Meeting the EV challenge: Responsible sourcing in the electric vehicle battery supply chain

TRAFIGURA

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Executive summary

As one of the world's leading independent commodity traders, Trafigura deploys infrastructure, skills and our global network to move physical commodities from the places they are plentiful to where they are most needed. We make trade happen and we make it our mission to do that responsibly.

In this briefing paper, Trafigura sets out how it intends to meet the challenge posed by the rapid increase in demand for the raw materials for lithium-ion batteries, with particular regard to the cobalt supply chain.

The 2015 Paris Accord identified moving from fossil fuels to electrified transportation as a core strategy in the global effort to combat climate change. The transition to electric vehicles (EVs) is well underway. A growing number of governments around the world have announced plans to limit or ban sales of petrol and diesel vehicles. In the private sector, car manufacturers have announced multi-billion dollar EV-related investment programmes. Trafigura projects that the global EV fleet could reach in excess of 50 million vehicles by 2030.

The high energy density battery is a critical component for EV mobility and only lithium-ion chemistries currently deliver the required power and performance. This is driving demand for key raw materials, including lithium, graphite, nickel, and copper-cobalt.

Of these, the cobalt market has the most challenging supply chain. Under existing technology, each new EV requires 5–10 kg of cobalt. Trafigura's most conservative estimate is that annual demand for cobalt for EVs alone will reach 120,000mt by 2030, that is more than the total amount of cobalt produced globally in 2017.

Rapid market growth is needed to satisfy future needs, but the speed of the scale-up in cobalt demand is piling pressure on a vulnerable supply chain. Currently, two-thirds of global production comes from the Democratic Republic of the Congo (DRC). There are deposits elsewhere, notably in Australia and Cuba, but these are considerably smaller and relatively uneconomic to exploit, so future production is likely to be even more geographically concentrated.

Most of the DRC's industrialised extraction is controlled by a handful of companies; 80 percent of its exports go to Chinese refiners. It also has a large artisanal and small-scale mining (ASM) sector, which contributes to at least 20 percent, perhaps as much as 40 percent, of total cobalt production. Exact numbers are hard to come by, but it is thought to employ as many as 200,000 or more copper-cobalt miners[1], many of whom work with basic tools in tough conditions.

The informal nature of the sector makes it difficult to regulate. As a result, some upstream companies have decided to exclude ASM-produced materials from their supply chains. At Trafigura, we believe this is counter-productive. Constraining the supply of cobalt will only push prices up faster and that will encourage more, not less, ASM activity. What is more, the transition to EV should not come at the expense of the human rights and employment prospects of the many people in mostly marginalised communities that currently rely on work in this sector for their livelihoods.

With current technology, there is no realistic alternative to more cobalt. Trafigura proposes that the required rapid growth in global demand cannot be satisfied without a sustainable ASM sector. Engaging with that reality has to be the priority for producers, traders and refiners as they seek to meet evolving market needs.

The following pages examine the consequences for commodities of the transition to electric cars. They describe how we are partnering with NGOs and commercial operators to introduce responsible sourcing policies that enhance transparency, improve health and safety, and support employment in the DRC's ASM sector.

Trafigura is developing a new mining model with its partners that is formalising and professionalising ASM activity in the DRC, not just for cobalt but also in the closely-related copper sector, which has similar market dynamics. This model has the potential to transform the working lives of the more than 40 million people[2] that are directly engaged in the artisanal production of metals and minerals worldwide.

1 Source: https://uk.reuters.com/article/uk-artisanal-mining-ahome/commentary-for-cobalt-buyers-is-artisanal-mining-the-problem-or-the-solution-idUKKCN1G627E

2 Source: Intergovernmental Forum on Mining, Minerals and Sustainable Development (IGF), 2017. Global Trends in Artisanal and Small-Scale Mining (ASM): A review of key numbers and issues. 01 January. Available at https://www.iisd.org/sites/default/files/publications/igf-asm-global-trends.pdf

Market dynamics and EV mobility

Climate change and energy policy

In the historic 2015 Paris Agreement, 195 members of the United Nations Framework Convention on Climate Change (UNFCCC) signed up to a shared, long-term goal of keeping the increase in global average temperatures to well below 2°C above pre-industrial levels, and to aim to limit that increase to 1.5°C or less.

They also agreed that, to meet these ambitious climate mitigation targets, emissions would need to peak before 2020 and decline steeply after that. The International Energy Agency's (IEA) Sustainable Development Scenario (SDS) suggests that annual CO_2 emissions will have to be 43 percent below current levels by 2040 to stay on track with the 2015 Paris Agreement targets.

It is broadly accepted that meeting the Paris Accord objectives requires a reduction in the level of carbon emissions in the transportation sector. The obvious route to low-emission transportation is electrification of the vehicle fleet, in tandem with progressive decarbonisation of the global power grid. In ratifying the Paris Agreement, UNFCCC signatories agreed that, to keep global warming below 1.5°C, at least 100 million electric vehicles will be needed globally by 2030. This represents an increase of more than 30 times against today's levels.

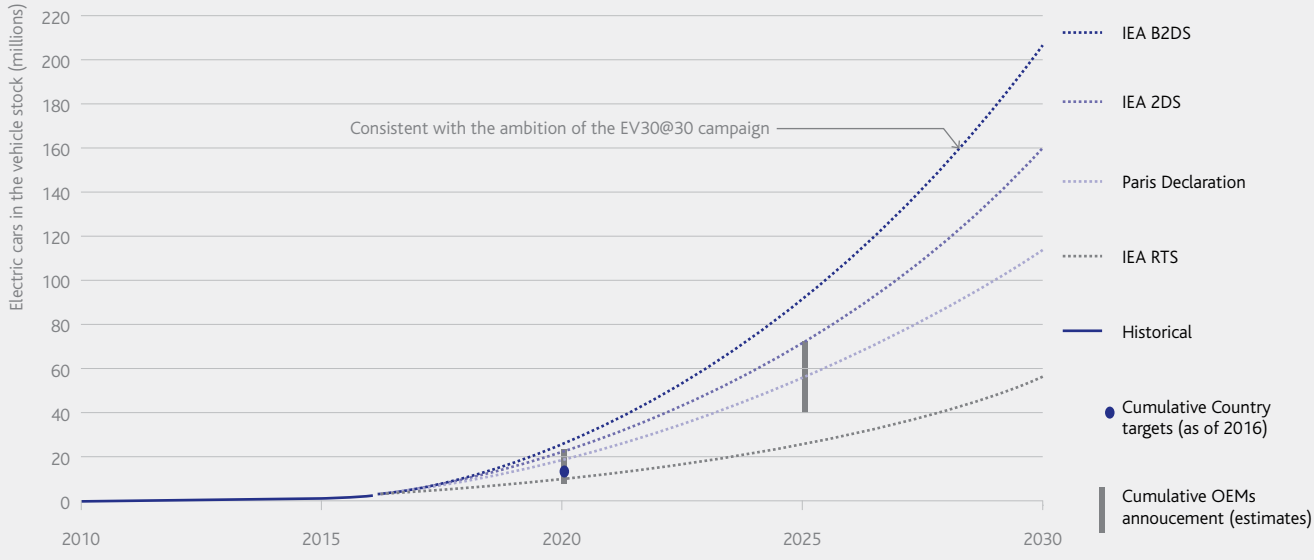
Since the Paris Agreement, nations have increasingly been coordinating their efforts to aid this transition. This, together with improved, lower cost battery technology, is stimulating rapid growth in the EV market. In 2017, record global sales of 1.1 million electric vehicles, a 54 percent increase on the previous year, increased the global stock of EVs to 3.7 million. In 2018, sales are on course to reach 1.6 million. China accounts for nearly half of all car sales and Norway has by far the highest per capita ownership[3].

EV sales and existing automotive manufacturer production announcements are well ahead of the SDS 2030 target. The IEA's central scenario now projects global stock at 130 million EVs by 2030. And as Figure 1 outlines, all indications are that that momentum is still accelerating.

By 2025, the battery market is expected to be worth $100 billion[4]. By 2040, batteries storing solar power for businesses and households will account for 57 percent of the world's energy storage capacity. Meanwhile, as EV battery technology develops, other future applications are coming into view, including drones and robots.

3,4 Source: The International Energy Agency, 2018. Global EV Outlook 2018. Towards cross-modal electrification. Available at https://webstore.iea.org/global-ev-outlook-2018

1 Deployment scenarios for the stock of electric cars to 2030



Source: Global EV Outlook 2018, OECD/IEA 2018

Rapid increase in EV demand

The rapid growth in EV adoption has more than kept pace with the ambitious objectives set out in Paris. EV batteries are now forecast to make up at least 90 percent of the lithium-ion battery market by 2025.

