

Social impacts of artisanal cobalt mining in Katanga, Democratic Republic of Congo

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Authors:

Nicolas Tsurukawa

Siddharth Prakash

Andreas Manhart

Öko-Institut e.V.

Freiburg Head Office

P.O. Box 17 71
79017 Freiburg, Germany

Street Address

Merzhauser Str. 173
79100 Freiburg

Phone +49 (0) 761 – 4 52 95-0

Fax +49 (0) 761 – 4 52 95-288

Darmstadt Office

Rheinstr. 95
64295 Darmstadt, Germany

Phone +49 (0) 6151 – 81 91-0

Fax +49 (0) 6151 – 81 91-133

Berlin Office

Schicklerstr. 5-7
10179 Berlin, Germany

Phone +49 (0) 30 – 40 50 85-0

Fax +49 (0) 30 – 40 50 85-388

Table of contents

List of tables	V
List of figures	V
Acknowledgements	VIII
List of acronyms and abbreviations	VIII
Executive summary	1
1 Introduction	5
2 Background information	6
2.1 The global cobalt market	6
2.1.1 Demand	6
2.1.2 Production	6
2.1.3 Reserves	8
2.1.4 Prices and market trends	9
2.2 The Congolese context	10
2.2.1 Geology and geography of Cobalt in the Copperbelt	10
2.2.2 History of mining activities in Katanga	14
3 Methodological approach and objectives	17
4 Scope of the study	18
4.1 The cobalt supply-chains	18
4.2 Current stakeholders	19
4.2.1 Artisanal miners	19
4.2.2 State-owned companies	21
4.2.3 Private mining companies	22
4.2.4 Traders	23
4.2.5 The State	24
4.2.6 Assaying companies	26
4.2.7 Local Communities	26

5	Impact on workers	27
5.1	Safe and healthy working conditions	27
5.2	Freedom of association and right to collective bargaining	29
5.3	Equality of opportunity and treatment and fair interaction	30
5.4	Forced Labour	31
5.5	Child Labour	31
5.6	Remuneration	33
5.7	Working hours	35
5.8	Employment security	36
5.9	Social security	37
5.10	Professional development	38
6	Impact on local communities	39
6.1	Safe and healthy living conditions	39
6.2	Human rights	41
6.3	Indigenous Rights	42
6.4	Community Engagement	43
6.5	Socio-economic opportunities	43
7	Impact on society	44
7.1	Public commitments to sustainability issues	44
7.2	Unjustifiable risks	45
7.3	Employment creation	46
7.4	Anti-corruption efforts and non-interference in sensitive political issues	48
7.5	Contribution to national economy	49
7.6	Contribution to national budget	51
7.7	Impacts on conflicts	52
7.8	Transparent business information	52
8	Social impacts on a product basis	53
9	Final conclusions and recommendations	55
10	Literature	59

List of tables

Table 1:	Price grids for heterogenite in some trade houses in 2006–2007. Sources: ARDERI 2006 (quoted in RRN 2007) and PACT 2007	34
Table 2:	Estimation of the budget for SAESSCAM community development projects	44
Table 3:	Estimated numbers for full-time occupation opportunities, functional unit production and working hours/functional unit ratio for artisanal cobalt mining in 2010.	47
Table 4:	Estimated number of artisanal miners in each deposit group of the Copperbelt. Source: calculated from PACT 2010, Vanbrabant et al. 2009 and SAESSCAM 2010	48
Table 5:	Access to different media (at least once a week) as a percentage of population categories. Source: DRC ministry of health 2007 (MH)	52
Table 6:	Working minutes of artisanal cobalt extraction in the DRC per product	54
Table 7:	Social indicator values of artisanal cobalt mining in the DRC for selected cobalt containing products	55

List of figures

Figure 1:	Share of cobalt demand by end-use application in 2009. Values are in tons of refined cobalt. Source: CDI 2010.	6
Figure 2:	Repartition of world land-based cobalt production from 1995 to 2010. Source: USGS 1995-2010	7
Figure 3:	Repartition of world refined cobalt production (2004, 2008) and world cobalt refinery capacity (2008). Source: USGS 2008a	8
Figure 4:	World land-based cobalt reserves (2010). Sources: USGS 2010, Ministry of Mining 2007, RELCOF 2005	9
Figure 5:	Cobalt price trends from year 2000 to 2010. Source: Arnold Magnetic Technologies Corp. 2010, quoted by USDE 2010	10
Figure 6:	Map of the Copperbelt. Sources: RGC 2010. Additional data georeferenced from maps of Anvil Mining 2011, Dewaele et al. 2008, GoogleMap 2011, Hanssen et al. 2005, TCEMCO 2009, UN-DPI 2000. Coordinate system of georeferenced data may differ from the RGC	11

Figure 7:	Sketch diagrams illustrating the three major steps in the formation of secondary oxidized Co ores in Katanga (vertical scales are exaggerated). Source: Decrée et al. 2010a	13
Figure 8:	(upper left) Cristal of carrollite, cobalt sulphide (Katanga, DRC)	14
Figure 9:	(upper right) Cu & Co mineralised rock with silicified gangue in the ZEA of Kawama (Katanga, DRC)	14
Figure 10:	(lower left) pure heterogenite from Kabolela (Katanga, DRC) (collector's item)	14
Figure 11:	(lower right) Lubumbashi tailing (Katanga, DRC)	14
Figure 12:	Evolution of GECAMINES Cobalt production related to GECAMINES Copper production, world prices, and private operators' Cobalt production. Sources: USGS 2009 & GECAMINES 2010	15
Figure 13:	(left) Digger in the ZEA of Kawama, (Katanga, DRC)	19
Figure 14:	(right) Women washing ores in Kolwezi (Katanga, DRC)	19
Figure 15:	Flow-chart of the artisanally mined cobalt in Katanga and scope of the study	20
Figure 16:	Geographic distribution of copper-cobalt deposits and industrial basins. Deposit groups delimitations on the figure are not accurate. Sources: RGC 2010, TCEMCO 2009.	21
Figure 17:	Links between administration bodies and other stakeholders in the artisanal mining sector	25
Figure 18:	(left) Artisanal mining gallery in Katanga, DRC. Credit: Pr. Mota Ndongo K. E. C. 2009, University of Lubumbashi (Katanga, DRC)	28
Figure 19:	(right) Artisanal mining gallery with support benches in Kolwezi (Katanga, DRC). Credit: B. Litsani 2010, Congo Direct (Katanga, DRC)	28
Figure 20:	Women and children washing ores near Likasi (Katanga, DRC). Credit: T. De Putter 2010, Royal Museum of Central Africa, Tervuren, Belgium	32
Figure 21:	Warning sign in the region of Kolwezi (Katanga, DRC): "forbidden to women and children under the age of 18". Credit: T. De Putter 2010, Royal Museum of Central Africa, Tervuren, Belgium	33
Figure 22:	Average time spent in artisanal mining and trading (s = 142). Source: PACT 2010	37

Figure 23:	Map of the uraniferous sectors of the Copperbelt. Source: Lubala Toto et al. 2011	40
Figure 24:	Sanitary follow-up in Kidimudilo (Katanga, DRC). Credit: T. De Putter 2010, Royal Museum of Central Africa, Tervuren, Belgium	41
Figure 25:	Heterogenite and metatorbernite (cobalt ore and uranium ore) in a silicified rock from Shinkolobwe (Katanga, DRC). Credit: T. De Putter 2010, Royal Museum of Central Africa, Tervuren, Belgium	45
Figure 26:	Diggers loading 50 kg bags of ore at the artisanal mine of Kawama (Katanga, DRC). Credit: T. De Putter 2010, Royal Museum of Central Africa, Tervuren, Belgium.	50

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List of acronyms and abbreviations

ANR	Agence Nationale de Renseignements
ARDERI	Association régionale pour le développement intégré
ASADHO	Association Africaine de Défense des Droit de l'Homme
CADTM	Comité d'Annulation de la Dette du Tiers Monde
CAMI	Cadastre Minier (Mining Registry)
CASM	Communities and Small scale Mining
CTCPM	Technical Unit for Mining Planification and Coordination
CDI	Cobalt Development Institute
CEEC	Centre d'Expertise, d'Evaluation et de Certification
CEO	Chief Executive Officer
CF	Congolese Franc
CHEMAF	Chemicals for Africa
CISDL	Centre for International Sustainable Development Law
CMKK	Coopérative Minière Maadini Kwa Kilimo
COPIREP	Comité de Pilotage de la Réforme des Entreprises du Portefeuille de l'Etat
COMIDE	Congolaise des Mines de Développement
DGDA	Customs Duties and Excises Head Office (formerly OFIDA)
DGI	Tax Head Office
DGRAD	Administrative, Judicial, State-owned and Participatory Receipts Head Office
DRC	Democratic Republic of Congo

EITI	Extractive Industries Transparency Initiative
EMAK	Association des Exploitants Miniers Artisanaux du Katanga
ENRC	Eurasian Natural Resources Corporation
EP	Equator Principles
ESIA	Environmental and Social Impact Assessment
EU	European Union
FARDC	Forces Armées de la République Démocratique du Congo
FEC	Fédération des Entreprises du Congo
GDP	Gross Domestic Product
GECAMINES	Générale des Carrières et des Mines
GIS	Geographic Information System
GPRSP	Growth and Poverty Reduction Strategy Paper of the WB and IMF
GRI	Global Reporting Initiative
HIV	Human Immunodeficiency Virus
HMS	Heavy Media Separation
IAEA	International Atomic Energy Agency
IARC	International Agency for Research on Cancer
ICMM	International Council on Mining and Metals
ICRP	International Commission on Radiological Protection
IFC	International Finance Corporation
ILO	International Labour Organisation
IMF	International Monetary Funds
IPIS	International Peace Information Service
ISA	International Seabed Authority
ISO	International Organization for Standardisation
LME	London Metal Exchange
MC	Mining Code
MONUC	Mission des Nations Unies au Congo
MPI	Multi Poverty Index
MR	Mining Regulation
MRAC	Royal Museum of Central Africa, in Tervueren (Belgium)
MSq	Mining square
mSv	Milli Sievert (10^{-3} Sievert)
Mt	Mega Ton (10^6 metric tons)
NGO	Non Governmental Organisation
NOUCO	Nouvelle Compagnie
OCHA	Office for Coordination of Humanitarian Affairs
ODV	Opération Départ Volontaires
OECD	Organisation for Economic Co-operation and Development

OFIDA	Office des Douanes et Accises (see DGDA)
PE	Exploitation Permit
PER	Tailings Exploitation Permit
Ppm	Parts per million
PR	Research Permit
PROSA	Product Sustainability Assessment
RAID	Rights and Accountability in Development
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RELCOF	Réseau de Lutte contre la Corruption et la Fraude
RGC	Référentiel Géographique Commun
RRN	Réseau Ressources Naturelles (Natural Resources Network)
SADC	Southern African Development Community
SAESSCAM	Service d'Assistance et d'Encadrement du Small-scale Mining
SCCA	Sino-Congolese Cooperation Agreement
SETAC	Society of Environmental Toxicology and Chemistry
SICOMINES	Sino-Congolaise des Mines
S-LCA	Social Life Cycle Assessment
SMIG	Salaire Minimum Interprofessionnel Garanti
SODIMICO	Société de Développement Minier et Industriel du Congo
SOFRECO	Société Française de Réalisations et Constructions.
STD	Sexually Transmitted Disease
SX-EW	Solvent Extraction-Electro-Winning
TFM	Tenke Fungurume Mining
Tpa	Ton per annum
TRACE	Projet Traçabilité de l'Hétérogénite
UMHK	Union Minière du Haut Katanga
UNDP	United Nations Development Program
UN-DPI	United Nations Department of Public Information
UNEP	United Nation Environment Program
UNFPA	United Nations Population Fund
USA	United States of America
USDE	United States Department for Energy
USDS	United States Department of State
USGS	United States Geological Survey
VPHRS	Voluntary Principles on Human Rights and Security
WHO	World Health Organisation
ZEA	Zone d'Exploitation Artisanale

Executive summary

The Democratic Republic of Congo is the world's leading producer of cobalt, a commodity of which the demand has tripled during the last decade. In 2010, cobalt from Katanga Province ensured half of the global cobalt primary production. During the last decade, 60 to 90% of this cobalt stemmed from artisanal mining. Refined cobalt applications include metallurgical superalloys and booming chemical applications such as batteries for electronic devices and electric cars.

During a decade of wars and political instability, while industrial production had collapsed, tens of thousands of artisanal miners started exploiting heterogenite (a cobalt ore) in the province of Katanga. They supplied foreign traders (mainly Chinese), and the smelting facilities of the state-owned GECAMINES. Despite very basic working conditions, locals and migrants from other provinces were able to make a living of digging in the relatively peaceful South-East of the country. In 2002, however, as it had to raise loans from multilateral and bilateral donors, the transition government of DRC entered a privatisation process of the huge copper, cobalt and other mineral reserves belonging to the GECAMINES. A new mining code was promulgated in order to attract investors. The establishment of major mining companies excluded artisanal miners from large tracks of land that they could previously exploit, as foreign investors wanted to secure their assets and were unwilling to be liable for artisanal activities under precarious working conditions. Forced evictions not only resulted in violent protests but also animosity with local authorities who are often known for despising mining communities because of their "immoral" reputation. Being aware of the threat that 100,000 unsatisfied miners represent for political stability – and under the pressure of international public opinion – the state and some private companies, together with civil society, have been making efforts in the last years to solve the social problems arising from artisanal mining, which were only partially successful. Although it does not currently possess the capacity to refine the major part of its production, the D.R. Congo remains an indispensable supplier of raw cobalt ore for the years to come.

This study aims at analysing the current socio-economic consequences of artisanal cobalt mining in Katanga. The research is based on a literature review, telephone interviews and information derived or calculated from these data. An exhaustive set of socio-economic indicators were examined according to the 2009 UNEP/SETAC guidelines for Social Life Cycle Assessment of Products. Three stakeholder groups were considered: Workers, Local communities, and Society.

Artisanal cobalt mining is estimated to provide employment to between 67,000 and 79,000 permanent full-time miners. During the peak season, the total number of miners reaches 90,000 to 108,000 workers. About 74% of miners are diggers while the remaining are sorters and washers. The contribution of artisanal cobalt mining to national economy was assessed using 2 different methods. The first evaluation is based on the value of the production, which adds up to between 10,800,000 and 16,200,000 bags each containing 50kg of 5% cobalt ores (functional unit). Accordingly, the

contribution of the sector to national economy would have ranged between 149 and 324 million US\$ in 2010. The second estimation is based on miner's total revenue, which amounts to between 65 and 137 million US\$. Artisanal cobalt mining thus represents between 0.5 and 2.4% of the Congolese GDP. Considering that 80% of the economic activity belongs to the informal sector (which is not accounted for in the official GDP-figures), the actual weight of artisanal cobalt mining in the national economy would rather range between 0.1 and 0.5%. However, artisanal miners have little knowledge of world commodity prices, and are unable to negotiate fair wages for their production. For processing companies, traceability is virtually impossible since even state agents and union representatives label ores coming from illegal sites as ores originating from other legal artisanal mining zones.

In terms of working conditions, miners are exposed to landslide hazard, especially during the rainy season. Annual death rates reaching 0.4 to 0.5% of the workforce were reported in some mines, although security conditions vary considerably from one site to another. Miners are exposed to heavy metals through dust inhalation, food and water contamination. Above, high concentrations of Uranium are found in mines between Shinkolobwe and Kolwezi. There, miners are exposed to radiations of up to 24 mSv/year. Moreover, poor sanitary conditions in miners' camps favour epidemics, and a higher prevalence of HIV due to promiscuity, prostitution and the presence of former soldiers. Compared to the formal private sector, it is estimated that 13 to 20 hours or 35 to 52% overtime per week are typically performed by artisanal miners.

No evidence of systematic or explicit forced labour was found, notwithstanding hard working conditions and widespread child labour prevailing: between 19,000 and 30,000 of children under 15 years of age, and 9,000 to 15,000 of children aged between 15 and 17 years are estimated to work in artisanal cobalt mines. The majority of younger children carry out easy tasks such as ore sorting and washing. From the age of 15 or 16, young males are employed in mines. Nevertheless, small children are also reported to be sent for digging in narrow and dangerous galleries, to which they have an easier access than adults. Women are often not allowed to dig in the mine pit, which is the more lucrative activity and are therefore assigned to ore sorting and washing. Latent ethnic tensions towards migrants from other provinces might also result in inequalities, especially during economic hardship.

In terms of employment security, concession owners and traders keep employing miners as day labourers beyond the 23 days period that renders the legal right to a permanent contract. Very basic social security exists, as one can usually rely on a broad familial and/or professional solidarity network in times of hardship, but this informal system cannot meet the needs of everyone in the event of a general employment crisis. Apart from climbing in the hierarchy as team-leader or trader, artisanal mining offers very limited opportunities for professional development: most experienced and qualified people (e.g. former GECAMINES staff) can get employed in small-scale smelting. Above, NGO or social programs from large-scale mining companies offer training possibilities for professional conversion, but only to a limited number of miners.

Despite these negative aspects, many miners find satisfaction in their job, mostly due to the rapid cash turn-over, a higher remuneration range than that assigned to average workers of the informal sector, and their urban lifestyle. Of course, they might prefer better working conditions, within legal and profitable artisanal mining zones, a fair tax system and a transparent certification scheme, a free access to the market to negotiate better prices etc., but do not consider to change their occupation.

Artisanal cobalt mining also causes several negative impacts for local communities of the Copperbelt, especially resulting from soil, air and water pollution: According to Banza et al. (2009), populations living in a radius of 10 km from mine-related activities showed higher urinary concentrations of Co, Pb, Cd and U than those of a control population. Nevertheless, soils in the Copperbelt naturally bear high concentrations of these elements, and industrial mining companies have a share of responsibility as well. Regarding human rights violation, prostitution of children in artisanal miner's settlement has been reported. Indigenous rights are mostly ignored by groups of artisanal miners, in spite of the legal framework which imposes consultation of local communities and compensations for negative impacts on the resources of the community (agricultural land, drink water, woodstock, public infrastructures). Moreover, miners have higher incomes, and their presence results in local inflation that threatens the purchasing power of indigenous people. Rare cases of social investments from individual mine owners for drinking water supply and health care infrastructure are reported, although they do not result from a well-structured community engagement project.

Corruption remains widespread (DRC ranks 164 out of 178 countries at the corruption perception index). Many state agents engage in the mining sector although they are not eligible for mining rights. Miners often bribe security agents to access forbidden mines, and traders constitute networks of political protection to by-pass costly exportation procedures. Nevertheless, there were reports on a system with just one state agency collecting a single tax that is redistributed to other relevant services and that reportedly successfully reduced the tax burden on artisanal miners in Kolwezi.

