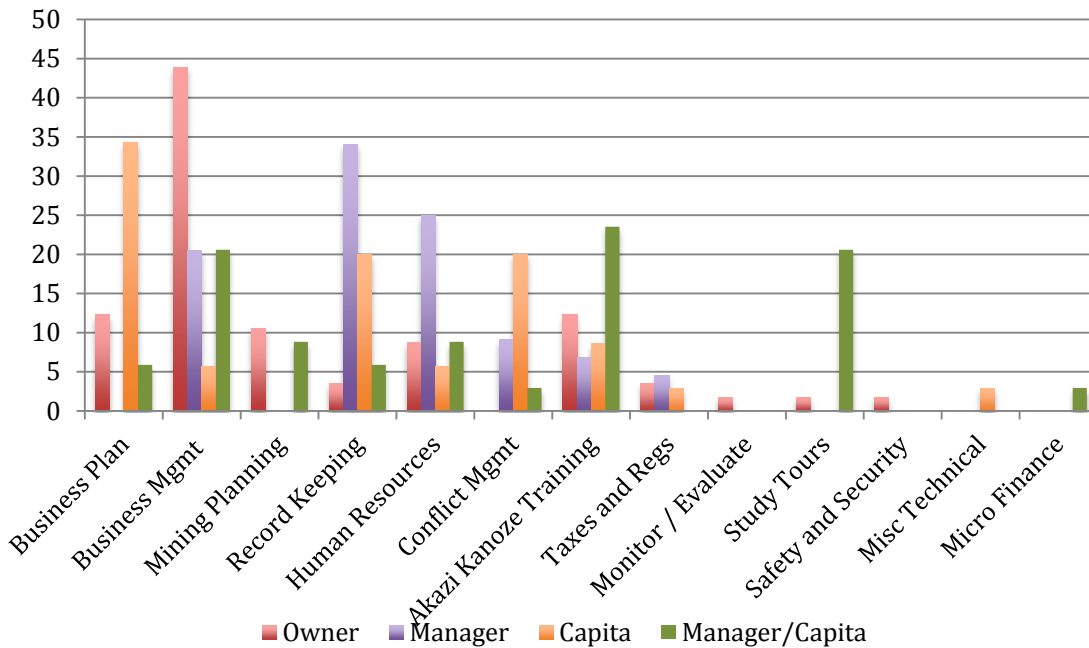


Figure 4: Business training needs identified by mine owners, managers, capita and manager/capita

5 DEVELOPMENT OF A RWANDAN POOL OF EXPERTS

This Chapter sketches where expertise is available in Rwanda in terms of business and technical management of small-scale mining operations. Outlining the available national expertise ultimately forms the base for any skill and knowledge transfer concept as discussed in Chapter 6. Where national expertise is incomplete, third party expertise (e.g., through international consultants) is required to first build the capacity of Rwandan trainers.

This research found that a range of experts currently working in the Rwandan mining sector have the expertise required to address the capacity gaps identified in the previous chapter. However, the availability of several of these experts is limited and a suitable mechanism to directly recruit such experts into a skill and knowledge transfer concept could not readily be identified through this work. However, through focusing on certain groups of Rwandan experts – or prospective experts – the skill and knowledge transfer concepts presented in this report still appear viable.

Sources of expertise in Rwanda refer to both technical and business professionals. On the former, experts include managing staff (Rwandans and expats) of the medium-scale mines and several exporters as well as *capitas* with significant experience. Further, Government staff already plays a key role in training miners.

The most relevant group to implement a skill and knowledge transfer approach refers to independent qualified geologists and mining engineers in Rwanda. While this group is currently small, the Government's initiative to develop the mining curriculum at the IPRC will soon bear fruit and a range of additional prospective experts will enter the market. While these do not yet have sufficient practical experience, facilitating their exposure to relevant practical questions and structured mentoring would prepare them to play a key role in further professionalizing the mining sector.

Also noteworthy are the range of business experts that may complement technical experts in stimulating the mining sector's business management capacity. Aside from selected staff already working for medium-scale mineral producers in Rwanda, banks, the Rwanda Revenue Authority and companies specializing on business development may all provide important contributions to sector development. Backstopping of both technical and business management experts through international experts may further increase the former's potential to act as successful trainers.

5.1 Summary of Training Priorities based on Identified Capacity Gaps

The pool of expert concept is based on the idea to progressively close existing capacity gaps in the Rwandan mining sector through building on the expertise selectively available in the sector (Cook & Mitchell 2014). The following list provides an overview on training needs based on identified capacity gaps in business and technical mine management – these gaps refer to different management levels: mine owners, managers, subcontractors and *capitas*. Many, but not all identified gaps may

be correlated with available in-country expertise. A qualitative evaluation of in-country expertise based on screening different stakeholders in Rwanda is provided further below.

Mine business management capacity gaps:

- Knowledge of the mineral value chain, market and pricing mechanisms, distribution of profits along the value chain;
- Regulatory standards and frameworks – Bank loan criteria, RRA accounting and tax obligations, labor standards, GMD & ICGLR inspection criteria, iTSCi and Conflict-free Smelter Program requirements;
- Records keeping methods, accounting, cost estimation, computer skills;
- Human resource management and community relations – Labor communication skills, corporate social responsibilities, and human rights awareness training.

Mine technical management capacity gaps:

- Mineral exploration – Basic exploration techniques and practical methods to estimate resources;
- Mine planning – Mine plan development and modern small-scale mining techniques;
- Mineral processing – Sampling techniques; basic mineral processing and waste management;
- Health and safety – Surface and underground safety and emergency procedures, ground control.

The ultimate goal of this research is to help designing training options to fill the mining and business knowledge and capacity gaps of mining companies in Rwanda. To accomplish this it was necessary to know something of the education level of the eventual learners, and to take a “bottom up” approach by listening to what learners (owners, subcontractors, managers and capitas) see as their learning priorities. These priorities need to be targeted in concert with priorities identified directly from this (or similar) capacity assessments in order to provide the right training incentives and facilitate subsequent application of newly acquired skills.

There is an ambivalence regarding priorities of mine business training and mine technical training. It appears that while mine owners want to learn more about business and planning, their preference is for technical trainings which are seen as the most immediate way to increase short-term profit. However, many mine owners lack the fundamental mine business planning background upon which technical mining decisions should be executed. Hence, moving forward on selected items with a technical production focus only would not account for the necessary longer-term perspective of facilitating sustained mining sector growth.

All mines are using banks and most are using accountants³⁰, suggesting that miners are at least partially compliant with RRA requirements. Training can build on this knowledge and management platform.

For the purpose of business management training, it is promising that the education level of mine owners seems to be higher than reported by many industry observers, some of whom have suggested that many mine operators are functionally illiterate.

³⁰ Accountants (and other staff such as secretaries) may not always work exclusively for the owner’s mining company but may work for his other business ventures as well.

However, there does not seem to be a direct correlation between education level and actionable knowledge of skills relevant for mine management yet. Different company-internal management structures (owners using managers, subcontractors and capitas) are in place. This structure should be targeted and leveraged for maximized training impact. Once experience from rolling out the skill and knowledge transfer concept increases and capacities are progressively built, refinements of the present management structure may result.

5.2 Framework for the Pool of Experts: Expert Availability and Evaluation

This chapter identifies a number of qualified potential experts, but consultations with stakeholders made it evident that the availability of experts is a significant limitation to their ability to mentor mine owners or managers. Indeed, while the expat and Rwandan technicians and administrators working at the country's larger mines are very knowledgeable, they are very busy³¹. The research did not proceed to a point where the feasibility of specific recruitment mechanisms could be outlined in detail. However, the general recommendations on skill and knowledge transfer concept design provided in the following chapter are adapted to this inherent challenge.

Evaluation criteria to select experts were identified through the present research and consulted at the 1st workshop. Technical expertise, methodological breadth as well as social competence should be the main criteria for selecting the pool of experts, rather than relying only on certification or academic history. However, certification or recommendations by competent national, regional or international authorities may provide additional value. Additionally, honesty and integrity of prospective experts should be verified (e.g., through police records).

An open application process of interviews and review of CVs may be useful, but perhaps is not necessary, given the very small size of the mining community in Rwanda and insider knowledge of relative competencies.

While some people have a natural teaching “gift”, there are many skills that can be learned. Trainings for the pool of experts can be designed to develop many of the methodological and social competences listed in the table below. The local background of targeted trainee groups needs to be taken into consideration, however. Foreign experts (if necessary) should therefore always partner with local experts.