If emission targets laid out in the Paris Accord (COP21) and Electric Vehicle Initiative (EVI) commitments are to be met, 20 million vehicles must be deployed globally at a minimum by 2030 at a minimum. This looks entirely achievable.

2017 was a turning point for battery development and EV production. Governments around the world announced plans to phase out combustion engines, including France and the UK. Both will ban sales of petrol and diesel vehicles by 2040.

Also in 2017, the Clean Energy Ministerial, a global forum that brings together ministers with responsibility for clean energy technologies from the world's major economies, redefined the collective aspirational goal for EVI members. This includes eight of the world's ten largest automobile markets. The EV30@30 campaign is targeting a 30 percent market share for EVs by 2030. The EV30@30 scenario projects a global stock of 228 million EVs by 2030, around 100 million more than currently anticipated.

Meanwhile, in the private sector, car manufacturers have committed over $140 billion to EV projects over the next 10 years.

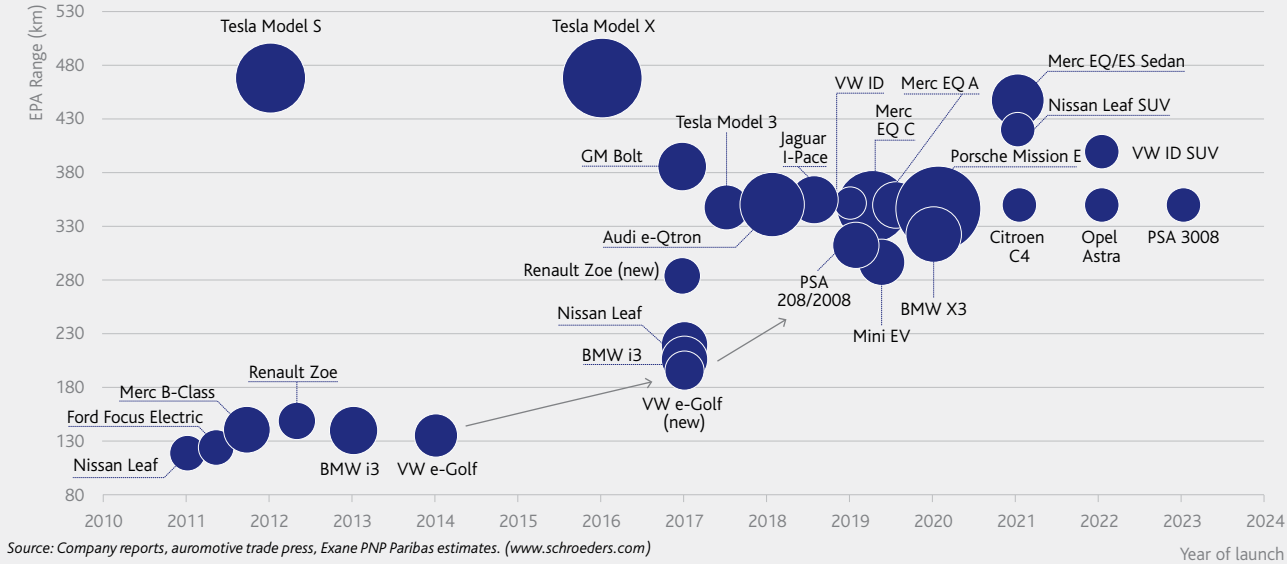
Volkswagen announced an $84 billion investment in electric cars and batteries in 2017[5]. It will launch 80 new electrified models by 2025; it will have electric options on all 300 of its models by 2030. BMW plans to produce 12 all-electric models by 2025 and will have electrified versions of all models by 2020. Mercedes will produce electric versions of all its models by 2022; it expects EVs to reach cost parity with traditional cars by 2025.

Longer-range EVs are crucial if they are to be marketable as standard family cars. Until recently, Tesla was the sole serious contender in the 300km+ EV market, but competition in this segment is now intensifying. Figure 2 highlights a proliferation of product launches in the run-up to 2020 and beyond. This increased product availability, along with greater consumer awareness and government support programmes, looks likely to kick-start EV transition in the wider market.

Forecasts on the rate of global auto-fleet electrification are successively being revised upward, mainly as a result of faster than expected reductions in battery costs. While the battery technology powering the vehicles of tomorrow isn't new, the unprecedented growth in scale is starting to test the entire electric vehicle supply chain and its ability to scale up.

5 Source: Lambert, F., 2017. VW announces massive $84 billion investment in electric cars and batteries 11 September. https://electrek.co/2017/09/11/vw-massive-billion-investment-in-electric-cars-and-batteries/

2 EV plan of major global manufacturers



Source: Company reports, auromotive trade press, Exane PNP Paribas estimates. (www.schroeders.com)

Promoting sustainable development

The development of battery-powered transportation is considered key to a greener future, but, paradoxically, realising this goal could inflict unintended harm on both humans and the environment.

Electric vehicles may be cleaner in operation, but without careful management, sourcing the raw materials for the batteries they require could impose significant social and environmental costs. The question for regulators, manufacturers and raw material producers is how best to stimulate and manage the exponential growth in raw materials required while meeting environmental objectives and avoiding harm for vulnerable communities.

If batteries are to help rather than hinder global sustainable development, the entire value chain needs to be addressed. Achieving that will depend on international coordination and close cooperation between public and private sector organisations.

There is significant untapped potential for innovation along the value chain. If electrification is to satisfy sustainable development objectives, considerable progress needs to be made to reduce battery production costs, enhance performance and maximise the benefits of the circular economy.

Recycling is another priority. By 2030, it is expected that up to 11 million tonnes of spent lithium-ion batteries will have been discarded. As yet, there are few effective recycling systems in place to minimise pollution and promote reuse and recycling.

In September 2017, the World Economic Forum (WEF) launched the Global Battery Alliance to meet these challenges. It brings together leading businesses from the entire battery value chain, along with governments, international organisations and NGOs. The WEF Global Battery Alliance seeks to connect and scale up efforts to ensure that the battery value chain is socially responsible, environmentally sustainable and innovative.

Trafigura is a founding partner. It is applying its expertise to the delivery of essential raw materials. It is engaging with its counterparts to manage the complex set of practical issues needed to develop a rigorous methodology for responsible sourcing of battery raw materials, with cobalt a particular focus.

Reducing the carbon footprint of batteries in electric vehicles

To meet the climate change challenge effectively, battery resources have to be used as efficiently as possible, while avoiding pollution and securing a strong supply of raw materials at low environmental cost.

Simply adding to the global stock of electric vehicles will not, by itself, deliver the necessary climate change benefits. Indeed, over their entire lifecycle – taking account of raw materials, manufacturing, use and recycling – electric vehicles could theoretically generate more carbon emissions than equivalent combustion engines.

For instance, on average, building an electric vehicle currently costs twice as much in energy terms as the equivalent petrol or diesel car. This is primarily because battery production is so energy-intensive. Raw materials have to be sourced, refined and transported, and the manufacturing process uses a lot of electricity. The situation is improving as economies of scale take hold, but increased production levels on their own will not unlock the full green potential of EV mobility.

EVs are generally far cleaner in operation than combustion engines, but the extent of this benefit is dictated by the electricity source. A fossil fuel-powered battery is necessarily dirtier than one powered by renewables. The more renewables there are in the national energy mix, the greater the achievable emissions reductions so governments have an important role to play.

Promoting the circular economy

The negative environmental effect of producing batteries becomes less material the longer they are kept in use. Although lithium-ion batteries are durable, they have a limited lifespan. Typically, after 10 years or so, their charging capacity will drop to 70-80 percent. At this point, they are no longer viable for EVs.

However, they can be used in other contexts and several companies are looking at secondary uses for used EV batteries in grid storage and other applications. This could add 10-15 years to the expected life of today's batteries. Of course, extending battery lives also defers recycling opportunities. As a result, more raw materials will have to be found from primary sources.

Volumes are currently limited as relatively few spent batteries are available, but this approach may well gain traction as the market matures. Battery recyclers are actively preparing the infrastructure for a future when greater volumes are available.

Cobalt is the material of most interest to lithium-ion battery recyclers. The high cost of cobalt extraction from ores makes recovering cobalt relatively attractive. The EU's CROCODILE project, which is setting up and operating a data exchange infrastructure for information sharing between all involved public authorities and private partners, is developing advanced metallurgical systems that have the potential to recycle 10,000 tonnes of cobalt annually. This represents nearly two-thirds of current EU demand. It could have a meaningful impact on the supply chain risk of cobalt for Europe. However, as battery technology advances, the proportion of cobalt in lithium-ion batteries is likely to decline and this may limit recycling in future by making cobalt recovery less economically attractive.

