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Fueling the future of mobility
Battery metals will not be for everybody

How western EV players should secure their end-to-end value chains, to cope with current geopolitical risks?

Introduction

The global pandemic, starting 2020, demonstrated that the established status quo of global trade, especially in raw resources, as well as cross-continental supply chains are more susceptible to disruption than thought before. This has been further exacerbated by the conflict in Ukraine, which extended consequences on global trade strained production and supply of crucial goods – such as grain, gas as well as metals for the modern industry.

Furthermore, the progressive transition towards green mobility will require sizeable amounts of special metals. For instance, NCM (Nickel – Cobalt – Manganese) batteries use 20+ different key materials across 6 main modules: Cathode, Anode, Battery System, Module periphery, Cell housing, Electrolyte separators and other components. Among all those materials, Lithium (2.1% in weight), Cobalt (6.1%), Nickel (6.1%), Manganese (5.7%) and Graphite (16.1%) appear most critical ones for an NCM111 battery[1,2].

In 2021, nearly 10% of light duty vehicles sold globally were EVs (however, four times the market share of 2019), amounting a total of 6.6M units (of which 4.4M EV, and the rest PHEV), and bringing the global fleet to 16.5M units (BEV of PHEV). As far as the heavy-duty market is concerned, in 2021, the global electric bus stock was 670 000 (4% of total) and electric heavy-duty truck stock was 66 000 (0.1% of total)[3].

Going forward, by 2030, as penetration will increase, according to the IEA "Stated Policies Scenario", the global EV fleet across all road transport modes (excluding two/three-wheelers) will expand rapidly up to 200 million vehicles: an average annual growth of over 30%, reaching an approx. 7% global penetration rate[4].

Therefore, EV batteries sector is expected to capture a more and more significant share of metals demand by 2030. The expected uptake in EV adoption will be reflected in the EV share of metals demand. 50+% of the lithium extracted in 2021 (as lithium carbonate equivalent) was used in EVs and storage[5]; this proportion should reach 80+% in 2030 following typical EV penetration rates scenarios[6]. Similar patterns are expected for Cobalt (34% i in2021[7]), Nickel (4% of Class I and Sulphate in 2021[8]) and natural Graphite (18% in 2019[9]).

Figure 1: Key components of a typical NCM111 battery
Lithium, Cobalt, Nickel, Manganese and Graphite are critical metals for battery production, being key components of the Anode and the Cathode

