

Oro blanco: assembling extractivism in the lithium triangle

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Oro blanco: Assembling Extractivism in the Lithium Triangle*

Abstract

As the drive for global electrification proceeds apace to wean the world off fossil fuels in order to address the climate emergency, new pressures are placed on agrarian environments and peoples in areas abundant in key minerals for electric batteries. The so-called Lithium triangle between Chile, Argentina and Bolivia is one of those places. We develop an account of the ‘assemblages of extractivism’ at work in this zone that operate at a material, institutional and discursive level. It draws on fieldwork from the region and is conceptualised using different strands of political ecology and political economy to understand how the construction of a commodity, the materiality of lithium and the role of the state intersect with and negotiate diverse local understandings and engagements with this latest form of ‘renewable extractivism’.

Key words: Lithium; extractivism; political economy; political ecology; decolonisation; transitions

1. Introduction

A transition away from carbon intensive sources of energy is critical to address the climate crisis, as established by numerous expert bodies and authoritative reports (IPCC 2018; SEI et al 2020). A prerequisite for the transition to a low-carbon economy lies in technologies for storing energy to bridge gaps that exist between times of peak energy production from renewable sources and times of peak consumption, and for powering vehicles. Given the technological foundations of this move to renewable energy production and storage, the emergent post-fossil-fuel era is characterized by a techno-managerial approach focused on a mixture of socio-technological innovation and pricing mechanisms consistent with neoliberal approaches to energy transition (Newell 2018). Since 2010, the global growth of electricity generation capacity from renewable sources has increased from about 25% in 2001 to 82% in 2020 (IRENA 2021) mostly from the generation of renewable sources such as solar, wind, bioenergy, hydropower, and geothermal. This dimension of the proposed solution to the climate crisis aligns with broader capitalist imperatives: permanent technological revolution driven by finance capital (Perez 2002), albeit in this instance mobilised to provide the same patterns of energy consumption while reducing the production of atmospheric carbon dioxide in pursuit of the elusive decoupling of growth from emissions.

Technological fixes focused on energy storage have followed similar patterns to the technologies of energy production. Lithium-ion batteries first designed in the 1990s have become increasingly central to modern lifestyles of consumption and transportation: they are found in numerous items from computers, cell phones, electric cars to prototype electric airplanes. Due to its unequaled lightness as well as its storage capacity (Kazimierski 2019) lithium, often dubbed ‘white gold’, is

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a crucial component of current energy storage solutions. Although lithium is relatively abundant on earth, current technology means that it can only be extracted profitably from certain resources, such as brines. The largest brine reserves are in the so-called ‘lithium triangle’, a rural territory that stretches over southern Bolivia and northern Argentina and Chile.

While some claim that lithium extraction constitutes ‘sustainable mining’ given the cost-effectiveness and energy-efficiency of its extraction as it mainly relies on the energy of the sun (Reporte Sostenible 2019; SQM 2021; Tarantini 2020; Voskoboynik and Andreucci 2021); there is mounting evidence that the chemical and water used for processing lithium causes large-scale environmental disruption to the salt flats and surrounding environment where it is extracted (Liu, Agusdinata, and Myint 2019; Babidge et al. 2019; OCMAL 2018).

The fact that solutions to address energy transition build on and at the same time reinforce older patterns of extractivism, has given rise to concerns and rejuvenated broader debates about the role and sustainability of extractive industries for local and international development (Bebbington et al. 2008). Critics have argued that market-led solutions have largely proven unable to address social and environmental issues or support a socially and economically just transition to sustainability (Dunlap and Fairhead 2014; Machado Araoz 2013a; Zehner 2012). Moreover, since lithium extraction is being carried out in a region where there is a long and painful history of extractivism since colonial times (of saltpeter and silver Bolivia and copper in Chile, for example), it constitutes what Watts refers to as hyper-extraction: ‘expanded, extended, or enhanced extraction’ (2021: 212). As such, along with intensifying environmental pressures, ‘hyper-extractivism’ appears to strengthen the traditional dependency and primary-exporter role of the global South to the benefit of geopolitically dominant economic powers in the global North, while further entrenching modes of ecologically uneven exchange (Jerez, Garcés, and Torres 2021; Roberts and Parks 2009; Rodney 1972). Of the thirty-five countries most dependent on mining, all but Australia and South Korea are developing countries. But this is not just about the global North and South. So-called ‘green mining’ is also being used to resuscitate old mining sites for lithium prospecting in poorer parts of richer countries such as Cornwall in the UK, for example, where once tin and copper were mined (*BBC*, September 17, 2020). What this points to instead is the importance of poverty and inequality and in many contexts their close relationship to class, race and gender as determinants of who are the likely beneficiaries of the new wave of extractivism and who is most likely to inhabit the sacrifice zones which resource it.

When considering the key political economy questions of the new accumulation strategy of the mining industry which we take to be ‘who benefits, who loses, how, and why?’, there is arguably little discernible change in the structural matrix of power relations within and between global elites and even in the sources of state revenues when comparing previous and current modes of extractivism. Therefore, when it comes to technologies of energy transition, historically constituted but dynamic global dimensions are critical, whether in terms of relations between states and geopolitical competition (IRENA 2019) or shifting alignments of state and (transnational) capital as they extend their reach and control over new frontiers in the global economy and

incorporate new groups within their circuits of capital (Newell and Mulvaney 2013). The large and increasing presence of Chinese companies in the lithium triangle (and in the lithium-ion batteries market) is a significant recent illustration of this trend (Zicari, Fornillo, and Gamba 2019).

To address these complexities, in this article we develop an account of the ‘assemblages of extractivism’ at work in this zone that operate at a material, institutional and discursive level, drawing on primary fieldwork in the region and using different strands of scholarship from political ecology and political economy to conceptualise them. Taking the case of southern Aysa Yala and drawing on year long ethnographic work in the region conducted with those in the frontline of this new resource frontier, we show how accumulation strategies pursued by the state and capital in Chile under the guise of ‘green growth’ intensify conflicts around access to and the value of lithium, land and water. In particular, we explore the social and colonial dynamics that characterise this site and assemblage of extractivism, as well as potential openings for more transformative politics. In this regard, we draw out the wider implications for understanding and engaging with the chains of transition and ‘assemblages of extractivism’ across the socio-spatial sites of the lithium economy and what this suggests about the potential to decolonise transitions so that they are more socially and ecologically just.

