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Strategic coupling beyond borders: Germany's extraterritorial agency in Namibia's green hydrogen industry

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Abstract

Amidst increasing geopolitical threats, geo-economic competition, and climate change concerns, this article reflects on why and how states alter strategic coupling processes abroad. Scrutinizing Germany's involvement in Namibia's green hydrogen industry, we conceptualize the decarbonization rationale as a state project that drives extraterritorial agency. Extraterritorial institutions accompany private enterprises with public institutional support, thus leading to three mechanisms through which extraterritorial agency shapes strategic coupling dynamics abroad: extraterritorial de-risking, extraterritorial asset creation, and market creation. We show that, even in liberal and coordinated market economies, states develop extraterritorial strategies to align global production networks with their strategic goals.

Keywords: global production networks; extraterritoriality; de-risking; hydrogen industry; strategic coupling.

JEL classifications: O13, O19.

1. Introduction

In a multipolar world of geopolitical blocs facing the climate crisis, the spatial organization of the global economy is increasingly influenced by state responses to geopolitical risks (Blažek and Lypianin 2024; Pavlínek 2024) and the decarbonization imperative (Bridge and Faigen 2023; Coe and Gibson 2023). As a consequence, even in liberal and coordinated market economies (Kim 2022), states develop strategies to align global production networks (GPNs) with their strategic goals not just within their territory but also extraterritorially (McGregor and Coe 2021). Trends to reshore, friendshore, and nearshore production reflect attempts to mitigate geopolitical and climate risks by actively shaping the geography of strategic production networks (Völlers et al. 2023; Kalvelage and Tups 2024). Notwithstanding, GPN research still tends to confine the role of the state to "the facilitation and regulation of GPN activities *within* the territorial boundaries of the state" (McGregor and Coe 2021: 7 emphasis added). To broaden the understanding of the role of states in GPNs *outside* their territorial boundaries, this article examines why and how states exercise extraterritorial agency to alter the geographies of global production in accordance with their interests.

While we appreciate that the literature increasingly recognizes, and distinguishes between, the influence of foreign and domestic states on the spatial configuration of GPNs (Glassman 2011; Smith 2015;

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Lim 2018; McGregor and Coe 2021), we observe a rather narrow understanding of extraterritorial state engagement in strategic coupling concerning three caveats.

First, in regard to the drivers of extraterritorial state engagement, we note that the literature often discusses motives and interests rather implicitly, focusing on aspects such as security (Glassman 2011) or economic concerns (Lim 2018). Moreover, the literature has not engaged with decarbonization as an important rationale of state action in GPNs (Bridge and Faigen 2023; Coe and Gibson 2023; Blažek and Lypianin 2024), even though such an engagement could offer insights into how different drivers, such as security and socio-ecological concerns, interact and materialize (Riofrancos 2023). Therefore, we identify three drivers of extraterritorial state action: socio-ecological concerns, economic development, and security threats, and conceptualize the decarbonization rationale as one possible state project resulting from the intersection of these drivers. Foregrounding decarbonization draws attention to specific GPNs (e.g. renewable energies, low-carbon technologies) and inter-state relations (e.g. the import/export of renewable energy and minerals critical for low-carbon technologies).

Second, research on strategic coupling tends to confine extraterritorial state agency to the strategic coupling of state-owned enterprises (SOEs) abroad (Lim 2018; McGregor and Coe 2021). We argue, however, that extraterritorial state agency is embedded in more complex organizational forms of state-corporate relationships that have not yet been conceptualized. Therefore, we have developed the term "extraterritorial institutions" to denote actors that pursue domestic interests in foreign states, such as development agencies, embassies, and development banks, and highlight that they can not only support SOEs but also domestic private companies in strategic coupling processes abroad. To capture these activities of extraterritorial institutions in support of private and/or public enterprises abroad, we coin the term "flanking."