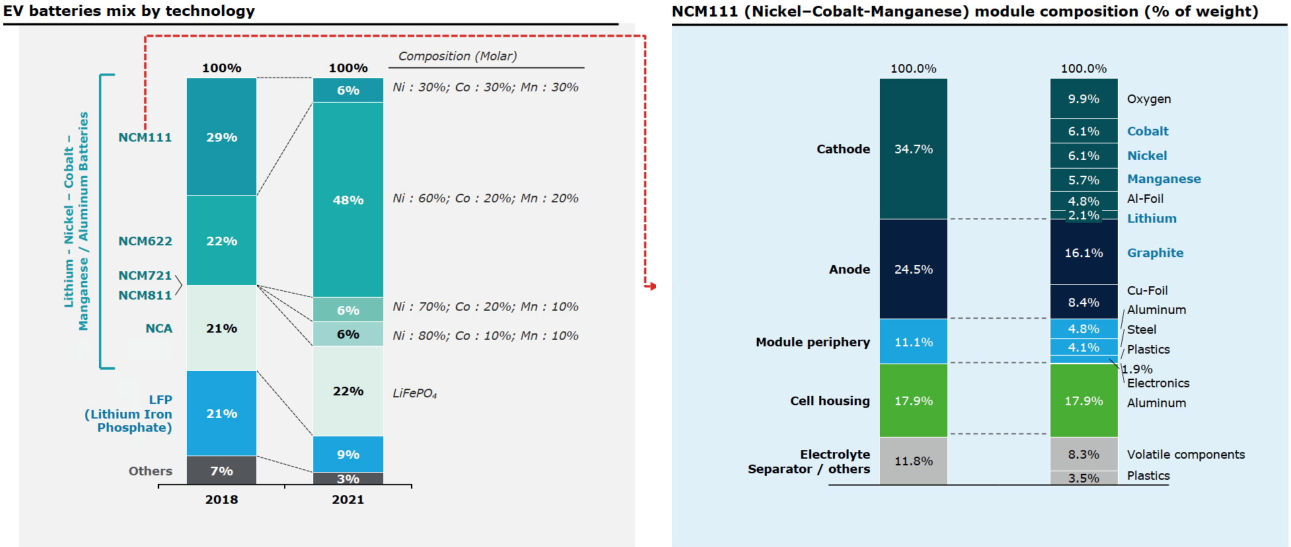
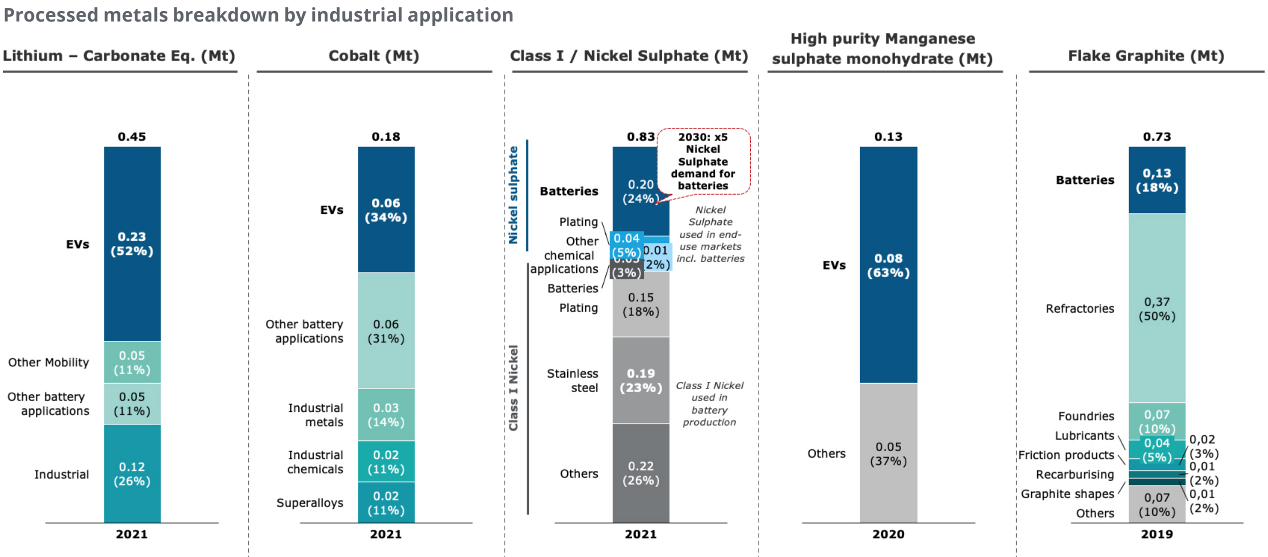


Figure 2: EV battery metals demand by application (2021)
Share of use by application for critical EV battery metals



Sources: Benchmark Mineral Intelligence; USGS; IEA; Monitor Deloitte Analysis

In this document, we will try to bring elements to discuss a major strategic issue in the field of EV battery metals for car manufacturers aiming at having a maximal impact on climate transition. Indeed, as the EV battery metals supply demand balance is expected to be tight in the future, and supply chains exposed to global geopolitical risks, what are the key industrial options to be developed?

- Beyond building-up joint ventures to secure batteries production near to their final assembly plants and end-markets, which upstream value chain stages of which metals should car manufacturers control in priority, reducing their overall country risk exposition and avoiding being China – dependent?
- Are there already any relevant experience feedbacks by major car manufacturers (GM, Stellantis, Tesla ...) to learn from?

Ev manufacturers must secure their supply chains, and beyond building batteries giga factories, also take care of the upstream stages, especially metal processing:

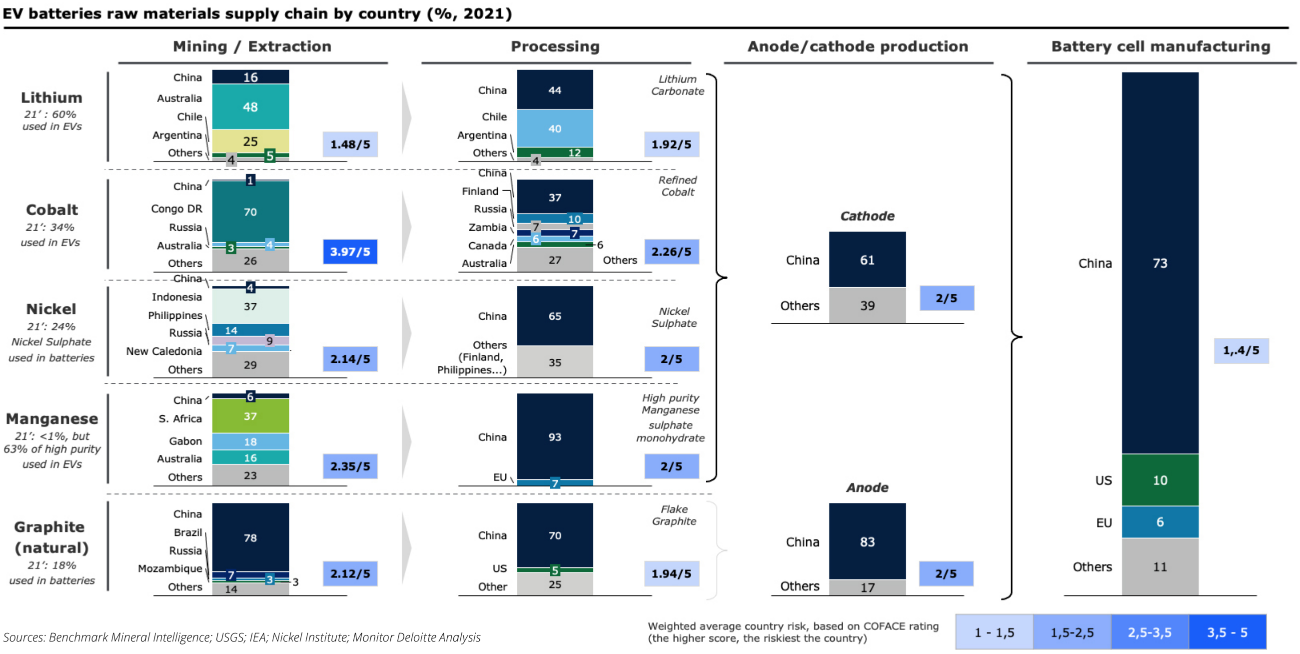
As EV demand strongly grows, car manufacturers and their suppliers are wisely hustling to increase battery production capacity, usually close to their final assembly plants and markets. It is estimated that there are currently over 300 battery giga factories in the construction or planning stages around the world. North America and Europe are trying to catch up with China (with respectively 11 and 8 giga factories added to their pipelines), and car manufacturers are massively investing in JVs with battery companies (i.e., 14 of the 23 North American giga factories in the current pipeline are JVs)[10]. Such acceleration in the downstream part of the value chain is crucial, as Europe is currently being dwarfed by China on anode (83%) and cathode (61%) production so as battery cell manufacturing (73%)[11].

However, having a firm foot in the downstream part of the batteries value chain is nothing if the metals supply is not put under control. Indeed, as the demand pressure from EV batteries will become stronger and stronger on a few critical battery metals (Li, Co, Ni, Mg and Graphite), the question of securing the upstream metals supply becomes also crucial for automotive manufacturers.

For each of critical metals, mining is usually concentrated with up to 3 to 4 countries having 70%+ global market share[12] (e.g., Australia, Chile, Argentina, and China with 95% of Lithium extraction), usually having a limited to moderate country risk (see Appendix for country risk definition), at the exception of Cobalt, being mainly mined in Congo DR. The leading countries are usually different for every metal, Lithium coming in majority from Australia and South America (Chile, Argentina), Cobalt for Congo DR, Nickel from Indonesia, Philippines, Russia and New Caledonia, Manganese from South Africa, and Gabon. The only Chinese stronghold is natural graphite where China holds 78% global markets share in 2021[13].

On the processing part, EV battery production processes require specific metal varieties, which can be for instance characterized by their degree of purity. Typically, only Grade I Nickel (>99.8% nickel) and Nickel Sulphate can be used in EV batteries, as opposed to Grade II Nickel, which is widely used in the steel industry. The same is also true for Manganese: 63% of the production of high purity Manganese sulphate monohydrate is used in EVs. This is nevertheless a very small share of the total Manganese production, 90% of which being dedicated to steel, and which has many other applications.

Figure 3: Key countries involved in EV batteries metals value chains, and their associated risk levels
Except for mining, the metal supply chain for EV battery cell manufacturing is overwhelmingly dependent on China



Sources: Benchmark Mineral Intelligence; USGS; IEA; Nickel Institute; Monitor Deloitte Analysis

The supply environment is therefore different here. Indeed, China is positioned at the 1st place for the processing stage on almost every value chain (93% of high purity Manganese sulfate monohydrate, 70% for Flake Graphite, 44% for Lithium Carbonate, 37% for refined Cobalt, and 65% for Nickel Sulphate).

