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Faces of capital in green transitions: Examining the actors developing and financing global lithium extraction projects

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Abstract

Technologies of green transitions, including electric vehicles and advanced battery systems, require vast amounts of lithium. Sites of lithium extraction are expanding rapidly to meet rising demand, with a wide assortment of actors seeking to capitalize on the opportunity. With lithium extraction known to pose various social and environmental threats to surrounding ecologies and communities, the actors involved are assuming a delicate and grave responsibility. Therefore, this study seeks to illuminate the evolving global landscape of lithium extraction, focusing on projects under development and the actors financing, developing and engaging with them. Using S&P Global's financial analytics platform Capital IQ, the study has traced vast and complex networks of investors, developers and customers associated with 23 of the world's most significant lithium extraction projects under development. It finds that significant projects are underway on every major continent, underpinned primarily by multinational corporations relying on diverse sources of international finance. It also observes regional variances in capital-intensity, ownership structures and investment dynamics. The paper argues that the profit-motive of capitalism is fundamental to these distinctions, compelling the question of whether lithium extraction that is inevitably centered on corporations' obligation to accumulate capital can be genuinely sustainable.

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1. Introduction

Climate change is arguably the most pressing development issue of our time, cutting across all areas of social and environmental wellbeing. Green transitions – referring here to the diverse visions of shifting societies' reliance on fossil fuels to renewable energy – are at the center of existing policy action against the climate crisis (Blair and Balcázar, 2022). The technologies due to replace fossil fuel systems – from solar panels to electric vehicles (EVs) and advanced battery systems – require vast amounts of minerals, known collectively as energy transition minerals (ETMs).

One such ETM is lithium, a vital and currently non-replaceable mineral in batteries that is today primarily extracted from the salt flats of Chile and the hard-rock deposits of Australia. Due to the crucial role of batteries in green transitions, the lithium landscape is on the precipice of drastic changes. If countries take action consistent with the Paris Agreement goals, lithium demand will rise by over 40 times between 2020 and 2040 (IEA, 2022, p. 9). Anticipating this staggering rise in demand, investment in lithium production is exhibiting similar voracity, with the lithium market size recently swelling to almost seven times its 2017 value (IEA, 2023, p. 12).

This trajectory implies an inescapable dilemma. On the one hand, lithium is an essential mineral to green transitions, and on the other hand, its extraction causes water depletion, biodiversity loss, pollution and land loss for Indigenous peoples (Bos et al., 2024; Chordia et al., 2022; Dorn et al., 2022). Assuming its necessity to avert climate collapse, and considering the threats implied in its expansion, lithium extraction is a delicate and grave responsibility.

Due to lithium being geologically abundant, many countries are aspiring to enter the lucrative market for the first time (Goodenough et al., 2021; S&P, 2024). Furthermore, owing to geopolitical tensions, primarily between the U.S. and China, several countries are seeking to reconfigure global supply chains of various ETMs, including lithium. Threats of supply chain disruptions, geopolitical and otherwise, are also motivating a diversity of actors to engage more directly with the lithium industry, such as EV manufacturers (Dempsey and Campbell, 2022).

These growing interests in lithium extraction arise against a backdrop of a global economic system that has never been more intensive and total in its consumption of planetary resources (Dunlap and Jakobsen, 2020). Furthermore, the mineral demand of green transitions risks perpetuating gross injustices that characterize historical and contemporary resource extraction, in which costs of prosperous consumption are externalized to regions and communities that reap none of the benefits (Axel Anlauf, 2017; Brand and Wissen, 2021).

In this vein, this research evaluates the conditions under which lithium extraction is being undertaken, specifically by delineating where new extraction sites are being developed and examining the actors invested in their development. This task is contextualized by the present state of global capitalism, in which "all… other factors are subordinate to the one question of whether resource production will produce monetary returns to investors" (Huber, 2021, p. 167).

1.1. Purpose and aim

The present study aims to look beyond the well-documented socio-environmental impacts of lithium extraction towards the actors funding and seeking to profit from it, in the name of green transitions. It focuses on a subset of the world's most significant lithium projects under development and traces the actors engaging with them. These actors are effectively entrusted with delivering and employing the raw materials of green transitions, a fundamental task for the future of the planet. In particular, the following reasons motivate the topic and angle.

Fundamentally, the study seeks to illuminate the web of actors that underpin this new era of extraction compelled by green transitions. Arboleda (2020a, p. 22) muses that global capitalism can feel like "a faceless, 'structural' force that exists in a separate plane of reality to that of the mundane workings of states and firms [which is] politically paralyzing and analytically obfuscating". In this vein, the research scrutinizes the "faces" of the actors enabling and driving new lithium extraction projects, thereby contributing to making these particular networks slightly less opaque and more accessible.

Furthermore, through the case of lithium as an ETM, it aims to add nuance to narratives of green transitions as inherently sustainable. Green transitions are generally pursued alongside a continuation of massively uneven consumption patterns around the world (Brand and Wissen, 2021), and a global economic system in which profit, and profit only, is king (Huber, 2021). While costs of increased ETM extraction are likely to be endured by already marginalized communities and future generations (Bond and Basu, 2021; Lèbre et al., 2020; Owen et al., 2023; Riofrancos, 2023), corporate actors are poised to make large profits (Barbesgaard and Whitmore, 2022). Therefore, and further rooted in the idea that the growth imperative of capitalism is the mainspring of the present state of climate crisis, there is considerable concern that green transitions under an unaltered system of capitalism will only reproduce global and national inequalities (Ajl, 2021; Anlauf, 2017; Sultana, 2022). By shedding light on the particular actors of the lithium extraction, a more general evaluation can be made as to whether or not green transitions are proceeding in a fair and ultimately sustainable manner.

Finally, and most practically, the study is intended as a potential resource for communities that, now or in the future, may be impacted by these lithium projects being developed, enabling them to better understand and, if necessary, seek accountability and justice from the actors associated. This purpose is inspired by the organization Inclusive Development International (IDI), which traces investment and supply chains of invasive and harmful projects in order to help communities seek accountability from responsible actors, discussed further in chapter 5.

1.2. Research questions

In view of the above context and aims, the study asks:

- What are key features of the most significant lithium extraction projects being developed in the world, focusing on location, investment cost and ownership?
- What are key features of actors financing and developing new lithium extraction projects, focusing on location, institution type, and role(s) in the project(s)?
- What is the geo-spatial relationship between the actors, sources of capital and territories of extraction for new lithium projects?

While the first two questions are descriptive and addressed largely in separate sections, the latter question cuts across the first two and forms the analytical fabric of the research. Further, the presentation of the projects in response to the first question provides the groundwork for answering the second question, in which the actors of the same projects are analyzed. The term geo-spatial refers to geographic locations, specifically nation-states.

2. Background: lithium for green transitions

Technologies at the frontline of a green transition, such as electric vehicles (EVs) and advanced energy storage systems, require extensive quantities of certain minerals such as lithium, cobalt and graphite for their production (IEA, 2022). Minerals like these are often referred to as energy transition minerals (ETMs). Many ETMs are often also considered "critical minerals", a term that highlights potential difficulties in securing their supply and their importance to economic or national security (see for instance: European Union, 2023; U.S. Geological Survey, 2022). As a result, a wave of new policies, legislations and bilateral and multilateral agreements to secure access and trade of critical minerals is altering the contexts of ETM mining (Bermack et al., 2023; IEA, 2023, p. 5). They include export restrictions, resource nationalization and cooperation agreements between allied nation-states (ibid.).

While similar trends apply to other ETMs, the lithium industry is undergoing an especially pronounced expansion. Demand for lithium is expected to increase by 42 times by 2040, driven almost exclusively by the green energy sector (IEA, 2022, p. 9). Accordingly, lithium's global trade value increased by over 430 percent between 2010 and 2020 (Kowalski and Legendre, 2023, p. 5). Further, the amount of capital directed toward exploring and developing lithium projects rose by 50 percent in 2022, largely in Canada and Australia but also significantly across Africa and in Brazil (IEA, 2023, p. 24). Lithium extraction and refining was also a top recipient of venture capital in 2022, second only to battery recycling (ibid.). Nevertheless, S&P Global (2022) estimates that there will be a demand gap by 2029. These trends indicate that lithium extraction has become a remarkably lucrative industry, with investors rushing in to capitalize on the forecasted high demand. Despite this financial influx, the World Bank suggests that a lack of private capital will be a key challenge to low and middle income countries implementing their own green transitions (World Bank, 2023, p. 5).

In terms of geological resource availability, there are sufficient lithium reserves around the world to meet the rising demand (IEA, 2022). Over half of the world's lithium is contained in the "lithium triangle" – an area that traverses Bolivia, Chile and Argentina (USGS, 2024). Other substantial reserves are found in Australia, China and North America, while Europe and Africa both contain smaller but also significant quantities (ibid.). Despite the widespread reserves, extraction is currently dominated by Australia, Chile and Argentina, while most of the world's lithium processing occurs in China (IEA, 2022, p. 138).

The main types of lithium deposits are hard-rock ore, brine and clay, with the extraction process differing significantly between them (Sverdrup, 2016). Brine and hard-rock are the most common types of deposits for extraction, while clay extraction is more limited (Cai and Li, 2017, cited in Sun et al., 2017). Hard-rock lithium mining is similar to conventional types of mining in that lithium is extracted from ore dug from rock. Extraction from brine is a more unique process, in which groundwater containing lithium concentrate is pumped up from reservoirs that lie underneath salt flats (Bustos-Gallardo et al., 2021). Subsequently, the water is evaporated in the first step of separating out the lithium (ibid.). Brines have generally been considered to have the lower operating and project development cost, although new technologies are gradually making ore and clay deposits more cost-efficient (Tran and Luong, 2015). When lithium is destined for use in lithium-ion batteries (LIBs), extraction is followed by processing, yielding one of several possible types of lithium chemicals – most commonly lithium carbonate or lithium hydroxide

(Sun et al., 2017; Tran and Luong, 2015). The dominant applications of LIBs are consumer electronics, electric vehicles (EVs) and energy storage systems (Sun et al., 2017).

3. Literature review

Lithium extraction has become an increasingly common research topic in view of its necessity for currently leading visions of green transitions (Bos et al., 2023). In broad terms, the extraction of lithium and other ETMs for green transitions has largely been studied in terms of economic and societal development (Barandiarán, 2019; Cervantes and Garduño-Rivera, 2022; Revette, 2017), the distribution of costs and benefits among various populations (Anlauf, 2017; Bustos-Gallardo et al., 2021; Ciftci and Lemaire, 2023), and the geopolitical and other risks that cause insecurity along global mineral supply chains (Månberger and Johansson, 2019; Olivetti et al., 2017). The latter has been conducive to a variety of concepts and methodologies that trace power dynamics (Prina Cerai, 2024; Leruth et al., 2022) and value capture (LaRocca, 2022; Moreno-Brieva and Marin, 2019; Sun et al., 2017) along global supply chains. Two cross-cutting themes among lithium-centered studies is viewing lithium in terms of its central role in LIBs and a regional focus on the lithium triangle in Latin America.

3.1. Costs, benefits and impacts of extraction of lithium and ETMs

The increased extraction necessary to meet anticipated demand for ETMs presents tensions that imply unequal distribution of costs and benefits from green energy transitions (Newell and Mulvaney, 2013). Legitimizing the socio-environmental costs in the name of green transitions has been framed as green extractivism (Andreucci et al., 2023; Voskoboynik and Andreucci, 2022) and is commonly viewed to embody colonial dynamics (Anlauf, 2017; García López and Navas, 2019; Jerez et al., 2021).

In territories of lithium extraction, in particular in the lithium triangle, lithium is portrayed as a cornerstone for “inclusive, prosperous, zero carbon and post-petroleum futures” (Voskoboynik and Andreucci, 2022). Scholars have found that there is a view in the lithium triangle that the lithium industry can be different from previous experiences of extraction in which resources have been aggressively exploited by foreign corporations with few advantages for the populations (Barandiarán, 2019; Revette, 2017). Hopes for societal development from expanding lithium industries are often pinned on the state exercising greater control over the resource, although power asymmetries between states and the lithium industry may impede this goal (ibid.). Further, economic benefits that emerge from lithium extraction, such as employment opportunities, are relatively short-term as sites only operate over a couple of decades (Dorn and Gundermann, 2022). Nevertheless, some advocates suggest that foreign investment and expertise have proven essential to building up Latin American lithium industries, suggesting countries aspiring to enter the market should follow this path (Cervantes and Garduño-Rivera, 2022).

Lithium extraction for green transitions is often presented in terms of implied paradoxes. Bustos-Gallardo et al. (2021) characterize the dynamics of the lithium industry as a series of "ecological contradictions", given the harms induced by lithium extraction and the environmental end-goals to which it is supposed to contribute. With 65 percent of lithium reserves located in water scarce areas, water depletion poses a particularly salient threat to communities and ecologies surrounding extraction sites, especially as the brine extraction process relies on water-evaporation (ibid.; Lèbre et al., 2020). Water issues are further exacerbated by corporations apparently extracting more brine than permitted (Liu et al., 2019). Blair et al. (2023) suggest that direct and indirect social and environmental impacts of extraction are contributing to "ecological exhaustion" in the lithium triangle, in particular impacting Indigenous communities. Furthermore, environmental impacts are greater in brines with lower lithium grades (Chordia et al, 2022). While the same is not the case with hard-rock deposits, lower grade ore is associated with more intensive operations as size and scale is increased to ensure economic profitability (Bos et al., 2024). Additionally, the extraction and transport of ETMs requires vast amounts of energy, which cannot presently come from renewable energy (Azadi et al., 2020; Bos et al., 2024).

Anlauf (2017) argues that the continuation of present production and consumption patterns while pursuing green transitions entails excessive mineral extraction that undermine socio-ecological justice in the countries to which costs are externalized. This is underpinned by the fact that the market for end-use products of lithium, such as EVs and battery-powered smart technology, are often far removed from the communities impacted by the costs of extraction (ibid.). Dorn and Gundermann (2022, p. 357) reach a similar conclusion, arguing that "green" discourses impelling lithium extraction "deepen existing Global North–South relationships, social inequalities, and power asymmetries". Kingsbury and Wilkinson (2023, p. 7) argue that such disparities are being reinforced on various scales, demonstrating that lithium extraction in Canada is directed toward already-established mining communities in Canada who are "geographically, politically, and ideologically distanced from the core and absolutely integral to the core's livelihoods".