Third, how extraterritorial institutions can support the strategic coupling of domestic lead firms abroad remains undertheorized. We propose a mechanism-based approach (Yeung 2019) and conceptualize three mechanisms through which states can shape strategic coupling processes by altering competitive dynamics: extraterritorial asset creation, extraterritorial de-risking, and market creation.

Empirically, we analyze why and how the German state supports (or *flanks*) the strategic coupling of the fully private German–British joint venture *Hyphen Hydrogen Energy* (hereafter Hyphen) with a range of political-economic activities in Namibia and how these efforts have influenced the Namibian state to grant the joint venture a concession to develop a large-scale export-oriented green hydrogen project in the country. The case is insightful for three reasons. First, it exemplifies how the decarbonization rationale can drive extraterritorial state action because industrialized states, including Germany, increasingly aim to decarbonize a wide range of energy uses with green hydrogen, an emission-free energy carrier. Second, the role of the state in the green hydrogen industry is pronounced because in as much as green hydrogen can replace fossil fuels, it changes the geopolitics of energy trade (van de Graaf et al. 2020). Likewise, the development of the first export-oriented green hydrogen projects is a function of strong (foreign) state support because such projects are rife with risks and characterized by a difficult business case vis-à-vis fossil fuels. Third, the case of German–Namibian relations is particularly interesting as it occurs in a post-colonial context, which has led some researchers to warn that the green hydrogen industry could reproduce unequal power relations between the two countries (Gabor and Sylla 2023).

In the next section, we develop our theoretical arguments, focusing on the drivers behind the formation of state projects, the flanking activities of extraterritorial institutions, and the mechanisms of extraterritorial agency. Following the methodology, we apply these theoretical arguments to the strategic coupling process of the green hydrogen GPN in Namibia. Finally, we discuss the implications for future research in the conclusion.

2. The drivers, organizational strategies, and mechanisms of extraterritorial agency on strategic coupling processes

We develop our theoretical arguments in three steps. First, we explain how different drivers of state action coalesce in state projects—in our case decarbonization. Second, we propose the term "extraterritorial institutions" to enable reflections on the agency of states to pursue their decarbonization goals abroad by—what we suggest calling—*flanking* private lead firms. Third, we conceptualize three mechanisms through which extraterritorial institutions can influence the strategic coupling of private lead firms in other countries (cf Fig. 1).