Even if current China country and business climate risks are considered as rather moderate[14], such a high level of dependency on a country with potentially unpredictable behavior – especially in the current fuzzy geopolitical environment – puts at jeopardy European car manufacturers efforts to secure their EV batteries supply chains. Obviously, recycling comes here again as an attractive lever for EU players to secure local sources of EV battery materials.

What can we learn from recent western car manufacturers on the ev metals value chains?

To cope with the rising uncertainty on EV battery materials value chains, so as with skyrocketing prices (e.g., Lithium price has increased by 400% over the 4 last years) car manufacturers, such as Tesla, Stellantis and GM are developing different types of partnerships, either capitalistic or not.

- **Long term purchase agreements** have been established by several manufacturers: Stellantis secured a 10-year deal with the Californian lithium supplier Controlled Thermal Resources (CTR)[15]. The European manufacturer is planning to launch 25 new EV models in the US, aiming for 5 million EV sales worldwide by 2030.

  Tesla has also secured its nickel supply with a long-term agreement with Vale, as well as Indonesian, Chinese and New Caledonian (Prony Resources) mining companies. Even though Tesla had initially committed to sourcing cobalt only from North America, it signed an agreement with Glencore, to source cobalt coming as a by-product from its copper-mining operations in Congo DR[16].

- **Capitalistic moves have also been performed.** Stellantis invested in the Australian start-up Vulcan, extracting lithium in Europe based on a new process called "Direct Lithium Extraction"[17]. In 2020, Tesla bought lithium claims on 10,000 acres in Nevada. The company is considering going one step further and getting into lithium refining with a $375 million plant project in Texas being under study[18]. Finally, in October 2022, General Motors announced that it would invest up to $69 million and take a stake in Queensland Pacific Metals (QPM) to secure a new source of nickel and cobalt for battery cells for its automotive production[19]. Following Tesla's example, which is buying nickel from Prony Resources in southern New Caledonia, General Motors will use Caledonian ore from the SLN mines. The raw material will be processed in a new plant on the East Coast of Australia. The battery-grade nickel will then be shipped to Detroit, GM's historic headquarters in the US.