3.2. Global supply chains and global value chains

Research focused on the global supply chains and global value chains of lithium have shown that extraction is heavily concentrated in Chile, Australia and Argentina (Sun et al., 2017). Further, lithium is primarily exported from extraction sites as chemicals and minerals in minimally processed forms, implying little value is added to the product. China is the largest importer of lithium and dominates processing and refining, which is where most value is added (LaRocca, 2022). Chinese refined lithium is used primarily in Chinese EVs and for domestic production of LIBs and battery products, of which the majority are exported to the U.S., Germany and other parts of Asia (ibid.). In addition to China, South Korea and Japan are also world-leaders in LIB production (Sun et al., 2017). These GVC dynamics of lithium present some contrast to other ETMs, which are generally extracted from developing countries with minimally added value and exported to developed countries where the majority of value is added (Fu et al., 2023). Nevertheless, Moreno-Brieva and Marin (2019, p. 238) find that "significant imbalance exists between producer economies and technology creators within the different stages" of battery production, with almost all value added by five countries: South Korea, China, Germany, the United States, and Japan.

This geographic concentration of lithium extraction, production and value-added processes has prompted academic focus on how geopolitical tensions and rapidly increasing demand may impact supply chains. Such concerns are often embodied in criticality studies, which have shown that, in particular, lack of production capacity (Olivetti et al., 2017) and supply shortages due to geopolitics (Månberger and Johansson, 2019) may impede lithium demands being met. Lithium may be particularly critical among ETMs as there is currently no viable replacement for the role it plays in EVs and other battery-based technologies (ibid.). Studying ETMs in general, de Koning et al. (2018) suggest that bottlenecks in ETM supply are unlikely, but that uncertainty about returns on investments into mining, slow turnover time of investments, and social and environmental concerns delaying project expansions pose risks to meeting the metals demand of green transitions. Further uncertainty in investment stems from the fact that economic value of extraction remains lower for minerals than for oil, with the profitability of critical minerals extraction contingent on future developments in technology and where more viable reserves are discovered (Månberger and Johansson, 2019). Recycling has also been examined as a necessary pathway to meet lithium demand, but studies indicate that current capacities are too nascent to contribute substantially in the short or medium term (Melin et al., 2021; Sverdrup, 2016).

Value capture along the lithium supply chains is also discussed as a potentially central element for making lithium extraction conducive to societal development (Goodenough et al., 2021; Perotti and Coviello, 2015). However, several studies, primarily focused on the lithium triangle, have shown that this is generally a misguided analysis of the benefits that lithium extraction can contribute (Barandiarán, 2019; Jerez et al., 2021; Revette, 2017; Voskoboynik and Andreucci, 2022).

Some studies have focused on the role of corporations in the global supply chains of lithium. Corporate ownership of mining companies is both highly complex and non-transparent (Prina Cerai, 2024; Leruth et al., 2022). Lack of transparency as well as weak fiscal administration have impeded countries in Latin America from capturing a reasonable portion of corporate revenues, as profits are difficult to verify (Perotti and Coviello (2015). The concept of "sources of control" (SOC) has been used to examine how non-majority or indirect shareholders exercise significant influence over lithium or other ETM firms, primarily in view of US–China competition and potential vulnerabilities along supply chains to geopolitical tensions (Leruth et al., 2022; Prina Cerai, 2024). SOC research argues that production of lithium and other ETMs may be controlled by "nontransparent webs of ownership and influence" (Leruth et al., 2022, p. 25), which, in the case of lithium, can largely be traced to Australian and Chinese firms (Prina Cerai, 2024).

Competition between the U.S. and China and global supply chains security more broadly is also reshaping the spatial geography of lithium extraction. Riofrancos (2023) contends that due to a nexus of reasons related to sustainability on the one hand, and national and economic security on the other, certain global North governments have been increasingly encouraging onshoring of lithium extraction. She terms this intersection of interests the "sustainability-security nexus", and argues that policies are to some extent successfully incentivizing corporations to shift lithium extraction from the global South to the global North. Related to this nexus is the concept of "friend-shoring", an approach by Western nations to secure critical minerals and break China's stronghold over the global battery supply chain (Prina Cerai, 2024). Agreements embodying this approach have been forged in different combinations between the U.S., Australia, Canada, the U.K., South Korea, Japan, the EU and several European countries (Vivoda and Matthews, 2023). One such agreement, the multilateral Minerals Security Partnership (MSP), comes with lucrative investment possibilities for countries that choose to join in its ambition to "construct alternative supply chains that can reduce reliance on China" (ibid., p. 8).

These studies provide insight into the social, environmental, economic and corporate dynamics of lithium extraction as the industry expands to accommodate green transitions and changing geopolitical contexts. No research has been conducted to provide a global perspective of the most significant lithium projects under development. Nor has a comprehensive approach been taken to tracing the network of actors affiliated with lithium projects. By contributing insights into these understudied areas of lithium extraction, this research seeks to contribute clarity to the complex dynamics that surround extraction of lithium for green transitions.

4. Theoretical framework

This research rests on two theoretical pillars. The first pillar is Martin Arboleda's book *Planetary Mine: Territories of Extraction under Late Capitalism* (2020a), which is used to contextualize and grasp in a broad sense the dynamics of capital and actors surrounding territories of extraction in the present stage of capitalism. The second pillar is the academic sub-field of critical resource geography (CRG), drawing especially on the contributions brought together by Himley and colleagues (Himley et al., 2021). Key ideas from these two sources are explained below, with a final section condensing the ideas into a framework.

4.1. The Planetary Mine

The present analysis is rooted in the notion of the "planetary mine" as elaborated by Arboleda (2020a). Arboleda employs the term to signify the intensive, pervasive and systematic exploitation of the Earth to which all material life is connected today, and the extensive networks of capital that underpin it. The denotation of "planetary" constitutes a shift from common applications of the synonym *global*, whose interpretation and connections to *globalization* have become too superficial, Arboleda suggests, to account for the interconnected crises of climate change and extreme wealth concentration. He describes the planetary mine as "one that vastly transcends the territoriality of extraction and wholly blends into the circulatory system of capital, which now transverses the entire geography of the earth" (Arboleda, 2020a, p. 5).

This research focuses on one aspect of Arboleda's argument, namely the capital flows and complexity of actors that are enabling some of the transformations occurring in the industry. Specifically, the analysis is guided by Arboleda's discussions of the recent trend of capital intensification in mining, how this has been enabled through engagement with the financial sector, and the role of the state in creating the conditions necessary for large-scale investments.

This research also adopts Arboleda's understanding of capitalism and capitalist imperialism as the context in which the observations are situated.

4.2. Capitalism and capitalist imperialism

Fundamental to the notion of the planetary mine is centering the system of capitalism as a global imminent force, compelling the expansion of territories of extraction for the reproduction of capital (Arboleda, 2020a). This means superseding state-centric framings of the political and economic geographies of extraction, including reframing how colonialism and imperialism of certain nation-states are understood in relation to resource extraction. Resource extraction is often viewed and closely linked to present and historical imperialism and colonialism (Curley, 2021). In *Planetary Mine*, Arboleda (2020a, p. 39) seeks to elevate this understanding, presenting a theory of contemporary resource imperialism that "takes seriously the essential unity of global capital accumulation". This paper adopts Arboleda's understanding of capitalist imperialism:

> ...this book proposes to understand imperialism as *one of the phenomenal forms in which global value relations assert themselves.* This means that capitalist imperialism— as opposed to dominant readings— is not autonomously determined by the political relations of the nation-state but by the directionally purposed drive to increase the organic composition of capital at the system-wide level. (Arboleda, 2020a, p. 26)

In this definition, Arboleda is emphasizing the need to grapple with the very essence of capital, rather than to be distracted by interstate dynamics that are the outcomes of a global system of capitalism, including dependency, unequal exchange and core-periphery relations. According to Arboleda, a focus on the international relations of individual nation-states obscures the supranational nature of capitalism and misleadingly implies that societal transformation can be achieved through national political and institutional reforms. He points to the post-neoliberal "pink tide" governments in Latin America as examples, noting that "despite their intention to overturn the hierarchical relations of the interstate system by political means, [they] became even more dependent on primary-commodity exports and more aggressively subsumed in the cyclical compulsions of the world market." (Arboleda, 2020a, p. 72). Arboleda makes this point in view of a broader argument against viewing the actors in the world economy primarily in terms of imperialism, underscoring the essential role of the profit compulsion of capitalism.

This research adopts the perspective that the actors studied – including corporations and state entities – are bound directly or indirectly by these imperatives of global capitalism. Therefore, the corporate dynamics observed are understood as component strategies that are ultimately aimed at the accumulation of profit (Campling, 2021). Campling (2021) reasons that corporations modify their organizational, economic and political strategies to the contexts in which they operate, which may concern access to resources, relations to buyers, availability of finance, and obligations of generating returns to shareholders or creditors. In simple terms, capitalism compels resource actors to prioritize profit ahead of all other concerns (Huber, 2021).

4.3. Capital-intensity

In the context of this essential drive towards capital accumulation, Arboleda observes that the mining industry has become "increasingly capital-intensive, smart, horizontally integrated, and autonomous" (Arboleda, 2020b, p. 122). Arboleda (2020a) links this to the coming of a "fourth machine age", which refers to the highly advanced technologies employed both at the sites of extraction and throughout the logistic and infrastructure systems that accommodate the related global supply chains. For instance, extraction sites are more cost-efficient, relying on streamlined and robotized operations with minimal human input. Further, declining ore grades (i.e. lower mineral concentration) compels evermore large-scale and advanced machinery, instruments and processing techniques. In turn, these effects have magnified the material footprint generated by the mining industry as minerals are excavated with greater intensity and more waste (ibid.). Developing and employing these continuously modernizing technologies implies unprecedented levels of capital injected into the industry, which in turn has caused economic profitability to surge (ibid.).

4.4. Financial engagement

Arboleda (2020b, p. 122) asserts that today's highly intensive and technologically advanced mining industry "has been directly contingent upon the mediations of a complex network of financial actors, practices, and instruments". Arboleda theorizes this financial component of the extractive industry and the role it plays in capital circulation and accumulation as the "money circuit of extraction". It is one of three circulatory systems contained in what he terms "circuits of extraction", a notion that relates Marx's depiction of capital circulation to the contemporary mining industry.

Especially illuminating for the purposes of this research are three interactions that Arboleda outlines between the money circuit and the productive circuit, which relates to the materials and structures on extraction sites such as shafts, pits, and processing facilities. The first interaction is the use of sovereign debt – credited by international financial institutions, multilateral banks and increasingly East Asian economies – to fund major infrastructure systems that will attract foreign direct investment. The second is the systematic engagement between mining companies and the global finance system. The crucial outcomes of this is access to unprecedented amounts of capital for realizing extraction projects and a redirection of corporate strategies towards tactical interactions with the financial system, such as strategic mergers and acquisitions or by announcements that inflate the share price at crucial moments (Labban, 2010). Further, generating shareholder value has increasingly become framed as an end in itself in corporate strategies (Labban, 2014), highlighting their significance as actors in the money circuit. The third interaction stems from an expansion of consumer debt, channeled through institutional investors and accessible to mining companies through the aforementioned finance engagements. Through hedge funds, pension funds, and investment banks, the savings of workers and middle class families have been transformed into "human revenue streams" for corporations in the extractive industries (Arboleda, 2020b, p. 123; French, Leyshon, and Wainwright 2011; Loftus and March 2016).

4.5. Geopolitics and the state

Campling and Baglioni (2019) considers relations between capital, nature and state to be a constant of capitalism, taking different forms across time and space. From one side, states create the institutional and infrastructural arrangements that both attract and subsequently protect foreign capital in exploiting natural resources (Cotula, 2020). From the other side, states may leverage their political power to create favorable investment conditions abroad for corporations from their country, in particular to secure key mineral resources (Curtis, 2016; Gordon and Webber, 2017; Veltmeyer, 2013). Multilateral development finance institutions such as the World Bank and the International Monetary Fund (IMF) have also been used as a means to this end (Garcia Lopez and Navas, 2019; Gordon and Webber, 2017; Andreucci and Kallis, 2017). Further, in contrast to the idea that powerful corporate actors are undermining states' authority, Arboleda (2020a) considers states to have become increasingly coercive, centralized, and authoritarian in their servitude to foreign capital. This is exemplified by states' roles in dispossessing communities of land, suppressing mining resistance and implementing corporate-friendly policies that undermine the needs of its own population (ibid.). Even when states adopt an active role in extraction through state-owned enterprises or through rent collection, these actions are still taken within the confines of ensuring profitability (Huber, 2021). The concept of the state differs from that of the nation, which is a constituted and contested imaginary without the tangible authority and institutions of states (Perreault, 2021).

Arboleda (2020a) also emphasizes that a geopolitical shift has occurred in the mining industry whereby resource exchange no longer centers around the interests of a “global north" or “the West”, but is rather dominated by China and the Asian Tigers (Japan, South Korea, Taiwan and Singapore). Part of this logic rests on the fact that China has in recent decades become the foremost lender to governments and firms, a key player in the logistics industry and the largest importers of metals and minerals. Thereby, Arboleda argues that China has strategically established domination over global supply chains in order to secure access to raw materials, in contrast to the political and military interventions that have characterized Western imperial powers. However, despite new, seemingly more peaceful iterations of foreign-led resource extraction projects, “the local communities and workers who coexist with geographies of extraction tend to experience the expansion of primary-commodity frontiers systematically in idioms of imperialism and neocolonial domination” (Arboleda, 2020a, ibid., p. 25).

4.6. Summary of framework

In the tradition of Marx (Campling, 2021), the ensuing analysis in chapters 6 and 7 moves between the *general* – grounded in articulations of *Planetary Mine* as they apply to an entire world-spanning industry – and the *particular* – comprised of observations about forthcoming lithium projects and the elaborate landscape of actors that underpin them.

Following Arboleda’s (2020a) form, the world market is the analytical starting point rather than any one national economy. Moreover, the research is framed by the notion that individual extraction sites are effectively constituent parts of a planetary mine, which is being expanded through the inherent drive of capitalism for capital accumulation. This compulsion transcends state borders, with capitalist actors operating across the entire planet to maximize profitability at each stage of the resource supply chain, from extraction to manufacturing. The distinct corporate strategies employed to maximize value are understood to be shaped by the particular contexts in which corporations and their subsidiaries operate. Meanwhile, states often assume the role of facilitating the international movement of capital, rather than restricting it. Given the crucial role of the global financial system to today’s mining industries, the concept of a monetary circuit of extraction guides the analysis of how actors across financial and extractive sectors interact to generate mutual profitability.