The analysis contributes to debates about the global political economy of energy transitions by looking at how social and political power shapes outcomes across sites and scales, while enhancing tentative attempts to decolonise transition debates and providing further empirical grounding and conceptual insights on the practical political economies and political ecologies of extractivism. This helps to bridge an understanding of the social dynamics of agrarian change with perspectives from socio-technical transitions, which continue to be more focused on the global North and the managerial politics of technology, finance and innovation than the deeper politics of social and economic transformation. By building an account of how energy transitions get enmeshed with local politics and their attendant inequities, we are better placed to account for the everyday politics of transition while locating it within the broader structures and power relations that characterize the global political economy. This speaks to the editors’ call to explore ‘the way agrarian struggles ... connect with the challenge of climate change, linking to and going beyond the already widespread challenges to expropriation and extraction in rural areas’ as ‘a vital focus for both thinking and action’ (Borras Jr. et al. 2022, 2). Our empirical analysis offers a case study of how different people — in relation to class and other co-constituted axes of social difference such as gender, race and ethnicity are affected by responses to climate change in agrarian settings as they are mediated through processes of social differentiation, trajectories of accumulation and agrarian politics (Borras Jr. et al 2022, 17).

In particular, therefore, the paper seeks to make three main contributions. Firstly, we elaborate the different elements of ‘assemblages of extractivism’: their material, institutional and discursive dimensions and the interacting and mutually reinforcing nature of these dimensions contributing both to scholarship on extractivism and work on assemblages (Anderson et al 2021; Jordhus-Lier 2022). For example, it adds to the work of other scholars working in the region such as Hope

(2021, 208) who explores the ‘assemblage of institutions, discourses, landscapes, and infrastructures that are at once disciplined and held together to materialise and legitimise particular interpretations of sustainable development’ in Bolivia and how this assemblage sheds light on the way ‘powerful, extractivist development logics’ are reworked and sustained. Secondly, based on extensive ethnographic work, we explore and engage with the everyday politics of transition and the lived experience of extractivism in the Salar de Atacama (Atacama salt flat) watershed: how communities in the frontline of extractivism navigate its complexities and contradictions. This helps to move transition studies beyond a dominant focus on elite socio-technical configurations without furnishing an account of their consequences. Thirdly, by identifying and explicating the relationality of transitions: the global connections between sites of production and consumption, we contribute to scholarship on the global political economy of energy transitions (Newell 2021; Van de Graaf and Sovacool 2020).

2. Understanding the Political Economies and Political Ecologies of Energy Transition

To build our account of rural extractivism in Latin America’s lithium triangle we draw upon scholarship from both political economy and political ecology, a combination of which we argue is critical to understanding and engaging with the ways in which ‘the dynamics of climate change’ both shape and are shaped by the rural world, ‘whether through state policies, international governance, corporate influence, or agrarian struggles’ (Borras Jr. et al. 2022, 1). The chains of explanation which link these sites of power and sustain particular strategies of resource extractivism, labour exploitation and value generation and their ecological impacts require critical attention to the role of the state and its relationship to national and international capital. But they also need to be grounded in particular socio-ecological rural realities with their attendant exclusions and patterns of social differentiation. As the editors note, political ecology sheds light on the way in which ‘capitalism and climate change are social and ecological processes that are both produced and experienced at multiple sites and scales’ (Borras Jr. et al. 2022, 4). Analytically, the challenge is to comprehend the ways in which local sites and struggles are related to and embedded within broader structures of power, without reducing what is historically, socially and culturally unique about those sites to abstract global actors and processes (Newell and Bumpus 2012). This more global and relational approach helps to illuminate the dynamics of accumulation and the circuits of capital which tie specific sites of extraction, dispossession, and ecological disequilibrium to particular owners of capital. Meanwhile, a complementary, more anthropological approach to the case in question allows us to understand the specific configurations of racialised, class based and gendered exclusions that interact with and reinforce dominant strategies of accumulation in the region.

Fortunately, despite the early neglect of questions of power and politics in the study of energy transitions (Meadowcroft 2009), theoretical resources from political economy (Baker, Newell, and Phillips 2014; Powers et al. 2015), global political economy (Newell 2021) and (global) political ecology (Lawhon and Murphy 2012; Newell and Bumpus 2012) are increasingly being applied to understand the procedural, distributional and ecological politics of energy transitions. The

organisation of global production networks (Baker and Sovacool 2017) and commodity-supply zones, understood as ‘spaces of immense fecundity and resource abundance’ (Bridge 2001, 2155), reflect the imperatives of the new mining boom. The lithium value chain, governed by national states and transnational capital, reflects many of these ‘chains of accumulation’ (Robbins 2014).

Firstly, these theoretical resources can be usefully combined with scholarship from critical Geography on the notion of ‘resourcefulness’ (Bridge 2011, 2014): the discursive, institutional and material making of commodities and resources such as land (Murray Li 2007) or what Jasanoff calls ‘sociotechnical imaginaries’ (Jasanoff and Kim 2013). These latter approaches underscore the importance of competing imaginaries and knowledge constructions about the value of resources which necessarily precede and enable their extraction and circulation. The socio-spatial politics of lithium combine territory, land, water and indigeneity where regions are constructed as commodity supply spaces (Bridge 2001). The fact that the Atacama salt flat is part of the Atacama Desert, usually highlighted as the driest desert on Earth, has helped to establish the misleading idea that the desert is devoid of biodiversity and human life. As a mechanism to legitimize lithium extraction from an Anthropocentric view, these territories are imagined as spaces of resource abundance: inhospitable and remote places with nothing but minerals that await to be exploited (Bridge 2001). Nevertheless, as we will show in the next sections, lithium itself is not only invisible in the territory – as it forms part of underground water (brines) in the Atacama salt flat, but as a chemical product results from destroying its natural environment (brines) and adding many other components to have the final products such as lithium carbonate or lithium hydroxide.

Baglioni and Campling (2017) propose a dialectic of materiality of resources given that they are at once physical entities and social categories. As Bridge puts it, two resource dynamics can be outlined when considering resources as a social category that organize our relationship with the non-human world. Firstly, what qualifies and is valued as a resource varies over time and space: ‘resources are a relational understanding of the non-human world’ (2009: 1219). Secondly, the classification of something as a resource depends on technology, knowledge, economic organization and, we would add, relations of power to project and enforce dominant understandings. Therefore, ‘resources are not: they become’ (Bridge 2009: 1219) after a process of social translation, showing how different worldings and conceptions of nature are constructed and experienced, including the question of humans’ wider connections with the environment of which they are a part (De la Cadena 2010). In Abya Yala, the positions of several indigenous movements highlight a different cosmology of the indivisibility of nature and society which is inclusive of non-humans and more-than-humans beings (De la Cadena and Blaser 2018; Viveiros de Castro 2004; Kohn 2015).