In any case, large-scale recycling of EV batteries is not expected to commence before 2020 and it will be 2025 before it is an effective alternative source. At least until then, demand for extracted cobalt will continue to accelerate.

Cobalt and the EV supply chain

Battery technologies and the need for cobalt

Its capacity for high energy density storage makes the lithium-ion family the key enabling battery technology. Different chemistries employ various combinations of anode and cathode materials. Each has advantages and disadvantages in terms of safety, performance, cost, lifespan and other parameters. The most prominent technologies for automotive batteries are lithium-nickel-cobalt-aluminium (NCA), lithium-nickel-manganese-cobalt (NMC), lithium-manganese spinel (LMO), lithium cobaltite (LCO) and lithium-iron phosphate (LFP).

Currently, the only commercially feasible technologies with the right gravimetric and volumetric energy density properties suitable for EVs are nickel-cobalt based.

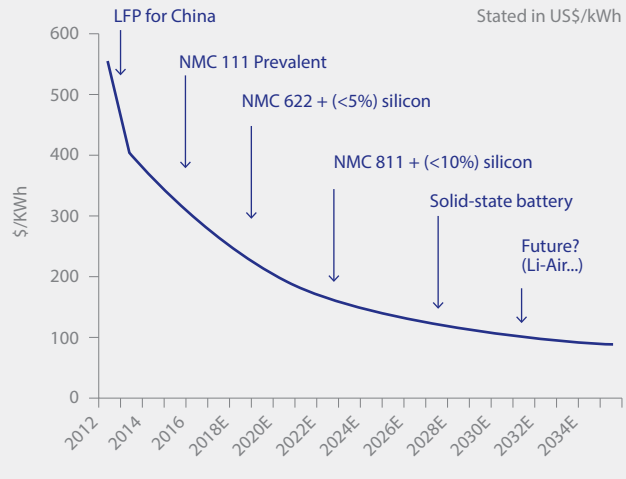
While there are some promising new directions, notably solid-state lithium-ion, these are still a long way from commercialisation, requiring significant R&D investment and improved economies of scale. With substantial sunk costs already in nickel-cobalt based technologies, it is unlikely that any such innovations will constrain the rapid growth in demand for nickel and cobalt in the battery space over the next decade.

The high cost of cobalt has encouraged battery manufacturers to seek alternatives, but it cannot be entirely eliminated. The current technological direction of travel is towards more nickel-dense chemistries, which tend to be cheaper and have higher energy density. However, even with the most nickel-dense chemistries, cobalt is still needed to preserve thermal stability. Since safety is of paramount importance, all commercial, high energy density cathodes will continue to contain cobalt for the foreseeable future.

3 Types of battery

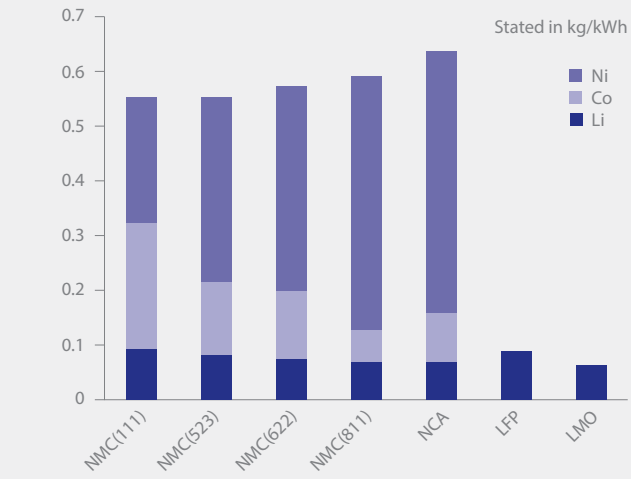
	USES	Li%	Ni%	Co%	ENERGY	POWER	SAFETY	LIFE	COST
LCO Lithium Cobaltite	Mobile electronics	40%	0%	60%	+++	+++	-	++	+
LMO Lithium Manganese Oxide	Nissan Leaf (old)	4%	0%	0%	-	+++	++	-	++
NMC Nickel Manganese Cobalt	Most new EVs	8%	20-52%	20-6%	+++	++	++	+++	+++
NCA Nickel Cobalt Aluminium	Tesla	14%	49-54%	9-6%	++	+++	++	+++	+
LFP Lithium Iron Phosphate	Chinese EVs (old)	5%	0%	0%	+	+++	+++	++	++

4 EV battery pack costs



Source: Bloomberg, SNE Research, Bernstein, Trafigura Research

5 Metal content of active cathode material



Source: Bernstein, Trafigura Research

Sourcing raw materials for battery production

As outlined in Figure 6 the growth in the market for rechargeable batteries will stimulate a large increase in demand for three key metals that act as raw materials. Battery-related demand for cobalt is expected to at least treble by 2025, exceeding total global production for all uses in 2018. The anticipated 350 percent growth in battery-related demand for lithium over the same period will, by 2025, equate to three-quarters of its expected global production.

The key raw materials for batteries are concentrated in very few countries. Securing access to these can pose social and environmental challenges. In some locations, mine workers and local people face exposure to pollution and serious social issues. Dust, fumes, water and air pollution are just some of the reported negative consequences. Human rights abuses have also been documented, with examples of hazardous working conditions and the use of child labour.

A 2017 MIT study concluded that some key constituents of batteries, including manganese and graphite, have sufficient supply for future demand needs[6]. There will be greatly increased demand from battery producers, but this will remain a relatively small proportion of overall global demand for these components.

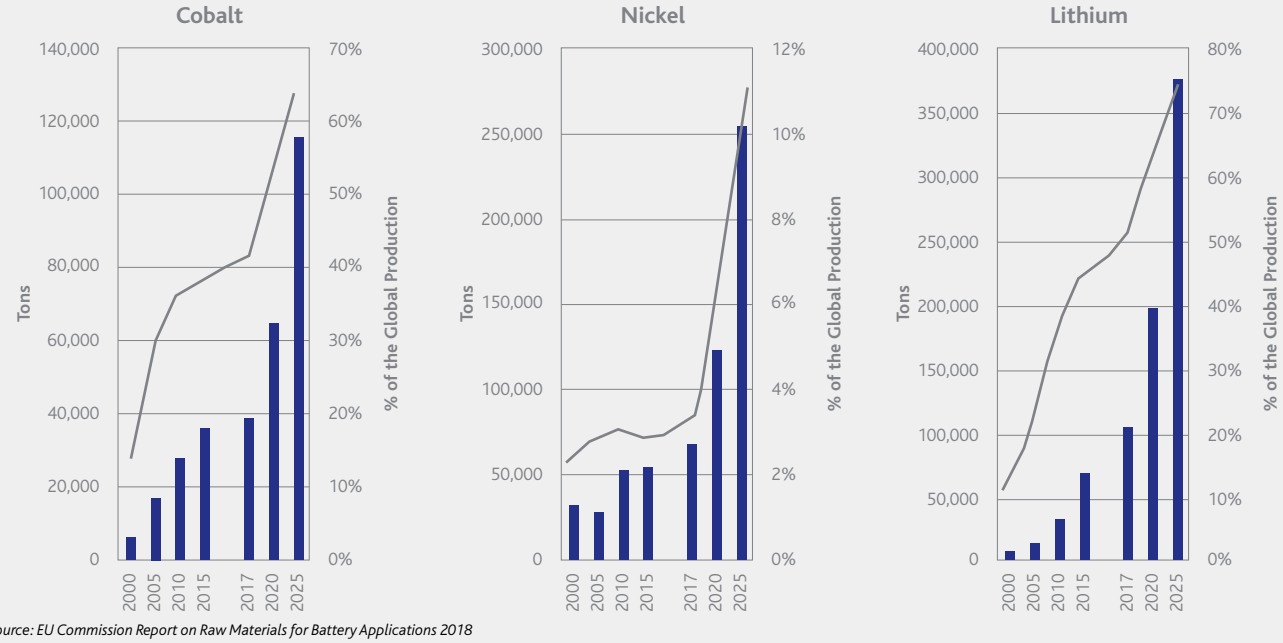
A McKinsey study expects EV-related cobalt demand to grow by 16 percent per annum. Total cobalt demand will be 210,000mt per annum by 2025[7], of which over half will be battery related. This will require additional supply capacity of 116,000mt compared to 2016 levels. Nickel production has suffered from chronic underinvestment for at least a decade and supplies of the class-1 nickel needed for EVs are less abundant. There are believed to be sufficient stocks to last until 2022-2023, but producers may need to invest in new capacity to meet future demand growth.