Despite all negative impacts, artisanal cobalt mining plays a crucial role in the socio-economic landscape of Katanga Province: It is labour very intensive thus providing income to a significant share of the population. Presupposing the introduction and penetration of sound working conditions, this labour intensiveness, together with the fact that artisanal mining can be taken up by unskilled workers and does not require significant investments, artisanal cobalt mining holds the potential to alleviate poverty and to trigger sustainable development in Katanga.

Therefore, it is strongly recommended that international efforts should focus on strengthening artisanal mining practices rather than introducing initiatives aiming to restrict or ban cobalt supply from artisanal sources.

To maximise positive impacts of artisanal cobalt mining in Katanga and mitigate negative consequences, we recommend:

- To Congolese authorities:
 - A revision of the mining code

- The creation of a sufficient number of artisanal mining zones (Zone d'Exploitation Artisanale - ZEA)
 - Full transparency regarding contract negotiation with extractive industries
 - Ensure a fair remuneration of miners by controlling authorised certification laboratories
 - Proper decontamination and an effective closure of the former Belgian mine (Shinkolobwe), as recommended in 2004 by the International Atomic Energy Agency.
- To multilateral and bilateral donors:
 - support to help SAESSCAM (Service d'Assistance et d'Encadrement du Small-scale Mining) fulfill its mandate towards artisanal miners
 - identification and dissemination of good practices
 - To downstream markets and industries:
 - Refrain from any general ban of cobalt from artisanal sources;
 - Engage in direct co-operations with artisanal mining communities to mitigate health, safety and environmental hazards, to improve working conditions and community development, and to improve skills and market access.

Furthermore, as employment security also depends on the profitability of artisanal mining, improved efficiency of artisanal mining will ensure its competitiveness, hence its resistance to economic shocks. Thus it is generally recommended to:

- strengthen the artisanal mining and support investments to upgrade informal groups of miners to formal small-scale mining cooperatives, and to authorize them to negotiate better prices at the right time, finance sample analysis, offer financial security to its members, and
- integrate artisanal extraction with downstream concentration process.

1 Introduction

Driven by a boom for its metallurgical and battery applications, demand for cobalt tripled between year 2000 and 2010. While cobalt extracted as a by-product of other metals was sufficient to supply the market during the 20th century, the steady growth in its demand in the last decade encouraged a large number of artisanal and small-scale miners (ASM) to extract heterogenite, a very common cobalt-ore in South-Eastern Congo. Unfortunately, what could have been an incredible opportunity to generate fair revenue and local development has so far not fulfilled its potential: the difficult coexistence of industrial and artisanal mining, combined with a lack of governance, generated severe negative social impacts in Katanga, the region that ensured half of the global cobalt production in 2010.

This study aims at describing thoroughly the socio-economic impacts of cobalt production in the Katanga province (D.R.Congo), and provides consumers, corporate and political decision-makers with an up-to-date and objective analysis of the situation. The study:

- describes socio-economic impacts for three stakeholder categories: Workers, Local Communities, Society;
- focuses on a single commodity (cobalt);¹
- encompasses a relatively broad geographic scope (the Katangan Copperbelt).

Chapter 2 displays background information about trends in the global cobalt market, including global demand, production, reserves and prices. It also provides a brief overview on the contextual elements of the cobalt mining sector in D.R.Congo, such as geology, geography and history of the region. Chapter 3 describes the methodological approach used in this study, while Chapter 4 defines the scope of the study and presents various stakeholders involved in cobalt mining activities. The results of the study are provided in Chapters 5 (impact on workers), 6 (impact on local communities) and 7 (impact on society). The conclusions and recommendations to improve the socio-economic impacts of cobalt mining in D.R.Congo are provided in Chapter 8.

¹ In Katanga, copper and cobalt often occur together. Whenever possible, impacts of mining activities were allocated to those activities that primarily target cobalt. Nevertheless, in some cases the boundary between the two mining targets is blurred so that no clear allocations could be made.

2 Background information

2.1 The global cobalt market

2.1.1 Demand

Over the past decade, cobalt demand grew steadily, resulting mainly from an increase in chemical applications, notably rechargeable batteries and catalysts. This trend is expected to continue, in line with the battery demand for portable devices and electric or hybrid vehicles (CDI 2010), although a stagnation due to the development of alternative technologies could also be expected (Vandeputte 2008). Currently applied cathode material (Lithium Cobalt Oxide with 60% cobalt content) could gradually be replaced by Nickel Manganese Cobalt Oxide, Nickel Cobalt Aluminium or Lithium Iron Phosphate technologies containing 10-20%, 9% and 0% cobalt respectively (Metal Pages 2008). Chemical applications (batteries, catalysts, colours) of cobalt account for 56% of the demand, while the remaining 44% result from metallurgical applications. Super-alloys are used to manufacture aircrafts, military equipment and gas turbine for electricity production (CDI 2010).

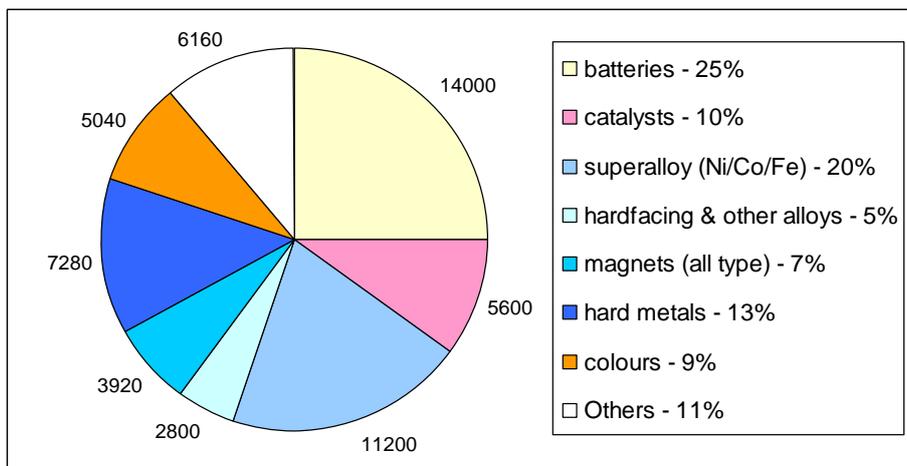


Figure 1: Share of cobalt demand by end-use application in 2009. Values are in tons of refined cobalt. Source: CDI 2010.

2.1.2 Production

Cobalt is mainly extracted as a by-product of nickel, except in the African Copperbelt where it is either a primary product or a by-product of copper.² 88,300 tons of cobalt was mined

² It is estimated that in 2009, roughly 50% of cobalt was mined as a by-product of nickel, 35% as a by-product of copper and 15% as a primary product (CDI 2010). This ratio seems to be derived from 2008 statistics, as deposits from DRC and Zambia “only” produced 50% of world cobalt that year (=35% by-product of copper + 15% primary product). Since

worldwide in 2010, of which 51% in DRC (USGS 2010). The contribution of Congolese artisanal mining remains difficult to evaluate.

Neither Congo nor neighbouring Zambia has sufficient refining capacities to treat all the extracted ores to the refined stage (Figure 2 und Figure 3). Although Congolese authorities try to attract investors to build on-site facilities, supply in unprocessed ores and concentrates from Congo is vital for refiners in other countries such as China, where 120 refiners had developed a total refining capacity of 30,000 tons per annum (tpa) by 2008. It is estimated that the equivalent of over 21,400 tons of cobalt were imported as raw ores or concentrates into China from Congo in 2008 (USGS 2008a).

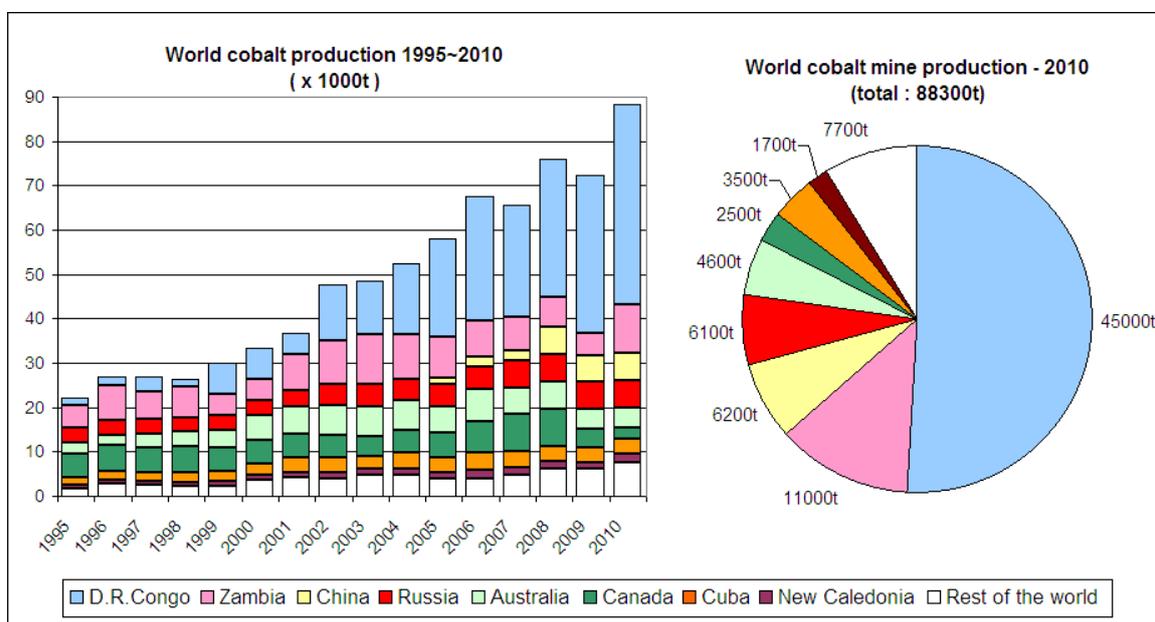


Figure 2: Repartition of world land-based cobalt production from 1995 to 2010. Source: USGS 1995-2010

Morocco also produces primary cobalt (2% in 2008, see Figure 3), production in DRC (41% in 2008, see Figure 2) would presumably be split between 1/3 of primary cobalt (13%) and 2/3 of secondary cobalt (28%). Part of the cobalt considered as secondary (i.e. mined industrially) might actually be primary cobalt, since artisanal miners supply large-scale copper treatment facilities with their cobalt-rich heterogenite.

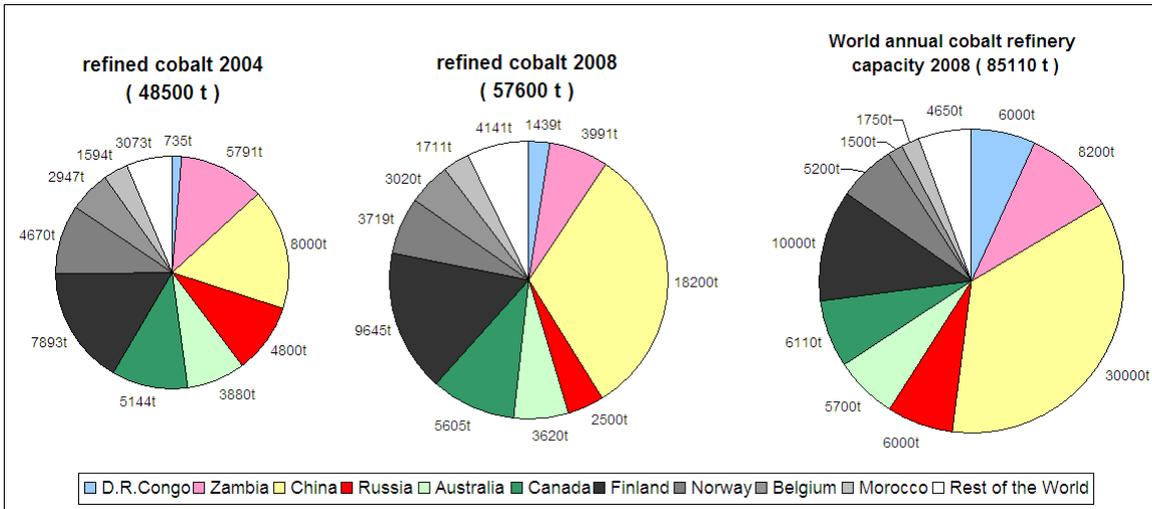


Figure 3: Repartition of world refined cobalt production (2004, 2008) and world cobalt refinery capacity (2008). Source: USGS 2008a

Although world cobalt supply is not considered critical in the short and medium term, the USA, EU, Japan and South Korea are implementing recycling strategies (Treffer et al. 2011, Kwade et al. 2011) to prevent shortage, as their industries heavily rely on import of this commodity (USDE 2010, EC 2011). Beside mine production, Kapusta (2006) estimated that 10,000 tons of cobalt was recycled globally in 2005.

2.1.3 Reserves

USGS estimates of world land-based reserves of Cobalt amount to 7.3 Mt (or 83 times the world production in 2010), with a reserve base of 13 Mt. Prospecting and profitability of known deposits improved during the past decade: in 2001, only about 3.5 Mt of cobalt out of a 10 Mt reserve-base was considered to be economically mineable by the USGS.

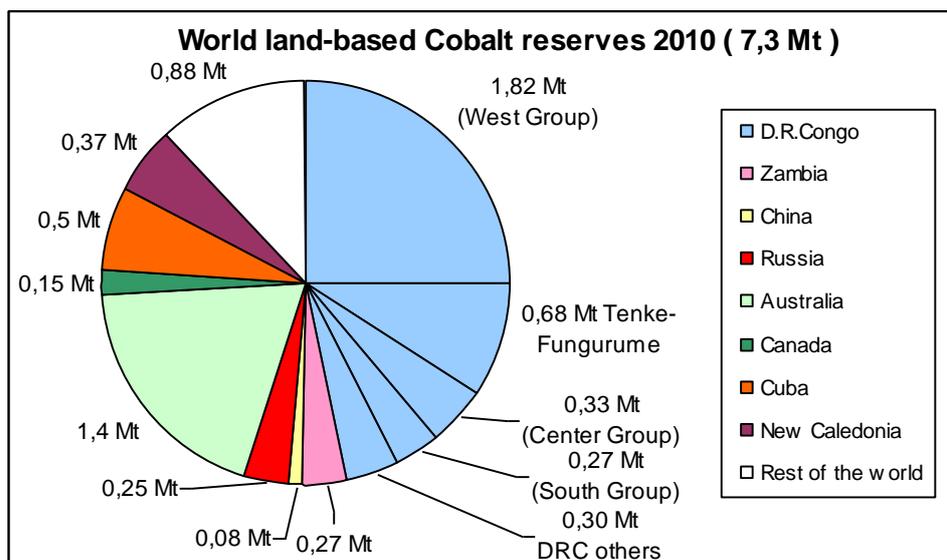


Figure 4: World land-based cobalt reserves (2010). Sources: USGS 2010, Ministry of Mining 2007, RELCOF 2005

The African Copperbelt still holds more than a half of global reserves, mainly found in the tiny portion of the belt between the cities of Kolwezi and Likasi, an area not bigger than Rwanda or Slovenia. According to the Congolese Mining Code, part of the reserves (“DRC others” in Figure 4) might include cobalt-rich slag from old copper-extraction tailings, containing over 0.6 Mt cobalt. Small amount of cobalt is also found in former concessions of the Société de Développement Industriel et Minier du Congo (SODIMICO), further south from Lubumbashi (Ministry of mining 2007).

An alternative source of cobalt that could develop during the next decade are the seabed reserves, estimated to hold at least tenfold the total available cobalt in continental deposits: the Exclusive Economic Zone of the Hawaiian archipelago and Johnston island alone would contain 2.6 Mt of cobalt (ISA 2006). According to USGS (2011), as much as 1 billion tons of hypothetical and speculative cobalt resources may exist on the ocean floors. Regulations for prospecting and exploration of polymetallic nodules were published by the International Seabed Authority in 2010, and such regulation for the so-called cobalt-rich crusts is to follow in 2011.

2.1.4 Prices and market trends

The price of cobalt, as many minor metals, is tied to a small number of end-use sectors and a small number of producers. As a result, its market is more fragile than the major metal markets (Eggert 2010). Moreover, cobalt production partly depends on copper and nickel prices that are the major products in cobalt-bearing deposits (USGS 2008a).

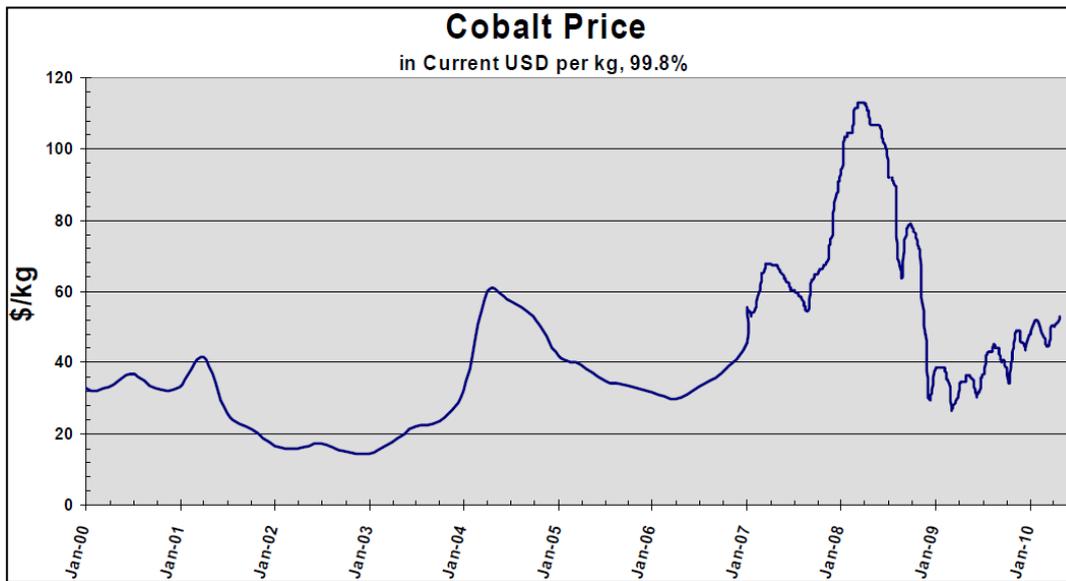


Figure 5: Cobalt price trends from year 2000 to 2010. Source: Arnold Magnetic Technologies Corp. 2010, quoted by USDE 2010

A market surplus of cobalt kept prices low until a strong demand for batteries led to a spike in 2004, followed by a trough due to implementation of public health and environmental regulations and subsequent slow-down of demand from chemical industries (USDE 2010). As a response, cutbacks in existing operations and delays in planned nickel-cobalt and copper-cobalt projects were observed. This led to a dramatic price increase as demand recovered in 2007, before collapsing during the global economic downturn in 2008. Cobalt became a commodity on the London Metal Exchange (LME) in February 2010, reflecting the will of industries to stabilise the prices in the future (LME 2010). So far though, volumes traded on LME remain negligible.

2.2 The Congolese context

2.2.1 Geology and geography of Cobalt in the Copperbelt

The copper-cobalt rich rocks of the Roan outline an arc stretching from Kolwezi in DRC to Luanshya in Zambia, which forms the Copperbelt *stricto sensu* (Figure 6).