Table 8: Characteristics of successful trainers

Technical expertise	Methodological Competence	Social Competence
Interdisciplinary expertise	Ability to share knowledge	Affable personality structure and behavior (frankness, obligingness, tolerance, loyalty, independence, integrity, reliability, natural authority, flexibility, sound self-confidence, optimism, will-

³¹ While the experts working at some mines in Rwanda are busy, it is important to note that their expertise has repeatedly been mobilized over the past five years for temporary training efforts (as shown in the next chapter).

Technical expertise	Methodological Competence	Social Competence
		ingness to learn, success oriented)
Sound technical knowledge in ...	Analytical way of thinking	Interpersonal skills
Ability to anticipate the social and economic consequences of measures	Ability to solve problems	Ability to manage conflicts and to take critic
Ability to anticipate the ecological consequences of measures	Ability to investigate and to process information of primary and secondary sources	Ability to convince and to reach a consensus
Ability to quantify the economic implications of measures (costing, study on the economic efficiency, feasibility studies etc.)	Ability to acquire and digest new knowledge	Sensitivity and understanding for cultural and social circumstances
	Ability to advise, to instruct, to train	Willingness to perform, perseverance
	Ability to establish priorities	Sense of responsibility and interested to take responsibility
	Ability to manage task (structuring etc.)	Ability to cooperate
	Ability to manage resources (time, personnel, funds)	Ability to work in a team
	Ability to create networks, to include and involve other groups	Experience in the country; knowledge of the language
	Ability to estimate the implementation possibilities and the chances for future developments	Flexibility, creativity, innovative and venturesome
	Knowledge of methods for the development of strategies, planning methods, supervision, evaluation (M+E) methods and methods for the adjustment of projects	Interest in continuous improvements, future oriented
	Knowledge of methods for presentation, motivation, sensitization, moderation, communication and transfer of knowledge	
	Handling and adjustment of instrumentalized methods to the present necessities	

Table contents courtesy of Projekt Consult GmbH

5.3 Technical Professionals

There is a significant shortage of experienced mining professionals in Rwanda where most qualified geologists and mining engineers are at retirement age. 30 technicians are just emerging from the IPRC's 3 year mine technician diploma program—while the technical training of these students is very good, they still lack practical experience. Both populations would need teaching training and technical skills upgrading

(which could be delivered intensively in a combination of classroom and field-based curricula).

5.3.1 Staff of medium scale mines and exporters

Mining companies active on the larger former government (REDEMI) concessions usually employ the most skilled technical and administration experts, both local and expats. This refers particularly to the mines of Nyakabingo, Rutongo, Gifurwe, Rwinkwavu, and Musha. Further, experienced staff from some mineral exporters and processors (e.g., Mineral Supply Africa, FECOMIRWA) and selected academic lecturers (e.g., at IPRC) falls into the same category.

These and other expat and Rwandan professionals' time is extremely limited due to their intense workloads and production schedules. No one revealed any enthusiasm for participating directly in training activities, but there are some who would participate in a supervisory board, checking training content as it is developed, and back-stopping technical challenges encountered in the field.

5.3.2 Independent Rwandan geologists and mining engineers

Rwanda has not had a geology or mining engineering program for many years. Additionally, the small scale of mineral deposits in Rwanda has very limited professional employment possibilities; new professionals have not been trained in the years prior to sector re-privatization.

That said, the first group of 32 young mining technicians will soon graduate from the IPRC. These technicians have 3 years of training and have learned many skills which, while most are directly applicable to large scale conventional mining, can be adapted to the "real world" of Rwanda's artisanal mines if given intensive practical field trainings and ongoing mentoring.

Currently there are a small number of Rwandan geology and mining engineering students in universities abroad (pursuing MSc degrees). Their studies are supported through the SFAR (Student Financing Agency for Rwanda) program. In addition, a geology and mining program is currently being set up at the Kigali Institute of Science and Technology (KIST).

Effectively, the currently available pool of geologists and mining engineers is mostly limited to retired or nearly-retired professionals who formerly managed the REDEMI mines (and subsequent private companies) as well as experienced former government employees. At the moment, they mostly work on small contracts producing the pro-forma geological reports, business plans, and environmental assessments required for licensing mining concessions. Most of these are listed among the RNRA/GMD accredited service providers. Some of these professionals would benefit from skill upgrading training prior to delivering any training themselves.

5.3.3 Experienced capitas and miners from medium scale mines

While most capita lack formal education, they do have years of mining experience and competence in training workers. These skilled miners should be identified and their skills upgraded to a uniform level. The most qualified and experienced could be

selected, salaried and trained to be permanent trainers, perhaps partnering with mine site trainers.

5.3.4 Government staff

Some staff working for the Government, in particular GMD and Ministry of Natural Resources (MINIRENA), have a certain degree of relevant background knowledge. Mine inspectors in particular are already playing an active role in building the skills of miners in the field. While Government staff may lack experience or background qualification (e.g., few have a degree in geology or mining engineering) their capacities are progressively being built, partly with donor support (see below).

5.3.5 International technical experts

It may be necessary to contract international experts to train Rwanda's trainers, or to solve specific mining and mineral processing challenges. International experts refer to dedicated consulting firms, academics, or regionally experienced individuals with a focus on ASM. The ICGLR Conference Secretariat may develop into a resource center on such regional or international technical experts, since many Member States partly rely on external expertise for implementing certain aspects of the Regional Initiative on Natural Resources, including the dedicated reference to ASM formalization.

5.4 Business Professionals

5.4.1 Staff at medium scale mines and exporters

The same companies identified above as potential source for technical expertise are also candidates to provide business expertise.

5.4.2 Business capacity building companies

A range of business development companies are active in Rwanda, some of which have experience in the mining sector and expressed interest in designing business capacity training programs.

Further, in 2012, the GIZ incubated the private company "CEFE Rwanda", an entrepreneurship training program that could be adapted to the mining milieu³². CEFE trainings follow a "games" model, rather than a strictly classroom approach, a feature that might be positively received by the sector's learners. While having only a limited number of training contracts during the last 2 years, CEFE Rwanda may be a good partner to develop and deliver training modules.

EDC, the US educational consultancy which developed and still manages the WDC's youth job training program *Akazi Kanoze*³³, has proposed developing a business skills training for the mining sector. Even though some stakeholders have suggested that mine owners, subcontractors, managers and capita may be uncomfortable with a

³² <http://www.cefe.net>

³³ www.akazikanoze.edc.org

traditional schooling approach, EDC is confident that curriculum can be designed that would be enthusiastically accepted.

It is important, though, that business developers closely liaise with experienced mining professionals in order to develop solutions that are practically applicable in the ASM sector and its specific structures.

5.4.3 Staff at Rwandan commercial banks

The Government is encouraging the banking sector to play a stronger role in mining sector development. While commercial banks are not inclined to loan to the mining sector given its lack of collateral, self-financing, record keeping and regulatory compliance, several banks are willing to conduct pro-bono business capacity building trainings through their local branches. Such training is part of these banks' normal business development activities – they want to build solid relationships with clients as they believe that loan defaults are more preventable when good relations enable positive ongoing communication their clients. Some micro-credit institutions are also willing to support business training in the mining sector.

5.4.4 Staff of the Rwanda Revenue Authority

The RRA has offered to conduct trainings with artisanal miners to enable accounting practices that are the basis of compliance with tax regulations. It may be that the RMA should act as an intermediary, subcontracting this kind of training to private consultants to circumvent any fears miners might have about direct contact with the tax authorities.

6 SKILL AND KNOWLEDGE TRANSFER RECOMMENDATIONS

Chapter 6 identifies effective capacity building strategies for the sector beginning with a review of the history of miner training programs in Rwanda, followed by the identification of several short and long term training options, some focusing only on business and management skill building, and others blending business and mine technology skills.

The capacity building options discussed in more detail below include:

- On-site mining support training
- Classroom-based concepts
- Technical short courses
- Distance learning
- Setting up a demonstration processing plant

Several proven programs stand out as model solutions, notably the COPIMAR trainings which ran for 5 years in the late 1980s and early 1990s based on one-on-one training and support to miners on site. This approach could be adapted to match the changes of the past 10 years of liberalization of the country's mining sector.

Several classroom-based concepts might be valuable to improve basic business management capacities among Rwandan mine owners and managers. One program (*Akazi Kanozi*) is already implemented at a relatively broad scale as an ongoing TVET program for youth seeking to enter the broader work force in Rwanda. This program (or similar programs targeting business entrepreneurship) would need to be adapted through the addition of mining specific modules. Lectures delivered as part of any of these programs should discuss practical problems of direct relevance for mining companies.