Lithium and cobalt are both likely to be supply-constrained in the near future. Lithium does, however, benefit from diverse extraction technologies. This suggests that, with more research, there will soon be sufficient supply to meet current demand estimates. What is more, lithium resource exploration is still relatively immature; additional resources are constantly being discovered.

6 Source: McKinsey, 2017. The future of nickel: A class act 02 November. https://www.mckinsey.com/industries/metals-and-mining/our-insights/the-future-of-nickel-a-class-act

7 Source: Olivetti, E.A., Ceder, G., Gaustad, G.G., Fu, X., 2017. Lithium-Ion Battery Supply Chain Considerations: Analysis of Potential Bottlenecks in Critical Metals Joule Volume 1, Issue 2, 11 October https://www.sciencedirect.com/science/article/pii/S2542435117300442

6 Metals demand for rechargeable batteries



Source: EU Commission Report on Raw Materials for Battery Applications 2018

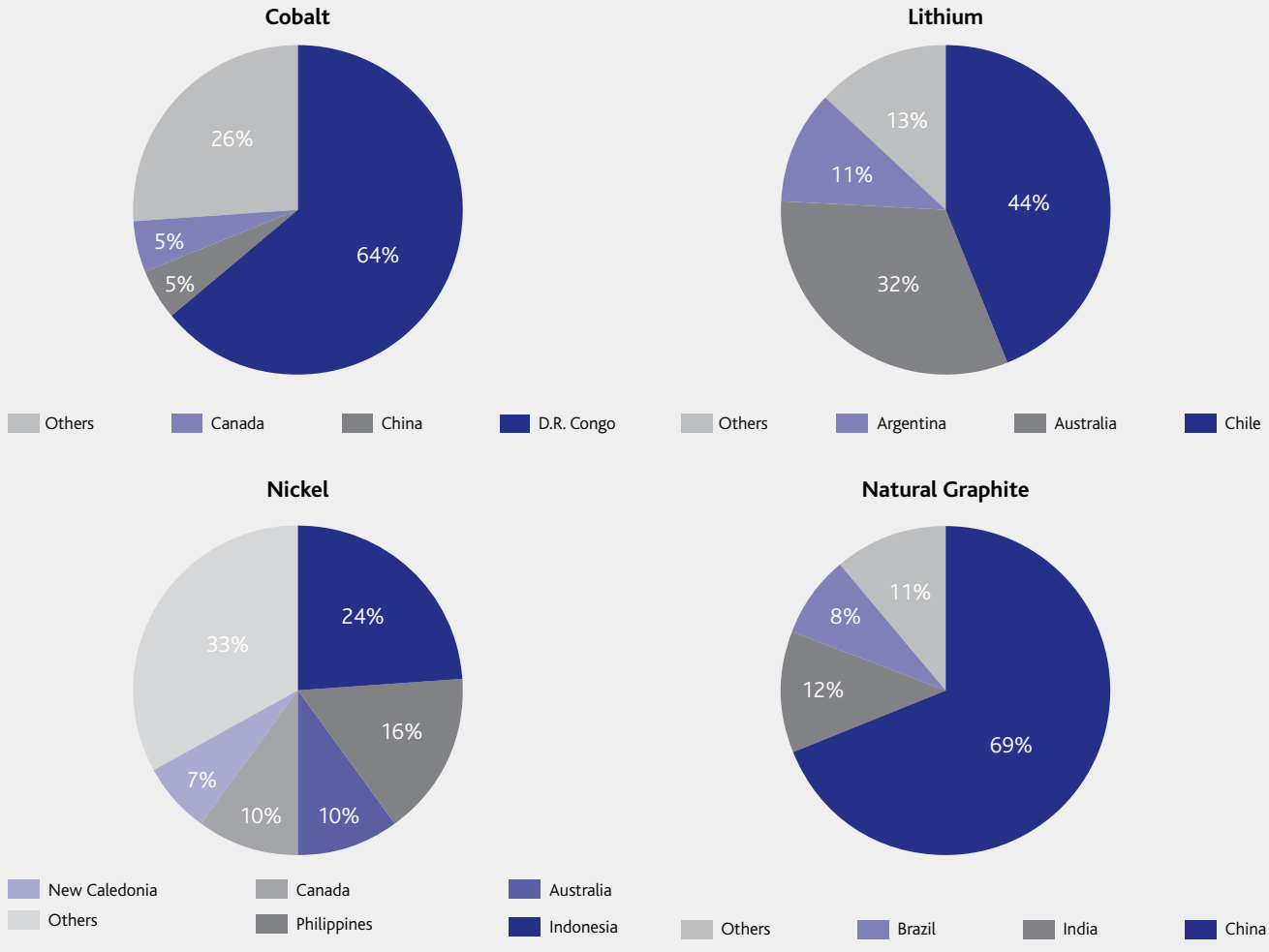
Of all the raw materials, cobalt is the most likely to suffer a supply shortfall. Indeed, anticipated future shortages are already reflected in the price, which quadrupled between 2016 and 2018.

The cobalt supply chain is particularly vulnerable. Cobalt production is heavily concentrated in the Democratic Republic of the Congo (DRC). That concentration that will only increase as new planned industrial mining comes on stream there.

Major manufacturers are now locked into a race to secure long-term supplies. Their requirements mean that lithium, cobalt, battery components and assembly plants, all need to be ramped up significantly to meet demand. The resulting scarcity is creating a sellers' market in the key raw materials.

To protect their supply chains, car manufacturers and other end-users are pursuing long-term agreements to source materials direct from miners. In 2018, Apple announced it was in advanced discussions regarding a five-year plus agreement to secure cobalt for its batteries. It joined BMW, VW and other manufacturers in the race to secure long-term supplies.

7 Global producers of raw materials for battery applications



Source: Report on Raw Materials for Battery Application

8 Global reserves – resources known to be economically feasible for extraction

	COBALT (T)	%	LITHIUM (T)	%	NICKEL (T)	%	GRAPHITE (T)	%
Argentina	–	–	2,000,000	–	–	–	–	–
Australia	1,100,111	15	1,500,000	–	19,000,000	24	–	–
Brazil	78,000	1	48,000	–	10,000,000	13	72,000,000	–
Canada	240,000	3	–	–	2,900,000	4	–	–
Chile	–	–	7,500,000	–	–	–	–	–
China	80,000	1	3,200,000	–	3,000,000	4	55,000,000	–
Colombia	–	–	–	–	1,100,000	1	–	–
Cuba	500,000	7	–	–	5,500,000	7	–	–
Democratic Republic of the Congo	3,400,000	48	–	–	–	–	–	–
Guatemala	–	–	–	–	1,800,000	2	–	–
India	–	–	–	–	–	–	8,000,000	–
Indonesia	–	–	–	–	4,500,000	6	–	–
Madagascar	130,000	2	–	–	1,600,000	2	940,000	–
Mexico	–	–	–	–	–	–	3,100,000	–
New Caledonia (France)	200,000	3	–	–	8,400,000	11	–	–
Philippines	250,000	4	–	–	3,100,000	4	–	–
Russia	250,000	4	–	–	7,900,000	9	–	–
South Africa	30,000	<1	–	–	3,700,000	5	–	–
Turkey	–	–	–	–	–	–	90,000,000	–
United States of America	23,000	<1	38,000	–	160,000	<1	–	–
Zambia	–	–	270,000	–	–	–	–	–
Zimbabwe	–	–	23,000	–	–	–	–	–
Other countries	610,000	9	–	–	6,500,000	–	960,000	–
World total (rounded)	7,000,000*	–	14,000,000	–	80,000,000*		230,000,000	–

*Manganese nodules and cobalt-rich crusts on the sea floor are estimated to contain more than 120 million tonnes of cobalt and large quantities of nickel (USGS, 2016).

The race for cobalt

Trafigura estimates that cobalt demand for EVs alone will reach 120,000mt by 2030. If EV volumes approach projected EVI initiative levels, those numbers could easily be a significant underestimate.

Just 6 percent of cobalt production is attributable to cobalt mining operations. Cobalt is typically mined as a by-product at nickel (50 percent) and copper (44 percent) mines. As a by-product, its pricing has traditionally been linked to the demand for these primary metals. This linkage may decouple as supplies become scarce and competition gets more intense.