Secondly, we propose the value of work on extractivism in appreciating these dynamics: understood as economic-political regimes based on the over-exploitation of natural resources (Machado Araoz 2013b, 129). Extractivism is often defined as a ‘modality of accumulation’ involving the appropriation of natural resources “in large volumes and/or high intensity, and that are essentially intended to be exported as unprocessed raw materials, or with minimal processing”

(Gudynas 2015, 13). Considering its planetary scale (Arboleda 2020; Chagnon et al. 2022) and effects, extractivism also embodies a particular way of thinking, highlighted by Durante, Kröger, and LaFleur as an extractive onto-logic: a “violent logic of taking resources -without reciprocity, without stewardship” (2021, 20), extending and expanding the coloniality of capital (Quijano 2000).

Indeed, in Abaya Yala, extractivism carried out by states (in the form of neo-extractivism (Gudynas 2009)) and by the market has allowed accumulation by dispossession by national and global elites (Harvey 2004; Green 2003), rights violations and violence, including the ‘slow violence’ associated with climate change (Nixon 2013). In Chile, Núñez, Benwell, and Aliste describe ‘eco-extractivism’ as a form of ‘green-grabbing undertaken by extractivist investors’ (202: 1). As Harvey (2004) suggests, the expulsion of peasant and indigenous populations by ruling classes and the state was key to the commodification and privatization of land and the exploitation of the subaltern class in favour of elites. Such wealth extraction by elites who are predominantly of European heritage, can be understood as the result of the dispossession and expulsion of the region’s original inhabitants, a form of internal colonialism. As Newell suggests:

In many ways, the patterns of exploitation we find within countries mirror the forms assumed by global relations of the colonial era. In parts of Latin America a form of ‘colonialism within’ is practiced when elites of white European or *mestizo* descent either forcibly remove indigenous Indians from their lands or extract resources coercively for global export. Invoking rationales employed by former colonizers, such controversial practices continue to be validated through reference to the need to modernize backward peoples and their “unproductive” livelihoods (2005: 77).

These dynamics have resulted in the production of social and environmental injustices premised on class, race and gendered inequalities, manifested, for example, in the overloading of mining and extractive and production waste in the territory of local communities (Perreault 2012). Thus, a process of territorial alienation and de-territorialization has occurred, as local populations are forced to migrate (Machado Aráoz 2015, 186). The extractive activities that rapidly expanded in Latin America from the 1990s onwards (Ocampo 2017) are currently being driven by a ‘super-cycle’ in commodity prices given the demand generated by China. This has led to a refiguring of regional politics, from the political and economic reforms under ‘structural adjustment’ of the Washington Consensus, to what has been labeled the ‘commodity consensus’ (Svampa 2015). This refers to the large-scale exportation of raw materials on which current economic development is configured in Latin America and the recent process of “reprimarization” as national economies deepen their dependency on their role as exporters of primary, raw materials and natural resources.

We combine these insights around the notion of an ‘assemblage of extraction’. Assemblage is a concept devoted to understanding processes of becoming, ‘of putting together, of arranging and organizing the compound of analytical encounters and relations’ (Lancione 2013, 359). Originally articulated but not subsequently developed by Deleuze and Guattari (1988), here we use it in a similar way to Hope (2021) to denote how extractivism is simultaneously materialised,

institutionalised and discursively produced and legitimised. Where this moves political economies and political economies of energy transition forward is through attention to what Li calls the ‘hard work required to draw heterogeneous elements together, forge connections between them and sustain these connections in the face of tension’ (2007: 2). The notion of an assemblage is especially useful for understanding the conduct and nature of this work across sites and scales which have to be aligned and operationalised for extractivism to occur. It affords a socio-spatial account (Anderson et al., 2012) of key aspects of the political economies and ecologies of lithium because its extraction rests on a series of imaginaries that have to be continually remade, about the value of a resource spread across territories which are subject to competing ownership claims, whilst being driven by national policy and influenced by mobile transnational capital. Conflicting imperatives and priorities pull in different directions requiring the political work of negotiation and accommodation and careful boundary work to mine and exchange the lithium, keep the finance flowing and minimize disruption to the commodity supply chain. This more distributed account of agency which recognizes that there are vulnerabilities, instabilities and impermanence at the intersections of different elements of an assemblage (Haarstad and Wanvik 2017) is not the same, however, as suggesting that systems of consumption, distribution and production are distantly related and loosely interconnected (Jordhus-Lier, 2022, 320). In this regard, exploring the practical work of holding together an extractivist assemblage should not ‘obscure the relational production of difference and inequality’ (Kinkaid, 2020, 465), but rather reveal what makes it possible.

3. The Political Ecologies of Extractivism in the Lithium Triangle: The case of Chile

Lithium became known as a mineral resource after 1817 when it was ‘discovered’ by a Swedish chemist. Almost 100 years later, a German company started producing lithium for sale, exploiting small deposits mostly in the United States and Australia to meet the needs of a small market. Along with its many uses (in industries from aluminum and glass to pharmaceuticals), lithium was used for nuclear energy and later in the first lithium-ion batteries launched in 1991 by Sony corporation (Fornillo, 2015). However, driven by media, corporate and policy discourses around green growth, with the lithium boom at its centre, a new extractive wave renamed this transnational territory a triangle marked by three salt flats the Uyuni salt flat (Bolivian Andean plateau), the Hombre Muerto salt flat (Puna of Atacama, Argentina) and the Atacama salt flat (Antofagasta region, Chile). The ‘lithium triangle’ became what Bridge (2001) calls a ‘commodity-supply zone’, a narrative that obscures everything but lithium.