Short courses can be organized on a wide range of topics. Of particular relevance for this assignment is their potential to streamline productive discussions on financing mining projects between Rwandan banks and miners – this relies on a common understanding where banks develop a deeper technical understanding of the mining environment whereas miners consider typical criteria for bank loans more closely when planning their business and implementing their operations.

6.1 History of Mining Trainings in Rwanda

There was a gap in mining training of over 15 years since the Genocide. Only recently (2009) have trainings recommenced, but there have not been any formal evaluations of the effectiveness of these programs. Nevertheless, for the purpose of designing new trainings, it is useful to review what trainings have taken past in Rwanda during the past 2 decades³⁴.

³⁴ To the best of his knowledge, the author has attempted to include all relevant training activities in his research. However, lack of accessible information may have resulted in unintentional gaps in the overview presented below.

Lessons Learnt Building Capacity of Artisanal Miners around the World

Knowledge of key lessons (what has worked well in ASM trainings and what has not) from miner training programs around the world should contribute to the design of successful training and skill transfer initiatives:

1. Ownership is key to long-term sustainability. It is helpful to ensure participation of the target trainees at the program's board level;
2. There should be harmonization with the national educational framework in order to allow accredited certification of course participation;
3. Training of the informal mining sector usually requires operational subsidies;
4. Mobile decentralized programs are more flexible and more cost effective than fixed centers;
5. Trainings should be practical because miners (and mine managers) often have little theoretical background;
6. Follow up trainings are essential – questions arise after courses are finished and there must be a mechanism established to provide on-going answers.

6.1.1 COPIMAR

From 1989 until 1994, COPIMAR's field-based geologists and mining technicians introduced basic geological principals and practical exploration and mining techniques. COPIMAR's training and support program collapsed with the Genocide in 1994. As the mining sector partly recovered during the years following the Genocide, COPIMAR was re-established but lacked the liberal European funding to deliver significant mining support and training programs. The sector underwent (re-)privatization mainly from 2007 through 2010, and COPIMAR was transformed into FECOMIRWA.

The idea to set up the COPIMAR structure in 1989 was copied from CADETAF³⁵ which was a 'comptoir' purchasing lead and zinc minerals in Morocco³⁶. COPIMAR was created as a federation of mining cooperatives to focus on artisanal workings in a time of vacuum after collapse of the state mining company, SOMIRWA, in 1985. It operated in parallel to REDEMI, a government company formed in 1988 to concentrate on the larger, semi-industrialized mining concessions.

COPIMAR's objectives were to reorganize the artisanal mining sector to contribute to the increase of mineral production and improve the quality of life in rural areas for miners. All COPIMAR members were local miners living nearby to the small mining sites. In each cooperative, miners elected a committee of 5 people as management team; they organized the mining activities under the supervision of a mining site manager appointed and paid by the COPIMAR office in Kigali and who was responsible for the cooperative finances. All the presidents of different cooperatives elected a committee at the national level which worked closely with the COPIMAR Director.

³⁵ Centrale d'Achat et de Développement de la région minière de Tafilalet et de Figuig

³⁶ From 1986 of 1988, different studies were done before setting up COPIMAR under the supervision of Jean Marie Holzem, an economic mining engineer sent by the European Union from Luxembourg. These studies included geological evaluations of the targeted small mines; appropriate mining techniques, mineral processing feasibility studies, and socio-economic impact evaluations.

The local cooperative structure was headed by a mining engineer or geologist assisted by trained mine technicians and mine captains (“capitas”). COPIMAR also organized all the district level cooperatives in a national federation through which any mining assistance would be channeled to district cooperatives. COPIMAR was headed by an expat mining engineer and assisted by four engineers / geologists (Chefs de groupe minier), attached to the district cooperative groups, an accountant and a secretary. The initial 4 “groupes miniers” were:

- Gitarama (today Muhanga);
- Rutsiro;
- Musenyi-Shori (today Bugesera);
- Kigali (today Kamonyi-Ruli).

The central management of COPIMAR was through a Director General appointed by the Minister of Mines. He had a deputy Director in charge of mining technical support and production; a finance and administration department, a geologist leading the mining group, and mining site managers (trained secondary school certificates holders).

Technical assistance through COPIMAR:

The *chefs de groupe minier*

- Conducted mineral exploration around the known artisanal deposits to check for possible extensions;
- Designed and supervised digging of water canals (races) to allow mining of weathered deposits by water monitor and mineral processing by ground sluicing;
- Supervised removal of overburden (calculating the quantity and cost of overburden and ore transport and financial support during execution of the work);
- Supervised the installation of mining equipment;
- Improved the performance of mine production and mine safety;
- Improved mineral processing techniques and mineral recovery rates.

In order to assist in mineral trading activities, COPIMAR further provided:

- Transport of mineral concentrates from district mining cooperatives to Rwanda’s only minerals upgrading plant (located at Gatumba at that time);
- Mineral upgrading by crushing, gravity separation by water and air, and magnetic separation to achieve the required concentrate grade for minerals export;
- Mineral export.

COPIMAR further assisted in buying mining equipment and facilities:

- Supply of small mining tools to cooperatives through loans to be reimbursed in instalments paid by withholding 5% of minerals sold to COPIMAR;
- Supply of small mining equipment and consumables to cooperatives such as water pumps, pipes and monitors, rails and “coco pans” (tipper cars), compressors, explosives, etc.;
- Supply of other simple equipment for minerals processing such as metal sluice boxes, grizzlies, etc.

Note that all durable mining equipment that was supplied remained property of COPIMAR – ownership was not given to the district cooperatives.

COPIMAR Funding:

At the beginning of the project, summary studies of artisanal deposits were done by the Government's Geology and Mining Department to define the needs for preparatory work and mining equipment. Mine production records were updated and combined with estimates of cash flow and were projected over a 10 year period. Individual mine profit calculations were made for each artisanal deposit using different mining scenarios. Based on this, potential funding sources were surveyed. The Government identified three potential donor funding sources: Austrian Fund, UN Fund for Equipment and SYSMIN fund:

- The Austrian fund referred to the remains of Austrian aid money allocated to Rwanda for a mineral processing study of the Nyakabingo tungsten ore deposit, estimated to be 1.5 million Austrian shillings (currently about \$250,000 adjusted for inflation)³⁷. It was proposed to allocate this money to the COPIMAR project, but no one knows if this was ever done.
- From the UN Equipment Fund (UNEF), COPIMAR received a grant of \$339,000 of which \$324,000 was allocated for equipment and \$15,000 was for the experts' travel expenses.
- SYSMIN was a fund available through the European Economic Commission which was allocated to help the governments of countries with low export revenues. Rwanda qualified for this due to the loss of export revenue from the fall of world tin prices and bankruptcy of SOMIRWA in 1985. The fund was given to the Government of Rwanda as a loan to be reimbursed at an interest rate of 0.75% over a period of 40 years, with payback starting in 1998. The Government of Rwanda received 2,840,000 ECUS or the equivalent of \$2,330,000 (currently \$4,520,000 adjusted for inflation)³⁸ from SYSMIN. The loan was in return allocated to COPIMAR which had to start paying back after receiving it in 1989. After the Genocide in 1994, EEC transformed all Rwandan debts to grants and therefore COPIMAR did not pay back much of money it received.

Present-Day Developments:

In 2010, COPIMAR changed its name to FECOMIRWA (Fédération des Coopératives Minières du Rwanda) in order to be in accordance with new cooperative regulations. Nevertheless, it kept the same objectives. Since then, some mining cooperatives withdrew unofficially from FECOMIRWA and began to sell their production to other minerals traders. This was due to the lack of funds at FECOMIRWA to compete with other traders on the local mineral market. Nevertheless, FECOMIRWA has recently received 200,000,000 RWF (about US\$ 275,000) as pre-financing for off take from an international business partner. Recently the RCA (Rwanda Cooperatives Agency), the state institution in charge of all cooperatives in the country, has urged all mining cooperatives to regroup in FECOMIRWA. FECOMIRWA is integrated as a member into Rwanda Mining Association.