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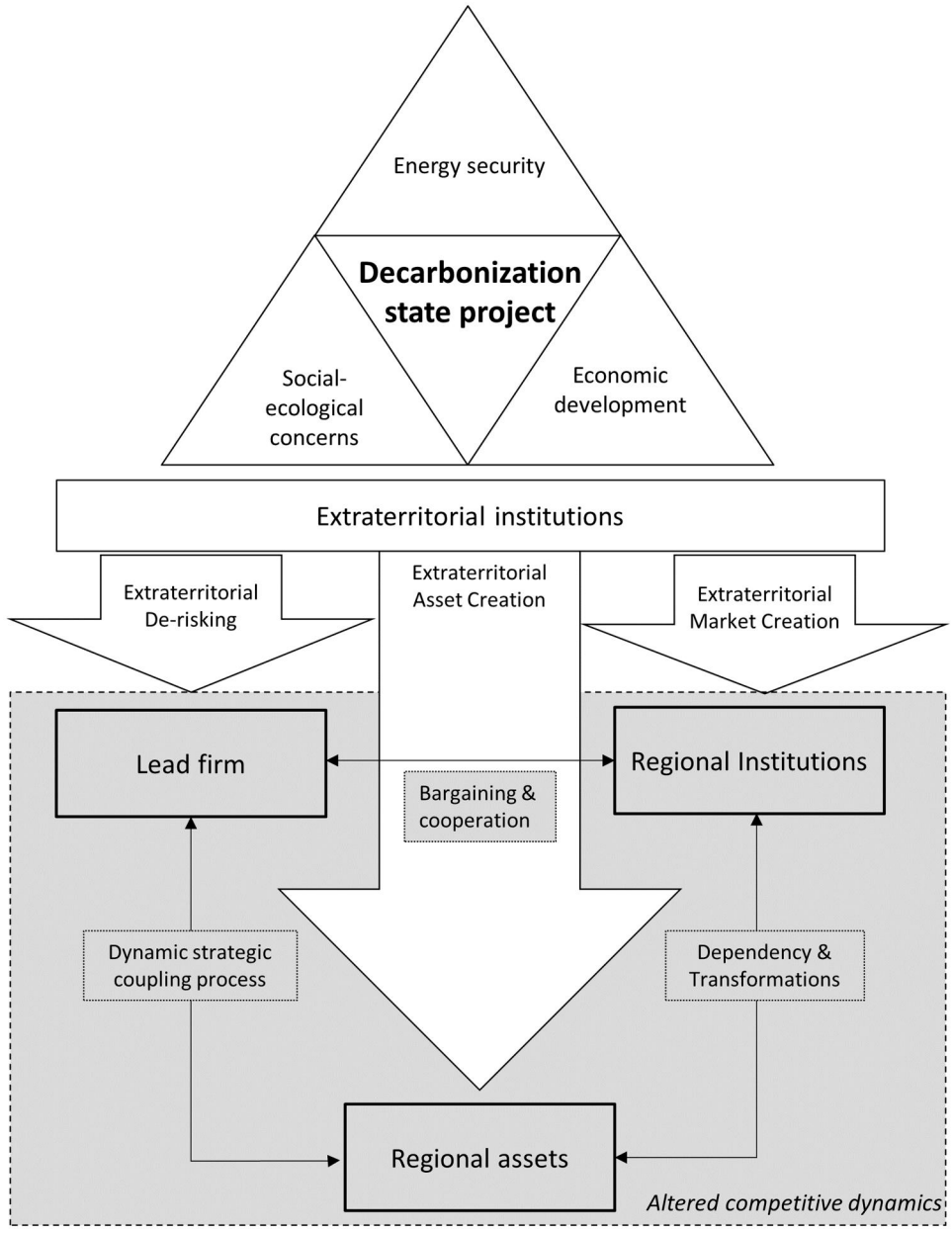


Figure 1. Expansion of the strategic coupling framework elaborated and visualized in Coe and Yeung (2015: 19) and Yeung (2015: 5); the elements of the original framework are depicted in the grey rectangle and proposed expansions in white above.

2.1 Extraterritorial state engagement amidst security, geoeconomic, and climate-change concerns

To understand why states act abroad, we propose distinguishing between three drivers of state action that have received (more or less implicit) attention in the GPN literature on extraterritoriality. These are social forces (Phelps 2007), geopolitics (Glassman 2011), and geoeconomic competition, as states (Lim 2018; McGregor and Coe 2021) compete in the new international division of labor (Alami and Dixon 2022). We show how these three drivers coalesce in a state project to demonstrate the analytical

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value of distinguishing drivers of extraterritorial state action that materialize differently in relation to one another in different states and geographical contexts.

First, extraterritoriality can result from the interests of particular national or transnational classes or social forces, which mobilize states to pursue their interests (Phelps 2007). These interests range from socio-ecological (Riofrancos 2023), over religious (Hunter 2017; Kadri and Abdelsalam 2020) to ideological concerns, such as anti-communist sentiments (Callaghan, O'Connor, and Phythian 2019). Climate change constitutes a particularly important socio-ecological concern today. However, social forces can mobilize the state to drive or hinder (extraterritorial) decarbonization efforts. On the one hand, when elites are beneficiaries of fossil fuel exports, states are likely to hinder (Bouzarovski and Bassin 2011) or slow down decarbonization (Koch 2022). Likewise, the threat of industry relocations to "pollution havens" (Poelhekke and van der Ploeg 2015) or to countries which offer a cheaper renewable energy supply (Samadi, Fischer, and Lechtenböhmer 2023) can motivate social forces, such as labor unions (Prinz and Pegels 2018), to protest against decarbonization. On the other hand, climate movements play an important role in demanding climate action from states (Jänicke and Jacob 2004), also in regard to financing climate change mitigation efforts abroad (Pickering and Mitchell 2017).