Although the ‘lithium triangle’ is a recent discursive construction, lithium extraction started around 30 years ago in Chile and Argentina but involves new developments such as Bolivia’s state-led extraction project in the Uyuni Salt Flat (Fornillo, 2019; Nacif and Lacabana, 2015). As such, lithium’s boom comes as a new wave of extractivism, rather than as a new site of extraction. In fact, Chile is the largest producer of copper (also needed for batteries), and the Antofagasta region accounts for 54% of national productivity (Sernageomin 2020); and the second largest producer of lithium, accounting for 22% of global supply (USGS, 2021). This makes it an interesting case

of how ‘green growth’ intensifies conflicts around access to and the value of lithium, land and water in ways which repeat previous growth strategies.

At the same time, however, lithium provides an interesting case of corruption and failed state control over ‘strategic mineral resources’: a category created by the US government’s growing interest in lithium’s potential for nuclear fusion in the context of the Cold War. Consequently, the Chilean military dictatorship changed legislation in 1982 to preserve the mineral as a strategic resource of national interest such that its extraction and exportation was overseen by the Chilean Commission for Nuclear Energy (CChen). This change was part of broader neoliberal reforms at the time, where almost all state companies and public goods such as land and water were privatized. Indeed, around 1978, the military government gave mining rights to exploit brines from the Atacama salt flat to the state economic development agency Corfo (Corporación de Fomento de la Producción). Alongside this, two projects were developed to extract brines as private-public partnerships: the first one was the Sociedad Chilena del Litio Ltda (Chilean Society of Lithium) between Foote (with 55%) and Corfo (45%) that started to produce lithium carbonate in 1984. This project was granted rights validated by CChen to exploit, produce, and sell 200,000 Li tonnes. However, five years later, Corfo sold its part, and the project was further developed by the transnational company Cyprus Foote (which then sold it to Rockwood Litio Ltda.) and since 2015, it has been run by the North American company Albemarle (Comisión Nacional del Litio, 2015). The second project began in 1986, where Corfo (25%) Amax (63.75%) and Molymet (11.25%) formed the Sociedad Minera Salar de Atacama Ltda (Minsal- Society Mine Salar de Atacama). The project was granted a contract for thirty-three years with an agreed leasehold and was allowed a maximum of 180,100 tons of lithium. However, as with the first case, by 1995 the entire project was owned by a national company, SQM Salar S.A. and had expanded to produce potassium salts, potassium chloride, potassium sulfate and boric acid and lithium chloride from lithium carbonate (Comisión Nacional del Litio 2015).

The boom in electromobility was a boost for both lithium extraction quotas, however it also served to intensify conflict with the indigenous and non-indigenous communities of the Atacama salt flat watershed. The Atacamanian indigenous communities, or Lican Antai, have occupied the Salar de Atacama basin for more than 9,000 years (Nuñez 2007). Traditionally, they developed agro-pastoralist practices, but have been increasingly absorbed by the mining industry (including lithium, but mainly copper mining) and more recently, tourism sectors (Molina 2019; Nuñez and Pourrut 1995). During the last 30 years, the different villages and ayllus¹ started to constitute “indigenous communities” legally recognized by the state (Law N°19253) and formed the Consejo de Pueblos Atacameños (CPA – Council of Atacamanian People). These organizations have been key entities in establishing their ancestral territory as well as in pushing their demands with the state and mining companies. Nonetheless, despite their ancestral use and knowledge of the

¹ As defined by Romero and Opazo, ayllus are the ancestral territories of high Andean communities: “The indigenous ayllu term corresponds to the representation of a place and is used by Andean societies to refer to a landscape synthesis made up of components and interactions of natural and social, physical and metaphysical, material and symbolic origin, human living beings and non-living beings” (2019, 43).

territory, the Chilean state has largely ignored their demands favoring its ownership of the mineral resources and the profits derived from mining. As a result, the indigenous communities established direct negotiations with Albemarle and only recently, resumed formal relationships with SQM, the biggest lithium company in Chile today.

3.1. Material assemblages: Constructing a commodity

To better understand how the ‘assemblage of extractivism’ operates in this instance, we first explore the material assemblage of lithium as a commodity. The drive towards electromobility in the global North has re-shaped these territories as lithium reserves. In this context, we argue that the reduction of complex landscapes to a ‘commodity-supply zone’ (Bridge, 2001) in the lithium triangle has enabled the state to grant more exploitation rights to current projects and to bid for more rights to extract lithium in the Chilean salt flats, a process we discuss further below.

The construction of lithium as a commodity in this area started in 1962 when the U.S. mining company Anaconda identified huge lithium deposits in the Atacama salt flat, while looking for water resources for their copper mining process in Chuquicamata (Slipak and Urrutia 2019). In 1977, the Chilean National Institute for Geological Research confirmed this potential, which along with the work of the USGS, has been key to supporting the idea of lithium abundance in Chile, said to be the largest reserves worldwide at 9,200,000 tonnes, a claim possible only because the Bolivian reserves (estimated to be 19 million tonnes), have not been incorporated into the U.S. Geological Survey (USGS 2022).

Even though lithium is a rather abundant mineral on Earth, the narratives concerning the potential scarcity in access to lithium deposits rather refer to the potentiality of the technology and knowledge required to *profitably* extract the mineral. In this regard, geological concepts such as ‘reserves’ and ‘resources’ highlight deposits of minerals that are susceptible to appropriation under certain conditions. In fact, USGS warns that:

Reserves data are dynamic. They may be reduced as ore is mined and (or) the feasibility of extraction diminishes, or more commonly, they may continue to increase as additional deposits (known or recently discovered) are developed, or currently exploited deposits are more thoroughly explored and (or) new technology or economic variables improve their economic feasibility. Reserves may be considered a working inventory of mining companies’ supplies of an economically extractable mineral commodity. As such, the magnitude of that inventory is necessarily limited by many considerations, including cost of drilling, taxes, price of the mineral commodity being mined, and the demand for it. Reserves will be developed to the point of business needs and geologic limitations. (2022, 197)

As such, lithium reserves constitute a form of ‘produced nature’, socially constructed by dominant forms of scientific knowledge, obtainable through technology, economic incentives and social valuation (Bustos-Gallardo, Bridge, and Prieto 2021). Even at a material level, lithium is a material/chemical construction, going from lithium carbonate to hydroxide. Brines need to be destroyed to obtain lithium (or other minerals), which means water needs to evaporate and the different minerals and salts need to be chemically separated and mixed with other components to

build a lithium substance suitable for ion-lithium batteries. The process is divided into two: the mining and the chemical. The mining process starts with brine extraction with a pumping system that has more than 370 productive 30-meters deep wells. The drilled brines (with a regular concentration of lithium at 0.2 ppm in brines) are transferred through channels to solar evaporation ponds, with a total surface of pools of 44 km². Lithium is concentrated in a process with several stages that can take around 14-15 months until it reaches a concentration of about 5.8% (Garcés 2017). In this process important quantities of lithium are lost with a lithium recovery efficiency of only 8.2% as shown by Osses in *Minería Chilena* (January 20, 2021).