³⁷ In 1988, 1 Austrian Shilling = US\$ 0.0825; <http://www.oanda.com/currency/historical-rates/>
Inflation adjustment = 2.03; <http://www.dollartimes.com>

³⁸ inflation adjustment 1.94; <http://www.dollartimes.com/>

6.1.2 Training Efforts from 2009 to Present

Private Sector-led Training

The expertise of private mining and exporting companies has repeatedly been mobilized in Rwanda. In 2009, Tinco gave a 2-week mine technology course to capitas from around the country. By all accounts, this was a successful program and many mine owners expressed confidence in the capitas who received this training. The comprehensive course covered all aspects of the mine life cycle from exploration to reclamation judging from the 98 page course manual, the content was likely too technical for the education level of the learners though. The program was funded by the RDB and was taught by Ruhigira Augustin Bida (FECOMIRWA).

With the support of the WDA, Wolfram Mining and Processing presented a 90-day course to 30 miners in the vicinity of Rwinkavu, from August to October 2014. The course followed a curriculum focusing on mining technology (geology, mining, equipment maintenance, environment, OHS, first aid, regulations) as well as security and due diligence.

Minerals Supply Africa (an exporter) offered two mine safety trainings in Kigali in June 2014. Each course had about 25 participants, half of whom were suppliers of minerals to MSA and half were drawn from the Mining Technology diploma program at the IPRC. The program included classroom training and a mine site visit. Field visits were followed by group discussion where teams made presentations describing what practices were correct and what could be improved. An important innovation of these trainings was the linking of mine management and profitability with operational safety.

Training is also part of the mandate of the Private Sector Federation (PSF). In 2013, the PSF and the Rwanda Mining Association delivered the course “Training of small scale miners in ore processing, drilling, blasting and safety in mining works“. Altogether about 102 students were trained in 2 sessions³⁹. The program was intended to travel to 18 Districts, but funding was not renewed after the pilot year. No follow-up or post-training assessments were conducted.

Integrated Polytechnic Regional Center (IPRC) Kigali:

A 3-year training program for mine technicians began at Kigali’s Integrated Polytechnic Regional Center (IPRC) in 2012. The IPRC is part of a national TVET network under the auspices of the Workforce Development Authority. In September 2015, the first class of 30 students will graduate. IPRC’s program focuses on medium-scale mine practice. The graduates are very energetic and committed and with support will be able to apply this theoretical knowledge to improve the performance of Rwanda’s artisanal mines.

³⁹ Ruhigira Augustin Bida, a mineral processing engineer from FECOMIRWA (also an instructor at the IPRC), taught the course.

IPRC Mine Technicians Course Contents (3 years):

- Basic mining engineering
- environmental science
- engineering surveying
- mining and exploration geology
- mine surveying
- fundamentals of underground mine design
- mine electrification
- surface mining methods
- basic mineral processing
- mining machinery
- mineral economics
- regulatory structures for environment and safety in mines
- underground mining methods and support system design
- entrepreneurship and mine management
- explosives and blasting technology
- materials handling equipment

Government-led Training

The Government is facilitating training on selected aspects of mining, usually through GMD. This includes frequent briefings on regulatory requirements, mostly done in workshop style. Since 2013, GMD has established a dedicated mine inspection unit and started rolling out and progressively expanding a scheme of regular mine inspections (in 2014-2015, more than 150 inspections were done; inspection summary data can be found in a mine site database published and updated on the website of MINIRENA). Mine site inspections include an informal training component, delivered by GMD inspectors on relevant inspection topics such as health and safety, environmental management, and due diligence. Experience shows that this field-based training delivery is more effective than workshop-style training for certain topics⁴⁰. GMD inspectors have also organized several training workshops directly at the province level where mine technical managers (rather than owners) were asked to attend.

Skill gaps in mining have been analyzed comprehensively by the Rwanda Development Board (2012). Several activities to institutionalize mine training in Rwanda have been proposed or supported by RDB, including the setting up of a mining curriculum at IPRC (see above).

Government agents, as trainers and regulators, may benefit from training themselves. This is often facilitated through donor support. The Australian government has been offering a number of short courses to Government employees on technical mining aspects over the past three years⁴¹.

⁴⁰ This may partly reflect the typical small-scale mining management structure in Rwanda where technical resource persons (e.g., managers and capitas) are often field-based.

⁴¹ While such short courses taking place in Australia are well-intended, they inevitably focus on discussing industrial large-scale mining operations, rather than artisanal and small-scale mining as relevant for Rwanda.

In the German-Rwandan technical cooperation context, BGR has been a partner of RNRA/GMD (and its predecessor) since 2008. As a part of this partnership, BGR employs a “train the trainers” approach whereby GMD counterparts (such as inspectors) are trained on relevant procedures such as certification, health and safety, first aid, or geology and sampling. BGR further provides logistical support to GMD to implement field activities (e.g., for geological sampling or mine site inspections).

In 2009-2011, BGR and RNRA/GMD co-organized implementation of the Certified Trading Chains (CTC) project, aiming to introduce standards on responsible mining practice in the areas of transparency, health and safety, security, community development, and environment. The project included audits providing recommendations for improvement at five medium-scale Rwandan mineral producers. The project further elaborated guidance documents on health and safety and other aspects.

In 2013, the BGR delivered a ground control course to about 20 GMD Mines Inspectors mine geologists and mine managers/capita. The 3-day classroom course and 1 day field trip presented the basic engineering theory needed to predict the stability of surface and underground rock structures.

Beginning in 2012, MINIRENA was selected as one of several ministries to implement the Strategic Capacity Building Initiative (SCBI) (in the context of the Africa Governance Initiative). The SCBI program is delivered through the Ministry of Finance and Economic Planning (MINECOFIN)'s Public Sector Capacity Building Secretariat. The SCBI program follows a long-term approach where young professionals are installed in host institutions (such as MINIRENA) to work on specific tasks in cooperation with an international expert. They enjoy special privileges (e.g., increased base salary and exposure to special training sessions) but, in turn, have a strong performance orientation in their work contracts. The SCBI program also temporarily employed international experts supposed to act as mentors of the young professionals over a period of several years.

Regional ASM Training Efforts

The ASM sector in the Great Lakes Region often faces similar regulatory and practical challenges from one country to another. While some countries tend to support ASM development and professionalization, others tend to suppress it to preferentially develop their large-scale mining sector. While an analysis of regional training approaches is outside the scope of this report, it should be noted that there may be considerable potential for peer exchange on this topic among the different Member States of the ICGLR.

6.2 Training Framework

In order for training to be effective in the Rwandan ASM sector context, it is necessary to consider a streamlined implementation framework. Implementation may be incremental but needs to be coordinated and include follow up and evaluation mechanisms in order to create longer-term impacts. Creating a capacity building Steering Committee was suggested at the assignment's second workshop, and a range of public and private sector stakeholders were potentially available as volunteers. Discussing the development the Terms of Reference for such a Steering Committee should be a next step. There is likely significant overlap with the Sector Skill Council concept proposed by RDB (2012).

The Rwanda Mining Association would be a good candidate institution to implement the training options presented below. The RMA itself however, seems in need of focused institutional strengthening. The RMA should hire an energetic training coordinator in order to pursue the business and mine management training options listed below, in coordination with the proposed Steering Committee.

The options identified above have already shown that they can increase business management and / or operational capacity. Pilot testing of the classroom options would be low risk because of the low cost per student ratio. A mining-adapted *Akazi Kanozi* program (see below) could quickly deliver management trainings to the sector. Feedback from these classroom trainings would inform the design of the somewhat more costly quick start and long term-mine based business and technical training modules.

6.3 Training Options

6.3.1 On-Site Mining Support Training

This strategy follows the COPIMAR model of direct mine site support. Mine management training could be integrated with the delivery of technical support directly to mine operators at their mines (including owners, managers, subcontractors and *capitas*). Small teams of Rwandan experts would support mine operators find solutions to specific practical problems they encounter—management issues such as working with Excel balance sheets or compensation negotiations, as well as technical challenges such as exploration or waste management.

As a part of this approach, the experts would be required to analyze why certain problems occur and provide advice not just on short-term problem solutions, but also on the longer-term framework to prevent a similar problem from occurring in the first place⁴². This approach should hence lead to incremental improvement over time. This could be further supported through adapted mining license obligations where procedures could be integrated to assess and reward continuous, broader technical improvement processes at mining sites (beyond production performance).

A quick way to begin to achieve short term increases in production and operational improvements (e.g., better recovery efficiency, environmental and safety performance) would rely on existing experts based in Kigali, backstopped by international experts who would also begin training prospective experts (such as IPRC graduates or selected *capitas*) in preparation for a long term program of district based expert teams rotating from mine to mine.