Second, geopolitical concerns, particularly military and the security of supply threats, constitute a second motive for extraterritorial state engagement (Glassman 2011; Kalvelage and Tups 2024). While several authors have argued that security concerns have incentivized states to onshore production (Riofrancos 2023) and might even signal a reversal of globalization and a trend towards regional production networks (Gong et al. 2022; Butollo et al. 2024), we argue that it might also compel states to act extraterritorially. For example, states are forced to respond to geopolitical trigger events such as violent conflicts (Blažek and Lypianin 2024), trade sanctions (Pavlínek 2024), military threats, or the weaponization of supply chain bottlenecks (Beaumier and Cartwright 2024). When such trigger events lead to the "geopolitical decoupling" (Blažek and Lypianin 2024) of domestic firms from foreign energy sources, states require the capacity to achieve new, geopolitically safe couplings to ensure security of supply. This is especially relevant for some industrialized countries, such as Germany, Japan, and South Korea, that are not able to produce enough renewable energy domestically at competitive costs (van de Graaf et al. 2020). Hence, there is a strong incentive to secure an economical and reliable renewable energy supply from abroad. Moreover, states try to anticipate and prevent geopolitical trigger events by "defensive decoupling" (Ando, Hayakawa, and Kimura 2024: 3) and building geopolitical alliances (Flint and Zhu 2019), which the development of international energy transportation infrastructures exemplifies (Sovacool 2012). In sum, the "geopolitical position of a country in the international system is thus one of the preconditions for its industries and firms to successfully decouple from the structural coupling and recouple in a more favorable strategic coupling" (Pavlínek 2024: 161).

Third, states increasingly compete as economic actors in "the new international division of labour" (Alami and Dixon 2022). To secure or improve their geo-economic position, states can be compelled to act in foreign countries, for example, to ensure domestic firms' access to foreign (export) markets (Shadlen 2005). For example, decarbonization offers resource-rich and advanced economies new opportunities for economic development. On the one hand, low-carbon technologies, from battery electric vehicles to hydrogen technologies, provide novel opportunities to specialize in technology development, manufacturing, and export (Baker and Sovacool 2017). On the other hand, the growing demand for energy transition minerals (IEA 2021) and renewable energy imports offers export-oriented development opportunities to mineral- and energy-rich countries (van de Graaf et al. 2020) but also puts pressure on states specializing in technology manufacturing to ensure a stable supply of these resources (Bridge and Faigen 2023; Coe and Gibson 2023).

Based on these insights, we argue that national and transnational social forces, geo-economic competition, and geopolitical concerns drive the formation of state projects that steer extraterritorial state action. However, depending on which of the three underlying drivers dominates, and how the drivers intersect in nationally specific ways, states will be inclined to interpret their extraterritorial role in different ways. In export-oriented industrialized countries with high vulnerability regarding energy imports, active climate change pressure groups, and the need to defend a position as technology leaders in a dynamic geo-economic environment, these three drivers may coalesce into decarbonization as an increasingly important rationale for extraterritorial state action (Riofrancos 2023). For example, extraterritorial state action may be characterized by national industrial specializations and resources and states might therefore be willing to deviate from strictly economic goals of value creation and

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capture for geopolitical reasons (Lim 2018). However, in different contexts, such as countries with an authoritarian governance structure and political-economic elites that benefit from the export of fossil resources, extraterritorial state action may take different, even violent, forms. In the following section, we explore how states can organizationally pursue state projects abroad.