With this foundation, this study focuses on three interacting aspects of the planetary mine to examine forthcoming lithium projects and the elaborate landscape of actors that underpin them: capital intensity of projects, engagement with the financial sector, and the geopolitics of lithium extraction as it pertains to Arboleda's understanding of capitalist imperialism.

5. Methods and limitations

5.1. Overview

This research is structured along two axes: first, it identifies some of the most significant lithium extraction projects under development in the world and records their key traits and conditions; and second, it details the vast landscape of actors that finance, operate and purchase products from the projects. It draws on the "Follow the Money'' methodology devised by the non-profit organization Inclusive Development International (IDI) and relies primarily on the financial information and analytics platform S&P Global's Capital IQ (Capital IQ) for data collection. The process culminated in a vast database in Google Sheets ("the database") that includes qualitative and quantitative data on 23 new lithium projects ("the projects"), around 350 actors such as project developers, investors and customers ("the actors"), and almost 1,000 shareholders. The analysis of the data relied on visualization and analytics functions in Google Sheets. The following sections provide further explanation of the Follow the Money methodology, the research process and limitations. Key terminology and abbreviations are found in Annex 1.

5.2. Follow the Money

Initially devised for communities negatively impacted by large-scale agricultural investments, today IDI uses the FTM method to hold corporations and other actors accountable for investment projects that cause forced evictions, harm ecosystems and displace communities (Blackmore et al., 2015). It is rooted in the idea that "Knowing who is financing the project, who is buying the produce and who else is making the project possible and profitable – in other words, 'following the money' – opens up a range of opportunities for improved accountability" (ibid., p. 2). Using financial platforms similar to Capital IQ, IDI maps the actors that are associated with an investment project, as seen in *Figure 1*, thereby illuminating opportunities for interrupting a harmful project's support network through advocacy or legal action. Other organizations that include similar techniques in their work include Corporate Watch (Corporate Watch, n.d.) and Bank Information Center (Bank Information Center, n.d.).

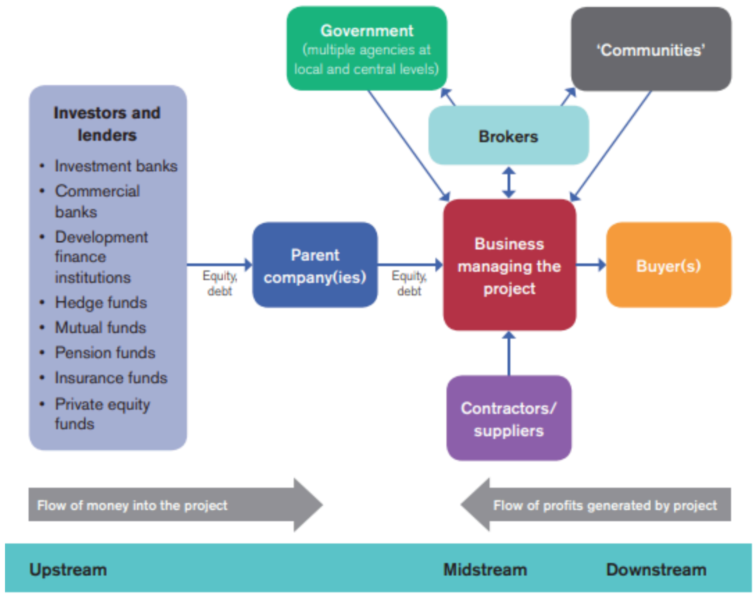

Figure 1. "Example of an investment stream showing the upstream, midstream and downstream actors and the relationships between all the different actors" (Blackmore et al., 2015, adapted from Cotula and Blackmore, 2014, p. 2)

The choice of using FTM stems from my experience as a Research Volunteer with IDI in the fall term of LUMID 2023. In this role, I conducted a global scoping study about critical minerals projects under development and their most significant actors, creating a foundation for future IDI campaigns. Inspired by this experience, this research sought to "Follow the Money" of one critical mineral in particular – lithium – and to plot the full range of actors involved in projects. Further, while IDI typically uses the method to conduct case studies, both my own IDI research and this thesis research modified the method to constitute a global overview of several investment projects.

5.3. Research process

In theory, the research process followed the below steps. In practice, it was not a linear process, and each of the four distinct steps took place, to some degree, throughout the period January–April 2024. Each of the steps are described in greater detail below.

1. January (and prior) – **Project selection:** selected projects to study, based on my data collected for IDI and further internet browsing.
2. January–February – **Design and creation of the database**: chose indicators to include in the data collection, created the database in Google Sheets.
3. February–March – **Data collection**: collected data on S&P Capital IQ
4. March–April – **Data analysi**s: conducted analysis using Google Sheets pivot tables, statistical formulas and filters

Project selection

The lithium projects in this study are intended to constitute the most significant projects currently under development around the world. No systematic approach for determining significance of mining projects could be found in the literature and the selection process was therefore conceived largely through trial-and-error. Initially, project selection was simply based on capital expenditure (capex) and/or size of the reserves encompassed by the project. Capex is an aggregate measure of financial spending estimated by companies (Beyer et al., 2019), which in the context of project development in mining refers to the estimated cost of bringing a project into commercial operation. Meanwhile, reserves size is based on exploration activities such as drilling tests and geology surveillance that are used to estimate the total amount of mineral resources contained within the permitted project site (Alzahrani, n.d.).

However, the process was less straightforward than expected. Firstly, capex was found to be an insufficiently reliable metric due to significant changes in companies' capex estimates over time and because it varied greatly across seemingly comparable projects. This is a common shortcoming of capex estimates in the mining industry (Bertisen and Davis, 2008). As for size, different companies release different metrics depending on the geology and stage of the project, and these estimates were also subject to changes over time. These factors made it difficult to create a definitive list of the largest or most "significant" lithium projects under development. Consequently, lists by news sources and mining journals that ranked "top lithium projects" became a systematic tool for compiling the list (see for instance: Mining.com, 2023)

In summary, through trial-and-error, projects were selected according to approximate comparisons in size and capex, with additional consideration for informal rankings found online, often directed at an investor audience. Fourteen projects were mentioned in two or more such lists, while three were only mentioned in one list, and three in zero lists (Annex 2.1).

The database

The database is contained in Google Sheets and centered on three main sheets: the "Projects" sheet, the "Actors" sheet and the "Top holders" sheet, described in detail in Annex 2.2–2.5. Annex 2.2 also includes a link to the database. While additions and modifications were made in the course of the research, principles of the FTM methodology are the foundation of the database and the terminology and indicators it contains. It primarily draws on Blackmore et al.'s (2015) published FTM guide and on IDI's online guide (IDI, 2021). For the analysis of the database, Google Sheets functions such as pivot tables, formulas and filters were used to grasp key trends and identify notable aspects.

According to Blackmore et al. (2015), the actors that collectively make an investment project possible may include parent companies, investors and shareholders, lenders, governments, brokers, contractors and buyers. Similarly, Arboleda (2020a)'s argumentation is founded on the notion that the mining industry is underpinned by a dense global network of actors. These actors can be divided into three categories based on their role(s) in the project: upstream, midstream, and downstream (Blackmore et al., 2015). For clarity, this research refers to the upstream actors as the investment stream, largely related to funding; the downstream actors as the supply stream, entailing commitments to purchase products from a project once complete, usually agreed through offtake agreements; and maintains the term of midstream actors, referring to those working directly towards developing the site of extraction. The actors of the database were primarily organized according to these three project streams, which were in turn broken into "specific roles" to categorize the actors' precise relationship to the project. Annex 2.5 details the specific roles and traits of each project stream, summarized below (*Table 1.*).

Project stream	**General description**	**Examples of specific roles** *(as listed in the database)*
Investment stream (upstream actors)	Shareholders, lenders, legal and financial advisors	Direct financing Indirect financing Prior investor Strategic advisor
Midstream actors	Developer company, subsidiaries, contractors, government agencies	50/50 Joint venture Contractor Local subsidiary Main or parent company Minority owner Royalty rights Uppermost parent (non-direct connection)
Supply stream (downstream actors)	Buyers such as commodity traders, manufacturers and (eventually) consumers	Binding project offtake Binding company offtake Non-binding company offtake Non-binding project offtake Processing or refining

Table 1. Description of each project stream and examples of specific roles within the category. See details in Annex 2.5.

Data collection

S&P Capital IQ (Capital IQ) is a financial information and analytics platform primarily directed at users in the financial sector. Access was obtained through the Lund University economics department. The data collection from Capital IQ was based on a framework protocol (Annex 2.6), which was expanded on a case-by-case basis. In short, identifying actors in the midstream, investment stream and supply stream entailed a series of steps to systematically sift through a combination of sources including news sources, company websites, Capital IQ pages, and corporate reports. While several sources were used to become oriented around the projects and the associated actors, the data recorded in the database was retrieved almost exclusively from the Capital IQ platform directly or through the company reports linked on the portal.

5.4. Limitations

A number of limitations of this study are discussed below. Primarily they relate to the fact that the research design and data collection has relied on certain imperfect processes, often rooted in uneven access to information. The ethics of this research was also considered according to Bryman's (2021) four key ethical principles: avoiding harm to participants and researchers, ensuring informed consent, protecting privacy, and avoiding deception. However, since the data of this research is based on publicly available information and without any interpersonal elements, none of these principles were considered relevant. Further, while my positionality is naturally a factor in how this research was designed and analyzed (ibid.), it is likely not a significant variable in the results.

Limited and changing information: Blackmore et al. (2015) note that investment chains are dynamic and often lack transparency, meaning that sudden changes and missing information is common in the FTM process. This was frequently the case during this research process. There was also an unevenness in the amount of information available for each project and actors, often related to where the project or actor was based. For instance, abundant information was easily accessed for North American companies through tax forms available on Capital IQ. In contrast, Chinese companies seem to disclose much less information. As a consequence, one Chinese project (Lakkor Tso) does not have a capex and its market value has been used as a proxy. The lack of transparency implies that the actors included in the research should be considered the minimal number of actors that may be involved in any particular project. Additional actors may be involved in a project, but would not be included in the data without a clear and publicly available papertrail. The tendency of investment projects to suddenly change plans, with delays particularly common to the lithium industry (Yao, 2023), means that information recorded in this research may already have changed. For instance, the capex often increases as projects progress and incur unanticipated costs, resource estimates may change, and the stage of development can go backwards or forwards depending on permitting, community resistance and more (Banya, 2023; Cecilia Jamasmie, 2024; de Koning et al., 2018).

Scope: The lithium supply chain extends beyond the scope of this research. In focusing on networks surrounding sites of extraction, other stages of production such as processing and refining, waste management and recycling are excluded unless they are directly linked with the extraction sites, such as if processing occurs alongside extraction. Additionally, the Asian continent likely represents a gap in the data due to lack of available and verifiable information.

Project selection: Due to the difficulty of comparing projects to each other in terms of capex and size, the selection of projects for inclusion in the study is somewhat subjective and cannot be considered definitive. Some of the projects included could be argued to not be especially significant, and some projects *not* included could perhaps have been well suited. A more scientifically generated list could have been produced with more time, such as by manually converting resource quantities to a harmonized measure. While time was a naturally constricting factor, the data did nevertheless reach a level of relative saturation (Lund, 2014). In other words, the project contenders that ended up being excluded were based in countries that had already been included and (upon brief examination) appeared to have relatively similar actor dynamics.

Top holders category: Data collection on the largest company shareholders ("top holders") was cast with a wide net and arguably includes the shareholders of project actors with marginal roles in the projects. However, this choice was based on the fact that there would also not be a definitive way to determine which companies are "too marginal" to be included in the list of top holders. In addition, the vastly interconnected networks on which mining operations are contingent signifies that seemingly small actors can play essential roles (Prina Cerai, 2024).

5.5. Data overview

Following the project selection process discussed above, 23 lithium projects ("the projects") were chosen as a sample of the most globally significant projects under development. *Table 2.* provides an overview of the projects and key indicators, also summarized below.

The projects are located in 14 different countries and on every major continent: Latin America (8 projects), Africa (7), North America (3), Europe (2), Australia (2), Asia (1). Most of the projects are hard-rock deposits (13 projects). Only the projects in Argentina and in China are brine deposits (7) and the final three projects are in either in the form of clay or jadarite. The capex of the projects range from USD 185 million to USD 2.4 billion, with a relatively even distribution in between. The projects are at development stages ranging from feasibility to construction[1], or they are already operating but undergoing large-scale expansions. Most are officially projected to enter into commercial operation in 2024 or 2025. However, delays among

[1] Mining development stages are not generally linear and consecutive, but rather overlap with one another and often repeat (Alzahrani, n.d.). For simplicity, the stages are considered as following the order of feasibility, permitting and construction. Expansion projects are simply denoted as expansion.

lithium projects are common. As a result, some projects either lack an official anticipated operation date or it is outdated, in which case the operation date is listed as "Unknown".

Project name	Country	Continent	Stage of development	Projected operational	Geology	Capex (millions USD)
Arcadia	Zimbabwe	Africa	Construction	Unknown	Hard-rock	300
Beauvoir (EMILI)	France	Europe	Feasibility	2028	Hard-rock	983
Bikita	Zimbabwe	Africa	Expansion	2023	Hard-rock	200
Carolina	United States of America	North America	Permitting	2027	Hard-rock	988
Cauchari-Olaroz	Argentina	Latin America	Expansion	Unknown	Brine	979
Centenario Ratones	Argentina	Latin America	Construction	2024	Brine	800
Ewoyaa	Ghana	Africa	Permitting	2025	Hard-rock	185
Goulamina	Mali	Africa	Construction	2024	Hard-rock	255
Grota do Cirilo	Brazil	Latin America	Feasibility	2024	Hard-rock	285.5
Jadar	Serbia	Europe	Feasibility	Forestalled	Clay or jadarite	2,400
James Bay	Canada	North America	Feasibility	Unknown	Hard-rock	381.5
Karibib	Namibia	Africa	Construction	2025	Hard-rock	266
Kathleen Valley	Australia	Australia	Feasibility	2024	Hard-rock	629.8
Lakkor Tso	China[2]	Asia	Construction	2025	Brine	741[3]
Manono	Democratic Republic of the Congo	Africa	Feasibility	Unknown	Hard-rock	545.5

[2] Lakkor Tso is in Tibet, an autonomous region of China
[3] The capex figure for Lakkor Tso is in fact the market value of the project, used as a proxy due to the official figure being unavailable.