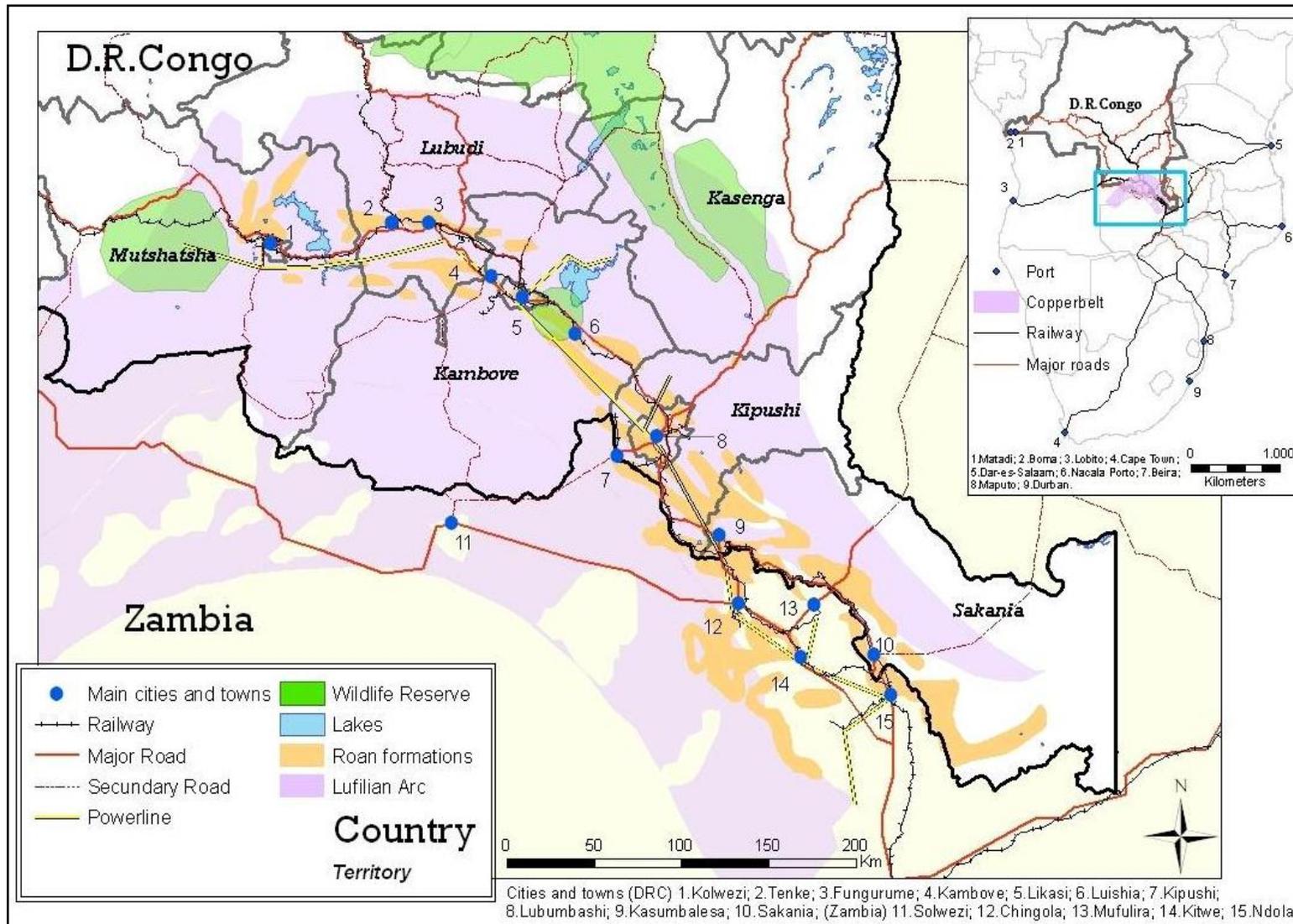


Figure 6: Map of the Copperbelt. Sources: RGC 2010. Additional data georeferenced from maps of Anvil Mining 2011, Dewaele et al. 2008, GoogleMap 2011, Hanssen et al. 2005, TCEMCO 2009, UN-DPI 2000. Coordinate system of georeferenced data may differ from the RGC

Some major copper deposits such as Kansanshi do not bear significant amount of cobalt, and are situated outside this belt, but within a greater geological set known as the Lufilian Arc. The mining land registry already delivered Exploration Certificates virtually covering the whole Congolese part of the Lufilian Arc, with exception only for biosphere reserves (CAMI 2006).³ The major mining cities are connected by national roads, and dilapidated but still active railways and power-supply line. The main custom post is Kasumbalesa, but the 1800 km-long porous border to Zambia is crossed by several minor roads. After possible processing in either Congo and Zambia, or both, mine products generally converge on Kapiri Mposhi, where they are loaded on railroad convoy to Dar-Es-Salaam (Tanzania) or to Durban (South Africa) (Meeuws 2004). Chilukusha (2008) also mentions export routes to Beira, Mozambique, and the tracks to Lobito (Angola) are undergoing restoration. The poor state of national road and railway network, the existence of treatment facilities in nearby Zambia, and increasing demand from Asia explain the preference for foreign exportation routes instead of national ports of Boma and Matadi on the continent's west-coast.

Cobalt deposits in D.R.Congo can roughly be classified in 5 categories:

1. Primary **stratiform deposits** of sulphides such as Carrollite $[\text{Cu}(\text{Co},\text{Ni})_2\text{S}_4]$ (see Figure 8), which mineralized around 880M years ago during the Roan period (Dewaele et al. 2008).
2. **Vein-type deposits** that mineralized later by remobilization of primary deposits along tectonic fractures and faults formed during the Lufilian orogeny (Dewaele et al. 2008).
3. **Cobalt caps**, or supergene enrichment of secondary oxidized ores such as heterogenite $[\text{CoO}(\text{OH})]$ (see Figure 9 and Figure 10), resulting from extensive weathering of primary deposits in superficial layers (Thys et al. 2009).
4. **Scree deposits** or “black earths” concentrated in the bottom of valleys by physical erosion of the cobalt caps (Decrée et al. 2010a).
5. **Tailings** left by decades of copper-mining (see Figure 11). An electric arc furnace technology was developed in Zambia to recover cobalt from slag grading 0.3–2.8% Co (Jones et al. 2001). Similar projects were recently implemented in DRC.

³ Although mining in those areas is also reported (Kyanda 2009b).

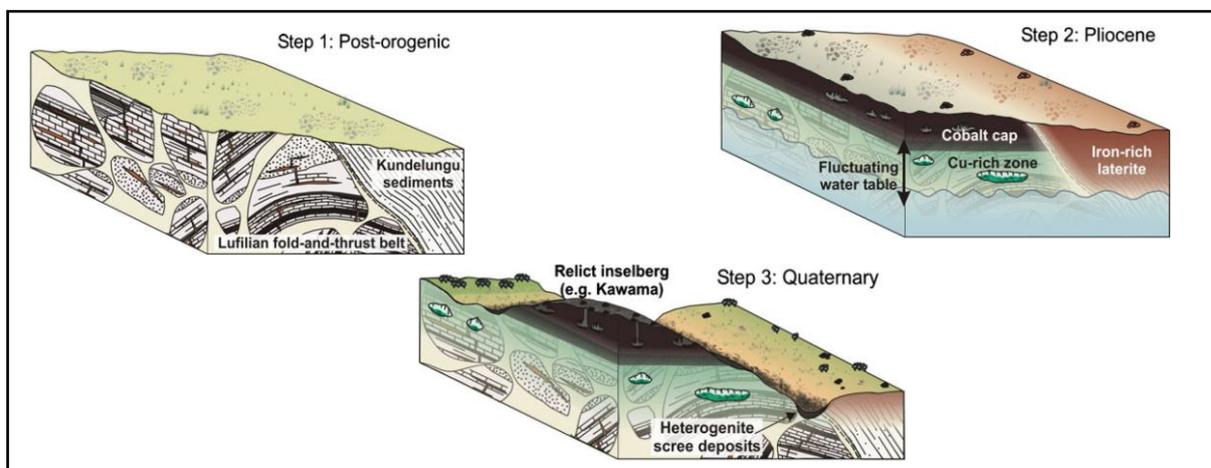


Figure 7: Sketch diagrams illustrating the three major steps in the formation of secondary oxidized Co ores in Katanga (vertical scales are exaggerated). Source: Decrée et al. 2010a

Stratiform and vein-type deposits lay deeper from the surface than caps and scree of heterogenite. The latter also show higher concentrations ranging from 4 to 54% of cobalt (Decrée et al. 2008), and thus have the highest economic value. These surface-near cobalt deposits within the reach of artisanal diggers occur mainly in the Congolese part of the Copperbelt⁴ (Ralph et al. 2011). Deeper Carrollite deposits are by contrast distributed along the whole Copperbelt, together with copper ores. Depending on the market prices, 60 to 90% of the Congolese mining production is extracted manually, using simple tools such as picks and shovels (Vanbrabant et al. 2009). Although heterogenite can contain high quantities of Mn, and Cu (Fontaine et al. 2010), it mainly owes its economic value to cobalt. Variable amount of other elements are also found: precious metals (Ag, Au, Pt), rare (Ge, In, V) and radioactive elements (U) (Vanbrabant et al. 2009). Controversial mining of Uranium-bearing cobalt deposits occur along a 300km arc on the southern facies of the Lower Roan Group, running from Shinkolobwe to Kalongwe (IAEA 1984) (see also Figure 23).

⁴ The Mindat database (Ralph et al. 2011) lists the minerals found in 32 mining sites in the Zambian North-western and Copperbelt districts, and 43 mining sites in the Katangan Copperbelt. Heterogenite is mainly found between Kolwezi and Likasi (11 records). There are 3 more records for Luishia, Lubumbashi and Kipushi, while none is mentioned for Zambia (only Carrollite) Mindat 2011. Expert opinion confirms this configuration (MRAC 2011).



Figure 8: (upper left) Cristal of carrollite, cobalt sulphide (Katanga, DRC)

Figure 9: (upper right) Cu & Co mineralised rock with silicified gangue in the ZEA of Kawama (Katanga, DRC)

Figure 10: (lower left) pure heterogenite from Kabolela (Katanga, DRC) (collector's item)

Figure 11: (lower right) Lubumbashi tailing (Katanga, DRC)

Credit (figures above): T. De Putter 2010, Royal Museum of Central Africa, Tervuren, Belgium.

2.2.2 History of mining activities in Katanga

1912~1959: the *Union Minière du Haut-Katanga* (UMHK) was created by the Belgian colonists to develop copper mining industries in Katanga. At that time, Belgium made considerable profit by refining and re-exporting Congolese ores. UMHK opened several mines, diversified production and created subsidiaries for electricity, coal and sulphuric acid supply, conveyance, etc. Accommodation, health care and education programs were set to attract workers. In 1959, annual production of UMHK reached 280 Mt of copper; 118 Mt zinc concentrates; 8.4 Mt cobalt; 2.1 Mt uranium; 148 t silver; 14 t germanium; and significant amount of lead, manganese and radium (Madsen 1998).

1960~1982: Despite declaration of independence of the Republic of Congo, 3 years secession of the Katanga province, and nationalization of the UMHK which became in 1967 the *Générale des Carrières et Mines* (GCM, or GECAMINES), the management and technical supervision remains Belgian (Madsen 1998).

1986: GECAMINES reaches historical production peak (Figure 12) with 476 Mt copper, 14.5 Mt cobalt, 64 Mt zinc, and employs 33,000 workers (Malango 2008).

1982~1997: According to Madsen (1998), successive Zairean CEOs modified the firm’s internal hierarchy and price structure of products. Increase resort to foreign private firms, first by subcontracting, then in the early 1990ies by purchase or privatization agreements. Madsen (1998) states that the balance sheet of the GECAMINES was gradually weakened by skimming of profit, embezzlement and other forms of graft.

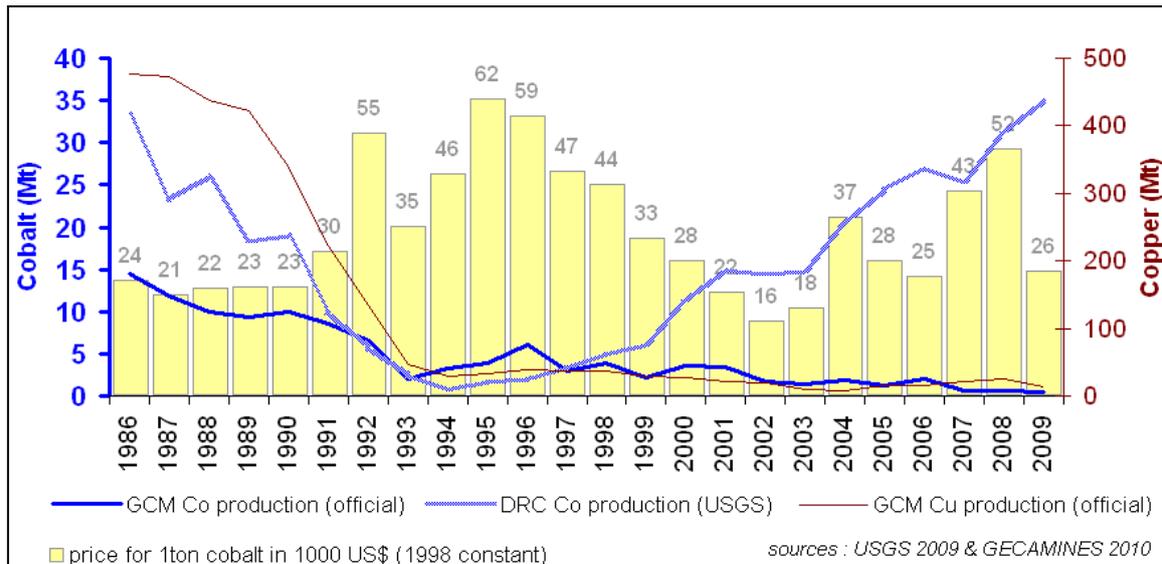


Figure 12: Evolution of GECAMINES Cobalt production related to GECAMINES Copper production, world prices, and private operators’ Cobalt production. Sources: USGS 2009 & GECAMINES 2010

1992: The governor licences the trade of metal scraps, in the hope of bringing about entrepreneurship and the emergence of a middle-class. This “Opération Mitraille” was a disaster for local infrastructures: people sold rails, cables, and whatever metal they could find to Lebanese and Indian traders. Equipment and stocks of copper and cobalt were spoliated by GECAMINES’ own staff, in a context of internal social tensions due to unpaid salaries and tribal rivalry (RELCOF 2005; Huart 2007). Ethnic tensions result in a vendetta against thousands of qualified Kasaian GECAMINES staff (see Chapter 7.7).

1996~1997: First Congolese war. Laurent Desire Kabila uses control over eastern mineral resources and promises of their privatization as leverage to gain support within international community, and overthrow Mobutu’s regime (Madsen 1998). Mobutu left an odious debt⁵ of 13 billion US\$ (CADTM 2004).

⁵ Odious debt are those contracted with neither the consent of, nor benefits for the population, the creditor being aware of this (CISDL 2003)

GECAMINES and a few private operators take the opportunity of high cobalt prices to start exploiting concentrated cobalt deposits. These valuable cobalt caps (see Chapter 2.2.1) were known for long, yet only by geologists, and had remained strategically unexploited because cobalt refined by GECAMINES as a by-product of copper had always been enough to meet the demand and to control the world prices (Huart 2007).

1998: L.D. Kabila authorises artisanal exploitation of copper and cobalt in Katanga which in fact, had already begun under the pressure of GECAMINES unemployed staff claiming up to 30 months of unpaid salary. According to Rubber (2007), Kabila legalized a sector in order to entrust its control to his acquaintances, and to ensure his control over Katanga, while his forces were under attack from his former Rwandan and Ugandan allies (2nd Congolese war).

1999: Creation of the Association of Artisanal Miners of Katanga (EMAK), responsible for stocking, conveying, invoicing and selling ores of its members (UNEP/OCHA 2004).

2000: Although artisanal mining was authorised, exportation of raw ores remained illegal. The governor of Katanga thus created the Nouvelle Compagnie, or NOUCO. This department of GECAMINES was meant to buy at a fair price, refine and market the raw ores dug by the so called “creuseurs”, in cooperation with EMAK, which is now recognised as an official supplier of the state-owned industry.

2001: L.D. Kabila is assassinated. His son Joseph Kabila is designated to replace him, and agrees on opening Congolese economy to foreign investors in exchange of new loans from bilateral and multilateral partners, which had turned away from the D.R.C. a decade before.

2002: Publication of the Mining Code, supported by the World Bank to promote foreign investment and economic revival.

2003~2005: Transition period with the end of the second Congolese war and reunification of the country. Representatives of rebel groups and political opposition join the government. A mining regulation supplementing the Mining Code is published, creating the Assistance and Supervision Service for Small-scale Mining, or SAESSCAM. GECAMINES records its lowest annual production ever, with only 9 tons of copper and 1.4 tons of cobalt, but national production increases due to artisanal mining (see Figure 3). After accumulating an outstanding debt of 1 million US\$ to EMAK, NOUCO was dissolved and replaced by an autonomous structure, the Compagnie Minière du Développement, or COMIDE. GECAMINES also hired private operators to supply its facilities with heterogenite collected from artisanal miners (Lutundula Com. 2005). 10,655 employees subscribe to the Voluntary Departure Operation, or ODV, supported by the World Bank to restructure GECAMINES and alleviate its payroll. Average compensation amounts to 3,200 US\$ for a group of 9,835 departed, and 14,400 US\$ for some 820 others (COPIREP 2004). Qualified workers could join private companies, and a consulting team was set up to help redundant staff conversion to other activities, although many of them are still involved as digger and/or trader.

2006: First democratic elections. J.Kabila remains president. Signs of political stability and the new legal framework appeals to foreign formal investors. As previously accessible GECAMINES concessions are now controlled by foreign companies, artisanal mining has become illegal in most deposits. In the framework of its restructuration by World Bank, GECAMINES is put under the administration of the Société française de réalisations et de constructions, SOFRECO and the State-owned Companies Reform Monitoring Committee, COPIREP.

2007: the Ministry of mine creates the Contract Renegotiation Commission, to examine legality and fairness of 29 privatisation contracts and joint ventures established with GECAMINES during the wars and transition period, without public call for tender.

2008: Conclusion of the Sino-Congolese Cooperation Agreement (SCCA), under which Chinese state-owned companies are to invest 6 billion US\$⁶ in infrastructure (including roads, railways, schools and hospitals), and a further 3.25 billion US\$ in Sicominex, a mining joint venture between Gécamines and the Chinese companies, that would possess rights to over 10 Mt of copper and some 0.63 Mt of cobalt reserves in Katanga. IMF objects that this deal creates a debt load that might be detrimental for the country's future.

