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The "Finance-Extraction-Transitions Nexus": Geographies of the Green Transition in the 21st Century

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Abstract: The hegemonic understanding of the green transition will require a massive surge in mineral extraction. We contend that this entails wider, radical shifts in 21st century financialised capitalism. While there has been increasing critical interest in the role of finance capital in development, the links between finance, extraction, and the green transition have been largely overlooked. We fill this gap by arguing that the green transition, understood as a transformation of global capitalism, is marked by new rounds of appropriation, exploitation, and extraction, (re)producing dependencies for resource-rich Global South countries. These emergent geographies of the green transition are best evaluated through what we call the "finance-extraction-transitions nexus". The nexus highlights the interplay between finance capital, mineral extraction, and the material, socio-economic, and environmental implications of the green transition. This provides new ways to theoretically, conceptually, and methodologically engage with resource extraction and the green transition in the age of financialised capitalism.

Resumen: La comprensión hegemónica de la transición verde requerirá un aumento masivo de la extracción de minerales. Argumentamos que esto implica cambios más amplios y radicales en el capitalismo financiarizado del siglo XXI. Si bien en la literatura crítica ha habido un creciente interés en el papel del capital financiero en el desarrollo, sostenemos que los vínculos entre las finanzas, la extracción y la transición verde se ha estado omitido. Este articulo llena ese vacío en la literatura critica argumentando que la transición verde, entendida como una transformación del capitalismo global, está marcada por nuevas rondas de apropiación, explotación y extracción, así (re)produciendo dependencias para los países del Sur Global ricos en recursos. Estas geografías emergentes de la transición verde se pueden evaluar a través de lo que llamamos el "nexo finanzas-extracción-transiciones". El nexo destaca la interacción entre el capital financiero, la extracción de minerales y las implicaciones materiales, socioeconómicas y ambientales de la transición verde. Esto proporciona nuevas formas de abordar teórica, conceptual y metodológicamente la extracción de recursos y la transición verde en la era del capitalismo financiarizado.

Keywords: finance, climate change, green transition, extractivism, geographies of green transitions

Introduction

Historically, transfigurations in the underlying energy system—such as the emergence of fossil capital in the coal belts of northern England (Malm 2015) or the shift from coal to oil that redrew the 20th century world order (Khalili 2020; Mitchell 2011)—have accompanied (or precipitated) radical transformations in the world economy. These transformations are historical moments which represent qualitative as well as quantitative modifications of capitalism that have had, over the past two centuries, enormous global significance. As arguably one of the most ambitious, large-scale, and globally coordinated policy efforts, this observation is also true of the ongoing transition from fossil fuels to green energy sources required to avoid a cataclysmic climate collapse in the 21st century.

This "green transition" presents a Herculean task.[1] One of the major challenges is how governments and private investors manage the increased demand for natural resources used in the production of green technologies and renewable energy, such as lithium, nickel, copper, or cobalt. So-called "transition minerals"[2] have already experienced a substantial increase in economic demand and political interest in recent years (see Deetman et al. 2018). And this is just the beginning. Analysts predict an explosion of demand for the metals and minerals that underpin the green transition, leading to another commodity supercycle (Jenkins and Hopkins 2019; War on Want 2021; World Bank 2017, 2020). The estimated mineral intensity of the green transition suggests that demand for these transition minerals could increase by almost 500% until 2050 (World Bank 2020).

The initial impetus for tackling anthropogenic climate change and the shift away from fossil fuels came from activist groups, scientists, and a handful of progressive policymakers. However, because the green transition also entails wider, radical shifts within global capitalism, these issues have become inescapable to governments and capital. As climate change and contemporary capitalism are intertwined—reproducing uneven global development (see Stevano et al. 2021)—activities centred on mineral extraction are part and parcel of the intersection between climate change policies and how financialised capitalism shapes emerging social, economic, and ecological relations. In recent years, the question of how to finance the extraction of transition minerals has increasingly become a focal point for governments, private inventors, and international financial institutions. These actors have started to promote what we consider to be the hegemonic green transition—a socio-technical transition led by capital from one energy system to another that leaves the underlying structures of capitalism in place. This has led to a qualitative shift in the involvement of finance in the green transition and climate change mitigation more generally. What once was a central demand of the climate movement has become the purview of capital in the 21st century. In this light, we see an urgent need to develop new theoretical, conceptual, and methodological tools to evaluate the relationship between resource extraction and the green transition in the age of financialised capitalism. In this article we develop the "finance-extraction-transitions nexus", a conceptual framework that captures how finance and extraction act as operations within the hegemonic green transition. It helps to emphasise the interplay between finance

capital, the extraction of transition metals and minerals, and the material, socio-economic, and environmental implications of the green transition.