It is also worth mentioning, that until the stage of brine extraction, companies can also extract potassium, boron, magnesium or sulphates contained in brines. Therefore, brine extraction affords a multiplicity of opportunities for the extraction of non-renewable sources, offering economic *flexibility* (Bustos-Gallardo et al, 2021), since companies can adapt to changing market demand for these different commodities. In fact, SQM used to be a producer of fertilizers and products associated with potassium. Given the entry of monopolies, SQM stopped basing its sales on potassium once the ‘lithium boom’ began.

To turn the ‘impure lithium carbonate’ into a substance that can be used for commercial purposes (mainly lithium carbonate or lithium hydroxide), the companies then take lithium to their industrial plants in La Negra (Albemarle) and Salar del Carmen (SQM) – both located near the Antofagasta city. In these industrial complexes, lithium and other products are processed and it is in these chemical processes where most of the drinkable water is consumed and polluted with substances used to get the lithium concentration needed for each product. They are then exported through the ports located in the same region to Asian countries such as South Korea, China and Japan, the main buyers of lithium carbonate (Cochilco 2021). Implied within this economic chain of extraction is a process of ecological exchange as the lithium process does not end in the Salar de Atacama, rather it continues to absorb water resources and to pollute further areas from the desert in the Antofagasta region.

3.2

3.2. Institutional assemblages: States of transition

The second element of the ‘assemblage of extractivism’ in this context, beyond negotiating the materiality of lithium and intensifying value from its extraction and processing along the supply chain, concerns the role of the state and its interaction with indigenous communities. The grounded anthropological account of the everyday material and cultural politics of extraction and its economies and ecologies as it is experienced by marginalised groups and subaltern voices can be fruitfully complemented, we argue, by political economy analysis of the role of the state in enabling, (un)governing and enforcing extractivism.

The general background to this is formed by what Leiva (2019) describes as the way strategies being adopted in the mining sector and underpinned by support from the Concertación (1990-

2010) and Nueva Mayoría (2014-2018) administrations and epistemic communities in Chile have ‘played active, generative, and decisive roles in conceptualizing and operationalizing innovative political technologies that institutionalized the power of transnational capital’ (2019, 133). This includes the use of political technologies such as the adoption of tools ‘to elicit communities’ “social license” to start new extractivist investment projects and to upscale existing ones’ (2019, 131-132). The overall aim is to construct ‘working alliances with domestic and foreign transnational capital, around shared goals of expanding the boundaries of mining capitalism and establishing the requisite conditions for its continued operation’ (2019, 135).

While Svampa (2015) positions states as the decisive actors in driving extractivism, Leiva suggests that ‘Chile’s new extractivist consensus actively incorporates a panoply of new actors including think tanks, consulting firms, non-governmental organizations, international development agencies, academia, political cadre, as well as corporate mining executives as fundamental protagonists in a process in which national government entities play a subservient, supportive role’ (2019, 135). The case of the National Lithium Committee bears this out. An initiative charged with providing a proposal to build a national policy for managing lithium, it included ministers and state representatives, experts in engineering, mining, law and economy (including international guests), union representatives, international organizations such as CEPAL, the copper state company (Corfo) and a representative from Aymara indigenous people.

As noted in the previous section, the role of the state has been highly controversial with a legal apparatus built during Chile’s military dictatorship and hardly modified since, plus an ongoing complicity with mining companies. For example, despite common knowledge about the water-intensive nature of lithium extraction, Chilean law considers brines as mineral resources, not as water. Consequently, brines are regulated by the Mining Ministry (following the Mining Code) and are not included in the Water Code (the legal body that regulates water resources). The rights to extract brines are given by the Mining Ministry regardless of the water rights given by the state agency, DGA (General Water Direction– Dirección General de Aguas). This difference has major implications in a context where the different agencies of the state do not work together. Therefore, the hydrological cycle of the basin is treated separately, even though brines are part of the water cycle of the Salar de Atacama watershed. Studies carried out by the DGA cannot comprehend the entire water cycle when excluding brines. Equally, as part of mineral resources, the state has so far relied on the information provided by the companies themselves to understand the amounts of brine that remain available. Only recently (and driven by scandals where SQM was found to misreport the total amount of resources used by the state) has an effort been made by the state to develop reliable research.

At the same time, the Chilean state faces internal contestation as there are three scales that constantly interact: the Chilean state (usually located in Metropolitan Region ‘the centre’); regional state (periphery) and the local government (municipalities). All three have conflictive relationships over resources and authority that can shape and reshape the ways in which policies are executed and enacted in local contexts. As a centralist state, the regions and municipalities are

not usually the ones that decide about the territory or the ones receiving the main economic revenues. Many conflicts revolve around the capture of revenues and rents. Local actors are often resentful that the lithium companies (and copper companies) are legally registered in the capital, Santiago, which means that all the taxes are received by the Metropolitan Region. They claim that given the fact that the extraction and the environmental consequences are being experienced by the habitants of the region, the companies should pay their taxes in the region as part of a social contract based on taxation and representation. As such, the governance of this chain of accumulation is deeply contested across an assembly linking multiple scales: the national capital and the regional capital (Santiago-Antofagasta); the regional capital and the rural areas where exploitation is taking place (Antofagasta- San Pedro de Atacama); and finally, Santiago and San Pedro de Atacama, mainly connected through the companies who usually are formally registered in Santiago.

The same centralising dynamics characterise the ownership of the mineral resources of the Salar de Atacama. As conflicts over lithium extraction have intensified, the state has insisted on securing the benefits and ownership of the Salar de Atacama, which has been a territory claimed as ancestral by the indigenous communities surrounding the salt flat. However, state action is also seen as part of a larger network of corruption in which the Chilean elite is embroiled. For example, a former judge explained in an interview that he was working for the Antofagasta regional government in the early 1990s, when it was decided that the Salar de Atacama could not be exploited anymore since it was recognized as a very fragile ecosystem. This resulted in intensive pressure being brought to bear to give concessions to SQM, driven by the economic and political elite from Santiago. Despite this lobbying, the government initially managed to stay firm in their position. Nonetheless, in a move that clearly shows the close relationship between companies and state elites in Chile, when he came back from holidays, there was a document signed by “a state officer” (someone unknown to him) overriding the decision and allowing the exploitation of the salt flat by SQM.