Project name	**Country**	**Continent**	**Stage of development**	**Projected operational**	**Geology**	**Capex (millions USD)**
Mt. Holland	Australia	Australia	Feasibility	2024	Hard-rock	1200
Pastos Grandes	Argentina	Latin America	Permitting	Unknown	Brine	448
Rincon	Argentina	Latin America	Permitting	2024	Brine	769
Sal de Oro	Argentina	Latin America	Construction	2025	Brine	830
Sal de Vida	Argentina	Latin America	Construction	2024	Brine	271
Sonora 1 & 2	Mexico	Latin America	Construction	2025	Clay or jadarite	800
Thacker Pass	United States of America	North America	Construction	2026	Clay or jadarite	2,270
Uis Lithium (Andrada)	Namibia	Africa	Expansion	2025	Hard-rock	497

Table 2. Overview of the lithium projects included in this study and corresponding key data

6. Analyzing the projects: location, costs and ownership

Arboleda's (2020a) notion of the planetary mine is grounded in the idea that the mining industry is underpinned by elaborate networks of actors and systems that extend far beyond territories of extraction. Nevertheless, analyzing the territories is a precondition for understanding how global networks of actors become rooted in particular sites. Therefore, the subsequent sections analyze the projects themselves. The first section focuses on the geo-spatial distribution of the projects, comparing regions and considering how certain state-level policies may have impacted the presence or absence of projects. The following two sections add further layers by examining variations in cost and tracing organizational strategies that characterize the projects.

6.1. Location

In general, extraction of ETMs is associated with developing countries who export low-value products, while developed countries are associated with value-added processes as well as with the implementation of the energy transition end-products (Fu et al., 2023). According to this research, the spatial distribution of new lithium projects is more complex, exhibiting contextual commonalities and differences that complicate attempts to generalize between developing and developed countries, or global North and global South. Crucially, there are significant projects underway on every major continent (*Figure 2*). Africa and Latin America are set to host the highest number of lithium projects out of the total 23 projects in this database. These two regions contain the largest lithium resources in the world, with ongoing exploration steadily identifying more economically feasible deposits (Goodenough et al., 2021).

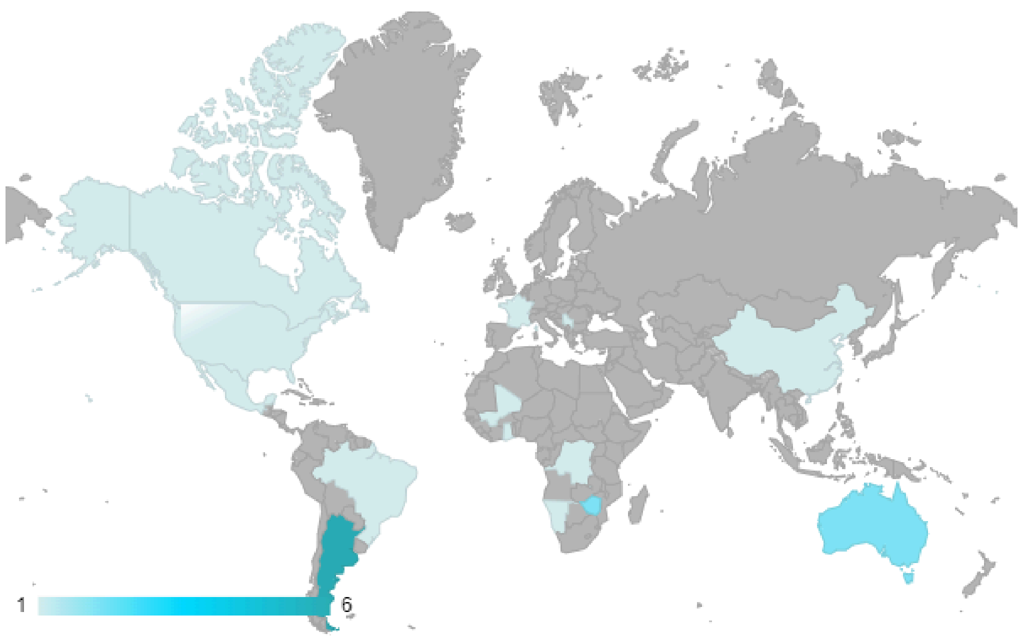

Figure 2. Map of the countries in which the lithium projects are being developed.

In Latin America, this research includes eight major projects underway in Argentina, Brazil and Mexico, of which six are in Argentina. Argentina stands out as particularly active in developing lithium projects, especially when contrasted with the other two countries in the "lithium triangle" – Chile and Bolivia, which do not have any significant projects under development. Meanwhile, Argentina's projects pipeline, which extends beyond the projects included here, positions it to become the second largest lithium producer by 2027 (Silva, 2023). The discrepancy in projects is not due to unwillingness to develop lithium extraction as all three countries are formally committed to leveraging their abundant brine reserves (Barandiarán, 2019). Instead, the divergence can be largely attributed to states' approaches to foreign investment (Cervantes and Garduño-Rivera, 2022). Revette (2017) showed that state-control over lithium is largely supported by the population in Bolivia. However, she also predicted, seemingly correctly, that power asymmetries between the state and the lithium industry would prevent the Bolivian state from realizing their objective of leveraging their lithium resources for societal development.

The African continent has been framed as a potential "major lithium production hub" (Barich, 2022). Seven significant projects were found to be underway in Zimbabwe, Ghana, Mali, Namibia and the Democratic Republic of the Congo (DRC). These countries plus South Africa are considered up and coming regions for lithium extraction in Africa (Goodenough et al., 2021). The various documents reviewed in this research indicated that most of these projects are among the world's largest untapped deposits of lithium. Consistent with historic low-value, primary commodity exports from Africa since colonialism (Rodney, 1972), all projects except **Manono** in the DRC were initially permitted to export lithium in a minimally processed form. However, the two projects in Zimbabwe will be subject to a new policy that requires companies to process extracted lithium locally, bringing the mineral up to a battery-grade before export (Nyabiage, 2022). Such policy changes are considered "sovereignty risks" and, coupled with infrastructural challenges, are among the reasons that investors are still apparently cautious to undertake further exploration and begin more projects (ibid.).

Multiple large lithium projects are also being developed within Europe and North America, of which five projects in France, Serbia, the U.S. and Canada are included in this research. The new projects identified in the U.S. and France embody Riofrancos' (2023) observation that global North countries are seeking to onshore lithium production in view of security and sustainability concerns. By global North, Riofrancos refers primarily to the U.S. and the countries of the EU, which aligns with the fact that the U.S. and the EU have been especially adamant about severing their dependence on critical minerals from China (Vivoda and Matthews, 2023). However, beyond the EU and the U.S., the generalization of "global North" does not convey significant meaning due to the distinct experiences of lithium and mineral extraction across the other European and North American countries in this study. For instance, while France, the U.S. and Serbia do not have significant lithium industries, Canada is already a leading producer (U.S. Geological Survey, 2024). Furthermore, the EU's policies related to the security-sustainability nexus do not necessarily extend to Serbia as an European but not EU country, although its **Jadar** project is framed as key to broader Europe securing its lithium supply chain (Vasovic, 2024). Serbia also has a history of resistance against transnational corporations exploiting the environment and communities (Velicu, 2019) in a way that further sets it apart from EU countries. Nevertheless, these newcomer lithium projects constitute a significant expansion in the resource extraction frontier, edging closer to societies that have become accustomed to raw materials being sourced from and externalized to “elsewhere” (Brand and Wissen, 2021; Riofrancos, 2023).

Also reflecting the discrepancies in a “global North” category is the role of Australia in the lithium industry. Australia is already a world leader in lithium production, mainly exporting in the form of lithium ores and concentrates, which are considered low-value products from hard-rock deposits. Australia is continuing to expand its extraction sites, with two particularly significant projects in Western Australia included in this database. Like the EU and the US, Australia is seeking to secure its supply streams of critical minerals (Bermack et al., 2023). However, with regard to the sustainability side of Riofrancos (2023)’s “nexus”, its government has been found to prioritize the economic value of its critical mineral resources and new investments over environmental considerations (Bebbington et al., 2022, p. 254-255).

In summary, while significant lithium projects are being developed in Europe, North America and Australia, there is no indication that this constitutes a “shift” away from present and historical centers of extraction, namely Latin America and Africa. In fact, more and larger projects are found to be underway in Latin America and Africa than in other regions. Rather than a *shift,* the geo-spatial distribution of projects indicates an *expansion* of territories that are deemed suitable for lithium extraction. This aligns with Arboleda’s (2020a) points primarily in two ways. Firstly, the promise of high and sustained demand for lithium on the world market (IEA, 2023) is driving the pursuit of lithium in new, inexperienced, and potentially underequipped regions of the world, such as Europe and Africa. In this way, the profit imperative is plausibly driving the expanding frontier of lithium extraction. This analysis is supported by Huber (2021, p. 171), who asserts that “One could have the technological know-how, the cultural demand for the product, and the state contract to extract in a specific property, but if the monetary costs of production outweigh the revenues from selling that resource, production won’t happen”. The second point concerns the divisions between a global North and global South, or developing and developed countries. Such categories were already unclear in the lithium industry given Australia’s, and to a lesser extent Canada’s, leading role in the export of low-value forms of lithium. However, as the U.S. and Europe also seek to grow their lithium industries, such geopolitical generalizations become increasingly irrelevant. Notably, environmental conflicts are also expanding in parallel with territories of extraction, as community resistance is similarly likely to coalesce regardless of where extraction occurs (Riofrancos, 2023; Scheidel et al., 2020).

6.2. Cost

The mining industry has become increasingly capital-intensive (Arboleda, 2020a). Rather than decrease expenditure, technological advancements that make extraction cheaper have only expanded the mining frontier, with firms spending more to mine more (ibid.). Yet, rather than being uniformly capital-intensive, this research finds that lithium projects range a great deal in estimated cost, or capex, with some notable patterns across regions.

The most capital intensive projects are decidedly in Europe, the U.S. and Australia, of which most are estimated to cost around USD one billion or more. The highest cost project is the currently forestalled **Jadar** in Serbia, owned by Rio Tinto (U.K./ Australia), with a capex of USD 2.4 billion. **Thacker Pass** in the U.S., owned by Lithium Americas (Canada), follows closely behind at USD 2.27 billion. Demonstrating the wide range in costs, the top five most expensive projects have a combined estimated capex of 7.84 billion USD – almost half of all 23 projects' capex combined (USD 17.02 billion total). Despite being among the largest deposits in the world, all seven projects in Africa are around or substantially below 500 million USD. The group of Latin American projects exhibit a relatively wide distribution, ranging from 271 to 979 million USD, and a median of around USD 785 million.

In theory, variation of capexes between lithium projects should primarily be determined by the geology of the deposits, with costs of brine projects generally being significantly lower than hard-rock (Desjardins, 2015).[4] Other factors include logistical accessibility of the project, energy infrastructure and the cost of construction labor (ibid.; Bustos-Gallardo et al., 2021). Further, due to being aggregate measures created by the companies themselves, capex calculations are subject to significant bias and error and to different company norms (Bertisen and Davis, 2008; Beyer et al., 2019). However, these factors do not appear to completely explain the patterns of variance in costs observed among the projects. Separating the projects by hard-rock and brine deposits yields similar variance as above, with distinctly higher costs in North America, Europe and Australia and the lowest costs in Africa and Latin America (*Table 3*). Furthermore, the average capex across all hard-rock projects is in fact slightly lower than the average of capexes across all brine projects.

[4] Extraction from clay deposits is more complex and variable due to nascent and site-specific technological needs (Cervantes and Garduño-Rivera, 2022), and are therefore not discussed here.

	Hard-rock		Brine		Clay or jadarite		Grand Total	
Continent	Number of projects	Average capex/ project (millions USD)	Number of projects	Average capex/ project (millions USD)	Number of projects	Average capex/ project (millions USD)	Number of projects	Average capex/ project (millions USD)
Latin America	1	$ 285.50	6	682.8333 333	1	800	8	647.8125
Africa	7	$ 321.21					7	321.2142 857
North America	2	$ 684.75			1	2,270	3	1,213
Europe	1	$ 983.00			1	2,400	2	1,692
Australia	2	$ 914.90					2	914.9
Asia			1	741			1	741
Grand Total	**13**	**516.63**	**7**	**691.14**	**3**	**1,823**	**23**	**740.18**

Table 3. Number of projects and capex by continent and deposit type.

While reasons for this variance in cost are not immediately apparent from the projects or the literature, directly comparing select projects provides some potential insight into contributing factors. When comparing the relatively similar projects **Ewoyaa** in Ghana and **Carolina** in the U.S., one cause of cost variance appears to be the level of processing integration pursued on the project site. **Ewoyaa** and **Carolina** are hard-rock projects of similar grade being built on new mining sites, although the mineral reserve of Carolina is somewhat higher. The capex of Carolina is almost USD 1 billion, while Ewoyaa is one of the lowest at USD 185 million. The key difference between the two projects appears to be that Carolina's lithium concentrate will be processed directly on site and turned into lithium hydroxide, while Ewoyaa will export a low-value product to the U.S. for processing, on a plant being developed by one of Ewoyaa's investors and incidentally funded by U.S. government investment (Department of Energy). Arboleda (2020a) argues that greater horizontal integration, as seen with Carolina, has been widely pursued as a way to enhance cost-efficiency in mining supply chains. Furthermore, since both projects' lithium will be processed in the U.S. and processing implies added-value, the U.S. captures the majority of value for both projects, notably facilitated by the U.S. state's investment in the processing facility to which Ewoyaa's lithium will be shipped. Furthermore, both projects have offtake agreements with the same company, entailing that large portions of both sites' products are also destined to supply the same companies, namely electric car giant Tesla and LG Chem, one of the largest chemicals companies in the world and supplying materials to batteries, electronics and more.

The type of dynamics seen in Ewoyaa have frequently been ascribed to resource imperialism and argued to contribute to uneven societal development (Ayelazuno, 2014). However, given the similarities between the two projects and the overlap in the actors involved in the exchange of products, these analyses do not account sufficiently for the profit imperatives driving the actors' corporate strategies. Instead, the two projects can be viewed as particular cases of capitalist imperialism, implying that the sites for extraction and processing are chosen from a global perspective of maximizing value. More specifically, as suggested by Campling (2021), the strategies implemented by the developers of Ewoyaa and Carolina can be assumed to be responses to the different contexts of Ghana and the U.S. in view of maximizing profit. For instance, the processing facility at Carolina is likely an outcome of greater access to financing, enabling the more ambitious project. Further, the U.S. state has played a significant role in creating a more profitable context for the lithium industry, primarily through the U.S. Inflation Reduction Act, which seeks to break its dependency on China for critical minerals and gain great control over supply chains (Prina Cerai, 2024).