To develop the "finance-extraction-transitions nexus", we draw on academic debates on the links between finance and development (Dafermos et al. 2021; Gabor 2021), the role of finance in the governance of climate change (Bracking 2019; Bridge et al. 2020; Castree 2010; Christophers 2018; Mawdsley 2018; Robertson 2012), international financial subordination (Alami et al. 2023; Bonizzi et al. 2022; Koddenbrock et al. 2022), and Marxist ecology (Arboleda 2020; Burkett 1999; Huber 2017, 2018; Mau 2023; Moore 2015). By situating our nexus at the intersection of these different literatures, we offer a synthesis that moves beyond socio-technocratic approaches to investigating transitions and brings to the fore the emergent geographies of the green transition, which are marked by new rounds of appropriation, exploitation, and extraction. By mapping out the geographies of green transitions, the "finance-extraction-transitions nexus" provides an analytical entry point into understanding how the green transition will (re)produce dependencies for resource-rich Global South countries.

In this article we develop the "finance-extraction-transitions nexus" as follows. After initially laying out the different conceptual components of the nexus, we first explore the literature on the role of finance in shaping development policies. This strand of literature has come a long way since Gabor (2018) first published her influential paper on the Wall Street Consensus (see, for example, Alami et al. 2021; Kedward et al. 2022; Schindler et al. 2023). However, the critical literature on finance-led development has thus far engaged very little with questions around extractivism and transition minerals. Secondly, we engage with the relatively "young" literature on "green" finance climate change as well as with the literature on international financial subordination. We draw on these literatures to understand the role of finance in green technology investments, which is relevant for exploring our "finance-extraction-transitions nexus". Thirdly, to develop our nexus we draw on studies on financialisation processes in the extractive sectors (Arboleda 2020; Borras et al. 2012; Gago and Mezzadra 2017) and on literature evaluating financialised extractivism of food crops, timber, and gold (see Bracking 2019; de los Reyes 2022). We use these contributions to explore the "finance-extraction-transition nexus" for the study of the role of finance in the extraction of materials needed for the green transition. Finally, we move back onto a higher level of abstraction to tease out our theoretical contribution through discussions of expanded reproduction and capitalism's frontiers, highlighting the geographical dimensions of the "finance-extraction-transitions nexus".

The Finance-Extraction-Transitions Nexus

The point of departure for starting to conceptualise our "finance-extraction-transitions nexus" is that extraction and finance are, in the words of Ollman (2015:10), internally related parts of the green transition. On the one hand, extraction captures the physical operations of capital and labour processes entailed in the production of surplus value through the free appropriation of

nature (Burkett 1999), capturing the transformation of nature into value (Huber 2017, 2018), or, to put it another way, the production of capitalist natures (Mau 2023; Smith 2008). On the other hand, finance corresponds to operations of capital engaged in its expanded reproduction through the money form as "interest-bearing capital". It acts as a temporal fix (Harvey 2006), moving future value into the present—principally through money lending and risk management—and representing "claims over wealth that is yet to be produced" (Durand 2017:1).[3] Finance smooths the emergent spatial and temporal disjuncture in the circuit of capital as it passes through production-circulation-realisation. However, as it "mediates the buying and selling of assets in (temporal and spatial) separation from physical ownership" (Purcell et al. 2020:455), finance appears geographically distinct from extraction and outside the sphere of production (although this is not necessarily the case). Importantly for our argument here, extraction and finance are the two operations of capital which are central to the form assumed by the hegemonic green transition already underway, enabling capital to emerge "as a political actor" articulated "with a diverse array of institutions and political forms" (Mezzadra and Neilson 2019:54).

We contend that we cannot fully grasp the unfolding green transition without grappling with the intertwined dynamics of extraction and finance. It is the dialectical relationship between internally related parts (extraction and finance) and the whole which they help compromise (transition) that we call the "finance-extraction-transitions nexus". Extraction and finance are the processes underpinning how political actors and different fractions of capital are approaching the move from fossil fuels to green energy and are making decisions about the institutions and technologies to achieve decarbonisation. Approaching the green transition from this vantage point centres the appropriation and exploitation of nature and labour.[4]

We explore this nexus along two different lines: (1) how finance capital, with the support of international financial institutions (IFIs), directs the speed, depth, and shape of new forms of natural resource extraction and the green transition; and (2) how the financialisation of resource extraction, including structural transformations of local financial systems, interact with international financial subordination and the creation of new dependencies. For this, we draw on different strands of critical literature.

Financial Capitalism and Green Extractivism

There is an expansive critical finance literature analysing the move from the "Washington Consensus" towards the "Wall Street Consensus". Gabor (2021) describes this as a paradigm shift that introduces the logic of bankability into development policy across the global economy. These tendencies are also visible at the energy-development nexus (Baltruszewicz et al. 2021; Dafermos et al. 2021). Like previous development paradigms, the Wall Street Consensus is heavily promoted by IFIs such as the World Bank, the IMF, or multilateral development banks.[5] However, while there have been some important contributions to the literature studying the effects of this paradigm shift on understandings of

development, how this shift impacts mineral extraction and development strategies in resource-rich economies in the Global South has, until now, been largely overlooked.