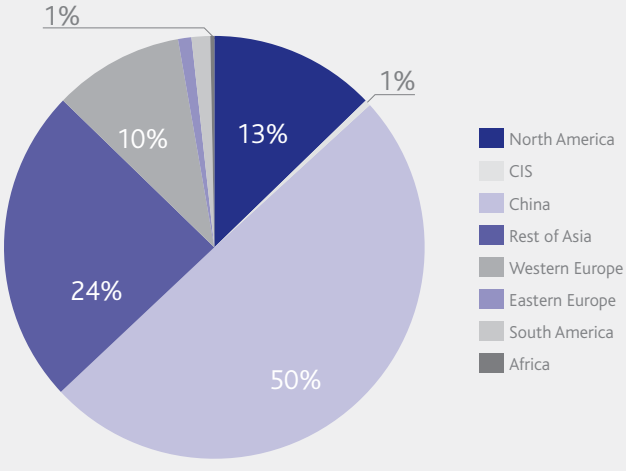
Copper-cobalt ore deposits are found primarily in the Lualaba province of the DRC. These usually contain at least 0.5 percent cobalt and 4 percent copper. Most of those orebodies are found close to the surface, making open-pit extraction, the most cost-effective mining process, feasible. In other parts of the world, cobalt is found underground in nickel-cobalt deposits at much lower concentrations. Globally, only two countries – the DRC and Australia – have significant cobalt resources. The average grade of Australian cobalt resources is 0.1 percent versus an average grade in the DRC of 0.5 percent or more.

Lualaba's cobalt is therefore significantly cheaper to extract and the region has become the world's leading source for the mineral. Over 64 percent of global cobalt production takes place in the DRC. Over the next four years, the majority of global production growth will come from new projects in the Lualaba province. This will increase the DRC's share to close to 75 percent by 2022.

China, the world's biggest cobalt consumer, is responsible for over 50 percent of global cobalt demand. China produces just 1 percent of its cobalt domestically and is heavily reliant on raw material imports, particularly from the DRC, from where it offtakes around 80 percent of cobalt production. China also controls 80 percent of global cobalt refining. Much of the other 20 percent is processed in Finland, but the cobalt raw materials feeding the Finnish refiners also originate from the DRC.

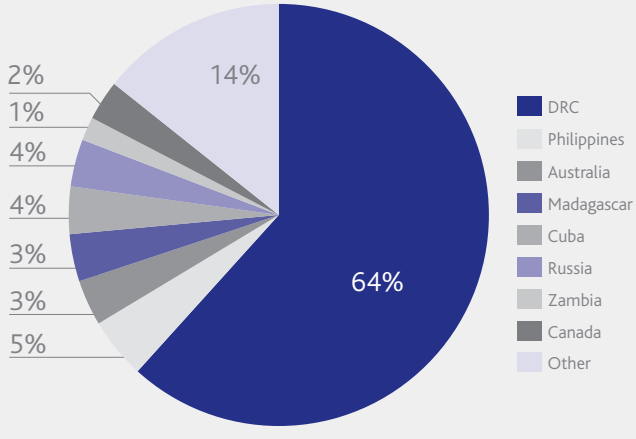
Given China's significant and growing domestic requirements, the question for the international community is how it can source the additional cobalt it needs to develop electrification and meet projected EV growth.

9 Primary cobalt demand – 2018



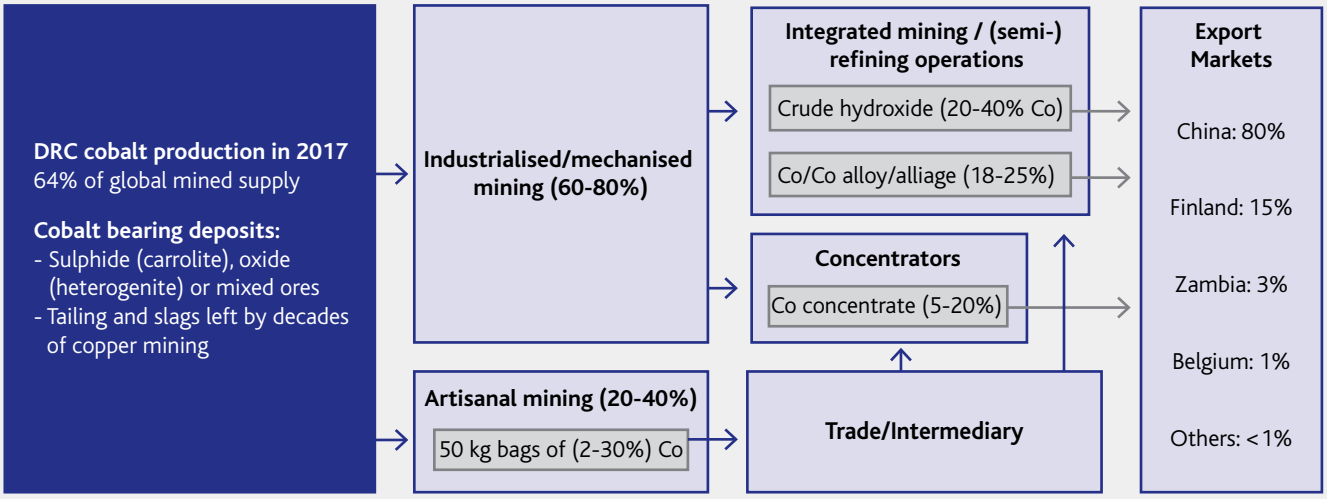
Source: Trafigura research

10 Primary cobalt supply – 2018



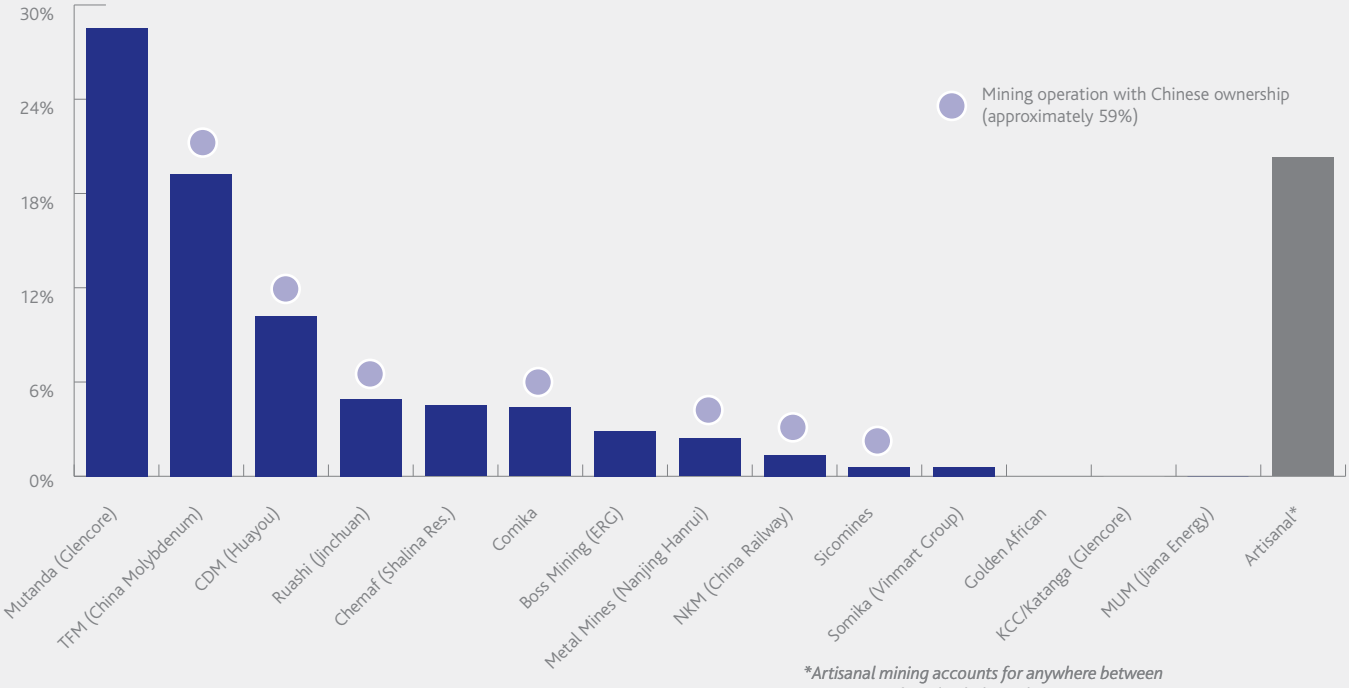
Source: Trafigura research

11 DRC cobalt production



Source: Trafigura research, Darton Commodities Ltd, company reports, estimates

12 DRC cobalt production by producer (2017 estimates/cobalt contained in MT)



**Artisanal mining accounts for anywhere between 20% - 40% of total cobalt production in DRC*

Source: Trafigura research, Darton Commodities Ltd, company reports, estimates

The role of artisanal and small-scale mining (ASM) in the supply of raw materials

Cobalt is mined through a variety of means – at mechanised and semi-mechanised operations, as well as through artisanal and small-scale mining (ASM). Mechanised mining is typically undertaken by major international mining conglomerates. ASM is highly labour-intensive and is conducted by individuals, small groups and larger cooperatives, often supplying middlemen and aggregators who have access to international markets.

