

# The economic impact of mining industries in the central African Copperbelt: Case study of Zambia and the Democratic Republic of Congo

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## 《Abstract》

In this article, we investigate the role of the Copperbelt in the world market of nonferrous metals. The analysed data were collected from the producing companies in the Democratic Republic of Congo and Zambia during field research in Africa. We found that the Copperbelt produced a median of 50% of the world's cobalt, 12% of copper, 3.2% of zinc, 1.8% of cadmium, and 0.6% of lead. The results show that the market of cobalt is highly concentrated; DRC, the leading producer and reserve holder, accounts for a half of world production. During the same period, Chile and Peru produced 13% and 3% of the world's copper, respectively. Also, mineral exploitation in African countries is usually a competition on two fronts: international and domestic. Nationalization policies in the Copperbelt region aim to achieve both political and economic independence. The exports of metals from the Copperbelt plays a pivotal role in the world market. Since the early 2000s, China has invested extensively in the Copperbelt region to extract, process, and refine the metals to meet its domestic demand for metals.

**Keywords:** Mining; economic growth; Copperbelt; Zambia; Democratic Republic of Congo; Africa

## 1 Introduction

The copper industry, as the principal sector, generates most of the revenue for the governments in Zambia and the Democratic Republic of Congo (DRC<sup>1</sup>). Historically, these two countries' economies have been based on the exploitation of mineral resources (Campbell, 2009). Mineral supply and demand play a pivotal role in economic development, with economic growth always being accompanied by an increase of per capita metal use (Ignacio, Nishiyama, & Tilton, 2005). Minerals are needed to produce the equipment and devices that make our daily life comfortable, such as smartphones, personal computers, electronic appliances, and electric vehicles (Wiedmann, Schandl, & Moran, 2015); (Casper, 2007). Dependence on mineral refers to the mechanization process to produce large quantities of goods and services to meet an expanding population in modern society.

The global known copper resources are estimated at 1,780.9 million tons, with the vast majority hosted as copper porphyry deposits that contain 10-times more copper than any other mineral deposit type, especially in

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1) Democratic Republic of Congo (DRC) is the second largest country in Africa by land area. It was called the Independent State of Congo under the King Leopold II (1885-1908). It was renamed the Belgian Congo (1908-1960). After the independence in 1960 it became the Democratic Republic of Congo until 1967. President Mobutu Sese Seko changed the name to Zaïre between 1971 and 1997. President Laurent Desire Kabila recalled the former name of the Democratic Republic of Congo since 1997.

Chile (Mudd, Weng, & Jowitt, 2013). The mineral resources of a country include its water resources and energy resources, such as coal, gas, petroleum, uranium, and geothermal energy (Deb & Sarkar, 2017); (Harris, Allen, & James, 1993); (Carr & Herz, 1989); (Govett & Govett, 1974). The central African Copperbelt is one of the greatest sediment-hosted stratiform copper and cobalt provinces on Earth, containing 140 million tons of copper and 6 million tons of cobalt and other important deposits (Cailteux, Kampunzu, Lerouge, Kaputo, & Milesi, 2005).

The discovery of precious metals has been a significant motive for settlement throughout the history of civilization (Skousen, 2007). In the Copperbelt, the mineralization is essentially a copper-cobalt ore that occurs mainly as three distinct types: sulfides, oxides, and migrating copper. The sulfides are found in the alteration zone below 70 m. In contrast to the sulfides ores extracted in underground mines, the oxides ores are found mainly in the zones close to the surface, allowing their extraction in open pits (Desouky, Muchez, & Cailteux, 2009). The grade of copper varies between 4 to 6% and usually remains uniformed in the same deposit. The high-grade ores are extracted first while low grade remains throughout the lifetime of a mine, so that the ore grade of copper decreases throughout the time of exploitation (Crowson, 2012). Production of cadmium has begun in 1941 by the UMHK as a by-product of the preliminary roasting of zinc concentrates from the Kipushi mine to obtain sulfuric acid. Lead is the fifth most widely used metal in the world. Lead has various isotopes, some of which are the product of atomic decomposition of uranium or thorium. In the northern Katanga, the Kipushi deposit (Zn, Cu, Pb) is located in south-eastern part of the Copperbelt of Katanga (Walraven & Chabu, 1994). The lead reserve in the DRC is not sufficient to justify economic exploitation.

Zambia has a significant deposit of lead reserve, and its exploitation is recorded in its archives. Cobalt is a bluish-grey, shiny, brittle metallic element (Taylor, 2009) and is a highly strategic, essential material for which no commercial substitutes have ever been found (Royen & Bowles, 1952); (Rumbu, 2010), (Dill, 2010).

The extraction of minerals from the earth requires an effective combination of production factors—land, technology, capital, entrepreneurship, and a skilled labour force—to make the exploitation profitable (Sexton, 2019). In the case of developing countries, especially in Zambia and the DRC, these factors are scarce. Generally, developing countries rely mainly on foreign investment in terms of capital, technology, and human expertise to develop mining projects. The local people in the DRC and Zambia extracted copper ore by traditional means to make a variety of instruments for hunting, war, and barter (Davis, 2010); (Hochschild, 1956); (Nyembo, 1975).

In recent decades, research addressing African business history has developed our understanding of some of the important research questions, such as the historical significance of African entrepreneurs; the spatial and temporary evolution of African business; its structure; and organization, management, and administration. Although the academic literature addressing African business has expanded, the recent past of African business has not yet been fully explored. More studies are needed to facilitate a better understanding of the varied past of African business (Jalloh, 2002). In this regard, this article attempts to answer the following research question: What role has extraction in the Central African Copperbelt<sup>2)</sup> played in the world market for nonferrous metals? There is

relatively less information available on the contribution of the Copperbelt to the world markets of metals.