In summary, as theorized by Arboleda (2020a) about the mining industry in general, immense amounts of capital are being invested in developing lithium projects. Closer examination reveals that there is a tendency for greater capital-intensity in Europe, North America and Australia and relatively lower costs for projects in Africa and Latin America. This divergence aligns with geopolitical delineations such as global North and global South. Yet, rather than a manifestation of a world-order, Arboleda would suggest that such regional trends are rooted in the capital imperative, which he argues transcends geopolitical relations.

6.3. Ownership

Campling (2021, p. 188) notes that "The corporate form is the most global and ubiquitous capitalist entity". In particular, *multinational* corporations (MNCs) are the owners of all projects in this research. According to the OECD, MNCs are established in more than one country and coordinate activities across the international branches (OECD, 2008). Examining the midstream of the projects in this research – that is, the actors working towards developing the site of extraction – reveals that connected to most MNCs is a network of conglomerate parent companies and/or globally dispersed subsidiaries.

Among the 23 projects, subsidiaries are located in 36 different countries. More specifically, the most common organization in the midstream is that the main-developer-MNC has at least one wholly-owned subsidiary dedicated to operating that project and incorporated in the project's host country. Often there are additional project-specific subsidiaries based in the same country as the MNC's head office and/or in other countries entirely. In the case of **Cauchari-Olaroz** in Argentina, developed by the Canadian company Lithium Americas, there are three subsidiaries that are all entirely focused on the project, in Canada, Argentina and The Netherlands, the latter of which channels the project's financing. The local subsidiary of **Mt Holland** in Australia, Covalent Lithium, is a 50/50 joint venture by mining giant SQM and a chemicals and energy branch of broadline retailer Wesfarmers. **Sonora 1&2** has the most affiliated subsidiaries: six local subsidiaries and another six dispersed in the U.K., Canada, China and the British Virgin Islands. Only two projects – Rio Tinto's **Jadar** in Serbia and Imerys' **EMILI** in France – do not appear to have any subsidiaries dedicated to the projects.

This variety of configurations in the midstream and the prevalence of linked-together international subsidiaries contributes some insight into organizational strategies of multinational mining corporations. It also illuminates the mobility with which capital moves across the planet while being primarily tied to one extraction site, as most subsidiaries are. Subsidiaries can have more or less autonomy from their parent companies and may uphold different labor and environmental standards depending on the jurisdiction of their operation (Campling, 2021). Further, while monetary value is not necessarily extracted from the plethora of subsidiaries within a firm, their organization may contribute to the *effectiveness* with which value is captured from productive processes (Campling and Quentin, 2021). Principally, jurisdiction of firms affects taxation, which can significantly impact the amount of value that is extracted at each stage of a global supply chain (ibid.). Organizing operations around a series of subsidiaries may also make it difficult for grievances against the corporation to be filed, both due to lack of clarity regarding the ultimately responsible parent company and due to difficulty seeking legal action against a separate legal entity (Blackmore et al., 2015; Coumans, 2019).

7. Analyzing the actors and their finance

Arboleda (2020a, p. 176) asserts that the capital-intensity of present extraction sites is directly contingent on corporations' unprecedented access to capital, gained through "systematic engagements between physical producers and the financial system". This section explores the particular actors that constitute lithium's money circuit of extraction, focusing on the sources and recipients of foreign direct investments (FDI), the role of development finance institutions (DFIs) and the composition of shareholders in public company actors.

7.1. Investors by country and FDI

The investment streams of the projects are reflective of the complex monetary circuit described by Arboleda (2020b). In addition to the web of ownership discussed in chapter 6.3, each project tends to be connected to several direct and/or indirect investors. On average, there are 4.45 actors in the investment stream of each project (excluding strategic advisors[5] and public shareholders). There are only a handful of cases in which the projects are *not* funded by at least one foreign investor. Those domestically-funded projects are in France, Australia, China and the U.S., and are also owned by main developers who are domestically incorporated companies.

Arboleda's (2020a) assertion that China and the Asian Tigers strategically finance infrastructure projects in order to pave the way for their own investments into mineral extraction suggests that these countries should be the most common affiliations of the investment and midstream stream actors. However, China and the U.S. appear with similar frequency in the investment stream, while in the midstream, Canada is also level with both of these countries *Table 4.* Moreover, actors from Australia are the most common across both the midstream and investment stream.

In terms of the number of projects in which the countries are invested, Australia remains at the forefront with 13 different projects, while Chinese, U.K. and U.S. actors are slightly less common, the former appearing in ten different projects and the latter two in nine projects each. Largely, the project-involvement of these actors constitute foreign direct investments, meaning that the actors are non-resident firms in the projects' host country, channeling and expending finance from outside the host country (OECD, 2008).

[5] Strategic advisors are excluded from the count because of the highly uneven availability of this information and because of the exceptionally large number of actors in this same role when the information *is* available.

Country	Midstream	Investment stream	Supply stream	Grand Total
Australia	24	24	2	**50**
United States of America	13	13	12	**38**
China	12	15	6	**33**
Canada	16	6	1	**23**
South Korea	2	8	7	**17**
United Kingdom	9	4		**13**

Table 4. The top six most common headquarters of actors in the investment stream, midstream and supply stream of the projects.

There is notable cross-over among actors *from* and projects *in* Australia, U.S. and Canada. In other words, actors from these three countries are investing in lithium projects on each other's territories. To cite just two examples: **Kathleen Valley** in Australia includes investment and midstream actors from the U.S. and Canada, and the **James Bay** project in Canada involves actors from Australia and the U.S. (see *Annex 3.1*). On the other hand, Chinese actors are entirely excluded from the five projects in these three countries, although they are prevalent in projects in Africa and Latin America. This pattern resonates with recent policies of "friend-shoring", in which the U.S., Canada, the EU, Australia and other allied countries have forged bilateral and multilateral agreements on critical minerals, largely in view of suppressing China's domination over supply chains (Vivoda and Matthews, 2023). On the other side, LaRocca (2020) observes that the Chinese government has been active in procuring a prominent position in the global lithium supply chain, especially in view of supporting its EV production goals. Responding to various incentives, Chinese corporations have become increasingly prominent actors in lithium upstream processes, supporting the goal of securing a steady supply of the mineral (ibid.). Further reflective of this sentiment is a 100 percent tariff imposed by the U.S. on EVs (Elliott, 2024).

Alongside this trend, widespread investments are also being directed to Africa and Latin America, to a similar extent by actors from China as from Australia, U.S., Canada and the U.K.. Several projects include actors from both China and one or more of the Western countries, indicating that the geopolitical rivalry embodied by friend-shoring does not extend beyond the tangible incentives and restrictions imposed by states. For instance, the main developer of **Manono** in the DRC is Australian company AVZ Minerals, which relies on three Chinese companies for financing of the project.[6] Similarly, the main developer of **Sonora 1 & 2** is Chinese company Ganfeng, which has secured funding from Australian investment firms and relies on several subsidiaries based in Canada and the U.K. for developing the project. Further, through off-take agreements with Ganfeng, **Sonora 1 & 2's** product appears likely to be used in the EVs production of Tesla (U.S.), BMW (Germany) and Volkswagen (Germany).

In line with Arboleda's (2020a) view that states are not weakening against powerful corporate actors, states are effectively directing and restricting foreign capital according to their interests. The U.S. and the EU are bringing lithium production to their own shores, in collaboration with their "friends" and are successfully excluding China from these new supply chains. Yet, these states' influence only extends as far as they are able to make the contexts of their own territories profitable for the corporations on which they rely. The fact that North American, Australian and EU corporations continue to collaborate with China outside of these territories, both purchasing lithium from Chinese actors and co-developing projects, attests to the fact that the global essence of capital pervades over geopolitical rivalries.

These dynamics, which are arguably relatively recent (Riofrancos, 2023, Prina Cerai, 2024), do not signify a *shift* in the geography of resource extraction, but rather an extension. The project **Karibib** in Namibia demonstrates how a multitude of international actors may converge to enable lithium extraction to expand to new areas. **Karibib** sits at the start of a highly complex network of actors and instruments that appears to closely embody Arboleda's vision of a planetary mine and the role of capital in it (2020a). The first trend observed by Arboleda with which Karibib aligns, is that the project constitutes a redevelopment of two existing mining pits based on a re-evaluation of the ore that can profitability be extracted. Lithium deposits that are low in ore grade are redeemed by increasing the size and scale of mining, simultaneously making the process more wasteful and ecologically destructive (Bos et al., 2024). Arboleda suggests that such reinstatements of extraction sites is enabled by unprecedented access to capital, earned by systematic engagement with the finance sector. The main developer of Karibib, Lepidico (Australia), indeed leverages a variety of means to secure finance, relying on private investment firms, conducting a significant merger with a previous site developer, issuing shares, and by courting the U.S. International Development Finance Corporation (DFC) as a "lead lender". Subsequent to this intensive extraction,

[6] Manono is currently in a legal dispute whereby AVZ Minerals is disputing the sale of shares by minority owner Cominière to Chinese company Zijin Mining.

unprocessed ore is shipped to the U.A.E., further elevating the carbon-intensity of Lepidco's chosen strategy (Bos et al., 2024).

Arboleda (2020a) would point to the inherent profit-seeking nature of capital to explain the choice of mining lithium in Namibia and of building a processing plant in the U.A.E., which resonates with Lepidco's own reasoning in selecting "Khalifa Economic Industrial Zone Abu Dhabi (KEZAD), a major industrial free zone, which allows full foreign business ownership as well as tax exemptions on imports and exports" (Lepidco, 2023, p. 8). Furthermore, Campling and Quentin (2021) show that tax avoidance, whether legal or legally ambiguous, is an important strategy to corporations' value accumulations strategies. Such a strategy could potentially be argued to extend to Karibib's supply chain and contractors, as these actors are based in Luxembourg and Switzerland, known for their liberal tax laws. A final notable feature of Karibib is its reliance on ADP, a company whose parent company is owned by the state, to construct the necessary off-site infrastructure, which Arboleda (2020a) has argued has become a central tenet of attracting FDI to mining. While there is no explicit indication that this is the case for Karibib, Arboleda notes that governments often take out their own lines of international credit to enable these industrial infrastructures, another potential arm in the money circuit of extraction.

7.2. Development finance institutions (DFIs)

Development finance institutions (DFIs) such as the International Finance Corporation (IFC) and the Inter-American Development Bank (IDB), have become vocal advocates for critical minerals mining for green transitions (Hund et al., 2020; IDB, 2022; IFCa, 2023). Most of their investments have been granted to projects further downstream from the mining process such as renewable energy projects or recycling (Kim and Lee, 2021). However, four international DFIs were identified as investors in three of the lithium projects. Another five projects are partially financed by domestic government entities.

The international DFIs found to provide *direct* investments to projects are all based in the U.S. – the IFC, IDB and the U.S. International Development Finance Corporation (DFC) – and funding projects in Latin America and Africa, namely **Sal de Vida** and **Karibib**. Pointing to a similar dynamic as the one surrounding foreign investments discussed above, finance from the U.S.-based DFIs are awarded to projects where the main developer is either Canadian or Australian. The following outline of Sal de Vida's networks of actors resonates with Arboleda's depiction of a highly global, complex and interconnected money circuit of extraction, with DFIs being one of several ways in which main developers engage with the global financial system. *Figure 3* depicts a simplification of the network of actors in IDI's style of FTM.

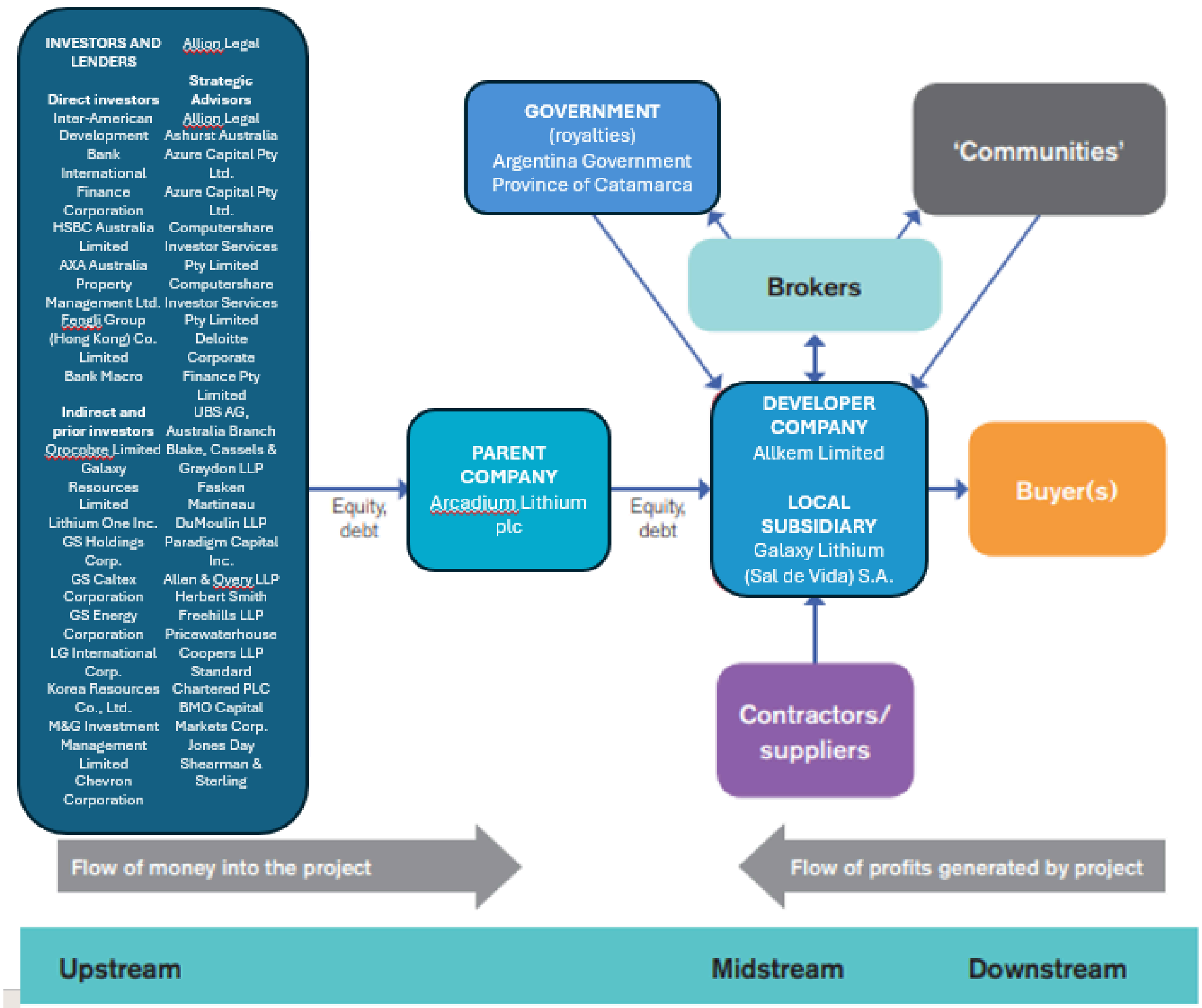

Figure 3. Follow the money chart of Sal de Vida, adapted from Cotula and Blackmore (2014, p. 2). Boxes with a general term signifies that no actor in this particular role was identified.