While their methods are simple, the operational impact of artisanal mining on a global basis can be significant, accounting for somewhere between 10–20 percent of the world's supply of all metals and minerals according to the International Institute for Environment and Development (IIED).

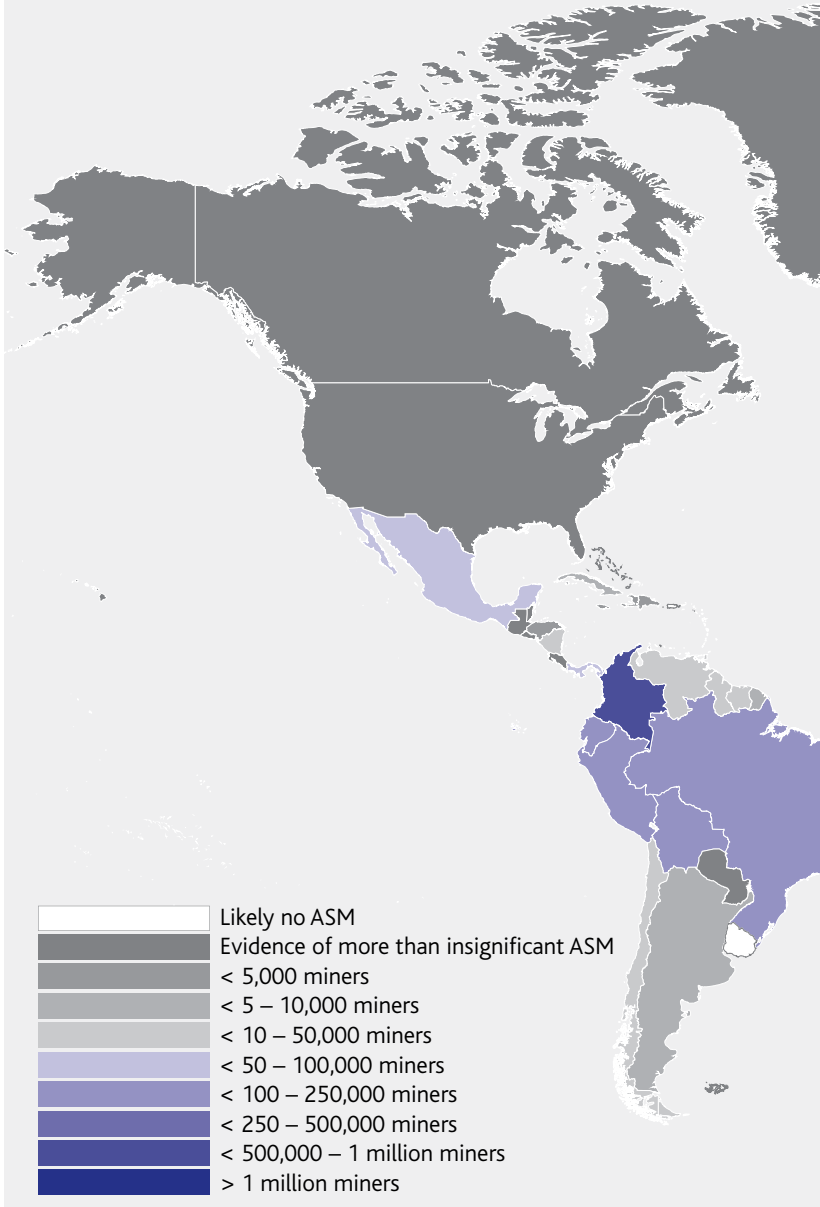
Rising international mineral prices and limited viable alternatives for income generation at a local level have contributed to the growth of the sector in recent years. In 2017, over 40 million people were estimated to be directly engaged in ASM worldwide, up from 30 million in 2014. Many more are affected: the World Bank reported in 2013 that around 100 million people worldwide – workers and their families – were reliant on artisanal mining; by comparison with 7 million people depended on industrial mining for their livelihoods that year.

Where DRC cobalt production is concerned, the relative ease with which the material can be recovered and the fact that it represents a source of such concentrated and growing wealth, has led to a significant rise in ASM activity. Although an exact number is difficult to pinpoint, it is estimated that there are as many as 200,000 or more copper-cobalt artisanal miners in the DRC.

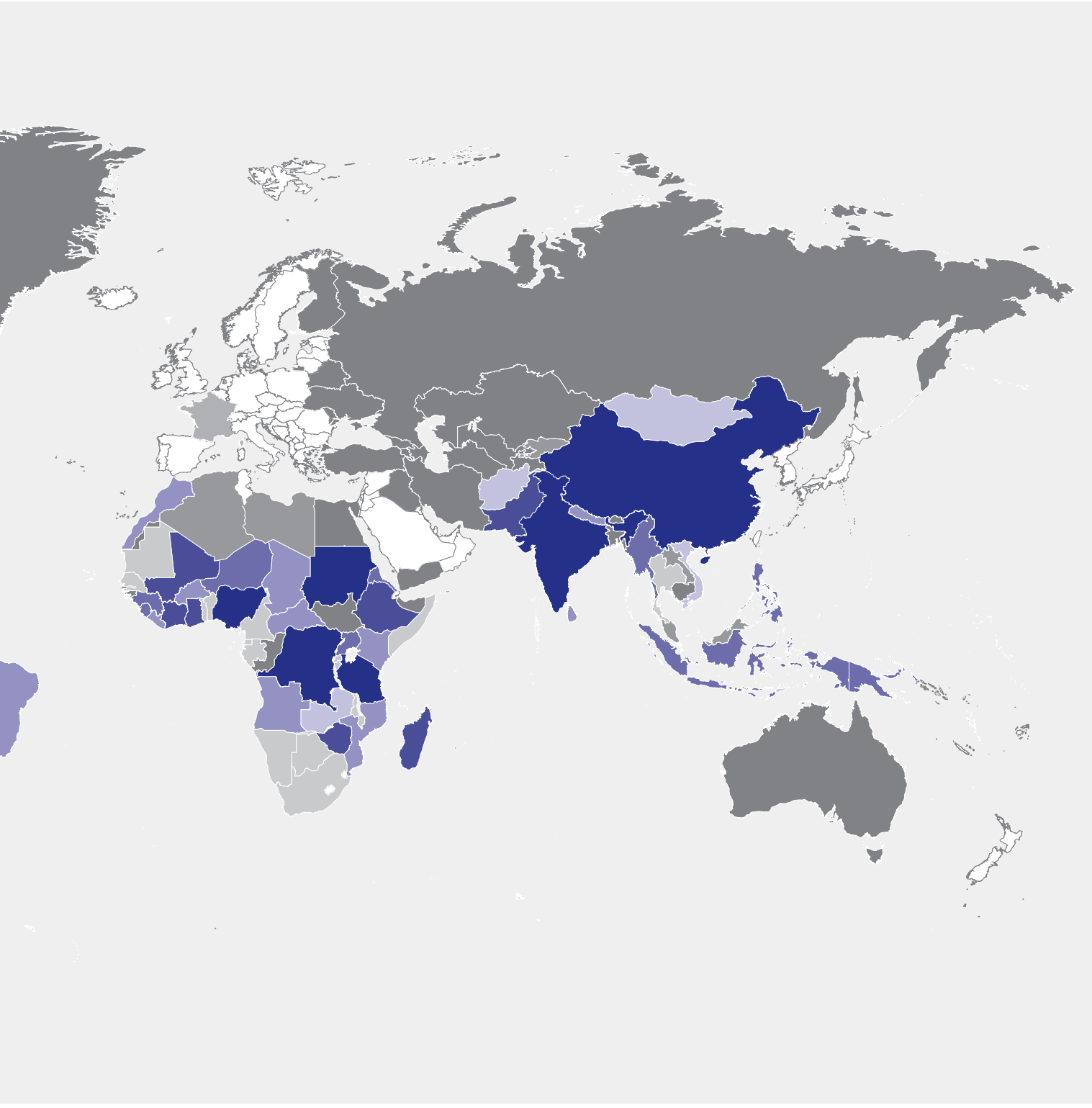
While the development of mechanised mines is both highly capital and resource intensive, production from ASM can very quickly deliver substantial volumes of high-grade cobalt.