2009: Copper and cobalt prices collapse. As a result, state revenue declines, planned foreign investments in Katanga are delayed and dozens of mining companies closed down. Unable to face its planned expenditures, the government renegotiates the SCCA in order to receive a 3 years loan and a debt relief from IMF (Mining Journal 2010).

2010: The contracts revision process draws to a close, finally clearing the business environment from legal uncertainties. Nevertheless, the Congolese state is still prosecuted by First Quantum Minerals (Canada) in international court of arbitration, for the cancellation of its licence on Kolwezi tailing, which is now owned by ENRC (Kazakhstan), after an international call for tender (Mining Journal 2010; Mineweb 2010).

3 Methodological approach and objectives

The socio-economic assessment of the cobalt mining sector in Katanga (DR Congo) builds upon the UNEP/ SETAC "Guidelines for Social Life Cycle Assessment of Products" commonly referred to as S-LCA guidelines, and Öko-Institut's sustainability toolkit "PROSA – Product Sustainability Assessment". The S-LCA guidelines and PROSA provide a comprehensive list of socio-economic indicators that were developed from a set of about 3,500 indicators from international standards and key documents, such as ISO 26000, the Global Reporting Initiative (GRI), the UN Global Compact, the OECD Guidelines for Multinational Enterprises, SA 8000 and the ILO conventions (Grießhammer et al. 2006).

⁶ To be compared with a national budget of 0.7 billion US\$ revenues and 2 billion US\$ expenditure in 2006, and an estimated GDP of 13.13 billion US\$ in 2010 (CIA World Factbook 2011)

This study applies the above mentioned methodologies to the case of artisanal extraction of cobalt in the province of Katanga, in the Democratic Republic of Congo. Provided information are based on bibliographic resources (universities, international organisations, research institutes and NGO publications, legal texts, official statistics, Environmental and Social Impact Assessments from companies, local press etc.) and telephone interviews.

Since many – if not every – stakeholders have inherent interests in portraying the information in a certain way, which is beneficial to their stake, reliability of data is often problematic in the current Congolese context. For example, the representatives of a union might exaggerate the number of their affiliates in the hope of being awarded a partnership and financing from foreign NGOs. A local administration official might underestimate the number of artisanal mining zones and miners under his authority, to lessen the amount of tax that he is required to re-cede to the central administration. Local press might not deliver reliable information since journalists depend more on emoluments from those they write an article about, than from newspaper sales (Rubbers 2008). In such paradigm, transparency means weakness, and one is not relieved from suspicion even when actually telling the truth. Quantitative data available in most bibliographic sources are thus a mere hint about the reality, and shouldn't be considered without understanding the context in which they were published.

PACT (2010) also notices that several allegations are quoted year after year in different publications, without successive authors verifying if they're still up-to-date. On the other hand, the mining sector in Katanga has been increasingly monitored during the last decade by civil society, which provided extensive literature about this topic, making possible to summarise an exhaustive set of relevant information focused on the socio-economic impacts of artisanal cobalt mining.

4 Scope of the study

4.1 The cobalt supply-chains

This study focuses on the artisanal mining of cobalt, defined by the Congolese law as the extraction and concentration of mineral substances, using artisanal tools, methods and processes. However, it is important to understand the up- and downstream connections of these activities: Heterogenite extraction and processing generates short-term benefits for smelters and refiners, but threatens the profitability of investments in the long-term for concession owners. Many individuals – including administration officials and security forces – make direct profit from the control over resources and market access (PACT 2010).

Figure 15 gives an overview of the network linked to artisanal cobalt mining, different stakeholders among these categories and also illustrates the scope of the study.

4.2 Current stakeholders

4.2.1 Artisanal miners

Artisanal miners are defined by the Congolese law as people carrying out extraction and concentration of mineral substances, using artisanal tools, methods and processes. The number of people involved full-time in cobalt mining would range between 67,000 and 79,000, and reach between 90,000 and 108,000 workers during seasonal peaks. Different sources of information, along with reasons that make such estimations difficult, are outlined in more detail in Chapter 7.3.



Figure 13: (left) Digger in the ZEA of Kawama, (Katanga, DRC)

Figure 14: (right) Women washing ores in Kolwezi (Katanga, DRC)

Credit (figures above): T. De Putter 2010, Royal Museum of Central Africa, Tervuren, Belgium.

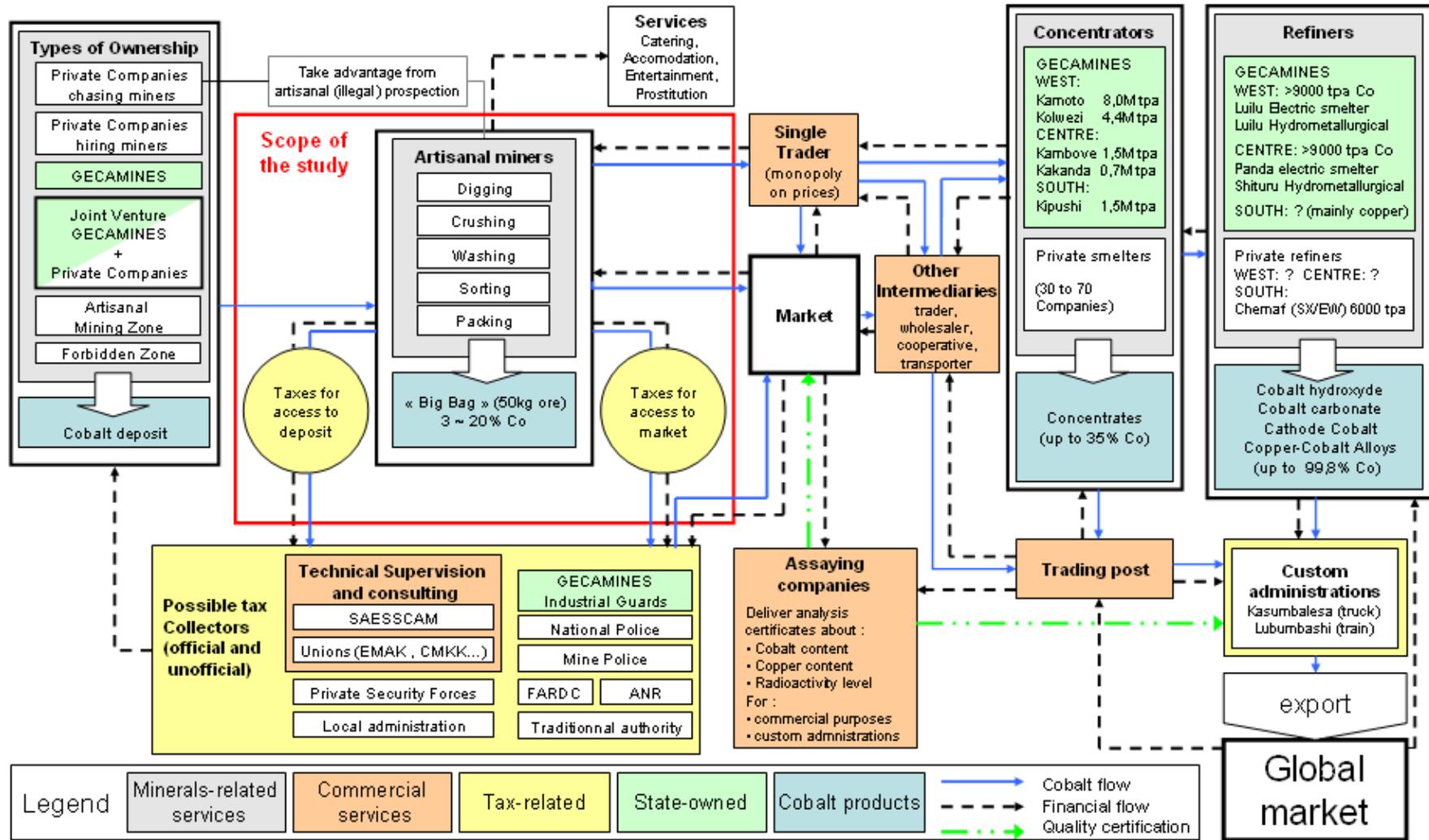


Figure 15: Flow-chart of the artisanally mined cobalt in Katanga and scope of the study

Another specificity of artisanal cobalt mining is the lack of correlation with distinctive social background, except for widespread poverty, which strikes every category of the population. Whole families involve in artisanal mining, and unpaid state agents or university teachers dig ores alongside illiterates and economic migrants from neighbouring provinces or Zambia, as well as former staff laid off by the state-owned GECAMINES (PACT 2010).

4.2.2 State-owned companies

Back in the 1970s, the state-owned GECAMINES used to be the industry flagship of the country, generating 30% of public revenue and 70% of export incomes in foreign currencies (Malu-Malu 2002). A combination of political, economic and social factors led to enormous debts for the company (see Chapter 2.2.2 on the history of mining activities in Katanga). Although its 18,800 km² mining concessions and other processing assets have been largely privatized, GECAMINES still operates on own account or on behalf of joint-venture companies where it holds between 12 and 40% of the shares. Its structure remains organized around the cities of Lubumbashi (South Group), Likasi (Central Group) and Kolwezi (West Group). GECAMINES have a total concentrating capacity of 16 Mt per annum raw ore. In order to make use of this full capacity and to achieve production objectives, additional supply from artisanally mined ores is needed, especially in the West Group.

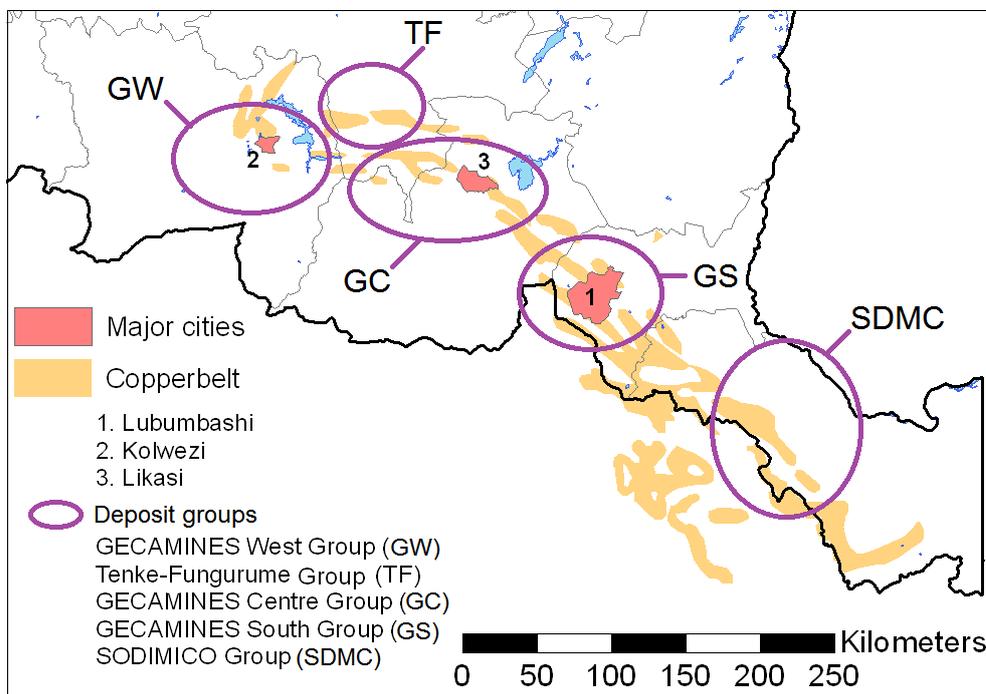


Figure 16: Geographic distribution of copper-cobalt deposits and industrial basins. Deposit groups delimitations on the figure are not accurate. Sources: RGC 2010, TCEMCO 2009.

SODIMICO is the other state-owned mining company in Katanga. It had large copper and zinc concessions, with comparatively low amount of cobalt, which were sold off cheaply during wars and the transition period around the years 1996 to 2006. As for GECAMINES, these contracts underwent a revision process in 2007 resulting in tense negotiation with foreign private companies, and an ongoing trial with the Canadian First Quantum Minerals (see Chapter 2.2.2).

4.2.3 Private mining companies

Private companies involve in different ways in mineral industries of Katanga:

- Providing capital for rights on concessions, for prospecting, and for facility building and rehabilitation.
- Operating underground or open pit mines.
- Concentrating industrially and/or artisanally mined raw ores and/or slag from tailings of previous industrial exploitation.
- Refining concentrates to produce copper, cobalt and/or zinc commodities.

It comprises locally influential figures, foreign state-owned companies and entrepreneurs, well-known multinational mining companies and their subsidiaries. Many have connections with complementary facilities in Zambia, Asia, or elsewhere. Despite the 2007-2010 contract revision process, criticisms remain over unfair joint-ventures that underestimate the contribution of GECAMINES in assets and expertise.

Private mining companies operating in Katanga are regularly confronted with artisanal miners operating on their concessions. In these cases companies might use different strategies to manage the conflicting interests with artisanal miners.

1. Confront them with security forces, and possibly seize their production.

This option is within owner's rights, but creates a risk of reprisals from the thousands of miners against the company's facilities, not to mention degradation of its image. Outsourcing a vigorous action already showed uncontrolled slip-ups, as it occurred in 2004 for Anvil Mining. The company provided logistic support for the army to secure its concession in Kilwa. The compulsory acquisition resulted in the killing of 9 to 70 civilians by the militaries, and 3 foreign Anvil Mining workers were sued for crimes against humanity (Global Witness 2010). In 2010, a Congolese victims association filed class action against the company in a Canadian court (Global Witness 2010).

2. Offer a compensation to peacefully vacate the area.

Given the context of widespread poverty and unemployment, offers for financial compensation will only foster miners' determination to recur as soon as possible to resume mining and/or negotiate additional compensation. Similarly, it is likely that training programs offering advantages too far above the local standard will confront the company with a massive inflow of candidates in addition to the group of miners it was dealing with at first. However,

recruiting staff among miners and train those as security guards, gravel-makers, exploration support workers, or site rehabilitation officers seem to be a win-win strategy, though the number of vacant positions is obviously limited.

3. Let the miners dig under control and buy their production at arbitrary price.

If the companies cannot avoid miners' hand-picking ores in their concessions, some companies argue they might as well take advantage of their production rather than being constantly plundered. According to PACT (2010), major companies are also willing to smooth the tension with miner communities. Establishing artisanal mining zones within their concessions, to let miners exploit specific ore bodies that are not suitable for industrial mining, would be a solution. There is unfortunately no provision for such agreements in the current mining code, and major companies –that are under the tight scrutiny of civil society- do not want to endorse responsibility over issues such as child labour that might occur without a clear legal framework.

4.2.4 Traders

Traders are defined by the Congolese law as individuals who purchase and sell mineral substances from artisanal exploitation. *Authorized* Traders from registered trading houses can also export these mineral substances. Eligibility is limited to

- individuals of age who are Congolese Nationals and hold a trader card
- individuals of age who are foreign Nationals, have a domicile in the National Territory, and hold a trader card
- Any legal entity registered in the DRC, whose corporate purpose is the purchase and sale of mineral substances from artisanal mining.

The mining code also explicitly exclude government employees and civil servants, magistrates, members of the Armed Forces, the Police and the Security Services, and the employees of state-owned mining companies (Mining Code, art. 27). Nevertheless, reality is far from this legal framework: It was reported that foreigners (in particular from China, India, Lebanon and Zambia) enter the country with a 3 months tourist visa, and operate for years as traders without any official authorisation (Malemba N'sakila 2008). Civil servants and state employees from a wide variety of departments secure benefits (including occasional 'tracasserie', regular corruption and illegal taxation, forced labour or trade, acting as traders, or mine ownership). As state-owned GECAMINES heavily depends on artisanal mining for production, its employees openly operate as traders, who run gangs of artisanal miners for hand-picking (PACT 2010). Around Likasi, 20% of the traders are retrenched GECAMINES staff (UNEP / OCHA 2004).

Traders are the intermediate stakeholders that allow operators from the formal market to purchase commodities produced by artisanal miners while declining responsibility regarding social and environmental impacts. In 2009, RAID reported that according to workers, Chinese and Indian buyers never ask where the ores are coming from. Even more scrupulous trading houses have little mean of

knowing where the ores were actually extracted, since state agents (who are “securing” illegal artisanal mining area) label the bags as a product of some existing legal artisanal mining zone (Vanbrabant et al. 2009).

4.2.5 The State

For the Congolese state, artisanal mining represents a source of both revenue and trouble. Responsibilities and decision power related to the mining sector are spread between national, provincial and local level administrations, with conflicting interests: while the government supports billion-dollar investment deals with foreign companies, local authorities have to face the wrath of thousands of dislodged miners. However, taxes levied on artisanal miners is the main revenue for many state agents at the bottom of the ladder: they seldom receive their salaries (paid in Congolese Franc), whose value has shrunk as the parity with widely used US dollar decreases. According to UNDP (2009), 67% of households whose head is working in public administration would live in poverty, and are thus easily corruptible. Government employees and civil servants, magistrates, members of the Armed Forces, the Police and the Security Services are neither eligible for mining rights, artisanal miners’ cards, nor traders’ cards (article 27, Mining Code), although many of them infringe this law (PACT 2010). Figure 17 summarizes competences of relevant administration bodies for artisanal mining zones and different categories of actors in the artisanal supply-chain of cobalt. Abusive taxes levied on miners, but also on traders, processors and exporters affect the share of benefits that is redistributed to artisanal miners. On the other hand, mutual agreement with state agents to operate illegally, to the detriment of the State revenue, can be profitable for both parties. Collecting taxes is the main activity for services dealing with miners, including the SAESSCAM, which could foster better revenue and working conditions if it fulfilled its role properly (PACT 2010). The ongoing decentralization process is meant to improve governance in the country’s administration by transferring competencies and fiscal resources to local-level government (WB & EC 2008). Theoretically, the central government must return 40% of the fiscal receipts to decentralized entities, but the latter prefer deducing their share at source, by partway omitting their tax base if required. In the medium-term, decentralization might also reorganize the networks of cobalt trade, as the current Katanga will split into 4 new provinces. The South and Centre Group deposits will then belong to the new Haut-Katanga province while the West Group and Tenke-Fungurume deposits will be part of the new Lualaba province. The creation of an export route in Lualaba, directly from Kolwezi (DRC) to Solwezi (Zambia) would compete with the currently inescapable custom post of Kasumbalesa, and might oust Lubumbashi from its leading economic position in Southern Congo (Berwouts 2010).