The close relationship between the state and the companies has also been exposed through corruption scandals. Not only did Julio Ponce Lerou became a main shareholder of SQM after buying the state company during the dictatorship of his then father-in-law, Augusto Pinochet; but since 2014 the company has been part of many corruption scandals such as illegal financing of politicians and stock market manipulation. Equally, in 2016, Corfo sued the company for breach of contract. SQM had illegally inscribed water rights and mining easements under its property and was also discovered to be misinforming the state about the real quantity of extracted brines and the lithium that was being sold. In response to the public scandal Corfo reached an agreement with the company and granted more rights to extract brines until 2030, along with slightly more revenues for local municipalities (Corfo 2019).

The other consequence of the state’s proximity to mining capital is a failure to recognise and protect indigenous rights. The conflicts between lican antai people and the state over sovereignty and autonomy have shaped the conflicts regarding mining companies. The Observatorio de

Conflictos Mineros de América Latina's (OCMAL) online database shows forty-eight socio environmental conflicts involving multinational extractivist corporations operating in Northern, Central, and Southern Chile, where indigenous people have been a key part of the resistance.² In this regard, even though the state ratified the ILO *Convention* No. 169 that specifies that indigenous people have the right to sovereignty and autonomy in their ancestral territories; the Chilean law has not been updated in line with this requirement. In fact, the indigenous law (law n°12,253), regulating the legal apparatus that indigenous communities need to use to be recognized is seen by those communities as “non appropriate” and detrimental for their autonomy and traditional way of organizing. The colonial nature of recognition policies has granted certain rights in so far as they do not challenge the dominant political economic model, whilst limiting further cultural and sovereign rights; a situation common in Latin America that has been called “multicultural neoliberalism” by Hale (2002). The Lican Antai have directly questioned the sovereignty of the Chilean state in this region, claiming that they should have both sovereignty and autonomy over *their* ancestral territory. As one Lican antai man stated:

... first of all, you need to realize that you are in an indigenous territory. “But the [Chilean] State...”, I am not interested in what the State says, because I do not consider myself Chilean.

In this context, public policies are seen as imposed and “chilenizadoras” or westernized. Some indigenous interviewees recalled the example of the National Reserve “Los Flamencos”, as a conservation project that restricted their access to their ancestral territory and practices within it. In fact, a few indigenous interviewees said that they would prefer that the states acted like before “when they were not present in the territory and we lived our life” as one Lican Antai woman put it. Therefore, for some indigenous actors the state is seen as overseeing a model of development that is having a detrimental effect on their culture and autonomy as communities. As a result of the lack of support from the state, indigenous communities have started to negotiate directly with mining companies (OLCA 2020) and in 2016 the CPA signed an Agreement directly with Albemarle so that the 18 communities that constituted the CPA received 3.5% of the annual sales of the company. Reflecting on this process one Lican antai man said:

... an agreement was reached, but we also base ourselves on what we have achieved as rights today, because in these cases it is agreement 169, article 15-16, which states that companies that are installed in certain [indigenous] territories, have to apply compensation measures and that is an obligation, that is, it is not the will of the company to say “hey no, you know, if you want to give them”, no, it is an obligation. Based on that, the Albemarle and well, lithium agreements were made, and other communities that even have an agreement with SQM, with Escondida, with Zaldívar.

In fact, recently, the CPA joined an agreement already signed by Corfo and SQM, to receive approximately forty-five million dollars of SQM earnings (Chululo, September 28, 2021). Both agreements have been highly contested within indigenous and non-indigenous local communities,

² Conflictos Mineros en Chile. Available at: https://mapa.conflictosmineros.net/ocmal_db-v2/conflicto/lista/02032300

where Aymara and other indigenous communities have been labeled as corrupt and only interested in money. As a result, territorial tensions and conflicts have shaped and continue to re-shape lithium extraction.

3.3. Discursive assemblages: Power/knowledge and coloniality

A last step in the ‘assemblage of extractivism’ is the ordering of appropriate knowledge to enable lithium extraction. This is important because as Núñez, Benwell, and Aliste show in their work on eco-extractivism in Chile ‘land ownership changes hands from colonists or pioneers to neocolonists or eco-colonists, and this transaction is imbued with a discursive rationale tightly associated with the environmental value of the land [and water in this case], and equally strongly with capitalist speculation based on that value’ (2020, 12).

Indeed, whose knowledge counts is contested in the Salar de Atacama watershed. When interviewing both state officials, companies and experts, there was common reference to the ‘lack of knowledge’ about the Salar de Atacama (its origins, cycle of irrigation, dynamics of groundwaters and changes over time) amid claims that reliable data to better understand its dynamics requires decades of stable measurement. However, as data was only recently acquired, there were many uncertainties, rather than answers. As Babidge identified, lack of scientific knowledge has “delayed regulatory action and sustained extractive activity” (2019, 96), moving *caution* to the future, discounting costs for future generations and allowing companies to keep expanding their operations.

Equally, elite scientific knowledge has been increasingly contested. A biologist explained her frustration that while the state and the companies said more research was needed, when the results provided a basis to oppose extraction, they were not taken seriously or seen as providing insufficient evidence. Corporate actors agreed that it was not just a question of acquiring ‘any scientific knowledge’ to understand the effects of brine extraction, but rather hydrogeological knowledge. However, one hydrogeologist insisted the “lack of data” means uncertainty remains until there is data over many years because of the need to understand a dynamic and changing environment:

...it is a system [salt flat] that is constantly in motion, especially because they are highly influenced by seasonality; that is, because of what happens in summer and because of what happens in winter, then it is so dependent on the rains... So no... it is no use to go one day, and measure and take a picture because in the end in 6 more months you will see something else... So, for that reason, it is relevant to have data over time. That is monitoring. -...- So now, and at this moment the Dirección General de Aguas [General Directorate of Water] has monitoring in Chile. But their data has very low density. And the ones that do monitor a lot are the mining companies themselves. That is, Albemarle in this case and Soquimich. But they are under no obligation to share their data.