The first section explains the background of the copper industry in Zambia and the DRC. The second section presents the analytical materials and methods. The third section presents the results. The fourth section discusses the local policies that influence the production of nonferrous metals in the Copperbelt in comparison with the international experience. The fifth section concludes the article.

## 2 Materials and method

This article analysed both the primary data and secondary sources, including archives of production companies, such as the Zambia Consolidated Copper Mining (ZCCM)<sup>3)</sup>, the Union Minière du Haut-Katanga (UMHK)<sup>4)</sup>, the Générale des Carrières et des Mines (Gecamines)<sup>5)</sup>, and

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- 2) Central African copperbelt (refers to as copperbelt) is a zone of copper deposits and associated mining and industrial development dependent upon them, forming the greatest concentration of industry in sub-Saharan Africa. The belt extends about 280 miles (450 km) northwest from Luansha in Zambia, into the Kowezi in Haut-Katanga province of the DRC. The zone is up to 160 miles (260 km) in width and contains more than a tenth of the world's copper deposits and a third of the cobalt deposits, found mostly in Late Precambrian sedimentary deposits.
  - 3) The Zambian Copper Consolidated Mines Limited (ZCCM) was created in 1982 as a result of the merger of two state mining enterprises which had themselves been created when the Zambian copper industry was nationalised in 1969. The main shareholders of ZCCM included the Zambian government controlling 60% of the shares, and the South African conglomerate Anglo American Corporation (AAC) accounting for 27.3%. AAC held pre-emptive rights to purchase any shares sold by the government.
  - 4) Union Minière du Haut-Katanga (UMHK) is the Belgian company founded in 1906 by Leopold II to extract copper metals in Katanga until the nationalization in 1967.
  - 5) La Générale des Carrières et des Mines (Gecamines) is the government owned company created in 1967 after the nationalization of the Union Minière du Haut-Katanga.

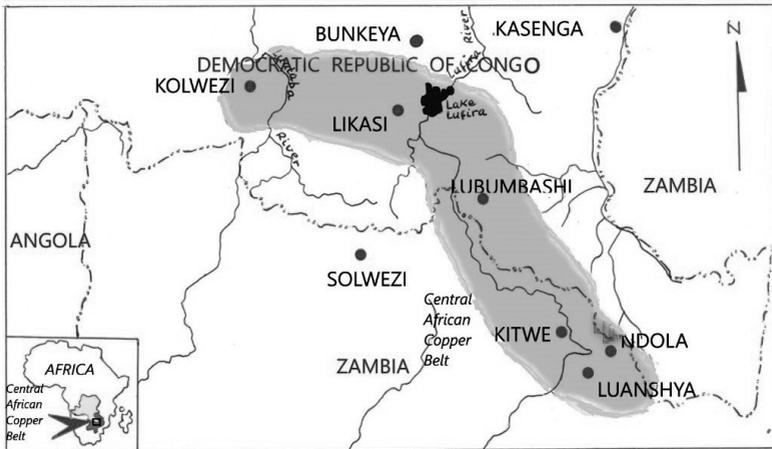
reports from the Ministries of Mines in the DRC and Zambia collected at their headquarters in Lubumbashi, Lusaka, and Ndola during the fieldwork.

This article relied on primary sources, including annual reports of companies by taking pictures, statistical data, and internal documents. During fieldwork trips in the DRC and Zambia, the authors interviewed the managers of the departments of research and development, production, and commercialization, as well as conducting interviews with miners who possessed a working experience of at least 25 years in the same company. These in-depth interviews were recorded and translated into English. The qualitative method was used to explain the neo-colonial policies in the copper industry based on the statements of living managers and miners.

The data relating to the demand and supply of nonferrous metals on the world market were retrieved from the database of the World Bank, and the statistical reports from the Chinese government. This data was analysed using the Stata<sup>®</sup> statistics Software, to estimate the statistics to evaluate the production and consumption trends of five nonferrous metals compared with the total world output. The historical prices of copper, cobalt, zinc, and cadmium were retrieved from the U.S. Geological Survey, with 1990 used as the baseline year to estimate the constant revenues (Survey, 2012). Figure 1 depicts the central African Copperbelt, where the principal mines and processing plants have been established.

The third section presents the results of output trends of five nonferrous metals, including copper, cobalt, zinc, cadmium, and lead. Lead is produced only in Zambia. The statistical summary of the five nonferrous metals is presented in Table 1.

Figure 1. The study area of the Central African Copperbelt.



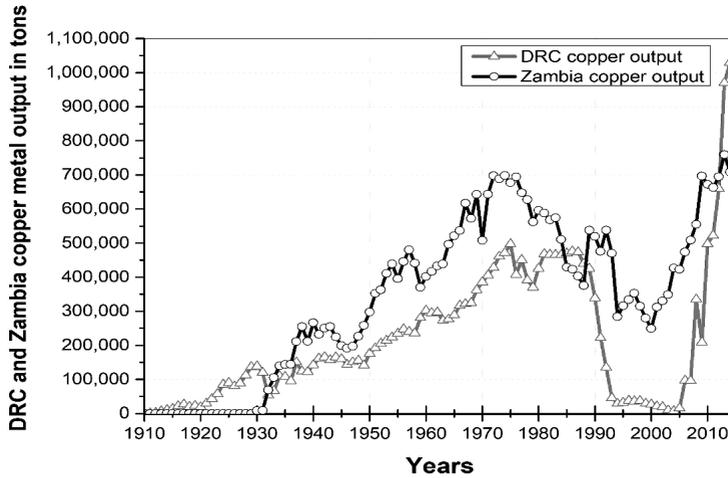
Source: Authors' drawing using the map from Kakanda Copper Mine 2007.