Given that recent reports by IFIs on mining and mineral extraction draw heavily from the finance-led logic of the Wall Street Consensus, this is a significant oversight. The World Bank (2020:31), for example, argues that increased demand for strategic minerals could provide "opportunities for resource-rich developing countries and enable them to meaningfully contribute to the clean energy transition". While advising that the "increasing extractive and processing activities *could* have serious environmental and social implications *if* these activities are not managed responsibly" (ibid., original emphasis), the Bank provides a set of measures for governments and investors to mitigate these risks. Through the adaption of so-called "Climate-Smart Mining practices" developed to align with the Sustainable Development Goals (SDGs) (World Bank 2020), the Bank aims to mitigate negative impacts on "already vulnerable communities in developing countries, as well as the environment in which they operate" (World Bank 2020:101). Climate-Smart Mining practices, the Bank argues, would allow public and private actors to "support the low-carbon transition through a holistic approach … [that] would enable the mining sector to transform its current practices—through innovation and new partnerships" (World Bank 2020:31).

A central pillar of the Climate-Smart Mining approach is the creation of market opportunities (Figure 1). Here, the report provides ideas on how to attract investment for the extraction of transition minerals by upstream financial companies. Firstly, market opportunities for private sector capital should be created through

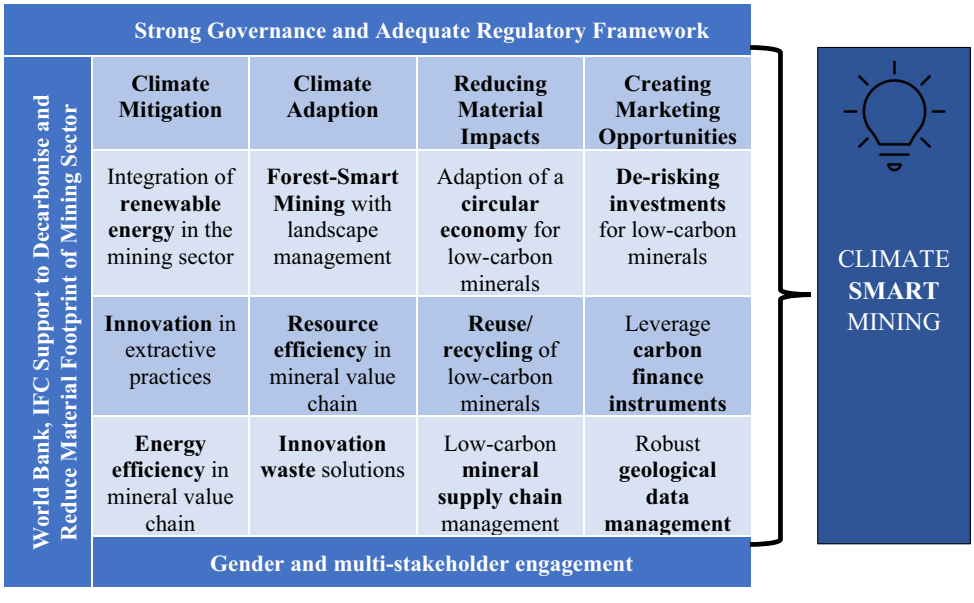

Figure 1: The World Bank's Climate-Smart Mining approach (source: own elaboration, based on World Bank 2020:101)

leveraging carbon finance instruments. Secondly, the World Bank (2020) report sees the de-risking of investments as integral to its Climate-Smart Mining approach. While de-risking practices have become more popular in financing climate technology, the World Bank includes market-creating tools to enable the extraction of transition minerals (Figure 1). De-risking is thus not only central in shaping the financialisation of green transitions, but also investment patterns around and extractive processes mining transition minerals.

As most of the world's known reserves of transition minerals are in the Global South, the Word Bank's Climate-Smart Mining approach sees the answer to the demand problem in scaling up investments through leveraging public funds and carbon finance instruments, such as carbon offsets (see Bridge et al. 2020).[6] The finance-led approach to mining hence has particular implications for Global South countries such as Argentina, Bolivia, and Chile—collectively known as the "lithium triangle" or "Puna de Atacama" (see NRDC 2022), which holds over two-thirds of the world's known lithium reserves—as well as the Democratic Republic of Congo as the world's largest cobalt producer, Indonesia as the global leader in nickel extraction, and Brazil, Guinea, and Jamaica where bauxite reserves are highly concentrated.

There are several impacts that the shift to the Wall Street Consensus provokes in extraction as an operation within capitalism which are of particular importance for resource-rich Global South countries. As finance capital is the driving force towards a low-carbon economy, it not only reduces the possibility of state-led initiatives such as the Green New Deal (see Pettifor 2019), but it also brings public finances further into the realm of financialised capitalism and shifts Global South countries further towards adopting broad-based, market and regulatory reforms aimed at attracting private investors. A recent IMF staff note on the de-risking strategy of climate-related investments is illustrative of these trends. It presents "potential ways to mobilize domestic and foreign private sector capital in climate finance … by mitigating relevant risks and constraints through public-private partnerships involving multilateral, regional, and national development banks" (Prasad et al. 2022:1). The IMF identifies several market failures that could prevent private finance capital from investing in climate-related extraction or production initiatives in Global South countries. These market failures arise from different uncertainties around climate risks, the lack of bankable projects, long investment time frames, high upfront capital and transaction costs, country risks, lack of robust local financial markets, and an uncertain governance landscape (see Prasad et al. 2022). The note stresses that "[b]lending public and private sector finance is useful to de-risk … investments for private sector capital in general" (Prasad et al. 2022:2).