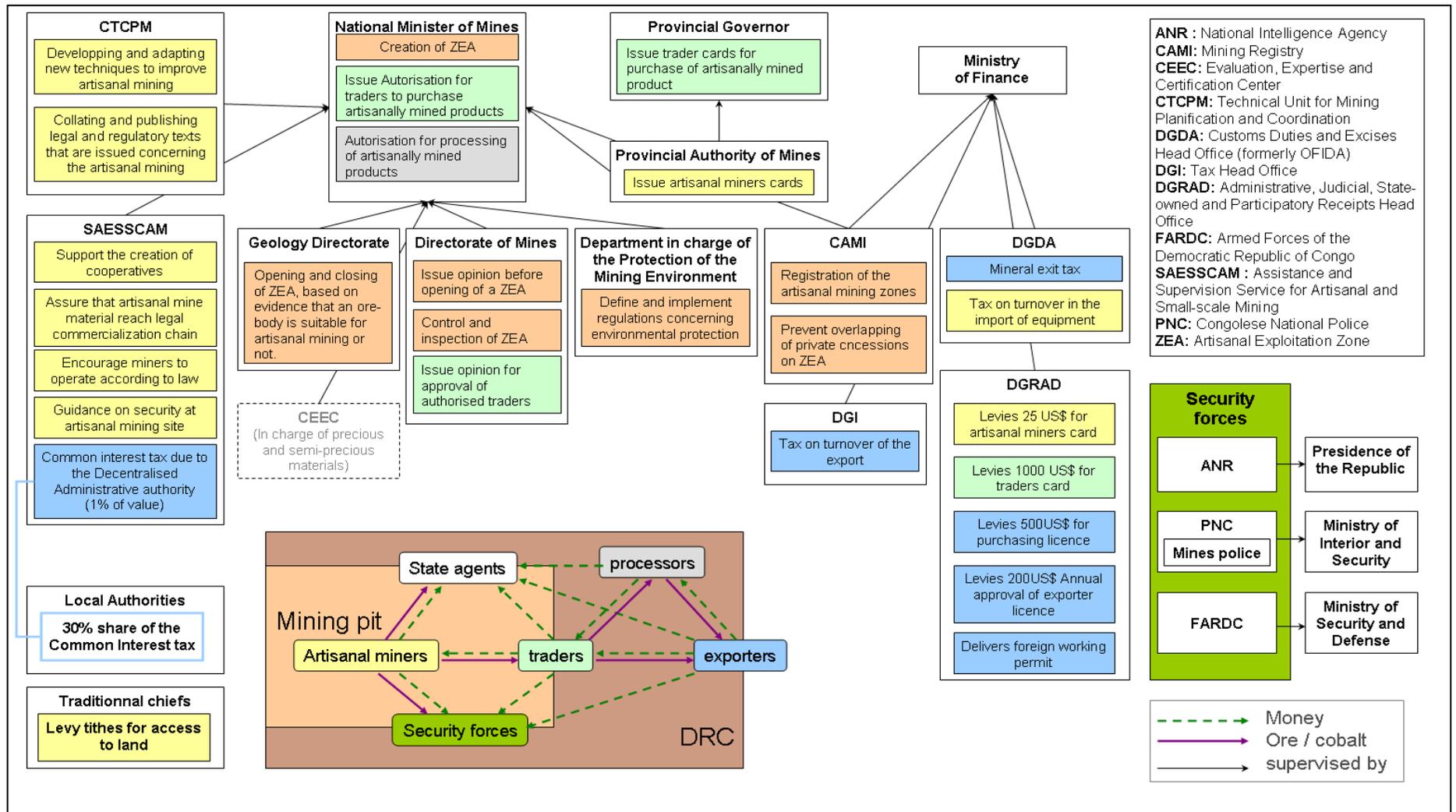


Figure 17: Links between administration bodies and other stakeholders in the artisanal mining sector

4.2.6 Assaying companies

Several assaying companies are currently conducting analysis to assess the copper and cobalt grade of ore samples, although informal discussions with experts revealed that reliability of the test results is questionable (expert opinion, 2011). From February 2004 to April 2005, Alex Stewart International Corporation (ASIC) had an official monopoly in Katanga for mineral analysis (Global Witness 2006). ASIC was awarded a contract for assaying all export minerals on behalf of the border control authorities for quantity, quality and radioactivity levels in 2005, but this contract was undermined by some national politician and awarded to Labo Lubumbashi (U.N. Security Council 2006). According to Global Witness (2006), Labo Lubumbashi is presumed to be affiliated to CHEMAF (Chemicals for Africa), and was created shortly after that ASIC representatives tried in vain to prevent 18 trucks of CHEMAF from crossing the border without radioactivity assessment. U.N. Security Council (2006) also reports the existence of such allegations. In 2006, ASIC and Robinson International Afrique were the only assaying companies that had the necessary staff and equipment in Lubumbashi and surrounding mining centres and could guarantee complete independence from any other commercial interests (U.N. Security Council 2006).

4.2.7 Local Communities

The Copperbelt hosts about 76% of Katangan urban population (MONUC 2004). Extrapolating this ratio, and considering a population growth rate of 3.2%, the communities currently living around cobalt mining areas can roughly be estimated to 8.1 million people (2.8 million urban and 5.3 million rural).⁷ Incidence of poverty is lower among households that are smaller, living in cities, run by a woman, with higher education and/or employment in the private formal sector. Nevertheless, poverty affects every social category and 69% of the total population (UNDP 2009). The average annual expenses amounts to 181 US\$ per capita, but only 98 US\$ for the poorest quartile of the population, which dedicates 69% of its monetary income for food. Under-5 years-old mortality rate is 15.4% (MH 2007). Katanga is the province where under-nutrition is the most widespread in D.R.Congo.

⁷ Basis for the calculation was 8.7 million inhabitants of Katanga in 2005 (UNDP 2009)

5 Impact on workers

5.1 Safe and healthy working conditions

Article 159 to 169 of the Congolese Labour Code make general provisions for health, hygiene and security at work, and define obligations for the employer such as the enforcement of prevention measures, availability of occupational medicine professionals and establishment of a monitoring committee for health and safety issues. The Mining Code and the Mining regulation make additional provisions regarding artisanal mining, in particular:

- Classification of Uranium as a reserved substance,⁸ subject to specific regulations (MC Art. 7).
- Control of health and security conditions by the Directorate of Mines (MC Art.14)
- Prohibition of the use of explosives by artisanal miners (MR Art. 2)
- Limitation of the depth of mining shafts to 30 meters, with horizontal banks every 2 meters (MR Art. 9)
- Sanitation and epidemic prevention in mining areas, by burial of human waste at a depth of 1.5 to 2m, ensuring that underground water systems are not affected and that the site is at least 100m from any watercourse. (MR Art. 4)

In reality, less than 10% of the miners have any knowledge of these regulations, and security conditions in artisanal mines are very poor. For instance, many tunnels are longer than 30 meters. They often follow ore veins and so are winding rather than vertical shafts. Vertical shafts often have galleries or horizontal tunnels leading off them. Some miners do understand the need to construct benches to improve security, and this is seen in many mines though the quality of work varies considerably (PACT 2010).

⁸ Exploitation of reserved substances is theoretically forbidden until the publication of the presidential decree that is to define a specific framework. This decree might be finalised soon to conclude a deal with foreign private investors of the nuclear sector (see also Chapter 8.2 about unjustifiable risks).



Figure 18: (left) Artisanal mining gallery in Katanga, DRC. Credit: Pr. Mota Ndongo K. E. C. 2009, University of Lubumbashi (Katanga, DRC)

Figure 19: (right) Artisanal mining gallery with support benches in Kolwezi (Katanga, DRC). Credit: B. Litsani 2010, Congo Direct (Katanga, DRC)

Hundreds or even thousands of miners can dig in tiny pits, with neither coordination, nor knowledge about previous operations that may affect the ground stability (Global Witness 2006). Danger of landslide is permanent, and the risk of accident increases during the rainy season while very dusty working conditions prevail during the dry season.⁹ The exact number of accidents is unknown, as there is no exhaustive reporting, likely due to the fear that mines considered as too dangerous could be closed down. RRN¹⁰ reported that the mine of Ruashi, exploited by about 2,500 to 3,000 artisanal miners, had 13 accidents in 2006, causing 35 deaths, 10 serious and 6 light injuries. Whether security conditions of the Ruashi mines in 2006 are representative of current artisanal mining sites of the Copperbelt should be investigated prior to extrapolation of this rate of 0.4 to 0.5% annual casualties to the total number of miners. As a comparison, Global Witness (2006) listed 41 deaths in 2005 in the mining sites around Kolwezi,¹¹ underlining that this counting is probably far below reality. The first cause of death is landslide, followed by suffocation and drowning (RRN 2006). A way to improve security in artisanal mining sites is the complete stripping of the pit,¹² i.e. removal of 5 meters of superficial ground, which would considerably enhance the stability of the shafts and galleries. Such an open-pit artisanal mine was opened near Lubumbashi in September 2010 (Radio Okapi 2010a).

⁹ Annual rainfall is about 1300 mm, of which 1200 mm fall between November and March (Faucon et al. 2010)

¹⁰ RRN, Réseau Ressources Naturelles, is a platform of local NGOs

¹¹ Assuming that security conditions did not improve significantly since 2005, that the “mines around Kolwezi” investigated by Global Witness include all artisanal mining sites considered for the estimated number of artisanal miners in the Kolwezi area (roughly 30,000 miners, see Table 4), the death rate would still amount to at least 0.1% of workers per year.

¹² *Découverte* which could be roughly translated by “uncovering” is the term used locally for such operation

In camps, there is very little effort made to provide sanitation. No latrines are constructed, drink water quality is poor, and human waste management is usually *ad hoc*. Alcohol, narcotics and prostitution are common (PACT 2010). As a consequence, the general state of health among miners' communities is bad: reduced life-expectancy, higher infant mortality rate, higher prevalence rate of HIV, diarrhoea, hepatitis, meningitis, bilharziosis, cholera, typhoid, tetanus, typhus, malaria, yellow fever, tuberculosis (COPIREP 2004), musculoskeletal disorders, respiratory disorders and headaches (Elenge-Molayi 2008). Furthermore, a biomonitoring study carried by Banza et al. (2009) showed significantly higher urinary concentrations of As, Cd, Co, Cu, Pb and U among communities living in a radius of 10 km from mines or smelting plants, especially children, compared to control subjects living in a 400 km-radius. Elenge Molayi et al. (2010) describe the different pathways of miners' exposure and pathologies related to Si, As, Co, Cu, Pb, Zn and U, but underline the difficulty of weighting the health significance of the risk resulting from artisanal mining.

Miners face several other risks: those who illegally sneak in concessions by night can be shot at by security guards if they're caught, or drown in a waterlogged pit in the dark (RAID 2009). Miners who exploit deposits on the Southern lineament of the Western Copperbelt extract ores with higher grade of Cobalt, but these are associated with Uranium in high concentration, and expose miners to radiation levels upto 24 mSv/year¹³ (UNEP/OCHA 2004). As a comparison, the recommended dose limits is 1 mSv/year for general public, 20 mSv/year for normal radiation workers (ICRP 2007), and 250 mSv/year for liquidators at the Fukushima nuclear disaster (Japanese Gov. 2011).

5.2 Freedom of association and right to collective bargaining

In 1969, Congo ratified the ILO No. 98 Convention on Right to Organize and Collective Bargaining. In 2001, DRC ratified ILO No. 87 Convention on Freedom of Association and Protection of the Right to Organize, and ILO No. 135 Convention on the Workers' Representatives. In the 2002 Labour Code, Article 230 guarantees the freedom of association for workers and Chapter V of Title XII on Professional Relations defines the national framework regarding collective bargaining. Despite such a comprehensive legal framework, only about 0.5% of workers in DRC is unionized (USDS 2011).

In Katanga, EMAK (association of artisanal miners in Katanga) was created in 1999 and appointed to organize artisanal miners and act as a union. However, credibility of EMAK was questioned as issues related to the misuses of leadership/ membership fees came to the forefront (Global Witness 2006). EMAK even established a security force of its own, the Policar (Police des Carrières), which, according to Global Witness (2006), extorted money from miners. Despite resistances from EMAK, the CMKK (Mining Cooperative Maadini Kwa Kilimo) emerged in 2004, offering an alternative union structure with lower affiliation fees. However, apparently CMKK encountered similar issues, as for instance misuse of leadership and membership fees, as EMAK. In 2007, CMKK claimed to have 25,000

¹³ mSv/year : milli-Sievert / year

members and EMAK 70,000 (PACT 2007). These numbers are, however, in contrast with the survey carried out by PACT in 2010: out of 267 interviewed artisanal miners, only 16% declared that they were affiliated to any mining cooperative. Extrapolated to the whole Copperbelt, this would represent only 11,000 to 17,000 unionized miners. However, access to many artisanal mining sites is conditioned to the clearance of a membership fee to one of these associations (Global Witness 2006), which is in violation of article 234 of the Labour Code forbidding compulsory unionization.

The very fact that only two unions dominate so widely the sector indicates that the creation of other associations is undermined or hindered, in a region where such initiatives are very common and spontaneous. As a comparison, the 2,379 employees of Tenke-Fungurume Mining (a foreign-based private company) belong to 6 different unions. Current development projects on artisanal miners' rights favour an enforcement of the SAESSCAM, the legal technical assistance service of the State for artisanal and small scale mining. In the absence of a functioning, efficient structure for collective bargaining, frustrated miners are prone to express their discontent, resulting in clashes with security forces that resort to force, often causing casualties (Radio Okapi 2010b).

5.3 Equality of opportunity and treatment and fair interaction

DRC (formerly Zaire) ratified branches D, E and G of the ILO No. 118 Convention on Equality of Treatment and Social Security in 1967, ILO No. 100 Convention on Equal Remuneration in 1969, and ILO No. 111 Convention on Discrimination in Employment and Occupation in 2001. Articles 11 to 13 of the Congolese Constitution enacted in 2006 guarantee equality of all Congolese citizens, and forbid any form of discrimination based on religion, familial or social background, residence, opinion or political conviction, or racial, ethnic, tribal, cultural or linguistic membership. Article 14 emphasize on gender equality. Furthermore, Article 26 of the mining Code ensures eligibility for any Congolese individuals of age to involve in artisanal mining.

Several discriminatory practices against women were found to be nevertheless common in artisanal mines. Examples of women managing artisanal-scale mining enterprises are very few, as they were found to have high obstacles in availing financial, legal, or technical support and gaining ownership of land (CASM 2007). Also, on a majority of mining sites, women are not allowed to dig ores and can only involve in transport and processing of ores, although digging offer higher remuneration range. PACT (2007) mentions a survey according to which in Kolwezi, Katanga, 30% of women actually dig, 60% process the material, and 10% provide transport and supply services. Reasons put forward to justify restricted access to women include various superstitions and frequency of sexual and gender-based violence in mines (CASM 2007). A UNFPA representative in Katanga cited by Kyanda (2009a) mentioned that 45% of the reported cases of rape were committed by miners. Discrimination was also found to be common towards migrants from other provinces, especially from Kasai. Local politicians were even found to demand a visa to work in Katangan mines from the citizens of other provinces (IPIS 2009). Historical background explaining the roots of ethnic tensions with Kasaians is

explained in Chapter 2.2.2 about history of mining activities in Katanga, and Chapter 7.7 about impact on conflicts.

5.4 Forced Labour

Congolese law defines forced labour as any work or service required from a person, under threat or without his own free will (Labour Code Art.2). In 2001, DRC ratified ILO No. 105 Convention on the Abolition of Forced Labour. ILO No. 29 Convention on Forced Labour was ratified by Congo in 1960. Article 10 of this Convention encourages the suppression of forced or compulsory labour executed as a tax, and article 11 limits the recourse to forced or compulsory labour to adult males of an apparent age of not less than 18 years. Article 21 specifies that forced or compulsory labour shall not be used for work underground in mines. Reports on forced labour were not found in the artisanal small-scale mining sector in DRC.

5.5 Child Labour

DRC ratified ILO No. 138 Convention on the Minimum Age for employment, specifying a threshold of 14 years. The Labour Code enacted in 2002 raised this limit to 16 years old. Light and salubrious work can nevertheless be entrusted to workers from the age of 15, with parental authorization and derogation from the Labour Inspection (Art. 38). Work is strictly forbidden under the age of 15 (Art. 133), and article 26 of the Mining code underlines that only Congolese citizens of age are allowed to work as artisanal miner. However, child labour is common in Congo, as 73% of the population suffer from multidimensional poverty¹⁴ (UNDP 2010) whilst about half of the Congolese population is less than 15 years of age (MH 2007).

¹⁴ The Multidimensional Poverty Index (MPI) identifies multiple deprivations in the same households based on education (2 indicators), health (2 indicators) and standard of living (6 indicators).



Figure 20: Women and children washing ores near Likasi (Katanga, DRC). Credit: T. De Putter 2010, Royal Museum of Central Africa, Tervuren, Belgium

In the Copperbelt, 28% of the workforce or between 19,000 to 30,000 miners are children under the age of 15, some of them being as young as 6 years old. Another 14%, or between 9,000 and 15,000 workers are 15 to 17 years old.¹⁵ Younger children mostly carry out light tasks such as sorting, washing and sieving of ores, and young male usually involve in heavy work such as digging and transport since they are 15 or 16 (Groupe One 2007b).

Nevertheless, small children are also hired to dig in narrow galleries where they extract ore more easily than adults (PACT 2010). Artisanal mining clearly implies work in confined spaces, during long hours, underground and/or exposed to hazardous substances (see Chapter 5.1 about safe and healthy working conditions), and should thus be regarded as one of the Worst Forms of Child Labour as defined in ILO No. 182 Convention, also ratified by the DRC in 2001. Prostitution is another form of

¹⁵ Calculated from the following estimates and ratio, in addition to data of Table 4 (see Chapter 7.3):
50,000 children (<18 years) out of 120,000 miners, or 41.6% children <18 years – Groupe One 2007a
Share of age-categories in child labor : 6-9 years (20%), 10-13 years (35%), 14-17 years (45%) – Kumwimba Musao 2006.

Other indicative values for comparison:

“20,000 children in mines in Katanga” – Unicef, quoted by Tshilobo 2005

“22,500 children (<18 years) out of 41,500 miners for Lubumbashi & surroundings only” – Groupe One 2007b

“At least 20,000 children in mines in Katanga” – Groupe One expert interviewed by RAID 2009

“40% of miners are children under 18 years of age” – Nouvelle Dynamique Syndicale 2004, quoted by CRONGD 2007

worst child labour, and is a frequent feature on artisanal mining sites (see Chapter 6.2, Impact on local communities: human rights).



Figure 21: Warning sign in the region of Kolwezi (Katanga, DRC): “forbidden to women and children under the age of 18”. Credit: T. De Putter 2010, Royal Museum of Central Africa, Tervuren, Belgium

Although local authorities and miners’ association have formally forbidden access to mines for children (Gunn 2007), there is little effective commitment on abolition of Child Labour. As PACT (2007) points out, every digger that leaves the artisanal sector reduces the income of the traders, therefore it is not this groups’ interest that such a change occurs.