### 3 Results of distribution and production trends of nonferrous metals in the Copperbelt

This third section presents the trends of nonferrous metals output, focusing on the Copperbelt region. The Copperbelt has produced considerable quantities of strategic metals for exports to the world market. The degree of economic development in the two countries allows only minimal local consumption of these metals because almost 90% of the output generates revenue through export to developed countries. Figure 2 depicts the mine production of copper in tons in the Copperbelt region, including the DRC and Zambia from 1911 to 2015.

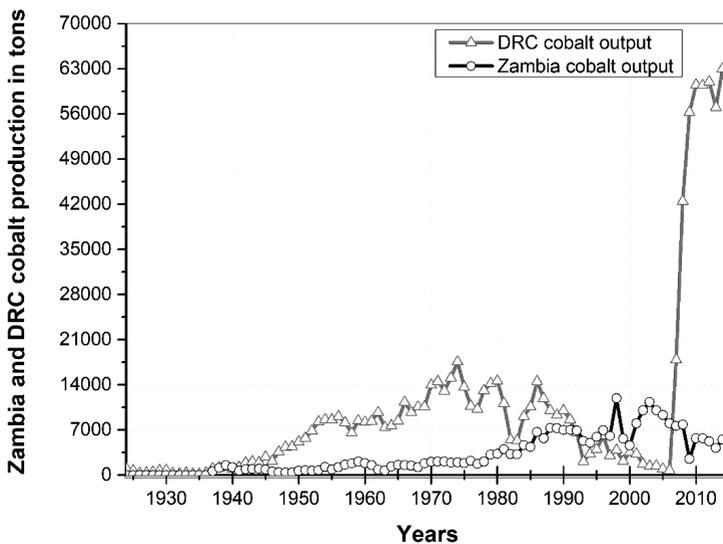
Figure 2 shows that Zambia was the largest producer of copper metal in Africa. Within the Copperbelt region, the DRC produced less copper metal

Figure 2. Zambia and the DRC's copper production in tons.



Source: Authors' collation from the computation of data from annual reports of UMHK 1911–1966; Gecamines 1967–2016; ZCCM 1928–2015.

Figure 3. Zambia and the DRC's cobalt production in tons.

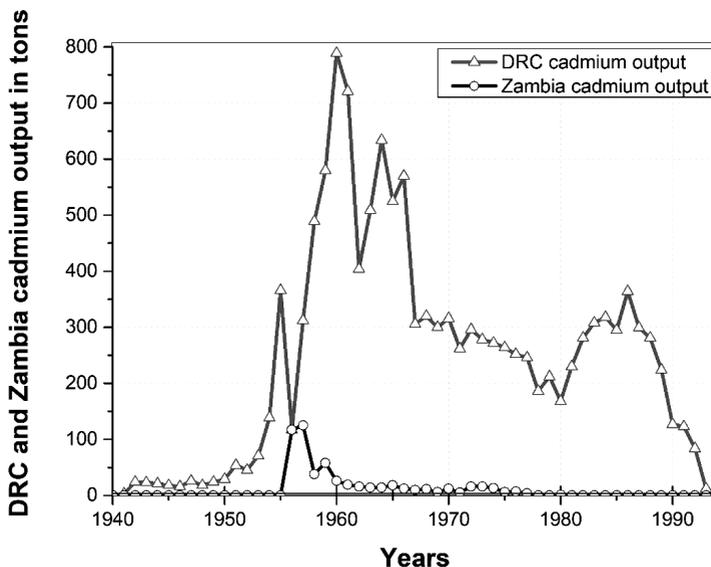


Source: Authors' collation from the computation of data from annual reports of UMHK 1911–1966; Gecamines 1967–2016; ZCCM 1928–2015.

than Zambia. Figure 3 shows the trend of cobalt production in tons in the Copperbelt region from 1924 to 2015.

Figure 3 shows that the production of cobalt metal in the DRC was

Figure 4. Zambia and the DRC's cadmium production in tons.

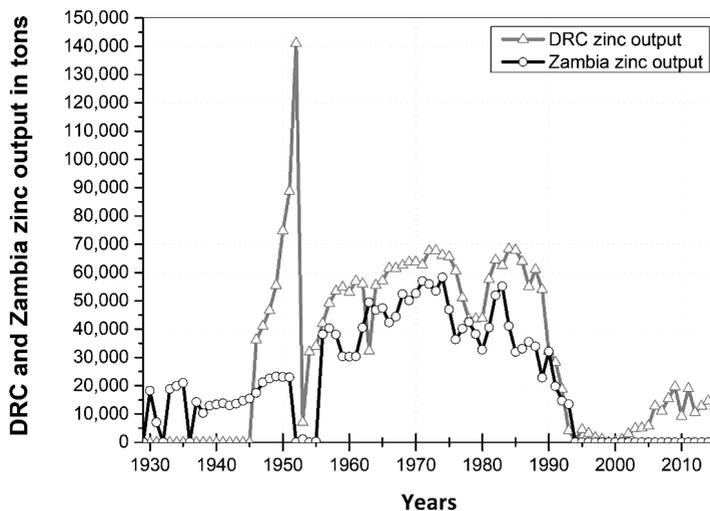


Source: Authors' collation from the computation of data from annual reports of UMHK 1911–1966; Gecamines 1967–2016; ZCCM 1928–2015; and the US geological database 1932–2016.

higher than in Zambia. Figure 4 shows the trends of cadmium output in tons in Zambia and the DRC.