Such blended finance strategies include green bonds, SDG bonds, green, social, sustainability and sustainability-linked bonds, sustainability-linked loans, venture capital investments, multi-sovereign guarantees to achieve higher leverage ratios, and PPPs that provide public equity capital to underwrite investments and to lower borrowing costs. Moreover—and in line with broader Wall Street Consensus ideas—the IMF recommends that IFIs and development banks support the development of local financial markets and local bond market infrastructure to deepen

local capital markets and their liquidity (see Prasad et al. 2022). This includes direct financing through debt or equity, intermediate finance through local financial and non-financial intermediaries, and large-scale PPPs. Hence, the strategy to mobilise private climate finance for Global South countries not only involves the de-risking of climate-friendly infrastructure projects or green technologies, but also importantly calls for support from transnational capital in the development of capability in managing large mineral endowments and in reforming local financial markets.

One example of how global PPPs increasingly aim to influence decision-making about transition minerals is the Global Battery Alliance, a public-private collaboration platform founded in 2017 at the World Economic Forum. In 2022 the Alliance launched the Critical Minerals Advisory Group to provide policy advice on "a range of macro-economic, social and governance issues related to the sourcing of critical minerals" (GBA 2024). Stakeholders include different governmental organisations and ministries, mining companies such as Glencore, Anglo American, and BP, multinational companies producing green technologies such as BASF, BMW, Tesla, and LG, financial actors such as the London Metal Exchange, as well as NGOs and IFIs, including the World Bank and United Nations Environment Programme. Since joining the alliance, countries such as Chile and the Democratic Republic of Congo have changed their regulatory frameworks governing lithium and cobalt respectively (see IEA 2021). The influence of finance in how Global South countries manage the extraction and export of transition minerals is increasing through these partnerships. This highlights how de-risking and financialised logic have taken over resource governance in resource-rich Global South countries.

To evaluate how finance operates within the hegemonic green transition implies analysing such initiatives of governance agencies, private financial companies, and IFIs as well as studying the role of these actors in shaping the mechanisms, direction, and depth of financing the extraction of minerals. This is the first conceptual piece to our "finance-extraction-transitions nexus". It will help to shed light on how the paradigm shift in development policy, the Wall Street Consensus, impacts investment strategies into resource-rich economies in the Global South and to unpack the territorialisation processes that underpin transition mineral extraction and produce geographies of green transitions.

International Financial Subordination and Mineral Extraction: New Dependencies

The second aspect central to unpacking the "finance-extraction-transitions nexus" is the evaluation of different dependencies within global financialised accumulation regimes centred on the extraction and export of natural resources. As the critical literature on extractivism rightly points out, extraction activities are at the core of global uneven development, asymmetric and unequal exchange relations, and global division of labour (Acosta 2013; Gudynas 2010). As such, we need to interrogate how the role of finance in the extraction of transition minerals expands existing and/or creates new dependencies. The high capital intensity of

extractive operations means the mining industry has become dependent "upon the mediations of a complex network of financial actors, practices, and instruments" (Arboleda 2020:122). To grapple with the significance of these developments in the mining industry, we contend that close attention needs to be paid to the role of finance in shaping value creation in, and value extraction from, resource-abundant Global South countries.

Studying the subordinate position of Global South countries in financial capitalism, for example, brings about new insights into structural value transfer from their economies to the Global North. Here, we draw on the understanding of global capitalism put forward by Alami et al. (2023) and Bonizzi et al. (2022), who highlight how the subordinate position of Global South countries internationally is inherent in their role in global capitalism, something that shapes their agency in and experiences of extractive operations. From this perspective, the agency of Global South countries is "circumscribed by their position in global capitalism … [and shaped by] an uneven hierarchy of classes and nation-states" (Bonizzi et al. 2022:654). Through structurally modifying models of capital accumulation across the globe, finance capital has been central in accelerating the transfer of value produced in Global South countries to the Global North.

This systemic function of finance in facilitating the transfer, storage, and realisation of value unfolds along several lines. Global South countries embedded into global networks of natural resource extraction, export, and production are pressured into adapting dollar-based financing systems and a generalised US model of market-based finance (Gabor 2018). This pressure is largely applied by financial players in London, Chicago, Washington, and New York (Fichtner et al. 2017; Gowan 2009). Much of the world's commodities are traded on the commodity markets based in London or Chicago. Furthermore, the New York Stock Exchange, along with global financial actors on Wall Street or in the City of London, all have undue power in determining the nature, size, and direction of financial flows globally. Supported by Washington-based IFIs, this concentration of power within global finance hinders the deepening of financial markets in Global South countries and amplifies pressure on non-financial corporations in the energy and mining sectors to borrow in US dollars from international financial markets, reinforcing the financial and monetary subordination of Global South countries even further (Bonizzi et al. 2022).