Creating “Mini isobanutse” or the “Perfect Mine”

While “perfection” per se is never possible, filling the business and mine management capacity gaps that have been detailed in the previous chapter would lead toward the evolution of “perfect mines” in Rwanda. The following options for skill and knowledge transfer can be lumped together as a “perfect mine” or “*Mini Isobanutse*” program – abbreviated “MINISOB”.

⁴² e.g., a given environmental problem may be due to a suboptimal environmental management plan

An adequate structure (similar to COPIMAR) would need to be adopted to manage such activities financially and logistically, as well as to monitor their effectiveness. Costs would be relatively high if only current Rwandan senior experts would be employed to deliver on-site training by means of a quick start option⁴³. Therefore, training additional experts to deliver district-based site training is important for long-term sustainability and impact of the program.

Once additional experts have been trained (IPRC graduates would be excellent training candidates) and broader funding is secured, these new experts would be sited in the districts to deliver continuous technical and business management support at the mine sites. The costs of this district-based training itself should be relatively low⁴⁴, but initial training, mentoring and backstopping of experts by international experts may temporarily increase start-up costs, similar to the SCBI approach outlined above.

Table 9: Evaluation of on-site mining support training

Option	Advantages	Disadvantages
Quick start	<ol style="list-style-type: none"> 1. quick production gains for some mines possible 2. limited training of new experts (e.g., IPRC graduates) 	<ol style="list-style-type: none"> 1. more costly per mine visit than long term option 2. 1 or 2 day mine visits by experts per year do not give opportunity for follow up on complex issues 3. difficult to prioritize mine visits (who will benefit?) 4. Terms of Reference may be complex and development of curriculum may be slow and relatively costly
Long term	<ol style="list-style-type: none"> 1. integration of business training with mine technology practice 2. longer-term production gains combined with safety and environmental performance improvement 3. broader capacity building and experience gains for new experts 	<ol style="list-style-type: none"> 1. high overall budget, even though costs per mine visit are lower 2. requires a high-capacity Rwandan or third party organization to manage program

⁴³ Typical consulting fees charged by a Rwandan senior expert may be up to \$250/day. For a team of two experts working in the field throughout the year (240 days), the resulting costs would amount to \$120,000/year, although a consulting fee reduction should be expected for a longer-term contract. Additional costs might be incurred in case international consultants are mobilized for backstopping.

⁴⁴ A team of two newly trained experts (e.g., IPRC graduates) equipped with motorcycles and basic technical equipment would cost as little as \$90 per day or \$22,000/team/year (using jeeps would increase the cost to about \$140 per day). Start-up training costs for 8 teams might be \$100,000 to \$200,000, basic and supervision and backstopping could be about \$200,000/year.

6.3.2 Classroom-Based Concepts

While little or no evaluation of recent classroom trainings of miners has taken place, stakeholders prefer to learn technical skills through hands-on practical trainings. Business management training, however, is more academic in nature and needs to be partly delivered in a classroom environment. Even so, classrooms can host positive social interactions and good teachers with good curricula can excite learners who might be adverse to school environments. Below, a selection of different existing business training concepts developed by donors or consulting offices is presented for practical illustration. Note that all of these options would need to be adapted to the mining sector environment prior to implementation.

Akazi Kanoze

The successful USAID youth work readiness program *Akazi Kanozi*⁴⁵ illustrates this point – *Akazi Kanozi* was designed in a way that is participatory, active and hands-on, so that the youth are actively engaged in the learning process, have the opportunity to practice and enhance new skills and gain the self-confidence necessary to find and keep employment.

Akazi Kanozi for the Mining Sector would adapt the existing youth job readiness program. The latter focuses among others on personal development, interpersonal communication, work habits and conduct, leadership, financial fitness and exploring entrepreneurship. Launching this program in the mining sector would build on the above basic curriculum, but would need to introduce business management modules to more closely reflect the needs of mine owners and managers based on the identified capacity gaps.

Potential contents for a *Akazi Kanoze* program focusing on mining:

- Organizational structures and legal status
- Rwandan regulatory framework
- Bookkeeping, use of Excel, etc.
- Record keeping
- Business planning and budgeting
- Risk analysis
- Production technology planning
- Basic business mathematics
- Calculation of profit/loss and break-even point
- Cost estimation
- Building relationships with bankers, lawyers and accountants
- Loan applications
- Communication and negotiation skills
- Human resource management
- Mineral value chain and certification
- Development of a business plan

The target learners of an adapted *Akazi Kanozi* program would be mine owners subcontractors, managers and capitas. It is recommended that there be two parallel curricula to meet the different education background, business experience and needs of the learners. Trainers would be Rwandans drawn from the trainer pool of *Akazi Kanozi*, so multiple groups could be trained simultaneously at 12 locations throughout the country. Instruction would be in Kinyarwanda.

⁴⁵ *Akazi Kanozi* is a Rwandan work readiness curriculum that was developed to provide youth with the foundational skills and knowledge necessary to become “healthy, productive workers and participants in civic and community affairs”.

The cost of the program would be \$40,000 for 400 miners, plus about \$70,000⁴⁶ to adapt the existing *Akazi Kanozi* curriculum, or \$275 per student for the first 400 students. Thereafter, the cost would be \$100 per student. The cost includes course facilitation, participant handbooks, training kits, management and assessment of training, and a certificate of competence endorsed by WDA for those who will have passed an external assessment. A typical, weekend-based course length would be about 3 months.

Creation of Competence for Competition

The German GFA consulting group has developed the C³ or “Creation of Competence for Competition” training package, based on project experience over the last 20 years around the world, including 9 African countries⁴⁷. Today, it comprises a variety of standard training manuals. Traditional target participants have been private sector workers such as start-up entrepreneurs or owners of micro, small and medium-sized enterprises as well as management consultants, credit officers, business associations and trainers who provide financial or other services to micro, small and medium-sized enterprises.

C³ is modular in design. Materials are adapted and combined according to the needs of each project. All C³ materials are based on active learning, with a strong fieldwork component.

Local trainers are subject to a strict selection process prior to their training and certification, in order to guarantee the quality of all licensed C³ delivery. Following their certification, local C³ trainers have access to a C³ portal and on-going support and exchange with GFA’s dedicated C³ Unit.

A C³ training program for miners would focus on two types of training activities. A typical component is the qualification of local master trainers. A mining program would develop technical business planning skills for mine owners and managers. Subsequent to the training, learners may participate in long term on-the-job training and coaching of managers during their working assignments.

The basic C3 curriculum

The Entrepreneur

- Introduction to business planning
- Personal entrepreneurial competencies
- Enterprise analysis

The Business idea

- Brainstorming
- Microfinance screening
- SWOT analysis

Market analysis and Marketing

- Market analysis
- Market Potential
- Market mix, costs and strategy

Production

- Production and technology planning
- Production capacity
- Calculation of production costs/break-even point
- Analysis

Organization and Management

- Form and legal status of companies
- Organizational structures

Financials

- Basic business mathematics
- Capital requirement and financial planning
- Profit and loss calculations
- Cash flow

Field work/Practical Work

- Elaboration of a business plan
- Business idea
- Marketing plan
- Production Plan
- Organization and management plan
- Financial plan

Business plan presentation to bank

- Project packaging
- Presentation

⁴⁶ This includes 2 months of ASM consultancy to help focus the curriculum design.

⁴⁷ www.c3-training.de

Competency-Based Economies Formation of Enterprises

CEFE⁴⁸ is an international network of entrepreneurship trainers which the GIZ incubated in Rwanda in 2011. Having passed its own start-up stage, CEFE Rwanda is currently a private sector network of certified trainers. CEFE follows a non-traditional classroom approach using “games and simulation exercises” to build participant enthusiasm for learning. These exercises build entrepreneurial competence in negotiation and competition, risk management and responsibility acceptance, costing, time management, organization, financing, financial statements, profitability ratios, and business plan preparation and presentation.

A 10-day CEFE program (8 hours per day) for 25 participants would cost about \$140 per student, including the cost of venue but not the cost of accommodation. Training would be delivered in Kinyarwanda by certified CEFE trainers. Curriculum development consultancy (to develop and adapt the general program to the mining context) would cost an additional \$40,000 (2 months of international consultant). Because CEFE Rwanda trained only 50 people in 2013 (persons with disabilities in Nyanza), and 100 in 2014 (job seekers in Kigali), their current institutional strength needs to be assessed.