But accepting and unleashing the potential of ASM cobalt as a driver for sustained economic development, can only be legitimately undertaken if the significant social, environmental, governance and reputational risks are mitigated.

13 Estimated number of artisanal and small-scale miners per country for all raw materials.



Source: www.artisanalmining.org, 2018



Responsible sourcing

Responsible sourcing: A practical perspective

As one of the world's leading commodities traders, Trafigura recognises the potential for adverse social or environmental impacts associated with the extraction, processing and sale of all metals and minerals – whether originating from mechanised or ASM sources.

The company's Responsible Sourcing programme, which directly reflects the OECD's 'Due Diligence Guidance for Responsible Supply Chains' (OECD Guidance), is aligned with relevant regulatory requirements such as Section 1502 of the US Dodd-Frank Act, as well as forthcoming EU Conflict Minerals Regulation. Importantly, the programme also extends to the purchase of all metals and minerals, geographies and those activities that Trafigura deems to be of greater risk.

Trafigura has a growing interest in the procurement and onward trade of cobalt. In 2018, the company announced a long term supply agreement with Chemaf, a leading mineral exploration, mining and processing company in the DRC. A component of Trafigura's agreement with Chemaf provided for ongoing support to Chemaf in building the company's ability to manage social and environmental impacts across its operations – particularly in relation to Chemaf's exposure to ASM at its Mutoshi concession in Kolwezi.

In an ever more complex operating environment, and with increasing demand for responsibly-sourced materials from international markets, Trafigura has seen a significant rise in requests from other commercial partners to enhance and sustain similar programmes of work.

Understanding and responding to ASM in the cobalt supply chain

Almost two-thirds of the world's cobalt is supplied by mines in the DRC. Between 20 and 40 percent of the cobalt mined there comes from the ASM sector. Often these miners are not in official employment, use basic tools, have no formal training and own limited safety equipment as they dig their own unsupported tunnels. Instances of child labour and other human rights abuses have also been reported. Even though their methods are simple, the economic impact of artisanal mining is immense: The Washington Post reports that artisanal miners contribute up to 25 percent of the world's cobalt supply.

This creates a problem, one which was poignantly illustrated in a report: *This is what we die for: Human rights abuses in the Democratic Republic of the Congo power the global trade in cobalt,* released by Amnesty International in January 2016. The report accused major companies, typically reliant on ASM production in part or in full, of taking limited or no action to prevent human rights abuses such as child labour occurring in their cobalt supply chains.

As consumer and media pressure mounts on major cobalt purchasers, global automotive and electronics companies are rightfully looking to choke points in their supply chain for assurance that proportionate measures are being taken to mitigate risks.

In response, the China Chamber of Commerce of Metals, Minerals & Chemicals Importers & Exporters (CCCMC), the Responsible Cobalt Initiative and the Responsible Minerals Initiative have sought to establish expectations for refiners to conduct due diligence on cobalt supply chains through their *Cobalt Refiner Supply Chain Due Diligence Standard*.

The initiative will surely gain momentum – requiring companies upstream, whether reliant on mechanised production or ASM flows, to demonstrate their efforts to source responsibly.

The need for a nuanced approach

In an effort to eliminate the risk of child labour and dangerous working conditions in the supply chain, the complete avoidance of artisanal mining might seem an obvious solution. But in reality this is neither practical nor desirable.

Artisanal mining in the DRC remains an important and legally recognised revenue generator for hundreds of thousands of people living in extremely challenging circumstances. Important to note is that ASM does not occur in isolation – it is often part of, neighbouring to, or integrated within, major mining operations.

As witnessed over the course of Trafigura's due diligence activities in the DRC and Zambia, the intersection between the formal and informal mining sectors can take many forms:

- Long-term, as well as transient, establishment of ASM digging communities on formal mine sites – often leading to protracted friction between parties;
- Persistent and unauthorised incursions of ASM diggers onto formal mechanised mine sites;
- The appointment of ASM cooperatives by mining houses to work on mining concessions, either prior to or alongside mechanised production;
- Direct or tacit support for ASM by local authorities either in line with, or in contravention to, legislation, including formal and unofficial taxation of ASM;
- 'Open market' purchases of ASM material by mining houses, often anonymous or covert with the intention of 'topping-up' production for onward sale;
- The direct purchase of ASM material by small buying stations for onward large-scale aggregation and smelting.

Managing expectations

In light of the above, Trafigura has committed to working with commercial counterparts to isolate and address the many challenges that ASM sourcing presents. Not only does this approach seek to support the miners themselves, but it is also helping Trafigura build mutually beneficial and long term commercial relationships with counterparts up and down the chain.

But the challenges of working with the ASM sector remain significant. Human rights impacts are shared – to varying degrees – between those directly involved with, or impacted by, formal and informal large-scale and small-scale cobalt mining.

Washing of cobalt ore at the Mutoshi concession in the DRC

Case Study: Facing the challenge at Mutoshi

Considering Chemaf's intention to develop its Mutoshi concession, initially through the appointment of ASM contractors, Trafigura engaged internationally respected NGO 'Pact' in January 2018, to support Chemaf in the ongoing maintenance of a responsible mineral sourcing programme in line with Trafigura's standards.

Pact has extensive experience working with artisanal miners in challenging environments and is a sector leader in the practical implementation of responsible ASM sourcing. Trafigura's growing partnership with Pact also extends to leveraging the organisation's developmental expertise in other localities and relevant to other business relationships.

Conducted in close collaboration with Chemaf and Trafigura, Pact's pilot intervention at the Mutoshi concession has already yielded important results, including:

- Strong liaison with government agencies, local stakeholders and mining cooperatives through the establishment of an official 'ASM committee';
- Registration of miners under formal cooperative structures;
- Development of controlled sites for ASM production on the Mutoshi concession under close observation by DRC state agents 'Service for Assistance and Supervision of Artisanal and Small-Scale Mining' (SAEMAPE), Chemaf and Pact staff;
- Establishment of standards of operation, health and safety and mineral processing, among others, at ASM sites to ensure security, efficiency and transparency;
- Development of road and transportation infrastructure to facilitate access to the mine site by ASM cooperatives and a buying station controlled by Chemaf;
- Secure transportation of ASM production by covered/controlled/tagged trucks to Lubumbashi for processing purposes by Chemaf.

The power of partnership

Many challenges remain and an intensive and sustained work programme is required to mitigate the risks identified. However, Trafigura believes that its partnership with Chemaf and Pact provides an important case study in collaboration between the formal mechanised mining sector and the often marginalised ASM mining sector.

Moreover, we believe that the model we are developing could offer important lessons to opinion formers and policy makers alike, in aiming to satisfy growing demand for cobalt, whilst supporting and promoting fundamental human rights, improving mining standards and efficiency, and maintaining high levels of local employment.

Trafigura will report on the progress of the partnership in its annual Responsibility Report and will continue to seek the counsel of the OECD and the World Economic Forum's Global Battery Alliance, of which Trafigura and Pact are founding members.

Day-to-day formalised ASM operations at the Mutoshi concession, DRC.

Viewpoint: Pact

Artisanal and small-scale mining (ASM) has a vital role to play in poverty alleviation and rural development. It also poses severe human rights and social challenges. The mining model pursued over the last 30 years has focused on industrialisation and pursued economies of scale for mineral extraction. A persistent focus on large-scale mining has pushed ASM to the margins, allowing it to be disregarded and remain largely unregulated.

Yet ASM supports millions of livelihoods around the world and can be a major contributor to local and national economies. The men, women and sometimes children that work in the sector use basic tools in tough, often unsafe conditions to produce as much as 15 percent of the world's cobalt, 15 percent of its new gold, 50 percent of its tin, and over 80 percent of coloured gemstones. Ninety percent of the world's mine workers are artisanal miners. They produce around 10 percent of all minerals.

ASM is difficult and dangerous work, but it is also lucrative. Miners generally earn more than other rural workers. Their higher income is recycled into local communities. Flourishing markets for goods and services develop around mining areas, stimulating local economic opportunity and development. Although ASM can sometimes divert labour and resources from other important economic activities, it also provides a financial fall-back in times of drought, crop failure, or population displacement.