These reforms towards adopting market-based finance regimes mean that asset and portfolio management take precedence over industrial growth or development, prioritising the demands of financial investors located in the Global North (see Braun 2016). Koddenbrock et al. (2022) find that for Ghana and Senegal, the expansion of finance and the "divorce" between the financial and the productive economy has increased since the adaption of a Wall Street Consensus style financial markets, underscoring how these developments are also outcomes of colonial and imperial legacies. Hence, the Wall Street Consensus encourages Global South countries to join de-risking partnerships and adopt finance-led green development models to create investible assets (see Gabor 2021; Musthaq 2021).

More recently, there have been attempts to implement such de-risking approaches to the green economy by converting natural resources to assets or by

pricing land into an asset class either for conservation or extraction of natural resources. Such "financing nature" or "blended finance for climate investments" approaches create new asset classes for nature (see Deutz et al. 2020; One Planet Lab 2021). The Mexican government, for example, together with the Inter-American Development Bank and International Finance Corporation with Climate Investment Funds, started laying the policy groundworks to facilitate financial investors entering the country for green investments and large-scale private mobilisation for climate-related projects, including mining of minerals (see One Planet Lab 2021). Similar initiatives where multilateral development banks have started to influence policy frameworks for finance-led green development have been seen in Brazil, Egypt, and India (see Deutz et al. 2020; One Planet Lab 2021). This highlights the role of IFIs in influencing policy frameworks in Global South countries to leverage financial security and access for private investors and underlines the penetration of mining by the Wall Street Consensus logic.

Besides the obvious limitations on monetary policy decisions, the adaption of Wall Street Consensus style reforms creates vulnerabilities for countries' fiscal balances as well as for the balance sheets of national firms. The dependencies on liquidity cycles of global financial markets, on policy decisions made by financial institutions and central banks in the Global North, and on investment strategies by multinational mining companies, all increase such vulnerabilities. Furthermore, the model of market-based finance relies heavily on derivatives (see Gabor 2021), which are highly volatile and create political as well as market uncertainties. Hence, aside from physical trade between producers, traders, and manufacturers in the commodity markets, financial trade in commodity derivatives is fundamental as it "determines who retains what value and who bears the risks in the context of volatile prices" (Wojewska 2022). As the regulation and investment strategies that influence price-setting are made by financial actors in the Global North, this can increase subordination and reduce the policy space available to Global South countries. The deepening of excising dependencies and the creation of new dependencies on global finance and commodity markets increase the Global South's exposure to the vicissitudes of global capital flows and prices.

Another important factor perpetuating the subordinate position of Global South countries is the extraction and export of natural resource-generated value from the Global South. Most of the profits of transnational mining companies are either repatriated to the Global North (where most of these firms have their headquarters) or channelled into tax havens, where profits are reinvested into speculative financial instruments and ventures, which has negative effects on commodity-producing Global South countries (Levy and Bustamante 2019). For example, Goda and Lysandrou (2019) contend that due to profit repatriation following capital inflows into the natural resource sector, current account balances of natural resource-rich Latin American counties have been negatively affected in the 2000s commodity boom. Similarly, in their study estimating the impacts of natural resource foreign direct investments (FDI) on current account balances of 31 Global South commodity-producing countries between 1995 and 2013, Rios Balleteros and Goda (2017:1) find that "the average net effect of a 1% increase in natural resource-seeking FDI was a 0.23% decline in the current account

(measured as a percentage of GDP)". This has made resource-abundant Global South countries increasingly dependent on balancing their sheets through loans from international financial corporations, which further perpetuate dependencies and financial subordination (see Franz 2021; McNelly 2023).

Furthermore, financialisation and financial subordination are accentuated by the increased participation of non-financial corporations in shareholder value-oriented activities (dividends, share buybacks, mergers and acquisitions), financial operations (insurance and credit; setting up banks, hedge funds, and brokerage firms), and financial investment (see van Huellen and Abubakar 2021). Through these activities, value created through mining activities in Global South countries can easily be extracted and transferred to investors and institutions located in the Global North (Bonizzi et al. 2022; Patnaik and Patnaik 2021).

With the increased investments in the mining of transition minerals, we will likely see an intensification of the dynamics outlined above, albeit playing out in different territories and at different scales due to the nature of transition mineral extraction. Exploring the "finance-extraction-transitions nexus" thus requires looking at the link between financialised regimes of capital accumulation and the extractive economy, but also between green transitions, new dependencies, and emergent frontiers of capitalism. Unpacking this second pillar of the nexus helps to understand how the emergent geographies of green transitions are (re)producing dependencies in global capitalism.