In fact, children also involve in artisanal mining to afford education fees, attend school full time (4 hours per day) and work before or after school, on week-ends and holidays (PACT 2010). As a comparison, in other districts of Katanga, it is reported that under-paid teachers ask for pupils to work 2 days per week in their farm (Kyanda 2011). According to a study led by PACT in Kolwezi in 2007, peer pressure from friends appears to be a strong motive for engaging in mining activity which is considered “almost a social activity”. 93% of children claimed that they would stop if there was something else to do. Although poverty is also cited as a driver, only 7% of the children think that their families could not survive without their contribution. Other children usually hand 35% of their earnings to their family, spend 25% on school expenses, and keep the remainder as pocket money. Exposed to alcohol, drugs and prostitution in artisanal miners’ camp, teenagers often abandon their studies. 30% of pupils would drop out of school between 1st and 6th grade primary school (MH 2007).

5.6 Remuneration

In 2008, DRC raised its guaranteed daily minimum wage from 500 CF (about 1 US\$) to 1680 CF (worth about 3 US\$ in 2008), despite the protests of the FEC (national council of employers) which had pleaded for 2.5 US\$ per day, equivalent to the average daily expense of a 5 person household in Katanga (UNDP 2009). The enforcement of the minimum wage remains difficult in many sectors of the Congolese economy. In comparison, revenues in artisanal mining look to be appealing: a digger

usually earns between 3 and 5 US\$ daily, and up to 30 US\$ on a lucky day¹⁶ (Peyer et al. 2011). PACT (2010) also mentions that in Kolwezi, projects to create alternative employment for artisanal miners need to propose a salary not less than 5 US\$ per day, on a long-term contract, together with other material benefits, to be attractive. Salaries for other tasks such as washing, crushing and sorting are comprised between 1 and 3 US\$ per day. However, living expenditures are probably higher in artisanal mines, which are often densely populated and located in the surroundings of industrial cities. Diggers typically work in teams of 5 males, and produce 30 to 50 kg (PACT 2007), or even 100 kg (ARDERI 2007) of heterogenite per person and per day. Children and women then wash, crush, and sort the ores. This manual concentration is fairly profitable, especially for low grade heterogenite. Indeed, as illustrated in Table 1, the theoretical price of cobalt ores is extremely sensitive to the grade.

Table 1: Price grids for heterogenite in some trade houses in 2006–2007. Sources: ARDERI 2006 (quoted in RRN 2007) and PACT 2007

Date	Somika	Bazano	Bazano	Chemaf	Forrest	Theoretical price range for a 50kg bag (US\$)
Source	Aug 06	Sep 06	June 07	June 07	June 07	
Cobalt grade (%)	Arderi	Arderi	PACT	PACT	PACT	
	US\$/ton	US\$/ton	US\$/ton	US\$/ton	US\$/ton	
3		120	117	120		5.9 - 6.0
4		199	200	205		10.0 - 10.3
5	276	397	383	310	400	13.8 - 20.0
6	367	405	480	420	520	18.4 - 26.0
7	457	504	579	520	630	22.9 - 31.5
8	551	606	711	625	780	27.6 - 39.0
9	684	746	809	770	870	34.2 - 43.5
10	780	847	884	875	960	39.0 - 48.0
11	851	921	n.a.	n.a.	n.a.	42.6 - 46.1
12	949	1022	n.a.	n.a.	n.a.	47.5 - 51.1
13	1041	1124	n.a.	n.a.	n.a.	52.1 - 56.2
14	1133	1226	n.a.	n.a.	n.a.	56.7 - 61.3
15	1224	1226	n.a.	n.a.	n.a.	61.2 - 61.3
16	1320	1226	n.a.	n.a.	n.a.	61.3 - 66.0
17	1429	1226	n.a.	n.a.	n.a.	61.3 - 71.5
18	1510	1226	n.a.	n.a.	n.a.	61.3 - 75.5
19	1542	1226	n.a.	n.a.	n.a.	61.3 - 77.1
20	1694	1226	n.a.	n.a.	n.a.	61.3 - 84.7

¹⁶ Although miners usually extract ores containing 3 to 5% cobalt (heterogenite mixed with other rocks), pure heterogenite in the Copperbelt can contain up to 54% cobalt (Decrée et al. 2008).

It also seems that price for raw ore does not evolve with world market trends of refined cobalt prices: Bazano didn't significantly change its remuneration grid between September 2006 and June 2007, while value of refined cobalt increased by more than 50% (see Chapter 2.1.4). The price paid to miners for the ores represent between 11 and 25% of the refined value of their cobalt content.¹⁷

In the end, artisanal miners' net salary depends on factors such as:

- The cobalt content of ores.
- Transportation costs due to remoteness from the water point for washing, or from a passable road.
- The interests deducted by traders who pre-financed the work.
- The amount of compulsory membership fees and tax collected by administrations, security forces, mine-owner, associations, etc., varying from 10 to 30% of their production (Vanbrabant et al. 2009; PACT 2010).
- Possibility to sell at the best price on the market, or obligation to deal with the mine-owner.

Mines with higher taxes are not necessarily less profitable, provided that they host better grading deposits. In worst cases, when artisanal miners discover a large and high-quality deposit, they are chased out by the concession owner or public authorities, for the benefit of a private company that will exploit the site industrially. Miners seldom receive any compensation for the time they invested in site exploration and the profit they are deprived from.

5.7 Working hours

The ILO Convention No. 1 on working hours in industries is not ratified by DRC. It defines a normal threshold of 48 hours per week for regular working hours in mining industries, and a maximum of 56 hours per week when overtime work is included.

Duration of one standard working week in DRC is 45 hours, or 9 hours per day, 5 days per week (Labour Code, Art. 119). Every worker is entitled to a weekly rest period of 48 hours and 9 days of national holidays (Art. 121), 1 additional day per month of paid holiday after 1 year of service (Art. 141 & 142), and up to 15 days of necessary¹⁸ leave with pay (Art. 146). A worker in the private formal sector who takes advantage of all his holiday dues thus works less than 39 hours per week on average.¹⁹

¹⁷ Calculated considering the average price in 2006 for 99.6% Zambian cobalt (16,36US\$/lb according to USGS)

¹⁸ Workers' wedding (2 days), birth of a child (2 days), child's wedding (1 day), death of the spouse or a first degree kin (4 days), death of a second degree kin (2 days).

¹⁹ = [52 weeks x 5 days/week – 9 days national holiday – (1day/month x 12 months) – 15 days necessary leave] / 52 weeks x 9 hours/day = 38.8 hours / week

An enquiry carried out by Kumwimbwa in 2006 reports that 77% of adult male miners work more than 8 hours a day. As most mines only operate during daylight hours (PACT 2010), 12 hours per day is probably the maximum shift even in peak activity period. Peyer et al. (2011) report that women work from 7 AM to 5 PM, or 9 hours of work, if this time slot includes one hour of break. Since mining can be relatively profitable (see Chapter 5.6), it can be assumed that miners take a day off from time to time. In addition, occasional strikes or conflicts on access to the pit leave miners with no other choice than temporary layoffs. When miners are denied access to profitable deposits, some of them sneak in guarded pits to work by night, from 10 PM till 4 AM, taking the risk of being shot by security staff (RAID 2009) but probably rather by bribing them.

A miner working 9 hours a day with only 2 days off per month would perform a weekly workload of 59 hours²⁰ (52% overtime). Even a miner taking a weekly day off and resting on national holidays would average 52 hours a week²¹ (35% overtime). In any case, holidays are not paid, and although average salaries are more attractive than in other sectors of the informal economy, there is no guarantee for a digger to be rewarded in proportion of his workload. The situation is slightly different for washers, crushers, sorters and transporters, who receive a fixed salary per treated unit. They can thus, in some extent, decide to increase, maintain, or reduce their working time according to financial needs.

5.8 Employment security

According to the Mining Journal (2010), during the 2008-2009 economic crisis about 300,000 workers employed in extractive industries lost their job in Katanga, and 60 mining enterprises had to close in the town of Likasi alone. Apart from about 25% of the miners who work only during peak season (see Table 4) mining is a year-long source of income for the rest. The Labour turnover rate is difficult to estimate; nevertheless the following figure shows that careers in artisanal mining can be as long as 20 years or more.

²⁰ = (365 days – 2 days off/month x 12months) / 52 weeks x 9 hours/day = 59.0 hours / week

²¹ = (52 weeks x 6 days/week – 9 days of national holiday) / 52 weeks x 9 hours/day = 52.4 hours / week

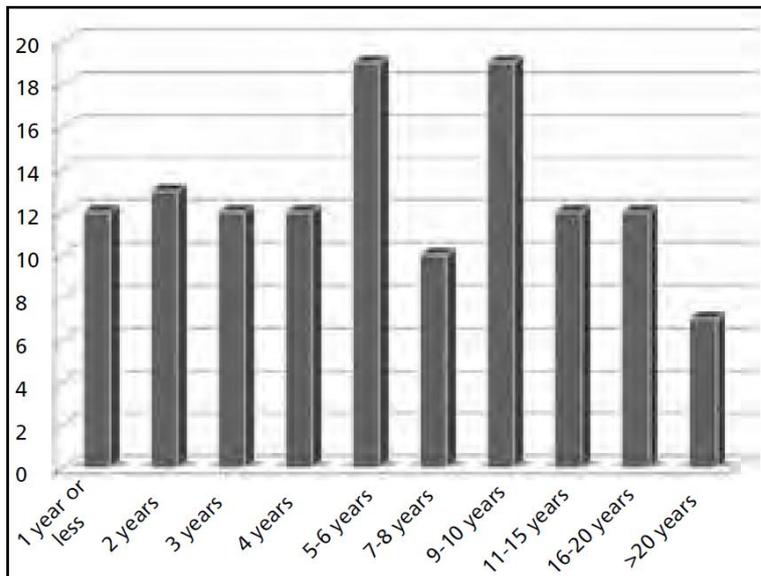


Figure 22: Average time spent in artisanal mining and trading (s = 142). Source: PACT 2010

Article 40 of the Congolese Labour Code stipulates that from the 23rd day of work on a day-to-day basis within a period of 2 months, the worker is eligible for a permanent contract. Although it is common for little traders to give miners a daily allowance while they start opening a new shaft, this should be considered as a loan rather than a salary, and miners as daily labourers rather than salaried staff. Access to a salaried status is one of the major claims of artisanal miners working in concessions controlled by big trade houses. In addition to social security and lighter working schedule (see Chapters 5.9 and 5.7), employees under contract benefit from a 14 days cancellation period in case of redundancy (Art. 64, Labour Code). Other miners work freelance, illegally occupying concessions of large scale mining companies, or in dedicated Artisanal Mining Zones, although there is no security of tenure either: Examples already exist of artisanal mining zones which were re-allocated to commercial companies within months of being designated as official artisanal mining zones (PACT 2010). Indeed, Article 110 of the mining code allows the closure of an artisanal mining area if a new deposit which does not lend itself to artisanal mining is discovered. If such a decision is taken by Mining Ministry administrations (for details see 4.2.5, Figure 17) Artisanal Miners are then obliged to free the area within 60 days.

5.9 Social security

In 1987, DRC accepted parts V, VII, IX and X of ILO No. 102 Convention on Minimum Standards of Social Security. Article 40 of the Congolese Labour Code stipulates that from the 23rd day of work on a day-to-day basis within a period of 2 months, the worker is eligible for a permanent contract and thus, as any Congolese employee, for registration at the National Institute of Social Security which provides medical coverage, family allowance and occupational pension. Labour Code (Art. 105)

guarantee workers with occupational disease or accident a maximum of 6 months holidays with 2/3 of the normal salary and other advantages in kind, and (Art. 130) allocate to female workers a maternity holiday of 14 weeks with 2/3 of the normal salary and other advantages in kind.

Awareness and claims about social security issues are more wide-spread in Katanga, as decades of prosperity and paternalist management of UMHK / GECAMINES left the memory of free health care for all employees and their families, free education for children and salary-based security of income. As a consequence, World Bank and COPIREP started a technical feasibility study in December 2010, in order to provide medical coverage for the 10,655 GECAMINES voluntary departed staff, many of whom are still involved in artisanal mining. Artisanal miners are generally denied their right to a permanent contract and subsequent social security. Although there is a labour inspection body, workers have no effective right to a remedy since they cannot trust the authorities or the courts to uphold the law and to protect their human rights of formal or informal workers (RAID 2009). The situation of miners is not different from that of 70 to 80% of the Congolese population working in informal economy (Kinkela 2009), and workers in need can only rely on familial solidarity. Associations such as EMAK eventually support families for burial fees when a member dies in an accident (Global Witness 2006).

5.10 Professional development

Possibility of professional development consists essentially in upgrading in the hierarchical structure of artisanal mines, from digger to team-leader, trader or cooperative leader. Opportunities for conversion out of the mining sector is however limited for artisanal miners due to their lack of education. Large-scale mining companies provide occasionally training opportunities, as a strategy to mitigate social tension with illegal miners exploiting their concessions. For example, in 2008 the social development programme of Anvil Mining trained 717 artisanal miners to work in exploration drilling teams, protect concessions as security guards, or to start new livelihoods such as farming, gravel making, trade etc.

In addition, article 233 of the Mining Regulation defines the organisation by the Provincial Division of Mines of a training programme on artisanal exploitation techniques and application of security and environmental protection measures prescribed in Annex V of the Mining Regulation. This training programme is particularly intended for miners who are withdrawn their licence card because of non-compliance with Article 112 of the Mining Code about occupational security, hygiene, water use and environment protection. PACT (2010) points out that such training course have not yet been organised due to lack of capacity of the competent administration. Besides, most artisanal miners never held any licence card in the first place, as these are too expensive, and they can't see any advantage in having one. SAESSCAM is the specialised service appointed to

- disseminate guidance on security at artisanal mining sites and to ensure this is observed

- facilitate acquisition of appropriate equipment for artisanal and small-scale miners to improve the quality and quantity of their production
- encourage artisanal and small-scale miners to invest in other economic sectors

Officially, 209 SAESSCAM agents operate in Katanga (PACT 2010). Each of them would thus roughly be in charge of 300 to 600 miners. Although tax-collection often takes precedence on technical assistance, an enforcement program supported by USAID in Kolwezi showed positive impacts, with properly trained and paid SAESSCAM agents contributing actively to the dissemination of improved artisanal extraction techniques (PACT 2010).

6 Impact on local communities

6.1 Safe and healthy living conditions

Extraction of pulverulent heterogenite in artisanal mines is likely to cause health hazards for nearby communities, such as exposure to heavy metal through dust inhalation, water and agricultural soil contamination. A biomonitoring study highlighted that populations living in a radius of 10 km from mine-related activities showed extremely higher urinary concentrations of Co, Pb, Cd and U respectively when compared to a control population (Banza et al. 2009). Nevertheless, the contribution of artisanal mining to these contaminations and their pathways is not completely understood. Indeed, soils in the Copperbelt can naturally bear high concentrations of these elements, and other stakeholders such as smelters or current and former industrial mining operators might also contribute to these pollution levels. Highest rates of uranium associated with cobalt is found along the Southern edge of the Copperbelt (see Figure 23) and surface concentrations of U_3O_8 were found to be locally as high as 4,400 ppm (Lubala Toto et al. 2011).

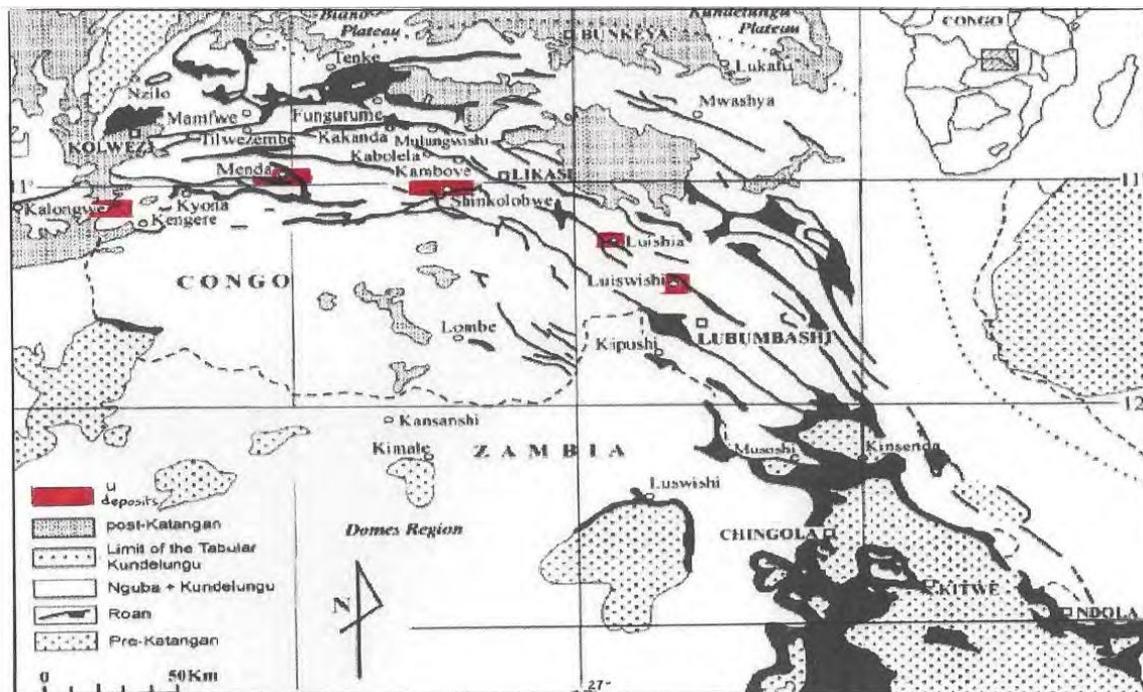


Figure 23: Map of the uraniferous sectors of the Copperbelt.²² Source: Lubala Toto et al. 2011

Artisanal mines can also affect the health of population in a broader region through surface water pollution: PACT (2010) reports that minerals are routinely washed in local water courses that are also used for personal hygiene, cooking and even drinking. This practice is conducted despite Article 10 of the Mining Regulation, which states that each “*Artisanal miner is required to avoid pollution of water resources used in agriculture, livestock rearing or for consumption. The collection or washing of stones or precious metals in a water course less than 500 metres from its source or to regularly used water required by human or animal populations are forbidden. The artisanal miner is required not to make excavations and not to wash stones or precious metals at a distance less than 20 metres from a water source.*”

Health hazards from radioactive materials result not only from distribution via water courses but also through the cobalt supply-chain itself. A mission of IAEA experts in 2004 found out that radiation dose rates received by people working near piles of ore at a depot in the city of Likasi could exceed the international dose criteria for radiation workers (20 mSv/year) if working in the vicinity for 12 hours per day over one year, for example a night watchman (UNEP/OCHA 2004).

Prostitution, promiscuity, lack of sanitation and hygiene contribute to high levels of disease and health problems in the miners’ camps. The presence of current and demobilized soldiers, a group with elevated levels of HIV/AIDS infection, also increases the risk of dissemination in the local

²² Main uraniferous spots (in red on the map) from West to East: Kalongwe, Menda, Shinkolobwe, Luishia, Luiswishi.

population (PACT 2010). Nevertheless, Decrée et al. (2010b) notice a growing awareness of these concerns at the provincial level, and authorities are now encouraging public health operations and training for health care staff.