Figure 4 shows that the production of cadmium as a by-product of copper metal was higher in the DRC than in Zambia. The output of cadmium in the Copperbelt region accounted for a relatively small quantity in comparison

Figure 5. Zambia and the DRC's zinc production in tons.



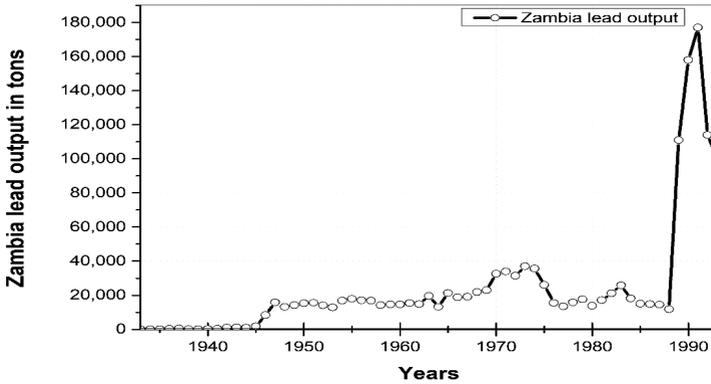
Source: Authors' collation from the computation of data from annual reports of UMHK 1911-1966; Gecamines 1967-2016; ZCCM 1928-2015, and USG database 1933-2016.

with copper and cobalt metals. Figure 5 depicts the trend of zinc output in tons in the DRC and Zambia from 1933 to 1993.

Figure 5 shows that the quantity of zinc production in the Copperbelt region remained low throughout the period under study. Figure 6 shows the trends of lead output in the Copperbelt, especially in Zambia.

Figure 6 shows that lead is produced only in Zambia, with no significant

Figure 6. Zambia's lead production in tons.



Source: Authors' collation from the computation of data from annual reports of UMHK 1911–1966; Gecamines 1967–2016; ZCCM 1928–2015 and USG database 1933–2016.

lead production by the DRC.

Table 1 shows that Zambia and the DRC have been the dominant producers of cobalt metal and copper metal in Africa since the colonial era. The fourth section will discuss the factors that influence the trends of

Table 1. Summary of nonferrous metals production in Copperbelt and the world in tons.

	World copper	CCB copper	World cobalt	CCB cobalt	World lead	CCB lead	World cadmium	CCB cadmium	World zinc	CCB zinc
Mean	6096933.33	577957.70	25697.20	15289.53	2515081.97	24067.69	13163.70	254.00	5474360.47	15261.80
Median	4290000.00	515900.00	20800.00	10490.00	2530000.00	15421.00	14100.00	263.00	5605000.00	18427.00
Mode	16100000.00	N/A	13600.00	66200.00	3490000.00	16800.00	5220.00	24.00	1470000.00	N/A
SD	5102608.20	416356.92	22041.14	16135.23	848031.24	34898.12	5598.85	203.35	3472891.53	7154.60
Kurtosis	-0.25	-0.09	2.36	5.26	-1.49	9.62	-1.41	0.24	-0.49	-1.16
Skewness	0.93	0.57	1.62	2.43	-0.23	3.09	-0.25	0.77	0.57	-0.47
Minimum	558000.00	998.00	1546.00	177.00	1030000.00	74.00	4050.00	1.00	709000.00	0.00
Maximum	19100000.00	1738000.00	97400.00	6850.00	3690000.00	177000.00	21900.00	815.00	13300000.00	25711.00
Observation	105.00	105.00	81.00	81.00	61.00	61.00	54.00	54.00	86.00	86.00

Source: Authors' collation from the computation of data from Stata Software.

Note: CCB: Central African Copperbelt; SD: Standard deviation

nonferrous metals production in the Copperbelt region relative to the international experience.

## 4 Discussion

In this article, we analysed the role of the Copperbelt in the world market for nonferrous metals. This section discusses the production trends of the five nonferrous metals in the Copperbelt relative to Chile and Peru. It is divided into four periods: the colonial era, nationalization, privatization, and the joint venture partnership with Chinese investors. We aimed to shed light on the contribution of the Copperbelt to the global markets of nonferrous metals. Since the early 1990s, China has been experiencing rapid economic growth, which requires a stable supply of metals to satisfy the domestic consumption of minerals and sustain its industrialization.

During the late nineteenth century, following the Berlin conference of 1885, European powers divided Africa into colonies under their control. The development of the Copperbelt has experienced challenges for both foreign investors and local workers. When the colonial British came into contact with the native people in Zambia, they did little or nothing for them, providing social services that were inadequate and imposing heavy taxation (Keith, 1937), thus obliging the native miners to work to pay their taxes (Spearpoint, 1937). In the Belgian Congo, similar working conditions have been implemented in the Katanga Copperbelt (Dibwe, 2001), resulting in industrial Katanga becoming known as the “land of death” due to hazardous working conditions in the copper industry (Russo, 2002). Industrial accidents in the copper mines of Katanga were more frequent

than in Zambia (Kalenga, Balyahamwabo, & Takai, 2016). During the early years of industrial production, the Copperbelt regions of Zambia and the DRC entered a phase of phenomenal mining expansion that created an insatiable demand for African labour to meet the increasing needs for metals (Kalusa, 2011).