Transitions and Frontiers within the Expanded Reproduction of Capitalism

So far, we have argued for the need to explore different ways to engage with the dialectical relationship between extraction and finance on the one hand and transitions on the other. We have drawn on different strands of critical literature to explore what we call the "finance-extraction-transitions nexus". However, to grapple with the centrality of finance and extraction in the green transition and to empirically apply this analytical lens to ongoing transformations of the global economy, we need to outline some central characteristics of capitalism. This helps to highlight the geographical implications of our nexus and its central contribution as a synthesis of various strands of critical political economy and geography literature.

For the purposes of our argument here, we understand capitalism as a socio-ecological system that reorganises social relations and nature to produce commodities for sale on the market. It does this by exploiting labour on the one hand and appropriating nature on the other. By its very nature, capitalism is expansionary as the reproduction of the system is predicated on the endless accumulation of capital through the production of surplus value on an aggregate level. In his seminal work theorising capitalism in its totality, Marx (1976) worked from the assumption that, on a high level of abstraction, capitalism is made up of two classes: capitalists (who own the means of production) and workers (who possess labour power they sell on the market in order to survive).

For capital to accumulate, commodities both need to be produced and consumed. By comparing the schemas of production and consumption across the three volumes of Marx's *Capital*, Luxemburg (1951:350) notes that "the realisation of surplus value for the purposes of accumulation is an impossible task in a society which consists solely of workers and capitalists". In other words, Marx's theory of capitalism falls apart if it assumes capitalism to be a closed, steady-state social system of only capitalists and workers. She argues that capitalism as a social system is predicated on expanded reproduction, prone to crises of overaccumulation and which requires the opening of new geographical spaces for the realisation of value elsewhere (see also Harvey 2006).

Historically speaking, capitalism has spread through the combined socio-ecological transformations implied by the conquest of the Americas and the expansion of the Great Frontier (see Webb 1951). In doing so, it produced a peculiar type of place, shaped by the world market, where "the production of nature (capitalism as world-ecology) and the production of capital (capitalism as world-economy) were two sides of the same coin" (Moore 2010:34). Theoretically speaking, this means that the exploitation of labour power is internally related to the appropriation of nature (Moore 2015:101). As Svampa (2019:6–7) argues, capitalism is underpinned by "vertiginous expansion of the borders of exploitation to new territories, which were previously considered unproductive or not valued by capital", perpetually opening new geographies of extraction to overcome its inherent crisis tendencies (see Franz 2021). "The historical geography of capitalism", Harvey (2003:140–141) contends, is therefore shaped by "the 'organic relation' between expanded reproduction on the one hand and the often-violent processes of dispossession on the other". Put another way, because capital has to forcibly overcome barrier points for accumulation, it has the structural need to always expand into new frontiers. Frontiers are actively produced by capital within the social sphere of capitalism through endless rounds of enclosures and privatisations, transforming social relations and practices, as well as increasing aspects of the material world, into commodifiable objects.

The notion of the "frontier" helps conceptualise the complex and, at times, fractious relationship between capitalism's "inside" and "outsides" (see Ouma et al. 2023). Capitalism's inside captures how social relations have been reorganised and, in many cases, transformed in order to valorise value—that is, to accumulate capital—within capitalism. However, as capitalism is always expanding, it always needs to create new "outsides" in the plural: new parts of nature to appropriate and an ever-expanding array of social practices and relations to transform into part of the valorisation of value. Extraction and finance, the two operations of capital at the heart of our nexus, play a central part in this expanded reproduction of capitalism.

On one level, resource frontiers capture the "dynamics in territorialisation as a result of the arrival of new forms of extraction" (Luning 2018:282), freeing up land for extraction, appropriation, and production, destroying communities and life-worlds of pre-existing communities, and producing nature as enclosable, compartmentalisable, and commodifiable (Smith 2008). Resource frontiers are spaces where metal and mineral deposits are found, fixed in geographical locations determined by the geological composition of the earth's crust. They are visible scars in the

ground opened by extraction, with their spread to the far-flung corners of the world underwritten and the risks extraction entails managed by finance. In short, resource frontiers opened for extraction are the material underpinnings of the green transition, marked by the subsumption of new land and mineral deposits to capitalist logic and the territorialisation of new capitalist spaces.

On another level, finance itself can also act as a frontier of capitalism, as credit and insurance markets spread and extend across the Global South and marginalised populations more generally. Financial frontiers are "a space where boundaries are drawn … display[ing] a mixture of progress, development, emergence, inclusion, and therefore lucrative opportunity, but also backwardness, unruliness, and danger" (Alami and Guermond 2023:1075). As concrete manifestations of the abstract ordering of capitalist societies in space, financial frontiers are produced by a combination of financial mechanisms, tools, and frameworks. Whereas resource frontiers are imagined as empty, wild places to be tamed by capital and as dispensable zones to be sacrificed on the altar of capital accumulation in the name of "development", "progress", and "modernity" (see Lerner 2012), financial frontiers are framed as "risky", "unstable", "irrational" areas. This risk is a double-edged sword: on the one hand, it needs to be managed, inviting intervention from IFIs and the dominant economic and geopolitical powers; on the other hand, it can be used to frame places as dispensable, laying the groundwork for extraction, either through the opening of resource frontiers or through the financialisation of everyday life (see Gago 2015; Gago and Mezzadra 2017). In other words, finance and extraction both operate to open resource and financial frontiers, which themselves are not always discrete.