Mineral smuggling and illegal trade is part-and-parcel of ASM activity, but the sector also generates important revenues for the state. In many cases it can be a significant contributor to GDP. Where governments have recognised its potential contribution they have acted to divert mineral flows onto the legal market. In Zimbabwe, for instance, changed gold buying policies, competitive pricing and practical market adjustments have increased ASM gold flows significantly. Zimbabwean ASM employs around 7 percent of the workforce, produces some 31,000 ounces of gold annually and contributes 1.2 percent to GDP. In the Great Lakes Region of Central Africa, introducing traceability of tin, tantalum and tungsten (3Ts) means that over 20,000 tonnes of conflict-free minerals per annum can now be produced and traded by ASM operators with full payment of all legally required taxes.

The social and environmental challenges and abuses associated with ASM are widely understood. In conflict-affected areas, miners are frequently forced to work under duress. In areas of extreme poverty, workers may be operating in dangerous conditions. Large-scale mines also complain about ASM's inefficiency and poor product quality. Some are concerned that the sub-standard ore bodies it produces contaminate their own products.

Given these facts, it is entirely understandable that there are those that advocate for ASM to be replaced with larger, safer installations, but this fails to appreciate its economic and cultural importance. There have been many well-intentioned initiatives to create alternative livelihoods for artisanal miners. They have rarely been successful. For practitioners, ASM is more than just an attractive source of income, it is imbued with history, cultural significance and questions of resource rights.

Rather than trying to avoid, ignore or ban ASM, we need to explore ways to manage it responsibly and look at how we can integrate ASM material more effectively into formal supply chains. These are the world's hidden suppliers. By recognising and engaging with them, it becomes possible to assess their socio-economic importance more accurately. Once their value has been properly quantified, their potential contribution to sustainable development can be improved.

The systems and procedures employed by large-scale mines may not be applicable to ASM, but there is a 'sweet spot'. Artisanal production can be made more efficient, safer and be better regulated through small-scale mechanisation and by enforcing minimum expectations for responsible supply chains. This approach can help to maintain the high levels of employment it offers while enhancing its contribution to communities and the state.

The challenges posed by responsible cobalt sourcing offer a remarkable opportunity to demonstrate the value of this formalisation of ASM in mainstream mineral markets. If this can be achieved, the benefits for the sector will stretch far beyond Africa's Copperbelt.

www.pactworld.org

OECD Guidance for upstream companies

The UN Guiding Principles on Business and Human Rights (UNGPs) require companies to take proactive steps to ensure they do not cause or contribute to human rights abuses within their global operations and do respond to any human rights abuses when they occur.

Therefore, to comply with current international standards, all companies that purchase cobalt, or components that contain it, must conduct supply chain due diligence.

The OECD Due Diligence Guidance recognises that companies at different stages of the supply chain have differing responsibilities. Upstream companies, which it defines as including smelters and traders, are expected to map the circumstances of the extraction, trade, handling and export of their minerals. Their due diligence should include expert on-the-ground assessment. They are also required to provide any information they gather to their downstream customers. Additionally, they are expected to take steps to identify, assess and manage any human rights abuses in their supply chain. They should, for example, act to minimise the risk of exposure of artisanal miners to abusive practices and support the progressive professionalisation and formalisation of the sector.

The OECD five-step framework

The OECD Due Diligence Guidance is a set of guidelines, endorsed by governments, for the responsible management of global mineral supply chains. It provides management recommendations, respects human rights and avoids contributing to conflict through mineral or metal purchasing decisions and practices. The guidelines cultivate transparent, conflict-free supply chains and sustainable corporate engagement in the minerals sector.

The OECD five-step framework outlines:

1. **Establish strong company management systems**
2. **Identify and assess risk in the supply chain**
3. **Design and implement a strategy to respond to identified risks**
4. **Carry out independent third-party audit of supply chain due diligence at identified points in the supply chain**
5. **Report on supply chain due diligence**

The Due Diligence Guidance may be used by any company potentially sourcing metals or minerals from conflict-affected and high-risk areas. Companies are required by law to follow the framework if US listed, and from 2021, it will be enforced by the EU specifically for the purchase of tin, tantalum, tungsten and gold (also known as '3TG' conflict minerals).

Viewpoint: The importance of supporting ASM – the OECD perspective

The *OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas* clarifies how companies can identify and better manage risks throughout the entire mineral supply chain, from miners, local exporters and mineral processors to the manufacturing and brand-name companies that use these minerals in their products.

The Guidance, which is applicable to all minerals and is global in scope, aims to help companies respect human rights, observe applicable rules of international humanitarian law in situations of armed conflict, avoid contributing to conflict, and cultivate both transparent mineral supply chains and sustainable corporate engagement in the mineral sector.

The overall objective of the Guidance is therefore twofold:

- To build secure, transparent and verifiable supply chains; and
- To promote responsible investment and trade in fragile areas.

In this context, one of the substantive areas of OECD's work in the responsible sourcing of minerals is to ensure that international standards do not further marginalise workers of the informal sector. This implies working on the formalisation of ASM.

The OECD, together with participating stakeholders of the OECD Guidance implementation programme, aims to support all initiatives seeking to improve international market access for legitimate artisanal mining communities, so that they can benefit from ongoing trade in conflict-affected and high-risk areas and to support their development.

ASM can play a crucial role for the local development of rural economies in producing countries. This acknowledgment led to the inclusion of a specific appendix in the OECD Guidance, calling on stakeholders to engage in the legalisation and formalisation of artisanal mining communities. The OECD has also developed a booklet that provides practical guidance and answers frequently asked questions relating to sourcing from artisanal and small-scale mining globally. Even though the document was specifically developed for sourcing of gold, the OECD considers that the principles and approaches outlined therein may also be relevant for sourcing any minerals from artisanal and small-scale miners, including cobalt.

It can be very challenging for international companies to engage, or even consider engaging with artisanal and small-scale miners, for various reasons. For example, one of the first and most immediate challenges often put forward by companies is the illegality of most of the ASM producers. This issue, however, does not represent under the OECD Guidance sufficient grounds for not engaging in this potential business relationship. In this instance, the OECD Guidance recommends that companies work with artisanal miners that are not associated with the most severe forms of risks[8] and who are willing to engage in credible legalisation processes; and use their leverage – jointly with local partners – to engage local authorities and convince them to tolerate and support responsible ASM production and export by allowing for formalization and legalisation.

This is only one of the many challenges of exploring commercial relationship opportunities with informal ASM entities. However, experience has shown that these challenges can be overcome when companies choose to adopt a progressive and constructive stance. The OECD is encouraged to see the increased interest from the international community (governments, international organisations, industry associations and civil society organisations) to engage in collaborative approaches to promote responsible ASM production of all sorts of mineral resources. Still there is a need for even greater awareness within the global industry in particular that responsible production also means sourcing responsibly from conflict areas and supporting artisanal miners in their efforts to meet the new demands of the market.

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8 As described in the Annex II of the *Due Diligence Guidance* http://www.oecd.org/daf/inv/mne/OECD-Due-Diligence-Guidance-Minerals-Edition3.pdf

Conclusion

The global market for EVs is gaining momentum. Governments are regulating in support of electrified transportation, infrastructure is being rolled out, manufacturers are investing, battery technologies are improving and consumers are increasingly buying into the benefits.

The speed and scale of this transition is testament to industry's ability to innovate and rapidly expand productive capacity to meet a major global challenge. This commercially-driven success has shifted the focus to the provision of raw materials.

For upstream companies, the challenge now is to match that innovation by radically scaling up the supply of physical commodities to meet fast-growing market needs. Trafigura is determined to do all it can to ensure that its customers continue to have access to the physical commodities they need when and where they require them.

When demand outstrips supply, large-scale, mechanised mining can deliver additional capacity. However there will always be significant lead-in involving exploration of long-term commercial viability followed by feasibility studies, extensive construction of plant, infrastructure and access routes. It can take years.

In the cobalt supply chain, the situation is further complicated because the element is usually extracted as a by-product of copper or nickel mining. Any investment decisions in new capacity have historically been informed by the market dynamics for these metals.

The ASM sector operates on a much smaller scale and that radically reduces lead-times. This increased scalability can make a decisive contribution in markets with rapidly growing demand. Upstream companies benefit by sourcing ASM materials, but they must also use their leverage to ensure fundamental respect for the dignity, human rights and employment prospects of artisanal miners.

The rapid growth in EV-led demand for cobalt creates a risk that it becomes a bottleneck in the EV supply chain. By engaging with ASM production through its partnership-based responsible sourcing model, Trafigura is helping to alleviate that risk. We are working closely with regulators, NGOs and commercial counterparts to plot an approach to mining that recognises and seeks to address the many challenges faced in working alongside the ASM sector.

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