During the colonial period, European multinationals provided most of the investment and managerial expertise and had exclusive control of the industry. The return on investment essentially compensated the investors, although a small share of the income helped to maintain the basic infrastructure and local labour force needed to continue the exploitation (Dumett, 1985). The living standards of miners in mining towns were higher than those in traditional villages. The role of the Copperbelt in contributing to the world output of cadmium and zinc was insignificant because it produced a total of less than 3% of these metals. The processing of zinc as a by-product of copper did not attract the investment needed to develop the appropriate processing facilities. Also, the DRC and Zambia accounted for 3% and 0.2% of cadmium output respectively. Moreover, the relatively low price of these by-products on the world market might have harmed the development of extraction and processing.

The cobalt market is highly concentrated; the DRC, the leading producer and reserve holder, accounts for two-thirds of the world production. The three African producers, including the DRC, Zambia, and Morocco, together account for about 82% of the world's primary production (Klass, Burrows, & Beggs, 1980). In 1964, soon after the independence of Zambia, the government decided to nationalize the multinational corporations to boost economic development (Libby & Woakes, 1980). Following

independence, the mining industry in Zambia was unable to generate sufficient income to initiate the production process (O'Faircheallaigh, 1986). Becoming aware of the failing copper industry, the government changed its policy to, once again, depend on foreign funding to finance its economic growth (Burdette, 1984).

From 1967 to 1992, the government officials of the DRC and Zambia thought that taking control of the major copper industry would support national sovereignty. The nationalization of mines and industrial plants would enable them to finance the countries' economic development projects. The production levels of copper metal increased from their colonial period median of 140,000 and 259,000 to 426,000 and 573,000 in the DRC and Zambia, respectively. These quantities accounted for a share of 6% and 8% of the total world production of copper. In contrast, the output of cobalt metal decreased from its levels of 58% and 10% in the DRC and Zambia to 48% and 8% respectively. The share of zinc and cadmium as a proportion of the total world production remained negligible throughout the nationalization period.

This transition period allowed the Zambian and Congolese government officials to determine adequate compensation in favour of the nationalized mining companies' shareholders. In Katanga, president Mobutu<sup>6)</sup> passed the nationalization law of January 2, 1967, that transferred the mines and metallurgical plants of the Union Minière du Haut-Katanga to the

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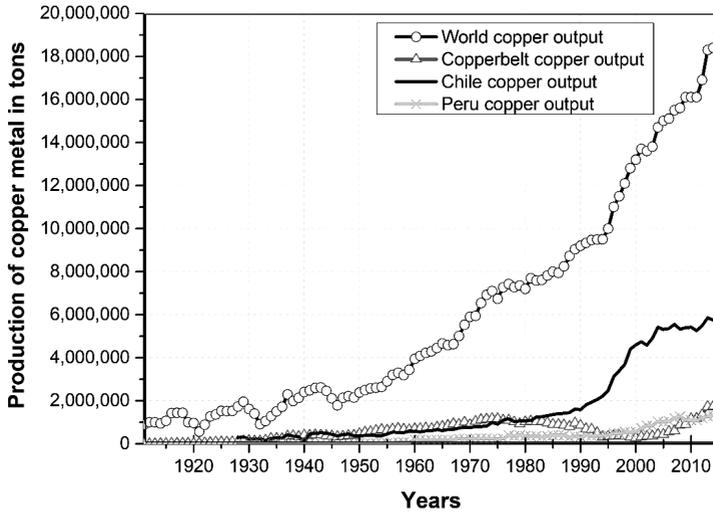
6) Mobutu Sese Seko was born on October 14, 1930, Lisala, Belgian Congo-died on September 7, 1997, in Rabat, Morocco. He was president of the Democratic Republic of Congo which he renamed Zaire from 1971-1997. As political and military leader, he seized power in a 1965 coup and ruled for some 32 years before being ousted in a rebellion in 1997.

government as a sole owner of a newly-formed company named Gecamines (Saquet, 2000). In Zambia, on December 24, 1969, President Kenneth Kaunda passed the nationalization law that transferred ownership of the copper mines and plants of the Zambia Anglo-American group and the Roan Selection Trust Limited group, with the government taking 51% ownership of the ZCCM (Fraser & Larmer, 2010). In both countries, these policies aimed to secure control of the major industries to finance the governments' economic development projects.

In developing countries, the nationalization of multinational companies operating in the natural resource sector has been an issue of considerable debate. Mtegha et al. argued that nationalization in the Copperbelt, as well as the Southern African Development Community (SADEC) region, aimed to achieve both political and economic goals (Mtegha, Cawood, & Minnitt, 2006). Fleming found that nationalization policies in the developing countries are motivated by increasingly economic self-reliance in order to reduce the excessive external economic dependence that impedes real economic and social progress (Fleming, 1973). Therefore, the host country should develop the ability to carry out production and fulfil its sales obligation before nationalizing foreign companies. Ericsson found that the world mining crisis of the 1970s was amplified by the economic slowdown in economic development of the third world countries (Ericsson, 1991). Figure 7 compares the copper metal production trends of the Copperbelt, Chile, Peru and the world.

The comparison of the nationalization policy in the Copperbelt and Chile resulted in the increase of production in Chile while a decrease of production was experienced in the Copperbelt. Chile is the largest producer

Figure 7. Comparison of copper metal production.



Source: Authors' collation from the computation of data from annual reports of UMHK 1911–1966; Gecamines 1967–2016; ZCCM 1928–2015; and the US geological database 1932–2016.