Frontiers, therefore, are not exclusively geographical (as Luxemburg imaged) as they are as much an ideational as a geographical project: "making geographical and temporal experience … Frontiers energize old fantasies, even as they embody their impossibilities" (Tsing 2005:28–32). They must be understood in "nonliteral and nonterritorial terms", revealing capitalism "to be characterized at each of its scales of development by a disruptive tendency that is pronounced in its moments of transition" (Mezzadra and Neilson 2019:77).

Capitalist development, due to its inherent crisis tendencies and its underlying contradictions, is always halting and uneven, passing through periods of radical turmoil, upheaval, and change. For our argument here, we see the green transition as the most recent tumultuous period of global capitalism. Indeed, one of the reasons why we contend that the green transition is such a critical subject of study is that transitions have the potential to transform and/or transcend capitalism as a social totality: transitions are moments of radical transformation, both within capitalism (as is the case to the transition from one energy system to another) or beyond capitalism (as is the case with the transition from capitalism to socialism). This framing of the green transition is useful as it draws attention to the interplay between capitalism's inside and outside, and the importance of frontiers to the overall functioning of capitalism as a whole.[7] It also centres how the hegemonic green transition produces new territories of extraction and appropriation—new outsides—that we call the geographies of green transitions.

Extraction and finance draw attention to often overlooked aspects of the green transition. They point to how, on the one hand, the hegemonic green transition, driven by operations of capital, is underpinned by material processes of extraction and the opening of a massive expanse of new commodity frontiers across the globe. On the other hand, focusing on finance shows how the green transition is catalysing new rounds of commodification and constraining both policy space for national governments and curtailing more radical proposals for alternative green transitions. Put another way, transitions within capitalism, including the green transition, necessarily (and often violently) redefine the relationship between capitalism's inside and outsides and involve processes of frontier-making.

Green technologies require a greater array of chemical elements than their fossil fuel counterparts, many of which are not yet mined at the scale required for the transition. As such, the geographical locations and geological compositions of mineral extraction are far more dispersed and complex than those linked to hydrocarbon extraction. Moreover, as the development, production, and sale of green technologies are deeply entwined with finance, the firms mining transition minerals and those further up the (increasingly vertically integrated) production chain have both the tools and the impetus to lead processes accelerating the expansion of capitalism's frontiers. Hence, resource frontiers linked to transition minerals will necessarily move and expand into different geographical localities. Indeed, it is precisely this reorganisation of resource frontiers and the accompanying reconfiguration of financial frontiers that we capture with our notion of the geographies of green transitions. It follows that one way to study transitions is to turn our attention to the production of emergent frontiers through finance and extraction. While the empirical study of how particular contexts are affected by the emergent geographies of green transition goes beyond the scope of the article, the conceptual and analytical discussion provided here offers potential routes forward to investigate the wider geographical and socio-ecological dimensions of the hegemonic green transition.

The Finance-Extraction-Transitions Nexus and the Geographies of Green Transitions

Any financialised green transition driven by the like-for-like replacement of fossil fuel technologies by their "green" equivalents is underpinned by transition minerals like copper, lithium, nickel, and cobalt, opening vast new resource frontiers in the name of tackling climate change. Throughout this article, we have drawn on recent critical debates on capitalism and frontiers, extractivism and financialisation, and international financial subordination to explore what we call the "finance-extraction-transitions nexus". As a conceptual and theoretical approach, this nexus will enable us to evaluate the wider geographies produced by the financialised green transition and the processes of natural resource extraction that it rests upon. Our discussions also point to the diverse ways in which finance capital, with the support of IFIs, is shaping green transitions, through de-risking, blended finance strategies, and PPPs—all part of the wider Wall Street Consensus policy logic that has dominated development cooperation in recent years.

While in this article we purposely chose not to expand on a particular strand of literature, we drew on different strands of critical literature to explore the "finance-extraction-transitions nexus". This nexus can provide a useful lens to critically unpack how parallel processes of financialisation and Wall Street Consensus policies shape mining processes in mineral-abundant countries and what effects this has on wider dependencies. By going beyond a static, linear, and socio-technocratic understanding of the green transition as imagined by capital, this dynamic approach draws attention to the limitations of the hegemonic green transition by highlighting how transitions reorganise the relationship between capitalism's "inside" and "outsides". Through underscoring how finance and extraction interdependently shape frontiers within the green transition, the "finance-extraction-transitions nexus" provides a novel way of understanding the green transition as yet another round of capitalist transformation where capital is produced and reproduced through the system's inherent tendencies of *expanded reproduction*. Our nexus hence showcases that the ongoing green transition has several material and territorial implications through the various ways in which it expands into new financial and resource frontiers. The nexus thus draws attention to the emergent *geographies of the green transition*, which are produced by any shift between energy systems within capitalism and the processes of territorialisation that necessarily underpin capitalist climate change mitigation attempts. As we show throughout this article, financial and commodity markets are crucial mechanisms through which finance capital shapes the ongoing green transition. This has significant implications for rethinking the green transition and points to the impossibility of managing green transitions within capitalism.