Figure 24: Sanitary follow-up in Kidimudilo (Katanga, DRC). Credit: T. De Putter 2010, Royal Museum of Central Africa, Tervuren, Belgium

6.2 Human rights

According to Tshilobo (2005), prostitution is wide-spread in artisanal miners' settlement, and involve children as young as 12 years old (often exploited orphans and street children), in violation of article 19 and 34 of the Convention on the Rights of the Child, and article 3 of the convention about the Worst Forms of Child Labour (ILO, C182), both signed and ratified by DRC.

Child labour before an appropriate minimum age, interfering with physical, mental or moral development of children in artisanal mines contravenes principle 9 of the declaration of the Rights of the Child. For many children however, seasonal mining during holidays is the only opportunity to earn money and afford school fees (Tshilobo 2005).

Although artisanal miners do not force eviction on local inhabitants, their presence and activity can considerably disturb the communities' habits. Houses can also threaten to collapse because of uncontrolled mining and the subsequent erosion processes under tropical climate (particularly in rain season). This problem became frequent in 2007, when a peak in urban artisanal mining was observed: chased away from concessions owned by

large scale companies, thousands of miners started digging streets and plots inside urban areas, causing entire villages and towns to disappear (Tshilobo 2007). Public authorities then undertook the creation of additional artisanal mining zones, in order to keep miners away from densely populated areas.

6.3 Indigenous Rights

Indigenous communities in DRC are acknowledged the right to manage according to customary principles lands that they have traditionally inhabited, cultivated or exploited in any ways (Land Law, Art. 387-389). Because it is often unclear whether a site falls under the rule of customary systems or state administration, this provision often gives rise to conflicts (Ngoma 2007). It is reported that artisanal mining sometimes challenges the authority of traditional chiefs as they are often not consulted prior to the mining activities (COPIREP 2004). Nevertheless, it has also been reported that some influential traditional leaders receive a share of the mining production as customary gravel tithes (Promines 2010). The question whether these revenues benefit the indigenous communities strongly depends on the individual case: For example, a chief in the vicinity of the Shinkolobwe mine is reported to make primarily personal profit from the illegal trade of uranium-bearing cobalt ores instead of distributing the income to the local community (ASADHO 2009).

Indeed, the Code of Conduct of artisanal miners (annex V of the Mining Regulation) stipulates that miners should abide by (...) the local customary laws and traditions. According to PACT (2010) though, it is a common practice of miners to try to negotiate an agreement that serve the chief's own interests rather than the broader needs of the community, while the arrival of artisanal miners seriously damages their environment. Given that miners – compared to the local agricultural based communities – have higher incomes, their presence generates local inflation and access to essential goods can become difficult for indigenous communities (PACT 2007). As a consequence, local residents often choose to involve in mining as well, or provide services to miners, abandoning livelihoods that might be more sustainable on the long term. Eventually, interactions with mining communities is often reported to lead to negative social impacts within the indigenous group, such as increase of polygamy and prostitution, excessive consumption of drugs and alcohol, and deterioration of familial and social cohesion (PACT 2007). Despite these negative impacts, it is also reported that well-managed artisanal mining can convey a sense of ownership and participation to populations who felt deprived from control over their 'own' resources by foreign industrial companies (PACT 2010).

There are also claims of severe human rights violations towards Pygmy communities in the mining sector of Katanga, but according to an Environmental and Social Impact Assessment carried out by the Ministry of Mines (2010) these populations are mainly living in the Northern and Western part of the province where no cobalt ore is extracted. Thus, this issue is of minor relevance regarding cobalt mining in the Copperbelt.

6.4 Community Engagement

The principles for interaction between miners and local communities are regulated in the Mining Code and Regulation (Article 451). The SAESSCAM is appointed to foster application of Mining Code and Regulation and fulfilment of legal requirements by artisanal and small-scale miners. Applicants for an exploitation licence must provide a report on the consultations with the authorities of the local administrative entities and with the representatives of the surrounding communities as well as the plan as to how the project will contribute to the development of the surrounding communities (Mining Regulation, Article 451). This procedure includes information for local populations about negative and positive impacts of the project, consultation for the definition of appropriate measures to mitigate negative impact and to conduct site restoration, and compensation for directly affected people. Nevertheless, in reality this procedure is not implemented: During a research by PACT (2010) no example of any public consultations, or reports resulting from such procedures by any mining authorities could be found. Still, social investments are sometimes made by mine owners/investors, such as the implementation of water points and health services at the Kawama Artisanal Mining Zone in Katanga, although these are exception rather than the rule, and are not based on development plans (PACT 2010).

6.5 Socio-economic opportunities

According to Vanbrabant et al. (2009), artisanal mining produces 60 to 90% of raw ore in Katanga and permanently employs more than 60,000 people (see also Chapter 7.3), creating opportunities for local communities to provide a wide range of services: catering and accommodation of miners, entertainment, certification, trade, storage, transport and further processing of ores (Vanbrabant et al. 2009). Of course, some of these activities such as prostitution also have adverse impacts on local communities and are described in Chapter 6.2 about human rights. Furthermore, commercial vehicle fleet necessary for the transport of ores resulted in an increased number of gas stations and garages, and created job opportunities for countless fuel and lubricant sellers, welders, boilermakers, ironworker, tyre-repairer etc. Traders have also increasingly recourse to internet for transactions, and cybercafés are now flourishing (Mota Ndongo 2009). Nkulu Mwine Fyama (2010) also states that artisanal miner communities settling in remote area encourage farmers to diversify and increase their production beyond their own needs, while they would otherwise not find sufficient outlet, because of the poor state of roads and taxes to access broader markets. In addition, artisanal mining generates direct revenue to official and unofficial state-agents, an issue that is also covered in more detail in Chapter 4.2.5 about the State and Chapter 7.6 about contribution to national budget.

According to Article 2, paragraphs 6 and 11 of the executive order of the 28th of March 2003 on the creation and statutes of SAESSCAM, the purpose of the Service for Assistance and supervision of small scale mining include:

- The promotion of integrated development of local communities wherever artisanal and/or small scale mining occur.

- The stimulation of investment by artisanal and small scale miners in other sectors, as a mean to prepare national economy to the post-mine age.

Article 21 of the above-mentioned executive order stipulates that the SAESSCAM is entitled to 16% of superficies rights on mining concessions, 10% of which are intended to finance local community development projects. This tax is supposed to be collected by the Mine Registry (CAMI), and then redistributed to other public services and administrations, including SAESSCAM. However, none of the SAESSCAM offices interviewed by PACT (2010) had received these funds. Estimation of the potential annual budget available for community development is presented in Table 2. It would amount to about 61,000 US\$/ year, which seems structurally insufficient to face the needs of local populations.

Table 2: Estimation of the budget for SAESSCAM community development projects

	Type of mining right			Total
	Research Permit	Exploitation Permit	Tailings Exploitation Permit	
Surface covered by mining rights ⁽¹⁾ [MSq]	63,404	4,751	180	68,335
Annual superficies right [US\$/MSq]	26.34 ⁽²⁾	424.78	679.64	-
Total annual superficies right [US\$]	1,670,061	2,018,130	122,335	3,810,526
16% share due to SAESSCAM [US\$]				609,684
10% of the share due to SAESSCAM intended for community projects [US\$]				60,968

MSq: mining square, equal to 85 ha.

(1): Territories and Communes hosting the Copperbelt and therefore considered as relevant are: Lubumbashi, Kolwezi, Lubudi, Mutshatsha, Sakania, Kipushi, Kambove and Likasi. Calculation is based on the list of mining rights granted between 2003 and 2005, available on the website of the ministry of Mining.

(2): Annual superficies right for concessions under Research Permits amount to 2.55US\$/MSq for the first two years, 26.34 US\$/Sq for the rest of the first period, 46.33US\$/Sq during the first extension period, and 124.03 US\$/Sq during the second extension period (each period = 5 years) (MC 2002).

7 Impact on society

7.1 Public commitments to sustainability issues

On behalf of artisanal miners, unions and cooperatives such as EMAK and CMKK involve in multistakeholder initiatives to improve sustainability of the artisanal mining sector (CASM, IFC and CommDev 2007). However, implementation of public commitments from leaders and representatives seem to be hindered by a lack of governance at different echelon of these organisations, as explained in Chapter 5.2 about freedom of association and right to collective bargaining. Several reports on sustainability issues in the artisanal mining sector are availed by PROMINES (a project of the Ministry of Mines dedicated to improved governance in the mining sector), as well as NGOs and a number of large scale mining companies facing illegal miners.

PROMINES also has an official mandate to coordinate actions from donors and prevent unintended negative impacts. Indeed, before any intervention, a thorough inventory of vested interests for traders, companies, authorities and security agents is recommended in order to avoid lobbying against sustainability measures (PACT 2010).

7.2 Unjustifiable risks

As explained in Chapters 5.1 and 6.1 on safe and healthy living conditions for workers and local communities, many cobalt deposits of the Copperbelt include uranium ores, which – during artisanal mining activities – are partly disseminated in the environment through water and dust, exposing workers to radiations and causing long-term contamination of the food chain. Around Kolwezi alone, 8 sites containing minerals with elevated level of radiation were reported by IPIS (2009), 3 of them being exploited by individuals. Suspicion of uncontrolled exportation of raw copper and cobalt ores containing significant amount of uranium, possibly supplying countries under ban of nuclear technologies such as North Korea (US diplomatic cable 2007; ASADHO 2009), lead to the presidential decree of January 2004 forbidding access to the most radioactive mine of Shinkolobwe. However, instances of continued uranium exploitation with the involvement of artisanal miners have been reported by several NGOs, such as IPIS in 2007 and ASADHO in 2009. Generally, it cannot be excluded that artisanal cobalt mining is interlinked with illegal activities aiming to mine and export uranium with unknown destinations.

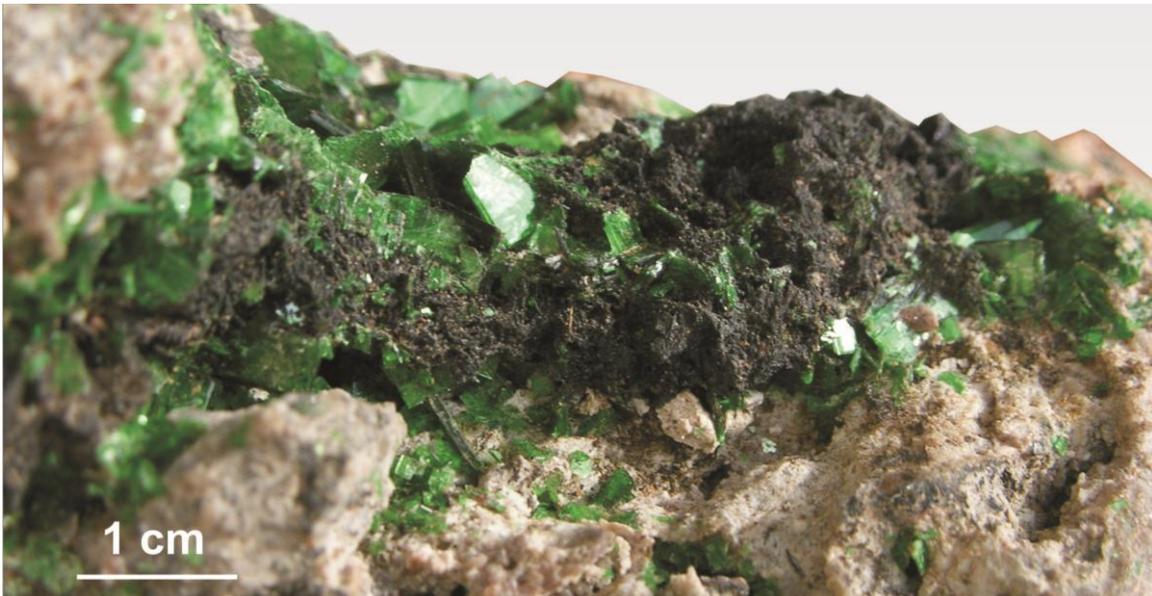


Figure 25: Heterogenite and metatorbernite (cobalt ore and uranium ore) in a silicified rock from Shinkolobwe (Katanga, DRC). Credit: T. De Putter 2010, Royal Museum of Central Africa, Tervuren, Belgium

7.3 Employment creation

Authorisation for artisanal exploitation of mineral resources in Katanga was meant to create employment and ease the social tensions in the late 1990ies (see Chapter 2.2.2 on the History of Mining activities in Katanga). A peak in the number of artisanal miners was reached during the post-war transition period, with up to 120,000 workers in the Copperbelt alone (Groupe One 2007).

For the purpose of this study, we define as functional unit a 50 kg bag of heterogenite, grading 5% of cobalt (i.e. 2.5 kg Co / 50 kg ore). As illustrated in Table 1 (Chapter 5.6 about workers' remuneration), some trading houses do not consider buying ores under the threshold of 5% cobalt. Although pure heterogenite (i.e. cobalt oxyhydroxide) have cobalt contents as high as 56%, what the diggers call "heterogenite" is actually mixed with other oxides and carbonides of Cu, Fe, Mn and Si rocks (Vanbrabant et al. 2009). Although from time to time miners do find ores of exceptional purity (and thus higher economic value), raw ores typically contain around 3% of cobalt, and are manually concentrated to obtain 5% Co, by washing, crushing and sorting (T. De Putter, pers.com, 2011). Manual concentration provides considerable added value (see Table 1).

Considering that 60 to 90% of Congolese cobalt production²³ stems from artisanal mining (Vanbrabant et al. 2009), miners in 2010 extracted between 27,000 and 40,500 metric tons of cobalt, equivalent to between 900,000 and 1,350,000 tons of 3% cobalt raw ore. As a digger extracts on average 1 to 2 bags of 50 kg raw ore per day²⁴ (RRN 2007), between 9,000,000 and 27,000,000 days of employment were availed to the Congolese workforce in 2010. Assuming that an artisanal miner works between 304 and 356 days per year,²⁵ ore-digging provided full-time employment to between 25,300 and 88,800 people in 2010. 900,000 to 1,350,000 tons of 3% cobalt raw ore represents 18,000,000 to 27,000,000 bags of 50 kg ores grading 3% cobalt. According to RRN (2007), a washer can treat 15 to 20 bags per day while a sorter (presumably crushes and) sorts 4 to 5 bags per day. Based on the same assumptions about annual working days, the artisanal processing thus provides occupation for 10,112 to 22,204 sorters, and 5,921 to 2,528 washers. After these manual concentration stages, the artisanal miners supplied the market with 10,800,000 to 16,200,000 functional units of product. The number of working hours per functional unit ranges between 8 and 38, as calculated in Table 3.

²³ Equivalent to 45,000 tons of pure cobalt (USGS 2010). As industrial mining projects reached the production phase, it is likely that the ratio of artisanal production declines from 2010 onwards. Nevertheless, it is estimated that share of artisanal sources is still above 60% in 2011.

²⁴ It should be kept in mind that miners might often dig during several days before reaching an ore deposit layer.

²⁵ A miner taking a weekly day off and the 9 national holidays works 304 days per year. A miner working everyday except national holidays would work 356 days per year. Further discussion and details are provided in section 6.7 about working hours.

Table 3: Estimated numbers for full-time occupation opportunities, functional unit production and working hours/functional unit ratio for artisanal cobalt mining in 2010.

	Scenario A: minimum production with maximum productivity	Scenario B: maximum production with minimum productivity
Number of diggers	25,000	89,000
Number of washers	3,000	6,000
Number of sorters	10,000	22,000
Full-time miners (total number)	38,000	117,000
Working hours ²⁶	121,500,000	426,600,000
Functional units (50 kg bag, 5% Co)	10,800,000	16,200,000
Working hours / functional unit	11	26

As illustrated by the calculation in Table 3, there are significant uncertainties regarding total employment creation of this sector. In addition, further uncertainties of these figures and other estimates arise due to the following reasons:

- Some miners only work on a seasonal basis (dry season), and/or when market prices are attractive, so their number is constantly evolving.
- Most of them are not registered, because registration card is too expensive (25 US\$) and do not provide any counterpart or advantage. This fact must be considered when interpreting official employment figures.
- Administration agents intentionally underestimate the number of miners they are in charge of, in order to lower their official tax base, thus the share of real income transferred to hierarchy and centralised services (PACT 2010).
- The definition of artisanal mining itself varies from one source to another, sometimes including the transporters who are essential to deliver the ores from remote areas, or bring them to washing spots if no water is available on-site.

An up-to-date estimation of the number of artisanal miners is provided in Table 4. The proportion of miners in the different areas seem consistent to the spatial distribution of cobalt reserves (see Chapter 2.1.3). These estimations are also consistent with the number of full-time job opportunities calculated in Table 3.

²⁶ Total amount of working hours for year 2010 range between 121,500,000 (= 356 working days x 9 hours/day x 38,000 workers) and 426,600,000 (= 304 working days x 12 hours/day x 117,000 workers).

Table 4: Estimated number of artisanal miners in each deposit group of the Copperbelt. Source: calculated from PACT 2010, Vanbrabant et al. 2009 and SAESSCAM 2010

	Permanent	Peak season
Kolwezi	20,000 ~ 24,000	27,000 ~ 32,000
Tenke-Fungurume	7,000 ~ 8,000	9,000 ~ 11,000
Likasi	13,000 ~ 16,000	18,000 ~ 22,000
Likasi-Lubumbashi	20,000 ~ 24,000	27,000 ~ 32,000
Lubumbashi-Kipushi	7,000 ~ 8,000	9,000 ~ 11,000
TOTAL	67,000 ~ 79,000	90,000 ~ 108,000

Deposits contain either cobalt (heterogenite), copper (malachite) or both, mixed in various proportions. At a certain point, part of the artisanal miner population in the Copperbelt is thus technically pulling its revenue out of copper rather than cobalt. Although, it would not be relevant to categorize them in such way, since miners are very mobile and simply extract what valuable ores they find. Another 26,000 to 31,000 permanent miners²⁷ would also be active in Northern Katanga, but those are not taken in consideration here because they do not deal with cobalt at all.

7.4 Anti-corruption efforts and non-interference in sensitive political issues

DRC ratified the UN Convention against corruption in 2010, and signed the SADC Protocol against corruption and the African Union Convention on preventing and combating corruption in 2003. The national legal framework against corruption includes articles 98 and 99 of the Constitution, the anti-corruption law of the 29th of March 2005 modifying and completing de penal code of 1940, and the law against money laundering of the 19th of July 2004. A national anti-corruption strategy was adopted in 2010, and laws for witness and expert protection are under preparation (MJDH 2011). State structures to fight against corruption include the Revenue Court, the auditing department of the Treasury, the commission of ethic and corruption prevention, the commission for good governance at the Prime Minister and the National EITI Committee. Despite such a comprehensive framework, DRC was still ranked 164th out of 178 countries on the Corruption Perception Index, and 40th out of 47 countries in Sub Saharan Africa (TI 2010). Corruption in the mining sector in Katanga is systematic as traders constitute networks of political protection to by-pass costly exportation procedures. According to Global Witness (2006), these networks would include officials from the central government in Kinshasa. As it generates considerable profit, many state agents involve in the

²⁷ Calculated from the same sources as those provided for estimations in Table 4.

mining sector although they are neither eligible for mining rights, artisanal miners' cards, nor traders' cards (PACT 2010) (see also Chapter 4.2.5 about the State as a stakeholder). An example of measures to combat corrupt business practices consist in the collection of multiple taxes by a single state agency that is responsible for redistributing taxes to other relevant services and cooperatives thus reducing the number of involved parties and transactions to increase traceability and accountability. This system was implemented by the SAESSCAM in Kolwezi with proper training and support from foreign cooperation partners (PACT 2010).