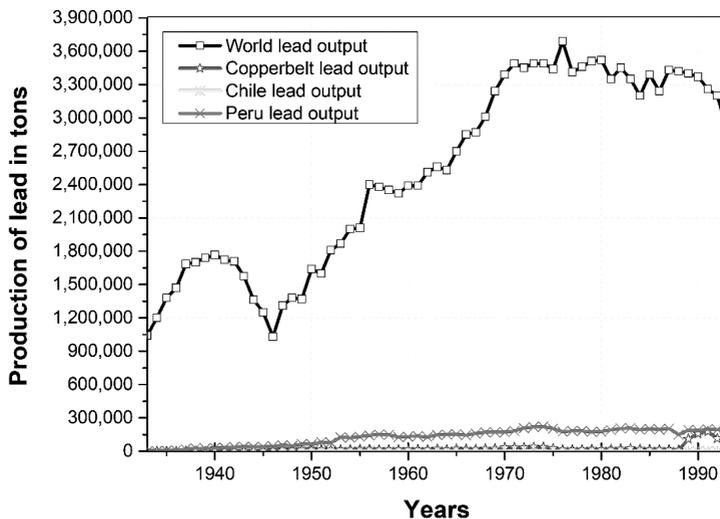
of copper metal in the world, accounting for one-fourth of the total world production since the fiscal year 2000. Peru has significantly increased its copper production, becoming the second single producer of the red metal in 2000. When the country nationalized its copper industry, Chile increased its production of copper from 657,000 tons recorded before the nationalization in 1968, to 1,050,000 tons in 1977. In the case of Zambia, Libby et al. found that nationalization raised serious doubts regarding its suitability as a policy for controlling the economy. The Zambian output has declined from 720,000 metric tons in 1969, which was the year of nationalization, to 658,000 tons in 1977 (Libby & Woakes, 1980). In the case of the DRC, the output rose from 321,000 metric tons in 1967, the year of nationalization, to 450,000 tons in 1977 (Kalenga, 2014). In 1967, the nationalization of the UMHK was the turning point in the history of the company's management

(Kovar, 1967). Following nationalization, a lack of expertise among the decision-makers in the DRC resulted in undervaluation of state-owned assets. This practice constrained the country's ability to generate an effective return from the mining sector.

The Copperbelt increased its copper output reaching a peak of 16% of the total world mine production during the period under consideration. Until 2012, Zambia was the largest producer of copper metal in Africa, followed by the DRC, which has held the leading position since 2013 onward. The first international copper cartel, established in 1935, terminated prematurely with the beginning of World War II (Walters, 1944). Although Zambia and the DRC, as the major African producers, joined the second international copper cartel in 1967, their influence on the world price of the copper metal was ineffective because of the sudden decline in demand for the red metal. Also, in Zambia and the DRC, the previous owners maintained the technical production power and commercial networks, but African executives could produce metals for exportation to the world market.

American, British, and Belgian owners, who lost their exclusive control of mines and industrial plants after the nationalization, reacted by seeking an embargo on exports of copper to the world market (Lasaga, 1981). These owners immediately benefited from the solidarity of the principal buyers and brokers on the world market. However, a few months later, some European consumers resumed buying the red metal from the regions with nationalized copper mines. Rapid economic development leads to high demand for metals to build infrastructure and facilitate the industrialization process. From 1994 onwards, the increased Chinese appetite for zinc

Figure 8. Comparison of lead production in Chile, Peru, the Copperbelt, and the world.

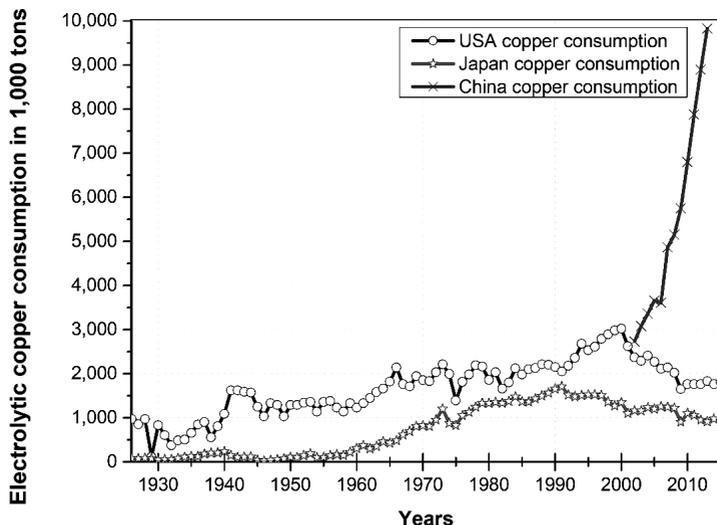


Source: Authors' collation from the computation of data from annual reports of UMHK 1911–1966; Gecamines 1967–2016; ZCCM 1928–2015; and the US geological database 1932–2016.

resulted in China becoming the largest producer and consumer of nonferrous metals. Figure 8 compares the share of the Copperbelt, Chile, Peru and the world market of lead.

Figure 8 shows that the quantity of lead produced in tons was insignificant in the Copperbelt, as well as in Chile and Peru, representing a tiny share of the world market for nonferrous metals. The same trend was observed for cadmium production in the Copperbelt relative to the world market. The DRC and Zambia play minor roles in the world market for cadmium metal for the entire period under study. The output of cadmium was insignificant in the world market. Furthermore, the trend of zinc

Figure 9. Consumption of electrolytic copper in tons in China, the USA, and Japan in metric tons.



Source: Authors' calculation using data from the US geology reports 1931-2018.

output in the Copperbelt accounted for less than 2% of the total world production. Figure 9 depicts the world's major consuming countries of the electrolytic copper from 1926 to 2015.