This impossibility also highlights areas for future study. Firstly, a closer study of financial instruments, actors, and institutions linked to green transition efforts is a crucial task to understand the empirical workings of our nexus. This is particularly relevant for understanding the role of finance capital in the extraction of transition minerals and the expansion of financial frontiers into Global South countries, with several implications for international financial subordination. A second area of further research involves the study of the territorial expansion of capitalism through emergent resource frontiers and the implications of new rounds of appropriation, exploitation, and extraction on the (re)production of dependencies of resource-rich Global South economies. A third crucial line of future research is the theorisation and empirical investigation of the role of the state in promoting finance-led green development centred around the extraction of transition minerals. As shown, PPPs have already started to be used in the promotion of green extractivism. The role of the state in supporting the extraction, transportation, and transformation of transition minerals as well as in making markets and creating the conditions under which financialisation occurs, needs to be analysed and evaluated in more detail. As capital has historically relied on the state for its territorial, geographical, social, and economic expansion, this is a crucial aspect in understanding finance-led extractivism of transition minerals within recent transformations of global capitalism that is absent from our argument and nexus as presented here. It is beyond the scope of this article to expand on the role of the state in this process or to apply our conceptual framing of the green transition

empirically, but these, we believe, will be fruitful routes forward for scholars taking up the "finance-extraction-transitions nexus".

As highlighted in this article, our "finance-extraction-transitions nexus" provides a lens for the critical research of transitions *beyond* the narrow, financialised, socio-technical transition currently being pursued by capital. This has provided us with a lens to shine a light on the contradictions that underpin the hegemonic green transition and its serious, some may say fatal, shortcomings. Our nexus highlights these various contradictions of the current transformation of global capitalism and the complex geographies of the green transition. This can serve as an entry point for future studies to explore the interplay between finance capital, the extraction of transition metals and minerals, and the material, socio-economic, and environmental implications of the green transition.

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Data Availability Statement

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

Endnotes

[1] Reference to the green transition in the singular throughout the article are references to capital's hegemonic vision of transition.

[2] The green transition and the implied increase of demand for electric vehicles, wind turbines, and solar panels will require huge quantities of transition minerals (IEA 2021), which is driven by the higher material intensity of renewable energy technologies. These transition minerals include copper, nickel, aluminium, cobalt, and lithium, as well as the "rare earth" elements neodymium, praseodymium, and dysprosium.

[3] It follows, then, that we can conceptualise financialisation as being characterised by "the accumulation of drawing rights over values that are yet to be produced" (Durand 2017:4).

[4] Although we do not explicitly address how the exploitation of labour is inherent to the dynamics of extractivism, we recognise that green extractivism has various implications for the exploitation of nature and labour (for a detailed discussion, see Arboleda 2020). This is particularly true for the role of territories in which private exploitation of underground minerals dominates (see Vélez-Torres 2014).

[5] Whilst it is beyond our analysis here, it also underpins Joe Biden's Inflation Reduction Act (IRA) in the United States, as the words of US Climate Envoy John Kerry when discussing the IRA in February 2022 suggest: "We need research, development, demonstration and deployment grants from governments, as well as blended finance packages that de-risk these investments" (quoted in Aronoff 2022). The implementation of the IRA has, Daniela Gabor argues, led to a further paradigm shift within the de-risking state, from a way to ensure private investment to a guide for capital towards green industrial policy. Nonetheless, this shift "does not change the relationship between the central bank and fiscal authorities, and it does not reform institutional capital" as it is still underpinned by the logic of "shifting risks from the private sector onto the state balance sheet" (Gabor, in Amarnath et al. 2023). In other words, the same shortcomings and limitations of de-risking

remain for the IRA and it falls a long way short of the Green New Deal envisioned by activists (Aronoff et al. 2019).

[6] There is a growing literature on the role of carbon markets and how carbon is translated into financial value (see Bridge et al. 2020). These markets transform carbon into an investible asset in order to generate future revenues. The leveraging of carbon assets for debt and the creation of interest-bearing capital is directly supported by international financial institutions, such as the World Bank, that provide loans for firms and governments on the basis of protecting nature. This is evidence of Wall Street Consensus policies penetrating "green" development strategies, which some call the neoliberalisation of nature (Bigger et al. 2018) or financialisation of nature (Ouma et al. 2018).

[7] For a provocative discussion on the role of borders in capitalism, see Mezzadra and Neilson (2013).

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