What this points to is the fact the disparity of data between the state and the companies does not allow the state to properly audit the companies, nor to make decisions about the quota taking into account reliable data. The knowledge inequalities are pronounced when considering that in Chile,

most hydrogeologists work for mining companies whilst the state mainly audits the companies' reports. This imbalance creates power hierarchies that benefit the companies, preventing the state from making independent and informed decisions. It is also of course the case that in order to raise capital to finance new mining ventures, companies undertake extensive surveys and (pre)feasibility studies when prospecting for mining wealth. For example, Albemarle and SQM both trade on the New York Stock Exchange which imposes regulatory requirements upon them. To take one example, a Pre-Feasibility Study running to over 270 pages in length was published in 2022 for the Securities and Exchange Commission in the US by Albemarle on Salar de Atacama Región II, Chile covering data on mineral resources, value and environmental impacts.³ Hence, the data exists, it is just not evenly shared, particularly with those who might oppose mining.

Despite the uncertainty claimed by the state, companies and experts, several indigenous interviewees repeatedly said that for them it was evident that the Salar de Atacama was being damaged – although they lack what state officials and mining companies would consider relevant 'data'. A lican antai woman said that she was raised near the salt flat, and she and her family were struck by the changes: not only some lagoons and freshwater spring pools were less abundant and there was less grass for their livestock, but there were notably fewer flamingos coming to the lagoons of the *Salar*. Equally, she said that it was clear for her the salt flat was damaged as it was a yellow color, instead of the white that it used to be and that was a sign of health. Another lican antai man highlighted the spiritual understanding of this damage:

The question is what is the state of health of the Salar de Atacama now? We don't know, we don't know, nobody knows! I mean, what we do know, and I am clear about it in a more spiritual way, we know that changes are happening. We know that the Salar de Atacama is being destroyed -...- It's like taking the blood out of the human body and bleeding it out little by little. Therefore, you know that it will die at some point.

The parallels with blood and water were often present when interviewing lican antai people about Puri (water in lican antai ancient language *ckunza*) and the *Salar*. For lican antai, both are considered more-than-human entities that are part of what Boelens describes as the hydro-cosmological cycle; the interconnection of 'cyclical dynamics of hydrology, agro-ecology, human lifetime and cosmology' (2014, 234). It expresses the Lican Antai view of "*Puri's walk*" in the territory and its relationship with the salt flat and its brines. Therefore, lithium extraction is understood as water mining, with the effect of destroying the salt flat and with it, the entire territory, including both human and non-human beings where Puri is the blood of the territory and the *Salar*, 'the heart' of the hydro-cosmological cycle in the basin. An elder lican antai woman explained it like this:

I have always said that my people have a trunk, its main trunk is the- the spiritual world and the Salar [salt flat] is like where the roots of a great tree of life are, because that is where life begins in the Salar. In other words, now with the scientific vision that we have of the Salar, with the extremophiles... there is a beginning of life.

³ <https://investors.albemarle.com/node/23741/html#exhibit9631231202110-k.htm>.

Although this is a vision also supported by scientific research (Dorador et al. 2009; Cubillos et al. 2018; Farías and Contreras 2018), companies and state officials interviewed referred to indigenous knowledge dismissively as ‘perceptions’ that needed to be evaluated against facts coming from data and scientific knowledge. In contrast, several lican antai people interviewed understood the need and benefit of using both ancestral as well as scientific knowledge as long as there is mutual respect. However, as long as the state considers ancestral knowledge as based on ‘perceptions’ not only do indigenous people not have tools to combat the environmental damage, but their own knowledge gets denigrated and lost. As such, the colonial understanding of what knowledge means and what types of knowledge are valid plays an important enabling role when it comes to expanding mining industries.

4. Decolonising transitions

Whether through violent forms of land acquisition and dispossession and epistemicide of the knowledge claims of others (De Sousa Santos 2014) or moving outwards, the uneven patterns of resource extraction and exchange within and between countries and within and between rural/urban landscapes, the “colonial shadow of green electromobility” (Jerez, Garcés, and Torres 2021) is cast over this case. In this sense, the case we have presented here lends weight to calls from others to decolonise energy (Ghosh et al. 2021) and for the study of transitions and to attend more seriously to the role of race (as well as other key social characteristics) in the politics of energy transition (Newell 2021a).

Neo-colonialism is manifest in the way knowledge is mobilised and denied, resources flow, land acquired, chains of accumulation built and projects implemented. This assemblage of extractivism both reflects, reveals and embodies multi-scalar inequalities operating within the current and historical geopolitical order. Current energy transition pathways indicate how global elites (and their national counterparts) continue to subdue the global South, and particular social groups within the majority world, reinforcing a long trajectory of resource regionalism and economic dependence (Humphreys Bebbington and Bebbington 2010, 147). Behind the talk of partnership and green growth we find the appropriation of territory, whereby dominant forms of capitalism preclude possibilities for traditional ways of making use of territory such as living from livestock and small-scale agriculture. These industries and imaginaries perpetuate a dependency circle: while mining consumes more water and does not allow other economic activities to be developed (such as agriculture), people are forced to sell their labour to mining companies in order to live according to ‘modern standards’ of development (premised on providing a formal education to their children, living in certain types of houses, having cars, and so on).

However, mining only increases the destruction of the ecosystem which supports peoples’ livelihood, which in turn only makes them more dependent on it so they are left without options when minerals for mining are exhausted, and they lose their jobs. Here, lithium operates both as promise and peril: socially constructed as ‘oro blanco’ (white gold) and the basis of a new mineral boom, but achievable only in ways and through means which repeat historical patterns of

dispossession, exclusion and uneven but dependent development: a situation with antecedents in Spanish colonialists violent search for the sacred gold of the Incas in the 15th century.