Figure 9 shows that the USA was the largest consumer of electrolytic copper metal until 2003, after which China became the world's largest

**Table 2. Summary of electrolytic copper consumption in the USA, Japan, and China in tons 1926-2015.**

Country	USA copper use in tons	Japan copper use in tons	China copper use in tons
Mean	1682.48	737.64	5467.75
Median	1760.00	820.00	5005.50
Mode	1760.00	52.00	N/A
SD	621.91	565.01	2397.60
Kurtosis	-0.25	-1.63	-0.85
Skewness	-0.20	0.07	0.66
Minimum	111.00	22.00	2736.00
Maximum	3020.00	1710.00	9830.00
Sum	149741.00	65650.00	65613.00
Observations	89.00	89.00	12.00

Source: Authors' collation from the computation of data from Stata Software.

producer and consumer of electrolytic copper. Table 2 summarizes the quantities of electrolytic copper consumed in three countries in tons.

Table 2 shows that the USA has been the leading consumer of electrolytic copper metal with the median value of 1,760,000 tons, which is double of Japan reaching 802,000 tons for the entire period, while China accounted for 5,000,000 tons during the last decade. Although the demand for copper metal has been increasing on the global market, the government policies implemented in the Copperbelt region did not equally distribute the income from the copper industry to local people. The Kofi Annan Report of 2013 found that the DRC lost US\$ 1.36 billion in five mining deals as a result of the alleged undervaluation over the period between 2010 and 2012 (Chan & Rowley, 2013). The case of the DRC better illustrates the high cost associated with opaque concession trading than any other country in the world. Indeed, reducing the actual value of concessions raises debate on the real intention of undervaluing the country's assets when granting the mining concessions. One reason would be the lack of expertise to accurately conduct the prospection and evaluation of ore deposits. In this regard, the Congolese government failed to play an important role in financing prospection projects to produce an accurate database of all national resources. Another reason could be secret agreements intended to attract bribes in mining operations.

The effect of opaque concession trading was that individuals became powerful and wealthy. At the same time, the public institutions lacked the budgets to finance development projects, despite the intention of nationalization supposedly being to redistribute the mining revenue to the population. This practice perpetuated the local people's poverty and misery

because they were excluded from the redistribution of national income. The mining towns and cities created around the production centres in the Copperbelt region witnessed a deterioration of living standards because the exploitation of metals enriched only the ruling class and neglected their fellow citizens. The situation became even worse during the nationalization period than it had been in the colonial era. Negi found that, in the North-western Province of Zambia, many towns did not have access to running water, electrical power, paved roads, or decent schools for preparing the next generation for a satisfactory life (Negi, 2011).

The gross per capita domestic product (GDP)<sup>7)</sup> in both Zambia and the DRC stagnated despite all political attempts to increase the living standards of the natives beyond the levels of the 1960s. In 1960, the per capita GDP was higher in Belgian Congo than Zambia. After 1985, the per capita GDP of Zambia exceeded that of the DRC. Since 2006, Zambia has achieved a per capita GDP of over 1000 dollars per person, while the DRC has become one of the poorest countries, at less than 500 dollars per year. Per capita GDP measures the market value of goods and services that can be bought on the market. The economist Parkin argues that GDP might be misleading in some cases. Indeed, some of the factors that influence the standard of living are not part of GDP, including household production, underground economic activity, leisure time, and environmental quality (Parkin, 2016). The informal sector has become the main source of income for most of the population in Zambia and the DRC.

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7) Gross domestic product (GDP) is one of the main measures of economic activity. The GDP of a country is defined as the total market value of all final goods and services produced within a country in a given period of time or a calendar year.

The mines' production of cobalt and copper in the DRC and Zambia does not necessarily translate into a better standard of living for people who claim to possess the rights to natural resources. When China started its business in Africa, it stressed a policy of non-intervention in Africa emphasizing not attach conditionalities to its foreign investment and aid (Bush, 2008). China has increased its production and consumption of metals for economic development. However, if appropriate management policy is not implemented, the "resource curse" will keep the Copperbelt region within a trap. Consequently, the producing countries in this region will continue to passively witness the depletion of their minerals, without any redistribution policy to change current trends. Kalenga found that the democratization of political systems in the region, beginning in the early 1990s, brought new hope to citizens, who believed that the income from the exploitation of mineral resources would overcome the prejudice experienced since nationalization (Kalenga, 2013). The governments of the two countries simultaneously engaged in the privatisation of the mines from 1992 to 2002. Privatisation is an umbrella term<sup>8)</sup>, and the decision to privatise usually involves financial gain, with governments selling state-owned enterprises to obtain proceeds either for short-term budget balancing or to pay debts (Henderson, 2008). Lungu argued that privatisation policies did not generate the expected revenue to finance the economic development in Zambia (Lungu, 2008).

During the colonial and nationalization periods, the DRC and Zambia

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8) Privatisation broadly means the shift of some or all of the responsibility for a function from government to the private sector. The common motivation for engaging in any type of privatisation is to substitute more efficient business operations for what are seen as less efficient, bureaucratic, and often politicized operations in the public sector.

supplied 60% and 11% of cobalt metal to the world market, respectively (Nyembo, 1975). The median value of copper metal production accounted for 32,000 metric tons and 315,000 metric tons in the DRC and Zambia, respectively. At the beginning of the privatisation, the DRC's cobalt metal output was at the lowest level of 3500 tons, representing 12.9% of the world's total production period, while Zambia was at the peak of 5900 tons, accounting for 25% of the world's total production. The collapse of the mines' production of copper and cobalt was a result of both domestic and external factors, especially the political instability that followed the end of the communist regimes and the formation of multiparty democracy. The Copperbelt region disappeared from the world market as a supplier of nonferrous metals. Kippin argued that the crisis at Gecamines in the 1990s reinforced the poverty cycle for the Congolese population (Kippin, 2008). The extensive cobalt and copper reserves within the region continued to attract foreign investment to meet the world demand for these strategic metals.