7.5 Contribution to national economy

Artisanal mining itself brings about little direct investment, but creates opportunities for the establishment of smelting facilities and carriage business. On the other hand, it is feared that anarchic exploitation of the superficial, most valuable deposits affects the profitability of future industrial mining projects and thus attractiveness of investments on the long term (see Chapter 2.2.1 about geology of cobalt deposits). All the Congolese cobalt is extracted to supply foreign demand, either in a raw, concentrated or refined stage, as there is virtually no industry in need for this commodity within the country (see Chapter 2.1 about the global cobalt market). While the government lobbies for foreign investors to construct state-of-the-art refining facilities in order to achieve maximum added value prior to exportation, cobaltiferous products from artisanal mining are still part of illegal supply-chains for foreign refiners (see Chapters 4.1 and 4.2). Besides, the artisanal production volume is highly unstable (see also Chapter 5.8 on employment security) as it depends on world demand for cobalt. For a country with a trade balance deficit amounting to 10% of the GDP (Guay 2010), the performance of the mining sector – which once constituted 70% of the exportation (Malu-Malu 2002) – remains crucial. An estimation of the contribution of cobalt artisanal mining sector to Congolese GDP relies on the following assumptions about:

- The annual cobalt production from Congolese mines;
- The proportion of cobalt from Congolese mines that is dug artisanally;
- The average cobalt grade of a functional unit;
- The price paid to miners for a functional unit.

Parameters 1 to 3 are discussed in Chapter 7.3 (Table 3). Accordingly, artisanal miners produced 10,800,000 to 16,200,000 bags containing 50 kg each of 5% Cobalt ores.



Figure 26: Diggers loading 50 kg bags of ore at the artisanal mine of Kawama (Katanga, DRC). Credit: T. De Putter 2010, Royal Museum of Central Africa, Tervuren, Belgium.

The price paid to miners for one such functional unit is displayed in Chapter 5.6 (Table 1) and lies between 13.8 and 20 US\$. The contribution to Congolese GDP would thus range between 149 and 324 million US\$.²⁸ The actual contribution to GDP of artisanal mining could even be higher, considering that traders often under-estimate the cobalt grade of ores: Indeed, the added value of metal concentration attributed to smelters could be partially created by artisanal miners.

Another way to estimate the contribution to GDP depends on assumptions about:

1. The total number of artisanal miners (permanent and seasonal);
2. The number of working days per year for a full-time miner;
3. The number of working days per year for an average seasonal or part-time miner;
4. The average wages paid to miners for each type of work;
5. The proportion of miners working in each segment of the production of a functional unit.

²⁸ 10.8 million bags x 13.8 US\$/bag = 149 million US\$; 16.2 million bags x 20 US\$/bag = 324 million US\$

Parameter 1 and 2 are discussed in Chapter 7.3 (Table 4). Considering arbitrarily that a seasonal miner works half of the year (parameter 3), the artisanal workforce is equivalent to 86,000 full-time miners.²⁹ It is assumed that miners work between 304 and 356 days per year (see Chapter 5.7 about working hours), and that remuneration (parameter 4) for a digger range between 3 and 5 US\$ per day, and between 1 and 3 US\$ per day for other workers (Peyer et al. 2011). The following ratio (parameter 5) can be derived from Table 3 (Chapter 7.3): 74% diggers and 26% of other workers. Accordingly, the contribution of cobalt artisanal miners to GDP would range between 65 and 137 million US\$.³⁰ If the wages reported by Peyer et al. (2011) are net revenue, the gap with the first method might partially be due to the share of income that miners spend on official and unofficial taxes (see Chapters 4.2.5 and 7.6).

The comparison of the two methods highlights the difficulty to estimate the economic weight of the sector, due to the lack of accurate and reliable data. Despite the numerous uncertainties, it is however likely that artisanal cobalt mining represents between 0.5 and 2.4% of the Congolese GDP.³¹ As underlined in the CIA World factbook, much of the Congolese economic activity – i.e. 80%, according to Kinkela (2009) – still occurs in the informal sector, and is not reflected in GDP data. Hence, the actual contribution to the national economy (including the informal sector) would rather represent between 0.1 and 0.5%.

7.6 Contribution to national budget

Due to the sector's widespread informality, contribution of the miners to the national budget is low and not comprehensively registered by the taxation system. For example, in a mine of Orientale, another Province of DRC, PACT (2010) reports that only 7 miners out of 200 held a license card, costing 25 US\$ per year. Miners do however pay various unrecorded taxes to a number of state agents (see Chapter 4.2.5 and Figure 17), for whom fees collected from miners' revenue constitute the main source of income. The amount is variable from one mine to another: in Kolwezi, SAESSCAM collects a global tax of 1% of the production, which it redistributes to other relevant services while a state-owned company deducts up to 30% of the production from miners allowed to work on its concession (PACT 2010). Vanbrabant et al. (2009) observed a tax-rate of 10% in an illegal mine near Lubumbashi. As mentioned in Chapter 7.5, value added created by artisanal cobalt mining is often retrieved by other stakeholders such as traders and processors. If artisanal mining were to decline, contribution to national budget from downstream activities is thus also likely to be affected.

²⁹ See Table 4; average full-time + ½ average seasonal or:
 $(67,000+79,000) / 2 + \frac{1}{2} [(90,000+108,000) / 2 - (67,000+79,000) / 2] = 86,000$ full-time equivalent.

³⁰ $86,000 \text{ miners} \times (74\% \times 5\text{US\$}/\text{digger}/\text{day} + 26\% \times 3\text{US\$}/\text{worker}/\text{day}) \times 356 \text{ days of work} = 137 \text{ million US\$}$;
 $86,000 \text{ miners} \times (74\% \times 3\text{US\$}/\text{digger}/\text{day} + 26\% \times 1 \text{ US\$}/\text{worker}/\text{day}) \times 304 \text{ days of work} = 65 \text{ million US\$}$

³¹ Based on CIA World Factbook estimation of the Congolese GDP for 2010 (13.13 billion US\$)

7.7 Impacts on conflicts

The mineral wealth of Katanga has alimented covetousness and motivated several conflicts: 1960-63 Katanga secession, 1978 Kolwezi battle during the Cold War, first (1996-97) and second Congolese war (1998-2003). Access to resources was used as bargaining chips not only with foreign powers but also for the central government to establish support network through the country: after overthrowing the dictator Mobutu, L.D. Kabila encouraged artisanal mining not only for employment creation but to gain allegiance from local influential figures who would make profit of it (Rubbers 2007). Ethnic tensions can also turn into inner conflicts in times of economic hardship. In 1992, 3,000 Kasaian Lubas were killed, and more than 500,000 were chased from Katanga to the neighbouring Kasai province, although most of them were born and raised in Katanga (Tuseko 2001). This conflict had its roots in colonial times, when Belgians recruited considerable staff in Kasai for the mining industry. Among them, many Kasaian Lubas experienced steep careers and as they increased their political and economic power, caused frustration in amongst Katangan ethnies (Dibwe 2006). After expulsion of Kasaians in 1992, tension raised again caused by the question who would finally benefit from the opportunities and positions left by Kasaians, between ethnies from the “useless” (North) and “useful” (South) Katanga, referring to the location of mineral deposits in the province (RELCOF 2005). Violence between groups of Katangan and Kasaian miners was reported in 2009 by IPIS, reviving memories of the dramatic ethnic confrontations in the past. However, a positive impact on conflicts of artisanal mining is that it gives a livelihood to former soldiers who might otherwise engage in extortion and banditism, as it occurs in other provinces (Feeney 2010).

7.8 Transparent business information

As detailed in section 5.6 about workers' remuneration, miners have so far had little access to information about the world commodity prices to negotiate fair wages. Access to media in DRC had remained limited for the Congolese population (see Table 5) and no example of regular information bulletin for miners over world commodity prices were found in the literature.

Table 5: Access to different media (at least once a week) as a percentage of population categories. Source: DRC ministry of health 2007 (MH)

	Radio	Television	Newspaper	None
Men (Katanga)	52	36	25	39
Women (Katanga)	29	26	5	64
Men (poorest 20%, DRC)	23	3	16	68
Men (illiterate, DRC)	30	2	(1)	70

Still, Mota-Ndongo (2010) observes that traders had been increasingly using the internet to follow world prices lately. It might be a matter of time before knowledge about fairer prices spread by word of mouth among miners.

For downstream processing companies (both well-disposed and ill-intentioned), it is difficult to ensure traceability of their product, since ores dug in illegal sites are labeled as extracted in legal artisanal mining zones by the unions and state-agents controlling these mines (Vanbrabant et al. 2009). On the national level, DRC started implementing the Extractive Industries Transparency Initiative (EITI) in 2005 and was recognised as a candidate country close to conformity in 2010. GECAMINES and 20 out of 21 major private companies of the copper and cobalt mining sector in Katanga took part to the 2007 EITI country report: The comparison between the amount of paid taxes declared by companies (78.8 million US\$) and that registered by fiscal administrations (68.3 million US\$) showed a 13% gap, or 10.5 million US\$.³² Price Waterhouse Coopers (2009) partly attributes this lack to different accounting and financial definitions, shifted fiscal years, and incomplete declarations, but reports that some gaps remained unexplained. Improved transparency in the collection of taxes from the industrial mining sector is crucial for artisanal mining, as a better allocation of resources is likely to foster governance in different services of the Ministry of Mines and benefit the miners.

8 Social impacts on a product basis

The assessment carried out in chapters 2 to 7 present a comprehensive basis for decision-making in various fields. Amongst others, the data and information can also be used to assess product specific social impacts. This approach is based on the life-cycle thinking, i.e. the concept that the economy of raw material extraction and further processing is closely linked to demand and consumption and that – according to the principle of extended producers responsibility (EPR) that is already routinely applied in end-of-life management – producers have a certain responsibility for upstream and downstream impacts of their products.

The following calculation is based on the worldwide cobalt market data (chapter 2.1.2), on the assumption that 60-90% of the cobalt from Katanga Province is extracted by artisanal miners (see chapter 7.3) and on the data presented in Table 3.

On the basis of these figures it can be calculated that about one third of the world's cobalt supply come from artisanal mining in the Democratic Republic of Congo, meaning that on average one third

³² It should be kept in mind that most industrial mining projects in Katanga were still at an investment stage in 2007. An increased amount of taxes is expected for the upcoming years, when the production phase will be reached. While major companies in the year 2007 calculated a volume of tax revenues amounting to 78.8 million US\$ of taxes, Tenke Fungurume Mining associated a figure of 36.5 million US\$ with the taxes only for the 3rd quarter of year 2010 (TFM 2010).

of the cobalt in each application can be attributed to the specific social impacts described in this report.

In addition, the data presented in Table 3 reveal that the generation of 2.5kg cobalt from artisanal mining in the DRC is associated with an artisanal labour input ranging between 11 and 26 hours. Thus it can be concluded that the production of 1 kg of cobalt from artisanal mining on average is associated with 444 artisanal working minutes in the DRC and that 71% of these hours are worked by diggers, 6.5% by washers and 22.5% by sorters (calculated on the basis of data contained in Table 3).

Taking into account that the Li-Ion batteries of an average notebook contain 65g of cobalt (Hagelüken & Buchert 2008) and that modern hybrid-vehicles use 2.5kg of cobalt (Morley & Eatherley 2008), this means that on average one notebook is associated with around 10 minutes of artisanal cobalt mining in the DRC, and a hybrid-vehicle with around 6 hours and 10 minutes. Table 6 presents the apportionment of these working minutes between diggers, washers and sorters.

Table 6: Working minutes of artisanal cobalt extraction in the DRC per product

	Amount of Co in application [g]	Share of Co sourced from artisanal mining in the DRC	Working minutes for artisanal Co-diggers in the DRC (per product)	Working minutes for artisanal Co-washers in the DRC (per product)	Working minutes for artisanal Co-sorters in the DRC (per product)
Notebook	65	1/3	7	1	2
Hybrid-vehicle	2500	1/3	263	24	83

Furthermore, the data presented in chapter 5.5 lead to the conclusion that 28% of this labour input is carried out by children under the age of 15, i.e. the cobalt of an average notebook is associated with nearly three minutes of child labour and an average hybrid vehicle with 104 minutes.

In terms of remuneration, it can be estimated that artisanal miners earn on average US\$ 3.00 for a full working day of 10 hours (see chapter 5.6). Thus the income per notebook is around US\$ 0.05 and per hybrid-vehicle US\$ 1.85³³.

Taking into account the death rates of 0.4 to 0.5% (average 0.45%) in some of the artisanal mines (see chapter 5.1) and assuming that these figures are representative for all artisanal cobalt mining in the DRC, given an average yearly working time of 3426 hours per artisanal miner, it can be estimated that the production of 4.7 million notebooks or 123,000 hybrid-vehicles are on average associated with one accidental death in artisanal cobalt mining in the DRC.

Table 7 gives an overview on the calculated social indicator values on a product basis:

³³ In parallel to the other calculations in this chapter, it is also assumed that one third of the cobalt in notebooks and hybrid vehicles is sourced from artisanal mining in the DRC.

Table 7: Social indicator values of artisanal cobalt mining in the DRC for selected cobalt containing products

	Average notebook	Average hybrid vehicle
Labour input per product	10 min	370 min
Child labour input per product	3 min	104 min
Remuneration	0.05 US\$	1.83 US\$
Fatal mining accidents	0.00000021	0.0000081

Of course, all these calculations are subject to various uncertainties, which are described in more detail in the analytical part (chapter 2 to 7). In addition, variations might also result from changes over time, either from shifts in the cobalt production in the DRC and/or worldwide, commodity price fluctuations, or changes in the production conditions within the DRC. Despite these uncertainties, the figures give an indicative quantitative insight into the relation of products to the cobalt extraction stage, which might help to shape the future discussion on social responsibility within complex global supply chains.

9 Final conclusions and recommendations

Despite several negative social impacts, artisanal cobalt mining has the potential to alleviate poverty in Katanga, and trigger a sustainable development in the province. The Mining code set the framework for a switch from artisanal mining to a more qualified and value added small-scale mining. The existence of a specific official service (SAESSCAM) with a mandate to assist artisanal miners is a great asset, as well as the network of unions and cooperatives encompassing the whole Copperbelt. Despite current dysfunctions and lack of governance and transparency at certain echelons of these organisations, they offer a structure that can significantly improve the lot of artisanal cobalt miners. Artisanal mining stimulates the local economy by:

- Injecting cash flow that is spent by miners to purchase local products and services;
- Providing seasonal jobs and extra revenue to other professional categories of the population, enabling investments in diversified sources of income;
- Financing importation of raw material and inputs necessary for the diversification of local economy.

Poverty strikes 70% of the population of the province, and people will indeed continue to work in cobalt mines with unsafe working conditions, health hazard etc., unless other sectors of activity offer decent employment. Economic diversification is also hindered by the limited availability of basic infrastructures that lay a burden on competitiveness of local entrepreneurs compared to imported products.

Reinvestment of profit from extractive sector into diversification of the economy is thus regarded as one of the key development patterns proposed for Katanga in the Growth and Poverty Reduction Strategy Paper (GPRSP 2006). Yet, this opportunity should be seized immediately while world market prices are favourable. Although D.R.Congo mined close to half of the world production in 2010,

many large-scale cobalt mining projects are flourishing in other countries, and polymetallic nodules and cobalt-rich crusts of the seabed could become very competitive sources for this commodity in the future. Besides, the development of substitutions for cobalt in some key applications might also reduce the demand in the next decade. Thus, there is a real risk for artisanal cobalt mining to become less profitable in the medium term.

In order to maximise positive impacts of artisanal cobalt mining in Katanga and mitigate negative consequences, we recommend:

- To Congolese authorities:
 - A revision of the mining code;³⁴
 - The creation of a sufficient number of artisanal mining zones (ZEA);³⁵
 - Full transparency regarding contract negotiation with extractive industries;
 - Ensure a fair remuneration of miners by controlling authorised certification laboratories;³⁶
 - Proper decontamination and an effective closure of the former Belgian mine (Shinkolobwe), as recommended in 2004 by the IAEA.
- To multilateral and bilateral donors:
 - Support to help SAESSCAM fulfill its mandate towards artisanal miners;
 - Identification and dissemination of good practices.
- To downstream markets and industries:
 - Refrain from any general ban of cobalt from artisanal sources;
 - Engage in direct co-operations with artisanal mining communities to mitigate health, safety and environmental hazards, to improve working conditions and community development, and to improve skills and market access.

Furthermore, as employment security also depends on the profitability of artisanal mining, improved efficiency of artisanal mining will ensure its competitiveness, hence its resistance to economic shocks. Thus it is generally recommended to:

- strengthen the artisanal mining and support investments to upgrade informal groups of miners to formal small-scale mining cooperatives, and to authorize them to negotiate better prices at the right time, finance sample analysis, offer financial security to its members, and

³⁴ For instance, artisanal exploitation zones should be protected from conversion to other types of concessions in order to give artisanal miners legal certainty in official ZEA. Otherwise, objective criteria and assessment methods should at least be published to determine if a deposit is suitable or not for large-scale, small scale and artisanal mining: size and average grade of the deposit, security conditions etc.

³⁵ The number of ZEA should increase, and therefore, large scale concession owners should have a legal possibility to “donate” deposits that are not economically exploitable at an industrial scale. This would ease social tension with artisanal miners: the more the artisanal miners in formal ZEA, the less the illegal depletion of valuable large-scale deposits. To encourage such transfer, liability for accidents and environmental damages resulting from the artisanal mine should be endorsed by SAESSCAM. Supervision by SAESSCAM and a free access to the market are crucial to guarantee that this mechanism will not be diverted as a justification for companies which currently exploit artisanal miners as daily labourers in their own concessions.

³⁶ For instance, by exerting pressure on mining companies to enforce article 40 of the labour code and offer daily labourers a permanent contract after 22 working days, and by establishing a sufficient number of formal artisanal mining zones, with attractive working conditions (security, fair tax system, access to market)

- integrate artisanal extraction with downstream concentration process.³⁷

³⁷ Laid off Gécamines staffs with basic metallurgical processing knowledge are reported to produce artisanal concentrates (Mota Ndongu 2010). GENIMIN, a Belgian engineering company, also designed an affordable and small-scale concentrator especially for artisanal mining production volume.

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