On the other hand, while lithium extraction has been depicted as environmentally damaging by NGOs, researchers and indigenous communities (Jerez, 2016; Liu et al., 2019) and conflicts remain between companies and indigenous communities, past research in Chile (Argento and Puente 2019; Babidge and Bolados 2018; Fornillo 2015; Jerez, Garcés, and Torres 2021; Nacif and Lacabana 2015) has overlooked the relevance of money and the job opportunities that communities have received from companies, along with scholarships to help children to study and finance for indigenous initiatives. Even if lithium companies do not offer many job opportunities (Slipak and Urrutia 2019), they do help to fulfill the needs of some rural communities. As opportunities to study and paid work concentrate in urban areas, the past decades have seen a massive emigration from the rural desert and the salt flat to the cities. The prospect of work in lithium mining means some might stay. As one indigenous lithium-worker and former indigenous leader stated: “This village was dying, everyone left to Calama city to work in mining companies. But with lithium, everyone came back”. This is a familiar development dilemma: better “take the benefits we can, while it lasts” as this worker stated. This dilemma was echoed by another former leader:

... it is a complex scenario, because we have talked with our brothers, and we have analysed it and mining is directly a mirage. It is directly a mirage because what is going to happen tomorrow when it is over, when the companies have to leave? What will remain? Well apart from the environmental hole that they are going to leave, then what will they be left with if they [atacameños] don't learn to do other things? Because we also have the conflict, especially in the youth, that many young people no longer know how to “throw a shovel”, or how to irrigate, nothing. So, they practically depend 100% on the work of the company, and if they are not in the company, they simply do not know how to do anything else.

As capitalism expands and national development remains tied to ideas of urban progress and modernity, paid work constitutes the only option to access the formal education system, healthcare services, housing, food, technology, and so on. In this regard, many interviewees reflected on the future and the possibility to stay on their ancestral lands. If lithium extraction ends, the villages/ayllus ‘will die’, but if lithium companies remain, the salt flat will die. Therefore, the more dependent the local communities are upon paid labour and the more traditional agriculture and livestock are abandoned and impacted by climate change through drought in particular, it will be harder to remain in the Atacama Desert. Those that defend ‘traditional’ ways of living continue to push for alternative futures to the salt flat as they see it as ‘death sentence’ for them and their ancestral territory. In this context, lithium extraction not only constitutes a depletion of resources, but also the advance of a modernity/coloniality (Quijano, 2000) that implies the destruction of other worlds and ways-of-being-in-the-world.

To decolonize the transition in this setting would require a challenge to the dominant but narrow focus on energy 'transitions' centred around elite, largely Northern, framings of 'socio-technical transitions'. This is underpinned by a ‘plug and play’ mentality of adding new energy sources or technologies to the mix without shifting the means of provision or disturbing the power relations

which keep unequal access and uneven exposure to harm in place. It stands in opposition to a more transformative agenda assembled around diverse knowledges and pluriverses (Escobar, 2018) and organised institutionally and materially around a regenerative rather than an extractivist economy.

5. Conclusion

The account we have provided here of the assemblages of extractivism organised around the lithium triangle in Latin America links global political economies and ecologies within and beyond the region. These operate internationally between core and periphery in the global political economy of energy transitions, but are closely related to patterns of internal colonisation when, as with this case, mestizos continue to appropriate the resources and labour of indigenous groups. As well as emphasizing material appropriation and power and resources, our account also drew attention to the institutional and discursive elements of an ‘assemblage of extractivism’ required to manage and extract value from the materiality of lithium. Following Bridge (2001), we showed how certain regions get constructed as commodity-supply spaces, which installs epistemologies that legitimize discourses of growth, development and construct the role of each territory as a source of comparative advantage in an increasingly competitive global economy.

The analysis contributes to debates about the global political economy of energy transitions and their uneven consequences and distributional outcomes and deepens an understanding of the everyday organisation of political economies and political ecologies of extractivism. Our analysis articulates a more relational and transformative account of how responses to climate change can invoke new injustices if they are not attentive to existing social inequalities (Sultana, 2022). In rural settings many of the inequalities revolve around the central dimensions of agrarian political economy: property, labour, income and consumption/reproduction (Borras et al. 2022), which currently replicate ‘extractivist assemblages’. These fundamental issues need to be brought to the fore in the study of ‘more than sociotechnical’ transitions. In this regard, historical materialist accounts of assemblages can usefully foreground the ‘relationship to nature and to each other through the wage relation and systems of social reproduction’ (Jordhus-Lier et al. 2022, 319). Politically and strategically, our analysis helps to illuminate what is at stake in attempts to decolonise transition debates: the need to disrupt and displace the discursive, institutional and material assemblages which normalise and reproduce extractivism. As well as challenging these historically constituted and contemporary expressions of class-based and racialised inequalities in particular, moving beyond assemblages of extractivism also means addressing issues of demand and over-consumption that drive extractivism as well as the narrow models of development which value only what is profitable for investors. It requires to go beyond a ‘plug and play’ models of transition which merely add technologies and energy sources to the mix rather than substituting them and reorganising systems of provision (Newell & Martin 2020). ‘Ecologising’ transitions also requires us to account for the ecological flows associated with transitions: the materiality and life course of minerals and the technologies they are used in, the circulation of pollutants and the energy embodied in the circulation of goods from production to exchange to consumption and waste management. But also, to see them as part of broader human and nonhuman ecologies in the

ways suggested by the Lican antai people in Chile. Finally, democratising transitions implies challenging questions of ownership and power distribution (Van Veelen and van der Horst, 2018) given the problems associated with the concentration of state power in a state-corporate nexus that we have documented here.

Drawing attention to these dimensions does not do away with the need to engage with (rather than just critically reflect upon) the live and real dilemmas about energy pathways, because in the end there is no such thing as clean energy or green mining. There is just cleaner energy and greener mining. We mine for materials for most everyday goods – titanium for bikes, surgical equipment, copper for cables or minerals for toothpaste- not just for energy; and not just rare earth minerals, though these are often the focus of debate. Therefore, some mining in the near term is inevitable, just as ancient lican antai had mining activities (Núñez, 2007); but the intensive and extensive nature of hyper-extraction needs to be countered. This means addressing questions around how to reduce the demand for minerals and how to minimize the impacts of mining where it does occur: in this case, improving the efficiency of lithium recovery seems an urgent first step to reduce the extraction of brines. For those in the front line of this mode of extractivism, it suggests the need for global solidarities to resist communities being played off against one another. Low carbon, renewable energy and mitigation projects are as conflictive as fossil fuel projects, but out of 649 cases of resistance movements to both fossil fuel and low carbon energy documented by the environmental justice EJOLT atlas, over a quarter of projects encountering social resistance have been canceled, suspended or delayed (Temper et al 2020). In this context, the discussion about minerals should be an entry point for re-thinking destructive economies. We need then to move beyond a narrow conversation about transition – which replaces one technology with another- to think about deeper transformations that are required to assemble knowledge, economies and institutions that are more equitable and sustainable.

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