Sal de Vida in Argentina is the first lithium project to which the IFC has directly provided funds, an initiative that the institution frames as a first step to increasing their support for critical minerals mining (IFCb, 2023). The IDB is also an investor in Sal de Vida, alongside a handful of commercial banks and investment firms. Prior to this particular finance package, capital was sourced from a consortium of Korean companies including LG International Corp. and GS

Caltex, a joint venture of GS Energy Corporation, subsidiary of industrial conglomerate GS Holdings Corp., and oil and gas giant Chevron. Sal de Vida has also changed owners several times due to mergers and acquisitions that recently culminated in the creation of Arcadium Lithium, a new frontrunner in the lithium industry and the parent company of Allkem, which is the project's current main developer. Labban (2014) has shown that corporate financial maneuvering such as mergers and acquisitions have become a prominent strategy of value generations for corporations. In accordance, a report on the state of mining by Bermack et al. (2023, p. 4) noted a trend among companies to use mergers and acquisition deals to "reposition themselves for long-term growth". Additionally, the employment of at least 18 actors serving as strategic advisors in the various mergers, acquisitions and large-scale investments related to Sal de Vida signifies the essential role of intermediary financial actors to the circulation of capital. Strategic advisors are discussed further in the following chapter.

The European Investment Bank is considered an *indirect* investment actor in **Centenario Ratones** in Argentina as their loan to the main developer Eramet (France) is aimed at advancing the company's extraction technology. While the investment is to fund research within the EU, the resulting knowledge and technological improvements can be presumed to be directed at Eramet's diverse operations, including Centenario Ratones. This may contribute to the already significant disconnect between countries extracting lithium and countries generating related knowledge and technology advancements for the various stages of the lithium battery GVC (Moreno-Brieva and Marin, 2019). Meanwhile, direct investors in **Centenario Ratones** include the Chinese steel and nickel company Tsingshan and Swiss mining giant Glencore, which also has an offtake agreement with the project.

Turning to domestic state-investors, there appears to be a regional divergence in whether financial support is given in the name of societal development or the energy transition. Government investments from the U.S. and France seek to support energy transition (respectively: the "Advanced Technology Vehicles Manufacturing Loan Program" awarded to **Thacker Pass** and an investment program aimed at securing critical minerals for the energy transition awarded to **EMILI**). Meanwhile, the government entities supporting national lithium projects in Africa and Latin America are development banks or funds – namely, the Development Bank of Namibia, Minerals Income Investment Fund (of Ghana), and the Banco de Desenvolvimento de Minas Gerais (one of the largest development banks in Brazil, focused on the state of Minas Gerais) – each claim to direct their investments for the benefits of their citizens.

In summary, DFIs and other state-backed lenders are found in projects on each of the major continents studied – North America, Latin America, Africa and Europe. Whether framed as necessary for societal development or green transitions, the presence of these institutions as lenders signifies that states and multilateral institutions have an interest in financing lithium extraction. The diverse financiers of Sal de Vida and Centenario Ratones also demonstrate that DFIs are only one component of the global financial system with which project actors may engage. Additional actors that serve as financial sources in these cases are manufacturing companies, such as LG, and other mining companies, which may or may not also be committed to purchase the project's product. This shows that the global financial system is not in fact confined to financial institutions but rather an assortment of corporations may serve as financiers.

7.3. Shareholders and strategic advisors

To further illuminate the actors that make up the money circuit of extraction of lithium projects, this section focuses on the top 15 largest shareholders of public companies across project streams.[7] It also considers strategic advisors, which, in this research, constitute the financial and legal advisors that are intermediaries to financial engagement. It shows that a large majority of actors with shareholders include the same couple of shareholder firms in their top 15 and that strategic advisors are prevalent as mediators of deals in lithium's money circuit.

Shareholders

Over 60 percent of shareholders were found to fall into Capital IQ's category of traditional investment managers. Banks made up the next 8.5 percent of all shareholders in the database, followed by corporations, hedge fund managers, pension funds and then venture capital firms. Although the top holders in the database are not only for mining companies,[8] the results point to Arboleda's (2020b) argument that the mining industry is increasingly relying on "human revenue streams" to raise capital. While there is no official definition on Capital IQ for these categories, it can be inferred that traditional investment managers, banks, hedge funds and pension funds include savings from middle class and workers households (ibid.).

Alongside the expansion of the financial sector to human revenue streams, passive investment has become an increasingly common strategy among investment managers (Fichtner et al., 2017). BlackRock and Vanguard, which are both top holders in 75 percent of

[7] Some companies have fewer than 15 shareholders in total, see details in Annex 2.3
[8] Top holders are included for all actors that are public companies, see details in Annex 2.3

companies, and State Street, which is the fourth most common top holder, are known as the "Big Three" of passive investment firms (*Figure 4*). Through their analysis of sources of control in the lithium industry, Leruth et al. (2022) found similar results, concluding that BlackRock and Vanguard, which are based in the U.S., held the most control in lithium companies through their ownership of shares. It also found that Chinese lithium company Tianqi was similarly prevalent, but in this research Tianqi only appears as a top holder once.

On the other side of the spectrum, the categories of sovereign wealth funds and state owned shares were each around 0.5 percent, suggesting that states are not generally seeking to profit from lithium extraction through company shares. One notable exception is Norges Bank Investment Management (NBIM), which is classed as a bank by Capital IQ but is in fact the largest sovereign wealth fund in the world (NBIM, 2017). NBIM consists of the revenue from Norway's oil and gas resources and has a market value of over USD 1.5 billion, which is dispersed across a vast number of companies (ibid.). It is a top holder in almost 60 percent of all public companies, only lower than BlackRock and Vanguard.

The highly concentrated ownership of shares presents nuance to previous discussions: while projects are generally associated with a vast network of diverse actors, shareholders are less diverse, with a small number of passive asset managers potentially wielding the greatest cumulative influence over the growing lithium sector. These findings are significant because generating value for shareholders has become an integral aspect of public companies' corporate strategies (van der Zwan, 2014). Therefore, as the public company actors seek to maximize value, significant amounts are likely to flow to these four far-reaching shareholders through the various shares they hold.

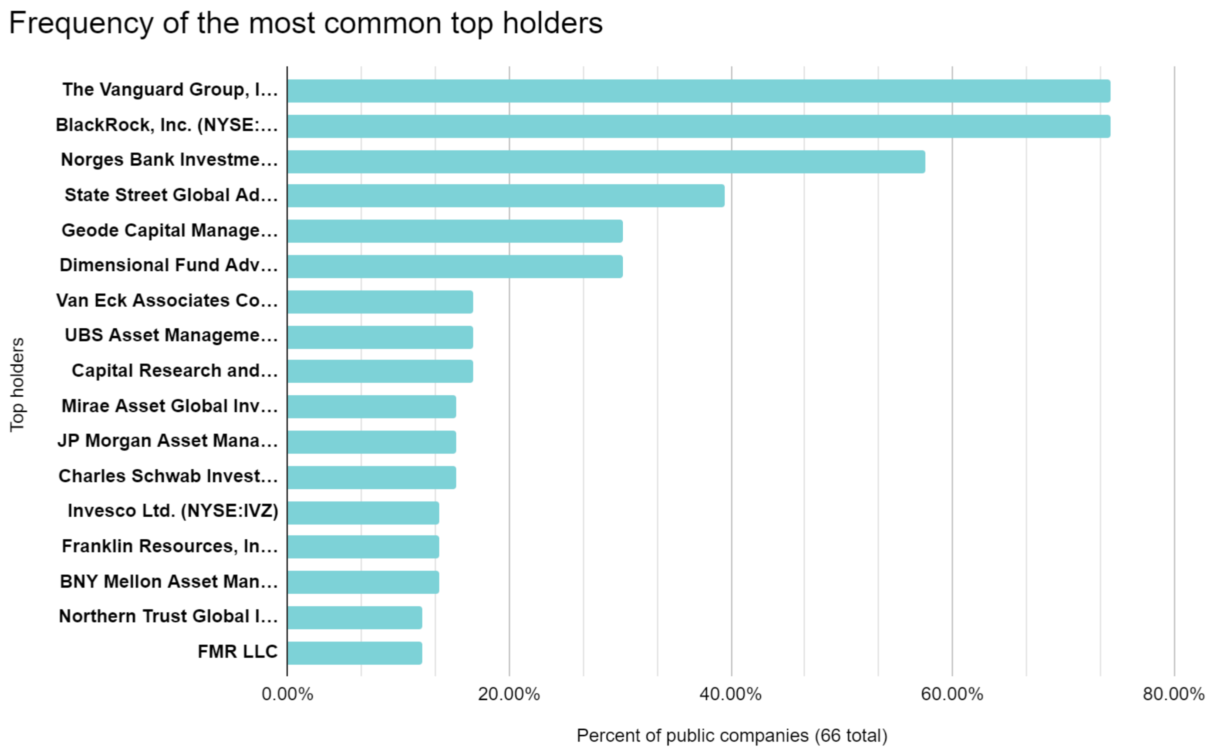

Figure 4. Vanguard, BlackRock and NBIM each appear as top holders in over half of all public company actors.

Strategic advisors

Associated with each project are usually multiple significant transactions such as mergers, acquisitions and large-scale investments and divestments, which are often mediated by strategic advisors. Their role as intermediaries between developer companies and the global financial system fundamentally enables the circulation of capital (Arboleda, 2020b). Most frequently these actors are classed as research and consulting firms, but may also be private investment firms, legal firms, banks or other forms of financial institutions (Annex 3.5). Despite only being successfully identified in relation to 14 projects, strategic advisors are the single most prevalent role of actors with 60 appearances in this category. Strategic advisors appear in clusters, with the number of firms assuming this role often equalling or outnumbering all other actors involved, as illustrated by Sal de Vida in the previous chapter. Furthermore, strategic advisors are almost exclusively based in the UK, North America, and Australia. This suggests that, contrary to Arboleda's (2020a) view that East Asia has risen to dominate credit lending in the mining industry, Western actors are still central to global finance, at least as mediators of it.

The exceptions are a handful of cases in which local advising firms are hired alongside international ones, the advising firms are based in tax havens such as Singapore and the Cayman Islands, or a Chinese mining company opts for Chinese advisors. As these advisory actors capture a proportion of the deal value for themselves, and they can be viewed as the part of “materially unproductive business processes” that are conducive to enhancing capital accumulation (Campling and Quentin, 2021).

8. Conclusion

With lithium extraction ramping up to meet the growing demand for EVs and advanced battery systems in the name of green transitions, this research sought to examine the actors entrusted with delivering this critical mineral. By assuming a supranational perspective, centered on the global essence of capital, the results contribute to a bird's eye view of emerging lithium projects and the international networks of actors that underpin them. As Campling (2021, p. 195) notes, capital “must always be rooted in particular places”, referring to the territories from which resources are extracted. In a globally interconnected world, where extraction sites are rooted and how they are connected to the rest of the world has profound impacts, both on the communities directly impacted and on the general state of the world (Himley et al., 2021).

While just a few countries currently dominate lithium extraction and production, this research found that the distribution of new projects reflects an *expanding* global landscape of extraction, with projects sprouting up in every major region. The U.S., France, Mexico, Mali and Ghana are among the relative newcomers to the industry, while projects in the famous lithium triangle are only ongoing in Argentina. Capital-intensity of projects was found to vary significantly by region, as did certain ownership dynamics. Given that the project developers are without exception corporations, profitability is necessarily a central driver in these geo-spatial variances, and arguably the most crucial one (Huber, 2021). Profitability is linked to geopolitics, which affects the evolution of state policies towards either corporate incentives or restrictions, which push and pull investments in new directions.

Beyond the territories of extraction, the study sought to evaluate the actors engaged with the projects through their development, investment and trade. In line with Arboleda’s (2020a) general observations, it has found that midstream actors are systematically engaged with the global financial system to secure capital for project development. Financial engagement entails diverse combinations of direct and indirect investments, mergers and acquisitions, and attracting powerful shareholders such as the Big Three investment firms. Other sources contributing finance include DFIs, sovereign wealth funds and "human revenue streams" such as pension funds and private savings made through investment banks. Actors across investment and midstreams are highly concentrated in Australia, the U.S., China and Canada, with geopolitical state-relations evidently impacting capital flows to some extent. As demonstrated by Chinese actors being absent from projects in Australia and North America, yet jointly engaged in projects on other territories, geopolitics only appears to impact these capital flows insofar as state policies compel it.

The above findings illuminate how profit directs lithium extraction for green transitions. The profit imperative of lithium's pivotal corporate actors implies a tension between extracting lithium to an extent and in a manner that is *necessary* and *most sustainable* versus to an extent and in a manner that is *most profitable.* This study therefore considers Ajl's (2021) concerns that green transitions will exacerbate inequalities due to the inherent prioritization of global capital accumulation are warranted. While transitioning away from fossil-fuels is a fundamental part of climate action, doing so within a framework of capitalism complicates placing the environment and human needs at the center (Huber, 2021).

Additionally, the geo-spatial distribution of – and relations between – projects, actors and sources of capital is complex and often convoluted. While familiar Western countries are consistently found to be prevalent, traditionally geopolitical delineations of global North and global South, or developing and developed countries, are not meaningful without a handful of caveats. Therefore, Arboleda's (2020a) argument for, instead, centering analyses on the essence of capital, how it flows and the role of states and other actors in mediating it, was found to be a useful framework in this type of research.