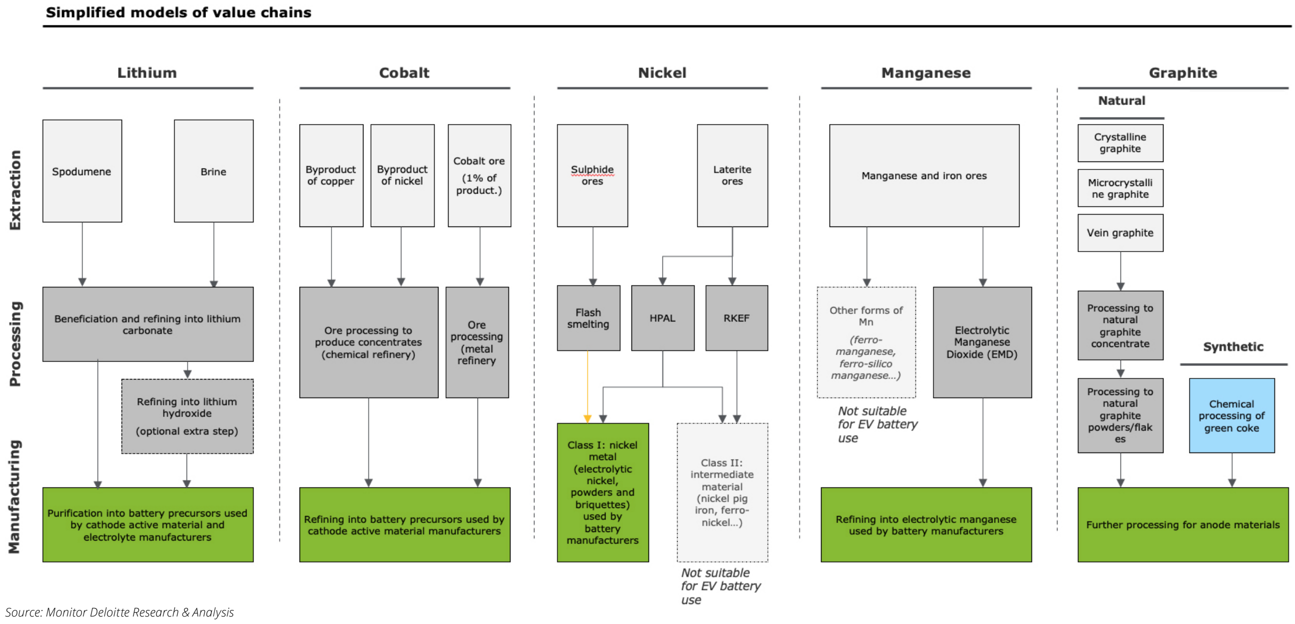
Conclusion

To cope with EV battery metals scarcity, and take the most from available metals to have the best impact on the road to a greener mobility environment, car manufacturers should deploy the following action plan to strengthen the resilience of their inbound value chains:

- **Secure metals supply on both mining and processing value chain stages** with "Western" players, through both long-term purchase agreements and wise capitalistic moves,
- **Continue establishing battery giga factories** through JVs close to final assembly plants and end markets.

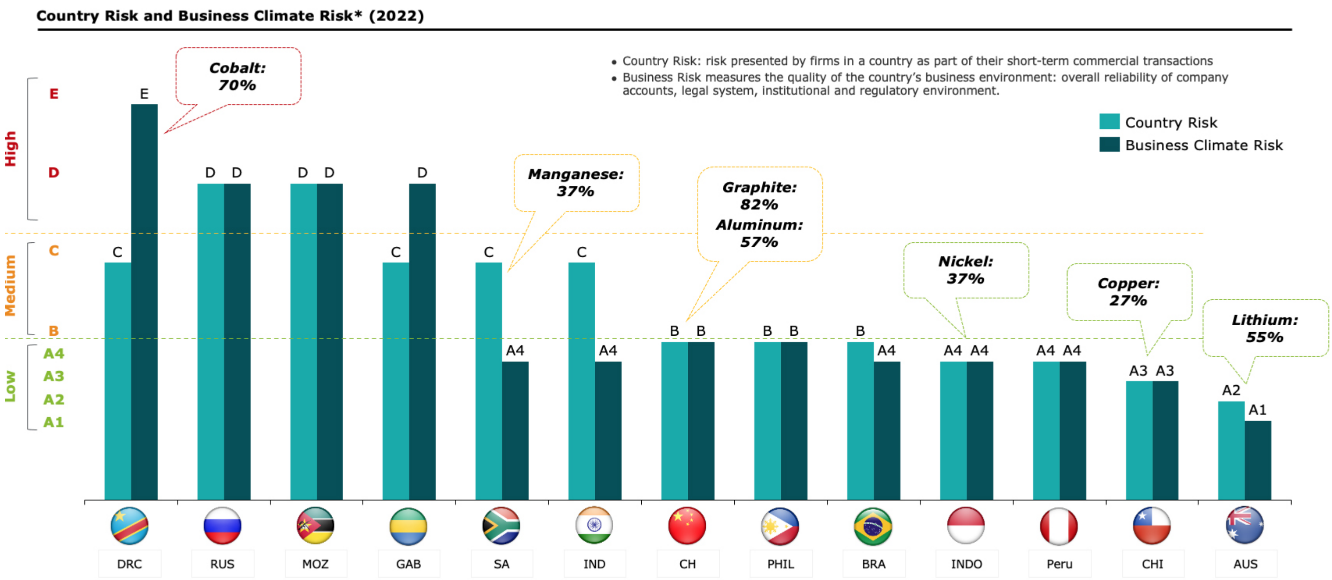
Appendix

Figure 4: Simplified of critical material for EV batteries
Critical metals simplified value chains



Source: Monitor Deloitte Research & Analysis

Figure 5: Country risk, as per COFACE (2022)
Some of the essential metals for EV batteries are dangerously concentrated in a single risk prone country (e.g., 70% of Cobalt in Congo DR)



Sources: USGS; IEA; Coface; Monitor Deloitte Analysis

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Glossary

EV: Electric Vehicle

GHG: Green House Gas

LCV: Light Commercial Vehicle

LFP: Lithium Ferro Phosphate (Batterie)

LMO: Lithium-Ion Manganese Oxide (Batteries)

LNO: Lithium-Ion Nickel Oxide (Batteries)

NMC: Nickel Cobalt Manganese (Batteries)

PHEV: Plug-in hybrid electric vehicle

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