Table 10: Evaluation of classroom-based business training programs

Option	Advantages	Disadvantages
Akazi Kanoze	<ol style="list-style-type: none"> 1. quick response to business management gaps 2. already proven training methods and curriculum (to be expanded) 3. access to experienced and skilled Rwandan trainers 	<ol style="list-style-type: none"> 1. training setup (weekends over 3 month) may not be sufficient to create impact 2. normally targeted at people with low education – needs to be adjusted to miners target group 3. program stakeholders do not have any experience in artisanal mining
C ³	<ol style="list-style-type: none"> 1. experienced provider of development training 2. off the shelf business and entrepreneurship modules 	<ol style="list-style-type: none"> 1. C³ has not been delivered to the mining sector (but: possible partnership with GFA daughter company experienced in ASM)
CEFE	<ol style="list-style-type: none"> 1. entrepreneurship trainers are trained 2. positive teaching approach 	<ol style="list-style-type: none"> 1. limited practical training experience 2. no experience in mining sector

6.3.3 Technical short courses

A range of technical short courses are delivered on mining topics in Rwanda and elsewhere. The following list is not exhaustive but gives an overview on selected priorities discussed during implementation of this assignment. Delivery of these courses may flank broader capacity building approaches as outlined above.

Mining for non-miners

Stakeholders expressed the need for a “Mining for Non-Miners” course designed to increase the background mining knowledge of professionals (accountants, bankers, donors, media, GMD staff) who work with the mining sector. The objective of such a

⁴⁸ <http://www.cefe.net>

course is for non-miners to better understand the potential role that they might play in the mining sector. This is particularly relevant for banks who are reviewing loan applications from miners. To this end, they should be familiar with mining and exploration procedures.

The typical course contents⁴⁹ may include:

- Essentials of the mining industry
- The mining value chain
- Exploration techniques, grade control and sampling
- Evaluation of mineral resource model
- Classification of resources and reserves
- Access to capital for growth and development
- Mineral funding philosophies (self-funding, joint venture, equity financing, bank loans)

The cost of a 3 day course delivered in Kigali would be \$4000 for 15-20 participants. The course would be delivered in English with optional translation into Kinyarwanda.

Tax compliance

The RRA believes that in many instances, miners are not fully aware of their legal tax obligations which include both proper book keeping and accounting as well as payment of taxes due. The RRA has offered to conduct free training seminars to help miners understand the requirements for accounting systems and tax payments (personal and corporate income tax, PAYE (Pay as You Earn) for employees, 15% withholding for unregistered workers, and VAT). Part of this training would introduce the RRAs online and mobile phone income declaration and tax payment interface

Small businesses around the world avoid contact with the tax authorities. Therefore to ensure full participation in a tax compliance training program, an alternate strategy might be to contract a 3rd party such as the RMA to deliver the RRA's curriculum.

Commercial bank training

Rwanda's commercial banks believe that the mining sector is currently too risky⁵⁰ due to a general lack of financial record keeping, tax compliance, business planning and reserve estimates. That said, banks are committed to helping increase the management capacity of mining companies whom they see as future clients.

Banks have offered their regional branch managers to conduct free trainings on loan requirements (e.g., credit history, length of banking relationship, collateral requirements, business plan, terms etc.). These trainings could take place in partnership with the RMA who could introduce bank managers to the technical and management needs of the sector.

⁴⁹ Course outline by Dr. Steven Rupprecht, University of Johannesburg.

⁵⁰ Currently, the risk level of other sectors (e.g., construction, energy importation of commercial goods, etc.) is lower than for mining.

Table 11: Evaluation of selected short course training options

Option	Advantages	Disadvantages
Mining for non-miners	1. curriculum already prepared 2. capacity building for mining sector financial services may lead to more productive relationships between banks and miners	1. limited number of students 2. costs (about \$200/student, depending on class size)
Tax compliance (RRA)	1. leads to increased tax compliance 2. courses already prepared 3. delivery at no charge by RRA	1. possible resistance to trainings offered directly by RRA 2. program reflects the needs of RRA, not the miners
Commercial bank training	1. relationship building with financing providers 2. courses already prepared 3. delivery at no charge by commercial banks	1. banks would control the curriculum which would hence reflect the needs of banks, not necessarily the needs of miners 2. formal learning environment

6.3.4 Distance Learning

Especially for those mining professionals in Rwanda that already have a university degree, distance learning can be an attractive option. EduMine⁵¹ is a unique provider of online training and education to the international mining industry. EduMine is university accredited and an International Association for Continuing Education and Training approved company. It offers online training solutions to mining companies, governments and educational institutions. EduMine's online learning platform hosts over 200 courses and programs that are authored by leading industry experts in the areas of:

- Exploration
- Engineering
- Mining
- Mineral Processing
- Environment
- Health and Safety
- Management

EduMine access requires registration and payment of course fees, either for a single person and short course, or a “distributed license” for a range of persons from a given organization. A “distributed license” which enables 20 users costs \$15,500⁵². It includes an online page tailored to an institution (e.g., the RMA or MINIRENA) where users access the courses (“online campus”) as well as unrestricted access to all the online courses for the users⁵³. Where certification is required to test whether users have met the learning objectives of the course (for continuing professional development credits, or to reward a user for their learning effort) bulk purchase discounts can reduce certification cost.

The online campus helps the client identify which courses suit their training needs –

⁵¹ <http://www.edumine.com>

⁵² An alternate license for 10 individuals costs \$10,000

⁵³ An example of a campus page is <http://www.edumine.com/campuses/ministry-of-mines-ethiopia/>

selected courses can be highlighted on the campus page, making it easier for the users to know which courses they should focus on. User activity in the courses can be tracked through the campus by the embedded reporting functionality, making it easy to keep track of who is putting in the effort to learn, and who may need a little encouragement.

Table 12: Evaluation of distance learning options in mining

Option	Advantages	Disadvantages
EduMine	<ol style="list-style-type: none"> 1. Suitable for advanced learners such as government professionals 2. mining sector expertise 3. proven delivery record for technical training 4. multi-disciplinary including management and technical courses 5. self-directed learnings 	<ol style="list-style-type: none"> 1. no learning from exchange with peers in real classroom 2. applicable to academic, English-speaking learners only 3. high cost (\$750 per year per student, depending on license)

6.3.5 Demonstration Plant as Learning Center

During the stakeholder interview process, MINIRENA officials expressed the need to design, test and demonstrate affordable and efficient mineral processing circuits. The desire for appropriate mechanized equipment is also a priority of 40% of the interviewed mine owners.

The efficiency of mineral recovery is widely known to be low in Rwanda. Yet, optimized processing plants are few in number. The few that do exist are relatively complete (variably including key equipment such as spirals, shaking tables, crushers and magnetic separators) but there is often insufficient (or nonexistent) feed for them to operate. This points to general deficits in the operators' business planning which, in this case, implies that a plant is designed for a certain throughput for it to operate profitably. Attempting to run a sub-economic processing plant usually results in its decommissioning; equipment is being sold or starts to slowly decay. Setting up a demonstration plant, therefore, needs to be integrated with business training to discuss how the investment and planned throughput links to operating costs and the eventual profits from increased recovery.

Testing of pilot mineral processing circuits in plain view of the eventual end-users would likely convince them that significant recovery gains can be achieved with adapted methods and technologies. Demonstration processing plants were shown to be an effective artisanal mining training technique in Brazil⁵⁴. Demonstration plant facilities do not need to be fixed but can be truck-mounted. Mobile training units were a key element of UNIDO's program to reduce mercury use in gold mining in Africa and Asia (the Global Mercury Project).

⁵⁴ In the 1990s in the Tapajos in Brazil, a demonstration mine for alluvial gold was owned and run by a regional mining association staffed by local miners and international experts. Ownership of the mine allowed equipment setup variations to be freely tested and demonstrated, and the recovered gold contributed greatly to the operating costs.

Table 13: Evaluation of learning centers

Option	Advantages	Disadvantages
Demonstration processing plant	<ol style="list-style-type: none"> 1. opportunity to test mineral processing solutions in a researcher-controlled context (if appropriately managed by experienced staff) 2. practical engagement with learns 3. offset of costs by minerals produced 4. practical illustration of business planning possible 	<ol style="list-style-type: none"> 1. questions about legal ownership of license area and equipment need to be solved 2. long-term management model required 3. relatively high initial cost of equipment

7 IMPLEMENTATION PLAN SCENARIOS

Chapter 7 illustrates indicative implementation timelines for the knowledge and skill transfer options identified in Chapter 6. A matrix is used where responsibilities for individual implementation steps as well as risks have been inserted. The information provided therein is not necessarily definitive and merely serves to encourage more discussions and consultations on this topic in Rwanda.