Finally, focusing on particular actors and projects and how their dynamics correspond to general theories of capitalism, as this research has done, is an intricate and substantial task. This paper explored a small portion of potential areas for analysis that emerged from the data collection. Therefore, further research could exploit the same database in several more ways, for instance, by focusing more on the end-users or the most prevalent corporations. Further study could also triangulate other data to better understand the dynamics that were brought to light, such as the project cost variances across regions or the financial impacts of corporations' globally expansive organizational strategies. Furthermore, the research could be extended to include additional segments of the lithium supply chains, such as processing facilities or recycling centers.

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Annex

1. Key terminology and abbreviations

Capex	Capital expenditure, estimated cost of project development
Critical minerals; ETMs (energy transition minerals)	Critical minerals tend to include most ETMs as well as other minerals considered important for economic and national security. Lithium is an ETM and is often considered a critical mineral, although the latter can vary across space and time.
Investment stream	Shareholders, lenders and other investors
LIB	Lithium-ion battery
Main developer	The company(ies) that owns the project and is the main actor developing it
Midstream	The segment of actors working towards developing the site of extraction. E.g. Developer company, subsidiaries, contractors, government agencies
MNCs	Multinational corporation
Public company actors	Actors that are public companies and therefore have public shareholders
Shareholders	Financial shareholders, associated with a public company.
Strategic advisors	Financial and legal advisors that mediate financial transactions
Supply stream	The segment of actors in this research that have committed to purchase products from a project once complete, usually agreed through offtake agreements: buyers such as commodity traders,

	manufacturers and (eventually) consumers *Not to be confused with global supply chains, which is a general term referring to the stages of extraction, production and end-use application that lithium may go through in different countries*

2. Methodology

2.1. Project selection

The below table is a screenshot from the database that shows how news and mining journal articles ranking “top lithium projects” were used systematically to select projects for inclusion in the research. The column furthest to the right shows the total number of articles in which the project is mentioned. The projects highlighted in orange were not selected for inclusion in the research.

1	SOURCE	Mining.com, 2023. RANKED: World's largest clay	S&P Global, 2	S&P Global, 2	Mining-techno	S&P Global, 2	Miningreview.	Seekingalpha.	Global data, 2	Energy X, 202	Kavout, 2024. Unlock February 2024's Top Lithium Stock	mining.com.au, 2024. Lithium 2024: A global quarterly perspective	S&P, 2023. Commodities 2024: US, Canada lithium prospects hope	
2	CRITERIA	Hard rock and clay	Africa, up and coming mines	Top M&A activity	Biggest mines in the world	Projects with first shipment	Africa, largest mines	New producers	Key players, market	Major projects	Top stocks	Key players, market	US and Canada	
3	YEAR	Aug-2023	Oct- 2023	Nov-2022	Aug-2019	Jan-2023	Oct-2023	Jun-2023	Oct-2023	Jan-2023	Feb-2024	Apr-2024	Dec-2023	
4	Goulamina	☑	☐	☐	☑	☑	☑	☑	☑	☐	☐	☑	☐	7
5	Manono	☑	☑	☑	☐	☑	☑	☐	☐	☐	☐	☑	☐	6
6	Mt. Holland	☑	☐	☐	☑	☑	☐	☑	☑	☐	☐	☑	☐	6
7	Thacker Pass	☑	☐	☐	☑	☐	☐	☐	☑	☐	☑	☐	☑	5
8	Arcadia	☐	☑	☑	☑	☐	☑	☐	☐	☐	☐	☐	☐	4
9	Bikita	☐	☑	☑	☐	☐	☑	☑	☐	☐	☐	☐	☐	4
10	Ewoyaa	☐	☐	☐	☐	☐	☑	☑	☐	☑	☐	☑	☐	4
11	Grota do Cirilo	☐	☑	☐	☐	☑	☐	☐	☑	☐	☑	☐	☐	4
12	Centenario Raton	☐	☐	☐	☐	☑	☐	☑	☑	☐	☐	☐	☐	3
13	Kathleen Valley	☐	☐	☐	☐	☑	☐	☑	☑	☐	☐	☐	☐	3
14	Jadar	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	2
15	James Bay	☐	☐	☐	☐	☑	☐	☑	☐	☐	☐	☐	☐	2
16	Karibib	☐	☐	☐	☐	☑	☑	☐	☐	☐	☐	☐	☐	2
17	North American Li	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☑	2
18	Rincon	☐	☐	☑	☐	☑	☐	☐	☐	☐	☐	☐	☐	2
19	Sal de Vida	☐	☐	☐	☐	☑	☐	☑	☐	☐	☐	☐	☐	2
20	Sonora 1 & 2	☑	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	2
21	Cauchari-Olaroz	☐	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	2
22	Rhyolite Ridge	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	2
23	Beauvoir (EMILI)	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	1
24	Cinovec	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
25	Lakkor Tso	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
26	Pilgangoora 2	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	1
27	Zhabuye	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	1
28	Carolina	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	0
30	Pastos Grandes	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	0
32	Sal de Oro	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	0

2.2. The database, Projects sheet

Link to the database (view-only):

https://docs.google.com/spreadsheets/d/1VBtrVi24tQ71_uEA_yjplJewLDVoGsP9my2u9vqCI0o/edit?usp=sharing

<u>Projects sheet</u>: All lithium projects on which the research is based ("the projects"). Indicators include *inter alia*: Project name, whether the project received funding from a development finance institution (DFI), country, continent, stage of development, estimated year of operations start, geology, estimated project cost (capex), size of resource, and data sources.

Project	Actor	Country	Continent	Industry Classif	Institutional	Inde:	Market	TEV	Total c	Project stream	Specific role in the	Focus	Date of	USD	% ar	TPA	Details	Sources
Kathleen Va	Liontown Resources Limitec	Australia	Australia and	Metals and mining	Public	10+	1,895.05	1,772.48	380.039	Midstream	Main or parent com	Y						Liontown FY23 ANNU
Kathleen Va	Commonwealth Bank of Aus	Australia	Australia and	Commercial bank	Public	10+	130,955.7	-	62,130.6	Investment chain	Direct financing	NA					The CEFC comr	https://announcement
Kathleen Va	National Australia Bank Lim	Australia	Australia and	Commercial bank	Public	10+	69,887.3	-	-	Investment chain	Direct financing	NA					The CEFC comr	https://announcement
Kathleen Va	Hancock Prospecting	Australia	Australia and	Metals and mining	Private					Investment chain	Direct financing						(Drama) Albema	https://www.capitaliq.c
Kathleen Va	Ramelius Resources Limite	Australia	Australia and	Metals and mining	Public	10+	1,386.10	1,235.60	759.7	Investment chain	Prior investor	NA	11/2016				As of Septembe	https://www.capitaliq.c
Kathleen Va	Clean Energy Finance Corp	Australia	Australia and	Other financial servi	Government Ins					Investment chain	Direct financing	NA					The CEFC comr	https://announcement
Kathleen Va	Export Finance Australia	Australia	Australia and	Other financial servi	Government Ins					Investment chain	Direct financing	NA					The CEFC comr	https://announcement
Kathleen Va	Société Générale S.A.	France	Western Europ	Commercial bank	Private					Investment chain	Direct financing	NA					The CEFC comr	https://announcement
Kathleen Va	Albemarle Corporation	United States of Ameri	North America	Commodity or speci	Public	10+	15,137.2	18,604.2	13,976.1	Investment chain	Direct financing						Albemarle Corpc	https://www.capitaliq.c
Kathleen Va	LRL (Aust) Pty Ltd	Australia	Australia and	Metals and mining	Private					Midstream	Local subsidiary	Y						2023 Quarterly Activit
Kathleen Va	Kathleen Valley Holdings Pt	Austria	Western Europ	Metals and mining	Private					Midstream	Local subsidiary	NA						2023 Quarterly Activit
Kathleen Va	Mila Resources Plc	United Kingdom	Western Europ	Metals and mining	Public	0	3.563	2.996	7.428	Midstream	Strategic alliance			0.1			On 26 July 2023	Liontown FY23 ANN
Kathleen Va	LG Energy Solution, Ltd	South Korea	East Asia	Digital technologies	Public	10+	71,268.8	78,612.1	26,203.7	Supply chain	Binding project offta	NA	2022				Liontown has bir	https://www.afr.com/c
Kathleen Va	Ford Motor Company	United States of Ameri	North America	Automotive industry	Public	10+	48,875.7	171,283.7	193,905.0	Supply chain	Binding project offta	NA	2022				Liontown has bir	https://www.afr.com/c
Kathleen Va	Tesla, Inc.	United States of Ameri	North America	Automotive industry	Public	10+	636,798.8	618,252.8	73,182.0	Supply chain	Binding project offta	NA	2022				Liontown has bir	https://www.afr.com/c

2.3. The database, Top holders sheet

<u>Top holders sheet</u>: The top 15 largest shareholders of each public company that is an actor in any of the projects (see example for the public company Piedmont Lithium in the below table). For each shareholder, indicators include *inter alia*: name of the public company and their industry classification, rank (in terms of relative percent amount of common stock held), type of investor as classified by Capital IQ (see categories in the below table). Certain small companies may have fewer than 15 shareholders.

Example of a public company's entry in the "Top holders" sheet (Piedmont Lithium)

A	B	C	D	E	F	G	H	I
Industry Classification (of the public company)	Public companies	Rank	Top holders	Common Stock Equivalent Held	% of CSO (Common Stock Outstanding	Market Value (USD in mm)	Position Date	Type of investor
Metals and mining	Piedmont Lithium	1	State Street Global Advisors, Inc.	183,786,600	9.568	23.5	1/31/2024	Traditional Investment Managers
Metals and mining	Piedmont Lithium	2	BlackRock, Inc. (NYSE:BLK)	147,492,900	7.678	18.9	12/31/2023	Traditional Investment Managers
Metals and mining	Piedmont Lithium	3	LG Chem, Ltd. (KOSE:A051910)	109,653,500	5.708	14	2/28/2023	Corporations (Public)
Metals and mining	Piedmont Lithium	4	The Vanguard Group, Inc.	105,233,542	5.478	13.5	1/31/2024	Traditional Investment Managers
Metals and mining	Piedmont Lithium	5	Invesco Ltd. (NYSE:IVZ)	53,948,700	2.808	6.9	12/31/2023	Traditional Investment Managers
Metals and mining	Piedmont Lithium	6	Van Eck Associates Corporation	53,906,500	2.806	6.9	12/31/2023	Traditional Investment Managers
Metals and mining	Piedmont Lithium	7	Geode Capital Management, LLC	39,676,200	2.065	5.1	12/31/2023	Traditional Investment Managers
Metals and mining	Piedmont Lithium	8	Mirae Asset Global Investments Co., Ltd.	39,006,400	2.031	5	12/31/2023	Traditional Investment Managers
Metals and mining	Piedmont Lithium	9	Principal Global Investors, LLC	36,171,100	1.883	4.6	12/31/2023	Traditional Investment Managers
Metals and mining	Piedmont Lithium	10	Mochkin, Levi Former Non-Executive Director	32,000,000	1.666	4.1	2/28/2023	Individuals/Insiders
Metals and mining	Piedmont Lithium	11	Morgan Stanley, Investment Banking and Brokerage In	29,786,900	1.551	3.8	12/31/2023	Banks/Investment Banks
Metals and mining	Piedmont Lithium	12	Norges Bank Investment Management	25,320,400	1.318	3.2	12/31/2023	Banks/Investment Banks
Metals and mining	Piedmont Lithium	13	Point72 Asset Management, L.P.	22,760,000	1.185	2.9	12/31/2023	Hedge Fund Managers (<5% stake)
Metals and mining	Piedmont Lithium	14	Invesco Capital Management LLC	20,782,000	1.082	2.7	12/31/2023	Traditional Investment Managers
Metals and mining	Piedmont Lithium	15	Northern Trust Global Investments	18,890,100	0.983	2.4	12/31/2023	Traditional Investment Managers

Columns in the To holders sheet	Categories for "Type of investor"
Industry Classification (*of the public company)*	Corporations (Private) Corporations (Public)

Public companies (*the company whose shareholders it is*) Rank *(1-15th largest shareholder)* Top holders (*the shareholder name*) Common Stock Equivalent Held *(financial indicator for reference only)* % of CSO (Common Stock Outstanding) *(financial indicator for reference only)* Market Value (USD in mm) *(financial indicator for reference only)* Position Date (*date of last change/update*) Type of investor (*industry of the shareholder company, see next column*)	Banks/Investment Banks Traditional Investment Managers VC/PE Firms (<5% stake) Individuals/Insiders Family Offices/Trusts Hedge Fund Managers (<5% stake) State Owned Shares Insurance Companies ESOP Sovereign Wealth Funds (>5% stake) VC/PE Firms (>5% stake) Hedge Fund Managers (>5% stake) Government Pension Sponsors

The public companies for which top holders are recorded.

Industry Classification (of the public company)	No. of public companies
Metals and mining	26
Commercial bank	11
Trading companies and distributors	4
Automotive industry	4
Other	3
Construction and Engineering	3
Commodity or specialty chemicals	3
Oil, gas and consumable fuels	2
Investment firm	2

Semiconductor Materials and Equipment	1
Industrial Conglomerates	1
Electrical Components and Equipment	1
Digital technologies	1
Broadline Retail	1
Grand Total	**63**

2.4. The database, Actors sheet

Actors sheet: All actors associated with a lithium project ("the actors"). Indicators include *inter alia*: actor name, associated project, country and continent of headquarters, industry classification, Institutional category (public/ private/ governmental), project stream, specific role, relevant monetary values or lithium quantities (if applicable), and data sources. The below screenshot of the actors sheet shows all the actors for the project Kathleen Valley as an example. The tables below further describe the data content and the dropdown menus.