During the early 1990s, the production of minor metals, such as cadmium and zinc, ceased completely because of the collapse of metal production, including copper and cobalt. Although Zambia maintained its production of copper, it is surprising to notice the country's entire zinc metal production nevertheless collapsed. A closer observation of the production of zinc and cobalt metals shows a similarity in the behaviour of these two producing countries. The government policies relating to the copper industry in the two countries have been influenced by international financial organizations. The World Bank and the International Monetary Fund (IMF) advised African government officials to privatise the state-owned enterprises to improve their competitiveness on the global market and to guarantee the

borrowing of funds from the financial markets. The prospect of changing the Zambian copper industry from state-owned to privatised was proposed in a working report that the World Bank-funded in 1994 (Craig, 2001). However, Pitcher found that privatisation was a key element in the effort to expand black ownership of businesses enacted by the post-apartheid government in South Africa (Pitcher, 2012).

The decade from 2000 to 2015 witnessed a particular form of partnership with Chinese investors. When resources are scarce for the individual, they are also scarce for the economy as a whole. An economy has an abundance of different resources that can be combined in all kinds of ways to produce a myriad of goods and services. The nature of Chinese relations with Africa, especially in the Copperbelt region, changed due to the increase in its need for minerals in the early 2000s (to meet the high demand for nonferrous metals in the context of rapid economic growth). China is rich in mineral resources, leading in the world's tungsten and antimony reserves. Coal mining was the principal mineral industry in pre-war China (Wang, 1944). However, nonferrous metals are indispensable raw materials for economic development, and demand for these metals increases concurrently with the rate of economic growth (Sun & Sun, 2017). From 2009 onwards, China became the largest producer and consumer of the six major nonferrous metals: copper, aluminium, zinc, lead, nickel, and tin (Farooki & Kaplinsky, 2012). Between 1996 and 2008, the domestic output of ten nonferrous metals increased five-fold, of which copper, aluminium, lead, and zinc increased nearly four-, eight-, six-, and four-times respectively (Ren & Hu, 2012). In addition to the domestic supply, China launched foreign mining projects in the Central African Copperbelt, focusing on the extraction and importation of cobalt, copper, and zinc.

In the DRC, the production of these metals, which are used in batteries, did not recover as quickly as that of the principal metals. In 2012, a new plant was under construction at the Kipushi mine to extract and process zinc metal exclusively. The economic impact of mine production on local communities has been almost non-existent since independence. Clark observed similar effects in Asia (Clark, 2001). However, the important reserves of copper and cobalt attracted both human capital, Western technology, and entrepreneurship to maximize the extraction and processing of metals in the Copperbelt (Fetter, 1992). Also, many cities and towns were created during the colonial period to attract and settle a workforce from distant locations of Africa in the Copperbelt region. These cities improved the living conditions by reducing mortality and increasing the productivity of African workers (Fetter, 2001). The privatisation of mines, especially the recent Chinese investment, has extended the production possibilities in both Zambia and the DRC. In 2014, the mines' production reached its historical peak levels of 1,000,000 tons of copper metal and 100,000 tons of cobalt metal, respectively. In the twenty-first century, the innovation of electric vehicles, artificial intelligence, robots, and electronic devices with rechargeable batteries will steadily increase the demand for nonferrous metals. The Copperbelt will continue to play a key role in the world market for nonferrous metals.

## **5 Conclusion**

In this article, we have explored the growth of extractive industries in the Copperbelt focusing on those processing the nonferrous metals. Using the primary archives of the main producing companies in Zambia and the

DRC, we argue that the Copperbelt produced the median value of 50% of cobalt, 12% of copper, 3.2% of zinc, 1.8% of cadmium, and 0.6% of lead as the total share of the total world production. In comparison, Chile and Peru accounted for 13% and 3% of copper, respectively.

The colonial period was characterized by the introduction of European capital, technology, and human expertise to develop the copper industry. Following independence, the different policies adopted by Zambia and the DRC failed to generate the revenues needed to finance the economic development of these countries. Nationalization policies, government interference, political instability, combined with the mismanagement of resources in the early 1990s, resulted in the collapse of the copper industry in Zambia and the DRC. In fact, ZCCM maintained its industrial plants at a low production level, but the situation was so severe at Gecamines that the company closed its principal processing plants.

When Zambia and the DRC were dealing with the copper industry crisis, the World Bank and the International Monetary Fund advised the Sub-Saharan governments to adopt radical privatisation policies, changing their state-owned firms from public ownership to private ownership to attract foreign investment and human expertise. In 1992, the government officials privatised Zambian copper mining to make it more competitive. In the DRC, government officials decided on a semi-privatised joint-venture partnership of state-owned companies with private entities, resulting in Gecamines signing joint-venture contracts with foreign investors. These foreign investors assumed most of the ownership and management control of the mines. The management of the mining industry in Africa illustrates the complexity of balancing the expectations of all stakeholders.

Mineral exploitation in developing countries is usually a competition on two fronts: international and domestic. In the first case, multinational companies exert tremendous and overarching pressures on the leaders of developing countries. Usually, this pressure is irresistible and unavoidable, given the unequal financial relations between the third world countries and the multinationals. On the domestic front, the bourgeois elites fight it out with the masses, who remain poor amid abundant natural resources. Both emerging and developed economies need a stable supply of nonferrous metals to build their infrastructures and maintain high lighting manufacturing, so the world demand for copper and cobalt will continue to increase. Within the Copperbelt region, the North-western province in Zambia and the Lualaba province in the DRC should play pivotal roles as suppliers of cobalt and copper metals.

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