Planning these options would benefit from a well-coordinated approach involving a capacity building steering committee (or sector skill council) assembling relevant stakeholders. The same entity would be responsible for monitoring. Actual implementation would fall under the responsibility of different actors from government, private sector and academia, with variable support by donors.

The Rwanda Mining Association could play a significant role in the process if it were to strengthen its management capacity, e.g., by installing a sector capacity building coordinator. A more complex management structure would need to be put in place to implement a long-term on-site mine training modelled along the COPIMAR approach (see Chapter 6) but, ultimately, this approach might result in the most significant long-term benefits for Rwanda's mining sector.

Table 14: Implementation timeline for quick start on-site mine training program ("MINISOB")

Quick Start / MINISOB	\$500/day (team of 2 senior experts) plus training and supervision														
Steps to take	Who is responsible	Risks and obstacles	1	2	3	4	5	6	7	8	9	10	11	12	
Steering committee meeting – review and revise implementation plan proposal		Lack of availability of steering committee members due to scheduling or compensation													
Secure stakeholder commitment	MINIRENA GMD RMARMA	Project may be a low priority for RMA or MINIRENA													
Funding		Slow approval of funds. Low priority or avoidance of sector on part of donors													
Define program, management structure, monitoring mechanisms		Availability and funding for consultants													
Negotiate contract with course provider		Project objectives unclear or too broad													
Screen and select expert mentors and IPRC mine technician trainees		Unreasonable compensation expectations; conflicts regarding hiring													
Training of experts		Availability of trainers													
Pilot 10 missions		Choice of mines													
Monitor, adapt and adjust ToRs		Ability of monitoring process to report critically; availability of steering committee.													
Continued mine site trainings		Dissatisfaction of mine owners with curriculum or delivery of training													
Monitoring and evaluation		Ability of monitoring process to report critically													

Table 15: Implementation timeline for long term on-site mine training program ("MINISOB")

Long term MINISOB	Moto based \$90 per day or \$22,000/2 person team/year (using jeeps would increase the cost to about \$140 per day). Start-up training costs for 8 teams might be \$100,000 to \$200,000, basic and supervision and backstopping could be about \$200,000/year																	
	Steps to take	Who is responsible	Risks and obstacles	1	2	3	4	5	6	7	8	9	10	11	12	13 - 18	19 - 24	25 - 36
Steering committee meeting – develop, review and revise implementation plan proposal	Steering Committee	Lack of availability of steering committee members due to scheduling or compensation																
Secure stakeholder commitment	MINIRENA, GMD, RMA	Project may be a low priority for RMA or MINIRENA																
Funding	MINIRENA, GMD, RMA	Slow approval of funds. Low priority or avoidance of sector on part of donors	Funding process could take over 1 year															
Define program, management structure, monitoring mechanisms	MINIRENA, GMD, RMA, Steering Committee	Availability and funding for project design consultants																
Tender and contract international consultancy to manage project with RMA	MINIRENA, GMD	Availability of qualified consultants																
Institutional strengthening of RMA, especially project management	MINIRENA, GMD and Consultant	RMA "buy in"; qualification and commitment of RMA managers																
Screen and select IPRC mine technician trainees or capitas	RMA and Consultant	Availability of IPRC technicians																
Procurement of basic equipment (vehicles/motos, IT, district offices, field gear)	RMA and Consultant	Quality of project budget; MINIRENA procurement process							Upon funding									

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Long term MINISOB	Moto based \$90 per day or \$22,000/2 person team/year (using jeeps would increase the cost to about \$140 per day). Start-up training costs for 8 teams might be \$100,000 to \$200,000, basic and supervision and backstopping could be about \$200,000/year																	
Steps to take	Who is responsible	Risks and obstacles	1	2	3	4	5	6	7	8	9	10	11	12	13 - 18	19 - 24	25 - 36	
Training of IPRC trainers	Consultant	Availability of consultant trainers																
Roll out first 2 districts	RMA and Consultant	Choice of districts; weather related access																
Roll out 2 additional districts	RMA and Consultant	Choice of districts; weather related access																
Roll out 4 additional districts	Consultant, RMA	Choice of districts; weather related access																
Backstopping and ongoing training	Consultant, RMA	Costs of mineral processing, water and waste management research																
Monitoring and evaluation	Steering Committee	Ability of monitoring process to report critically			Quarterly													

Table 16: Mining for non-miners implementation timeline

Mining for non-miners Short course		Per 3 day course delivered in Kigali -- \$4000 for 15-20 participants not including venue												
Steps to take	Who is responsible	Risks and obstacles	1	2	3	4	5	6	7	8	9	10	11	12
Steering committee meeting--review and revise global implementation plan proposal	Steering committee	Lack of availability of steering committee members due to scheduling or compensation												
Secure stakeholder commitment	MINIRENA, GMD and RMA	Project may be a low priority for RMA or MINIRENA												
Funding		Slow approval of funds. Low priority or avoidance of sector on part of donors												
Negotiate contract with course provider		Availability of trainer												
Secure venue														
Select and invite participants		Prioritizing participants												
Conduct training	Contract trainer	Commitment of participants to begin trainings on time and complete the entire course												
Monitoring and evaluation	Steering committee	Ability of monitoring process to report critically												

Table 17: Tax compliance courses (RRA) implementation timeline

RRA tax compliance courses Short course	Free if delivered by the RRA; to be negotiated if delivered by contractor													
Steps to take	Who is responsible	Risks and obstacles	1	2	3	4	5	6	7	8	9	10	11	12
Steering committee meeting--review and revise global implementation plan proposal	Steering committee	Lack of availability of steering committee members due to scheduling or compensation	█											
Secure stakeholder commitment	MINIRENA, RMA, RRA	Project may be a low priority for RMA or MINIRENA	█											
Funding	MINIRENA MINECOFIN	Required if stakeholders prefer to have Rwandan subcontractor deliver trainings; required for venues in Kigali	█											
Negotiate MoU for delivery with Ministry of Finance	MINIRENA	Conflicting goals and objectives	█											
Design course	RRA, RMA, MINIRENA	Length of course and non-threatening delivery style	█	█										
Secure venues	RMA, RRA	Hotels in Kigali; in Districts--free local venues such as schools		█	█	█	█	█	█	█	█	█	█	█
Select and invite participants	RMA provincial and district representatives	Sensitization of mining companies to the objectives of training		█	█	█	█	█	█	█	█	█	█	█
Conduct trainings	RRA or contractor	Commitment of participants to begin trainings on time and complete the entire course		█	█	█	█	█	█	█	█	█	█	█
Monitoring and evaluation	RRA, Steering Committee	Ability of monitoring process to report critically			█			█		█				█

Table 18: Commercial bank training implementation timeline

Commercial Bank Trainings Short Course		Free												
Steps to take	Who is responsible	Risks and obstacles	1	2	3	4	5	6	7	8	9	10	11	12
Steering committee meeting--review and revise global implementation plan proposal	Steering committee	Lack of availability of steering committee members due to scheduling or compensation												
Secure stakeholder commitment	MINIRENA, GMD, RMA	Project may be a low priority for RMA or MINIRENA												
Funding		(None required)												
Negotiate MoU with Banks	MINIRENA	Competing offers from different banks; level of bank commitment												
Design course	Banks, RMA, MINIRENA	Length of courses, complexity of content												
Secure venues	Banks RMA	Hotels in Kigali; in Districts--free local venues such as schools												
Select and invite participants	RMA provincial and district representatives	Sensitization of mining companies to the objectives of training												
Conduct trainings	Banks	Availability of Bank trainers; commitment of participants												
Monitoring and evaluation	Steering committee, Banks, RMA, MINIRENA	Ability of monitoring process to report critically												

Table 19: EduMine online learning implementation timeline (assuming target group MINIRENA and GMD staff)

Edumine (distance learning)	\$15,500 for 20 students / plus \$322 per additional student													
Steps to take	Who is responsible	Risks and obstacles	1	2	3	4	5	6	7	8	9	10	11	12
Steering committee meeting--review and revise global implementation plan proposal	Steering Committee	Lack of availability of steering committee members due to scheduling or compensation	█											
Secure stakeholder commitment	MINIRENA	Project may be a low priority for MINIRENA	█											
Funding	MINIRENA	Slow approval of funds. Low priority or avoidance of sector on part of donors	█											
Negotiate contract with EduMine	MINIRENA		█											
Prioritization and selection of MINIRENA participations	MINIRENA	Lack of interest or commitment of MINIRENA staff; internal conflicts over exclusion from program; ability of staff to share new knowledge with colleagues	█											
Online coursework	MINIRENA, GMD staff	Allocation of on-the-job time to course work; online interface too complicated.		█	█	█	█	█	█	█	█	█	█	█
Monitoring and evaluation	MINIRENA, EduMine, Steering committee	Difficulties measuring improvements in job performance		█	█	█	█	█	█	█	█	█	█	█