Project	Actor	Country	Continent	Industry Classif	Institutional	Inde:	Market	TEV
Kathleen Va	Liontown Resources Limitec	Australia	Australia and	Metals and mining	Public	10+	1,895.05	1,772.48
Kathleen Va	Commonwealth Bank of Aus	Australia	Australia and	Commercial bank	Public	10+	130,955.7	-
Kathleen Va	National Australia Bank Lim	Australia	Australia and	Commercial bank	Public	10+	69,887.3(	-
Kathleen Va	Hancock Prospecting	Australia	Australia and	Metals and mining	Private			
Kathleen Va	Ramelius Resources Limite	Australia	Australia and	Metals and mining	Public	10+	1,386.10	1,235.60
Kathleen Va	Clean Energy Finance Corp	Australia	Australia and	Other financial servi	Government Ins			
Kathleen Va	Export Finance Australia	Australia	Australia and	Other financial servi	Government Ins			
Kathleen Va	Société Générale S.A.	France	Western Europ	Commercial bank	Private			
Kathleen Va	Albemarle Corporation	United States of Ameri	North America	Commodity or speci	Public	10+	15,137.2(	18,604.2(
Kathleen Va	LRL (Aust) Pty Ltd	Australia	Australia and	Metals and mining	Private			
Kathleen Va	Kathleen Valley Holdings Pt	Austria	Western Europ	Metals and mining	Private			
Kathleen Va	Mila Resources Plc	United Kingdom	Western Europ	Metals and mining	Public	0	3.563	2.996
Kathleen Va	LG Energy Solution, Ltd	South Korea	East Asia	Digital technologies	Public	10+	71,268.8(	78,612.1(
Kathleen Va	Ford Motor Company	United States of Ameri	North America	Automotive industry	Public	10+	48,875.7(	171,283.7
Kathleen Va	Tesla, Inc.	United States of Ameri	North America	Automotive industry	Public	10+	636,798.8	618,252.8

Actor	Total c	Project stream	Specific role in the	Focus	Date of	USD	% ai	TPA	Details	Sources
Liontown Resources Limitec	380.039	Midstream	Main or parent com	Y						Liontown FY23 ANNU
Commonwealth Bank of Aus	62,130.6(	Investment chain	Direct financing	NA					The CEFC comr	https://announcement
National Australia Bank Lim	-	Investment chain	Direct financing	NA					The CEFC comr	https://announcement
Hancock Prospecting		Investment chain	Direct financing						(Drama) Albema	https://www.capitaliq.c
Ramelius Resources Limite	759.7	Investment chain	Prior investor	NA	11/2016				As of Septembei	https://www.capitaliq.c
Clean Energy Finance Corp		Investment chain	Direct financing	NA					The CEFC comr	https://announcement
Export Finance Australia		Investment chain	Direct financing	NA					The CEFC comr	https://announcement
Société Générale S.A.		Investment chain	Direct financing	NA					The CEFC comr	https://announcement
Albemarle Corporation	13,976.1(	Investment chain	Direct financing						Albemarle Corpc	https://www.capitaliq.c
LRL (Aust) Pty Ltd		Midstream	Local subsidiary	Y						2023 Quarterly Activit
Kathleen Valley Holdings Pt		Midstream	Local subsidiary	NA						2023 Quarterly Activit
Mila Resources Plc	7.428	Midstream	Strategic alliance			0.1			On 26 July 2023	Liontown FY23 ANN
LG Energy Solution, Ltd	26,203.7(	Supply chain	Binding project offta	NA	2022				Liontown has bir	https://www.afr.com/cc
Ford Motor Company	193,905.(	Supply chain	Binding project offta	NA	2022				Liontown has bir	https://www.afr.com/cc
Tesla, Inc.	73,182.0(	Supply chain	Binding project offta	NA	2022				Liontown has bir	https://www.afr.com/cc

Columns in the actors sheet
Project Actor Country Continent Industry Classification Public/private/governmental Index membership *(financial indicator for public companies, number of indices on which the company is listed)*

Market cap *(financial indicator for public companies, for reference only)* TEV *(financial indicator for public companies, for reference only)* Total cap *(financial indicator for public companies, for reference only)* Project stream *(see below)* Specific role in the project *(see below)* Focus project? *(indicator of whether the actor is dedicated only to this project, e.g. project-specific subsidiary, for reference only)* Date of involvement *(any relevant dates, for reference only)* USD, millions *(any relevant monetary amounts, for reference only)* % amount *(any relevant percentages, for reference only)* TPA amount (*tonnes per annum of lithium carbonate, for reference only)* Details Sources Notes

2.5. The database, Description of project streams and specific roles of actors

Project stream	**Specific role in the project** (database term)	**Description**	**Term(s) in text body** (if different)
Investment stream	Direct financing	*Use Of Proceeds* under *Transaction Details (S&P)* specifies only the project in question OR specifies the project as the predominant use. Alternatively, the	Investor

		investment is in a company (subsidiary or main) whose sole or main purpose is the development of the project.	
	Indirect financing	*Use Of Proceeds* under *Transaction Details (S&P)* relates to relevant company activities but does not specify the project in question OR specifies the project among other activities with equal or greater emphasis.	
	Non-local subsidiary (finance-related)	Subsidiary that is dedicated to management of finances	
	Parent company of Actor (indirect connection)	Parent company of an actor other than a project owner (see column with *Level of influence* to know if that actor is in the investment chain, midstream or supply chain)	
	Prior investor	Previous owner or investor who (financially) supported the project's development prior to the current project owners.	
	Prior local subsidiary	A subsidiary of a prior investor that was primarily dedicated to the project, and is incorporated in the same country as the project	
	Strategic Adviser	Firm that are explicitly referred to as strategic advisors in project documents as well as legal and financial advisors to M&As that directly concern the project in question (e.g. advisors on a project investment or takeover)	
	Other		
Midstream	50/50 Joint venture	Two project owners with equal shares in the project. The companies may have joint ownership of the project as an asset or through joint ownership of a subsidiary dedicated to the project.	Project owner(s)
	Contractor	Contractor hired by the Main Developer to work on project development. Usually to perform engineering or construction work.	

	Local subsidiary	A subsidiary of the Main Developer company that is is primarily dedicated to the project, and is incorporated in the same country as the project	Subsidiary Dedicated subsidiary
	Main or parent company	The company that is the main responsible entity for the development of a project. Usually they are the parent company of the subsidiary(-ies) dedicated to the project. They may or may not have a parent company themselves.	Main Developer; project owner
	Minority owner	Companies that owns less than 50 percent shares in a project (asset or dedicated subsidiary)	Minority project owner
	Non-local subsidiary	A subsidiary of the Main Developer company that is is primarily dedicated to the project, but is NOT incorporated in the same country as the project	Subsidiary Dedicated subsidiary
	Parent company of Actor (indirect connection)	Parent company of an actor other than a project owner (see column with *Level of influence* to know if that actor is in the investment chain, midstream or supply chain)	
	Royalty rights	An actors that is owed royalties from the project	
	Strategic alliance	A partnership between two companies that entails some kind of systematic cooperation.	
	Uppermost parent (non-direct connection)	Parent company of the Main Developer company	
Supply stream	Binding project offtake	The company has an agreement to purchase products **from the project**	Purchase agreement
	Binding company offtake	The company has an agreement to purchase products **from the project's Main Developer**, but the purchase may include a variety of projects owned by the same developer company	Purchase agreement
	Non-binding company offtake	The company has an agreement to purchase products **from the project's Main Developer**, but the agreement is not binding. For instance, the agreement is a "non-binding MoU" or there is some kind of announcement of an agreement but no sign of official documents	Purchase agreement

	Non-binding project offtake	The company has an agreement to purchase products **from the project**, but the agreement is not binding. For instance, the agreement is a "non-binding MoU" or there is some kind of announcement of an agreement but no sign of official documents	Purchase agreement
	Processing or refining	The actor is committed to processing the product of the project, either on behalf of the main developer or through a purchase agreement.	
	Parent company of Actor (indirect connection)	Parent company of an actor other than a project owner (see column with *Level of influence* to know if that actor is in the investment chain, midstream or supply chain)	
	Other		

2.6. Data collection protocol for the actors

This protocol is a framework from which I departed in each search. In reality, the process was not linear at all. Each project required a lot of back and forth between different pages on S&P, different company reports and between Google, company reports and S&P. Sometimes a project that has not had major developments recently is not mentioned in the most recent reports, requiring me to sift through several company reports from different years before finding comprehensive project information. *See Annex 2.5 for all possible roles of actors in each project stream.*

- **Midstream actors**

Including: *Current project owners, subsidiaries, top parent company, contractors, royalty rights*

Key search terms: *[project name], subsidiaries, parent, assets, owned by*

- ☐ Google – project name
- ☐ S&P – check the project page and developer company for:
  - Tearsheet → Parent Company
  - Private ownership
  - Investments → use filter or search for project name

- **Investment stream**

Including: *Project and company investors, preceding project owners*

***Key search terms**: investment, acquisition (acquire), lenders, creditor, liabilities, liquidity outlook*

- [ ] Annual reports
    - Search: project name, key terms
- [ ] S&P – check the project page, parent company and subsidiaries for:
    - Private Ownership
    - Public ownership (if public company)
    - Suppliers
    - Strategic Alliances
    - Key Developments (All Events) → search for M&A, Transaction

- **Supply stream**

***Including:** Offtake agreements, companies involved in processing or refining*

***Key search terms**: offtake (off-take), supply (agreement), purchase (contract), sale (contracts), client, customer, original equipment manufacturers (OEMs)*

- [ ] Google – offtake, supply agreements
- [ ] Annual reports (of developer company, subsidiaries, and potential customers)
    - Search: project name, key terms
- [ ] S&P – check the project page, parent company and subsidiaries for:
    - Customers
    - Strategic Alliances
    - Key Developments (All Events) → search for Client Announcements
        - Check for any advising or consultancy firms involved

3. Analysis

3.1. Projects with actors from Australia, U.S., Canada, China, U.K.

Projects with actors in the midstream and/or investment stream from Australia, US, Canada, China and the U.K.. Domestic projects are in bold. For instance, the 13 projects listed under Australia are either being developed or funded by Australia. Kathleen Valley and Mt. Holland are in bold because they are in Australia. Arcadia and Caucharí-Olaroz are among the projects that are also listed under China, indicating that there is some level of Australia-China cooperation on *these projects.*

Australia	**U.S.**	**Canada**	**China**	**UK and Guernsey**
13	**9**	**8**	**10**	**9**
Arcadia	**Carolina**	Cauchari-Olaroz	Arcadia	Sal de Oro
Cauchari-Olaroz	Ewoyaa	Pastos Grandes	Bikita	Sal de Vida
Ewoyaa	James Bay	Grota do Cirilo	Cauchari-Olaroz	Bikita
Goulamina	Karibib	**James Bay**	Centenario Ratones	Jadar
Grota do Cirilo	Kathleen Valley	Sal de Oro	Goulamina	Kathleen Valley
James Bay	Sal de Oro	Sal de Vida	**Lakkor Tso**	Rincon
Karibib	Sal de Vida	Thacker Pass	Manono	Sonora 1 & 2
Kathleen Valley	**Thacker Pass**	Sonora 1 & 2	Pastos Grandes	Uis Lithium (Andrada)
Manono	Uis Lithium (Andrada)		Sal de Vida	Ewoyaa
Mt. Holland			Sonora 1 & 2	
Rincon				
Sal de Vida				
Sonora 1 & 2				

3.2. Number of actors in each project stream, by project

Number of actors in the investment chain, midstream and supply chain of each project; average number of actors in each level (excluding Strategic Advisors)

Project	**Investment stream**	**Midstream**	**Supply stream**	**Total**
Sal de Vida	35	6	1	42
Arcadia	13	3	2	18
Sonora 1 & 2	11	13	5	29
Kathleen Valley	9	10	3	22

Ewoyaa	9	6	4	19
Pastos Grandes	8	5		13
Cauchari-Olaroz	8	11	6	25
Karibib	7	6	7	20
Grota do Cirilo	7	15	1	23
Carolina	7	3	2	12
James Bay	6	4		10
Sal de Oro	5	4	2	11
Rincon	5	3	2	10
Manono	5	7		12
Thacker Pass	4	11	1	16
Centenario Ratones	4	6	1	11
Uis Lithium (Andrada)	3	2		5
Mt. Holland	3	4	7	14
Beauvoir (EMILI)	3	1		4
Lakkor Tso	2	4		6
Goulamina	2	8	4	14
Bikita	2	3	1	6
Jadar		1	1	2
Grand Total	**158**	**136**	**50**	**344**
Average	**7.181818182**	**5.913043478**	**2.941176471**	**14.95652174**

3.3. Actors that operate across multiple project streams

Actors that are present in more than two project streams. For instance, Ganfeng appears three times each in the investment stream, midstream and supply stream, thereby appearing a total of nine times in the database.

Actor	Investment stream	Midstream	Supply stream	Total
Ganfeng Lithium Group	3	3	3	9

Co., Ltd.				
Tesla, Inc.			7	7
LG Chem, Ltd.	2		3	5
Sinomine Resource Group Co., Ltd.	1	1	2	4
Lithium Americas Corp.		3	1	4
Allen & Overy LLP	4			4
Volkwagen			3	3
SQM (Sociedad Química y Minera de Chile)	1	1	1	3
Piedmont Lithium	1	1	1	3
Orion Resource Partners	2	1		3
LG Energy Solutions, Ltd			3	3
JPMorgan Chase & Co.	3			3
Galaxy Resources Limited	3			3
Computershare Investor Services Pty Limited	3			3
Canaccord Genuity Group Inc.	3			3
BMW			3	3
Azure Capital Pty Ltd.	3			3
Allkem Limited	1	2		3

3.4. Number of actors classed as public, private or governmental

Number of government institutions, private companies and public companies present in each level of influence.

Public/ private/ governmental	Investmen t stream	Midstream	Supply stream	Total
Government Institution	12	10	2	24

Private company	105	81	6	192
Public company	39	42	41	122
Grand Total	**156**	**133**	**49**	**338**

3.5. Number of actors in each industry

Number of actors in each industry classification, based on total number of appearances and unique companies.

Industry Classification	**No. actors total**	**No. actors unique**
Metals and mining	118	84
Research and consulting	30	25
Investment firm	29	21
Automotive industry	19	6
Unknown	18	17
Other financial services	16	13
Commercial bank	16	13
Construction and Engineering	14	12
Commodity or specialty chemicals	14	9
Government entity	13	11
Other	12	12
Trading companies and distributors	9	7
Legal service	9	7
Oil, gas and consumable fuels	7	5

DFI	6	6
Industrial Conglomerates	3	3
Digital technologies	3	1
Industrial machinery	2	2
Data Processing	2	1
Broadline Retail	2	1
Semiconductor Materials and Equipment	1	1
Electrical Components and Equipment	1	1
Grand Total	**344**	**258**

3.6. Industry classifications of strategic advisors