Table 20: Business training (Akazi Kanozi, C³, CEFE) implementation timeline

Business training (classroom style)	About \$110,000 for Akazi Kanozi and CEFE to train 400 miners; C3 cost unknown													
Steps to take	Who is responsible	Risks and obstacles	1	2	3	4	5	6	7	8	9	10	11	12
Steering committee meeting--review and revise implementation plan proposal	Steering Committee	Lack of availability of steering committee members due to scheduling or compensation												
Secure stakeholder commitment	MINIRENA, GMD, RMA	Project may be a low priority for RMA or MINIRENA												
Funding	MINIRENA, GMD, RMA	Slow approval of funds. Low priority or avoidance of sector on part of donors												
Proposals from Akazi Kanozi, C3 and CEFE; contract negotiation		Project objectives unclear or too broad												
Adaption (or development of existing curricula to the mining sector)		Needs of miner not sufficiently well understood by curriculum designers												
Introduction of trainers to mining sector		Sensitization of trainers to mining issues												
Delivery of classes over 11 weeks	Course provider	Drop out of participants												
Monitoring and evaluation	Steering Committee, course providers	ability of monitoring process to report critically												

Table 21: Demonstration processing center implementation timeline.

Note: depending on its parameters and scale, this project can be either relatively straightforward (possibly skipping some of the steps outlined below), or more complex (with additional steps), with corresponding impacts on costs. The scenario below represents just one possible model.

Demonstration processing center	3-year operation. Opex approximately \$2 million Capex \$1 million or more depending on equipment. Possible recovery of some expenses by sale of minerals																
Steps to take	Who is responsible	Risks and obstacles	1	2	3	4	5	6	7	8	9	10	11	12	13 - 18	19 - 24	25 - 36
Steering committee meeting--review and revise global implementation plan proposal	Steering committee	Lack of availability of steering committee members due to scheduling or compensation	█														
Secure stakeholder commitment	MINIRENA, RMA	Project may be a low priority for RMA or MINIRENA	█	█													
Funding	MINIRENA	Slow approval of funds. Low donor priority or avoidance of sector on part of donors	█	█	█	█	█	█									
Tender and contract international consultancy	MINIRENA	availability of qualified consultants							█	█							
Institutional strengthening of RMA, especially project management	MINIRENA, Consultancy	RMA "buy in"; qualification and commitment of RMA managers							█	█	█	█	█	█			
Expropriate or partner with existing mine	MINIRENA	Legal basis of demonstration plant operation.				█	█	█	█								
Mineral processing studies	Consultancy	Tests sufficiently robust; representative mineralogy							█	█	█	█					
Design of plant options	Consultancy	affordability of plant designs									█	█	█	█			

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Demonstration processing center	3-year operation. Opex approximately \$2 million Capex \$1 million or more depending on equipment. Possible recovery of some expenses by sale of minerals																
Steps to take	Who is responsible	Risks and obstacles	1	2	3	4	5	6	7	8	9	10	11	12	13 - 18	19 - 24	25 - 36
Design of water and waste management systems	Consultancy	appropriateness of systems to Rwandan geography, cost of waste management solutions															
Facility and equipment commissioning	Consultancy	timely delivery of equipment													month 18		
Operations and miner trainings	Consultancy, RMA	life of mine/continuity of mineralization; by-in by mine operators													ongoing		
Monitoring and evaluation	RMA, Steering committee MINIRENA, consultancy	Ability of monitoring process to report critically						Quarterly									

8 ANNEXES

8.1 References

Cook, R., and Mitchell, P. (2014): Evaluation of Mining Revenue Streams and Due Diligence Implementation Costs along Mineral Supply Chains in Rwanda. Contract study for Federal Institute for Geosciences and Natural Resources (BGR); ISBN 978-3-943566-18-5; available online at <http://www.bgr.bund.de/mineral-certification>

Hilson, G. (2011): Can Microcredit Services Alleviate Hardship in African Small-scale Mining Communities? *World Development* Vol. 39, No. 7, pp. 1191–1203

Perks, R. (2013): Digging into the past: critical reflections on Rwanda's pursuit for a domestic mineral economy, *Journal of Eastern African Studies* Vol. 7, Issue 4, available online- <http://dx.doi.org/10.1080/17531055.2013.841025>

Perks, R. (2015): Mining Cooperatives: Re-invigorating small-scale mining participation and benefit in Rwanda. Downloaded July 30, 2015 www.open.ac.uk/socialsciences/bisa-africa/files/bisa-isa-perks.pdf

Rwanda Development Board (2012): Rwanda Skills Survey 2012 – Mining Sector Report.

World Bank (2014): Rwanda Economic Update, Edition no.6, Unearthing the Subsoil, Mining and its Contribution to National Development)

8.2 Interviewed Persons

Name	Institution
Dr. Philip Schütte	BGR Project Manager
John Kanyangira	Director, Mining Business Investment Development Support Services Unit, GMD
Dr. Michael Biryabarema	DG of GMD
Honorable Evode Imena	Minister of State in charge of Mining
Azalika Michael	Mining Engineer in GMD inspection department
Richard Niyongabo	(Mineral Economist, Mining Business Investment Development Support Services, GMD)
Leonidas Simpenzwe	RMA Focal Point; Exploration Manager TINCO
Marcelline Mukakarangwa,	International Business Development Officer, Office of the Canadian High Commission
Tuyishime Modeste	MINIRENA statistics officer
Peter Katanisa,	Advisor to Minister of Natural Resources
Diana Klein	Extractive Industries Adviser, UK Department for International Development (DFID)
Jean Malic Kalima	Chairman, Rwanda Mining Association
Nick Meakin	Micro credit advisor to Urwego Opportunity Bank_
Maj Rugamba	Robert (Rugamba Mining Company/ RMA chairman, Southern Province)
Kalinda	Kalinda Mining Company
Steven Kalyango	(CEO 7 Ways Mining)
David Bensusan	(CEO Minerals Supply Africa)
Germaine R. Mukamusana	(CRO Urwego Opportunity
Hunter Thompson)	(Director, Karisimbi Business Partners
Nick Barigire	(Director, Karisimbi Business Partners)

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Name	Institution
Bagilijabo Jean d'Amour	GMD Mines Inspector
Biringiro Alexis	GMD Mines Inspector
Kayihura Juvenal	GMD Mines Inspector
David Rwiyamirira	(MD 7 Ways Mining)
Iledeponse Niyonsaba	(Country Manager Pact/ITSCi)
Ruhigira Bida Augustin	(FECOMIRWA Executive Secretary)
Joseph Butera	(Mineral Economist, Mining Business Investment Development Support Services, GMD)
Jeffrey Bowan	(Economic and Commercial Officer, US Embassy)
Innocent Kayitana	(RRA Small & Medium Taxpayers Office, Head of Registration & Block Management Division)
Amagassi Hakizimana	GIZ / CEFE
Fred Nduko	IPRC Instructor
Steven Rupprecht	Professor, University of Johannesburg
Nduwaezu Jean Pierre	GMD Cadastre
Silke Lienendecke	TVET specialist, GFA
Gatabazi Emmanuel	Bank of Kigali
Isoile Habarugira	RIM Riseau interdioscean de Microfinance
Nkanika Proper	Consulting Geologist
Jean de la Paiz Ngizimana	Minerals Supply Africa
Joseph Kagabo	GMD Mines Inspector
Sindambwe Simon	Sindambwe Mining
Gaspard Baratmana	Director of Cogebanqe
Straton Karakeze	Accountant, Wolfram Mining and Processing
Albert Nsengiyumva	TVET Minster
Gakuba Jean de dieu	PSF Traning expert
Peter Martin Niyigena	SCBI /GMD
Louise Makakalisa	Secretary RMA
Jacques Sezikeye	Director Akazi Kanoze Access
Melane Sane	Akazi Kanoze
Christine	GFA 3C
Claude Gasita Mutorero	Wand Mining Consulting Company
Tumaini Olga	WDA
Andrew Thorburn	Trademark East Africa
Allison George	MINIRENA Strategic Advisor
Honorable Albert Nsengiyumva	TVET State Minister
Eric Niyongabo	Advisor to TVET State Minister
Paul Mitchell	Consultant Green Horizons/Estelle Levin Associate