2.2 Flanking domestic lead firms with extraterritorial institutional support as a means of distancing in postcolonial contexts

We propose the term "extraterritorial institution" to analytically foreground foreign-state and state-linked actors involved in strategic coupling processes abroad and distinguish them from the established GPN category of "regional institutions". Following Ospina Peralta et al. (2015: 32), we define extraterritorial institutions as "organizations that are not controlled by actors in the territories where they operate." This conceptual distinction highlights actors that pursue a foreign state's interests in strategic coupling processes.

Extraterritorial institutions will often be associated with different policy fields because states are organized along policy fields, such as climate and economic policy (Neilson, Pritchard, and Yeung 2014). Considering policy fields helps to reflect on the interests and functions of different extraterritorial institutions. In all policy fields, extraterritorial institutions might exist that influence GPNs, ranging from international research efforts and the attraction of foreign scientists by national ministries of research and innovation (Zhang, Cooke, and Wu 2011), and labor ministries that regulate labor standards across transnational supply chains (Sydow, Helfen, and Auschra 2021) to foreign affairs ministries and diplomats lobbying for market access in foreign countries (Jaklič and Šešum 2019), as well as export promotion agencies facilitating this market access (Yang 2014).

Besides policy fields, extraterritorial institutions might also be linked to different government levels. Hence, assuming a multi-scalar perspective offers insights into intra-state power relations and coordination. Often, national ministries will control extraterritorial institutions, such as development banks. However, supranational organizations, by definition, have influence beyond a single nation state but are subjected to uneven influence from different national governments (Ranis, Vreeland, and Kosack 2005). Hence, they can act as extraterritorial institutions in the interest of nation states too. Likewise, GPN research has shown that local state actors can exert extraterritorial agency (Breul, Revilla Diez, and Sambodo 2019).

To understand the coordination among extraterritorial institutions, we follow a strategic relational understanding of the state (Jessop 2016), which is often employed in the GPN literature (Smith 2015; Dawley, MacKinnon, and Pollock 2019; Bridge and Faigen 2023; Pavlínek 2024). From a strategic-relational perspective, state agency is understood as the result of struggles between state actors and underlying social forces. Hence, different extraterritorial institutions can pursue different, potentially competing goals. In this sense, coherent state action abroad constitutes an organizational achievement and outcome of intra-state coordination. The concept of state projects, which secure the "operational unity" of state action, describes this organizational achievement (Jessop 2016: 58, see as well: Bridge and Faigen 2023).

When extraterritorial institutions pursue a state project that concerns strategic coupling with a foreign region, strategic coupling encompasses the coordination of interests between foreign states, host states, and corporate entities (Smith 2015; Lim 2018). State–state coordination is important because states hold certain sovereign territorial rights, especially regarding land and resource use, policing, and defense (Bridge 2008; McGregor and Coe 2021). Hence, extraterritorial institutions will need to coordinate with regional institutions to perform certain functions in support of strategic coupling if they do not want to expand to perform those functions abroad themselves (as in colonialism) or arrange for other states to perform these functions on their behalf (as in neocolonialism) (Phelps 2007).

In regard to state-corporate relations, states can either directly participate in the strategic coupling abroad through SOEs (Lim 2018; McGregor and Coe 2021) or cooperate with private firms (e.g., Glassman 2011; Smith 2015). Both organizational strategies might allow states to achieve their interests abroad. Similar to SOEs, private firms transfer value and/or strategic commodities from territories abroad to the home region where they are headquartered (Vicol et al. 2019). Hence, when states are not in control of SOEs, states can cooperate with private lead firms. Similarly, states can cooperate with private lead firms if they offer organizational benefits over SOEs.

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We argue that the greater independence of private companies from their home states compared to SOEs can constitute an organizational benefit in strategic coupling processes. McGregor and Coe (2021: 9) have already argued that concealing ownership of SOEs might benefit state-state negotiations. They call this strategy "distancing", encompassing indirect forms of ownership, e.g., through intermediary government agencies, as well as "hybrid entities" (McGregor and Coe 2021) or "state-linked actors" (McGregor and Yeung 2022), such as development agencies, cluster organizations, and research institutions.

In this vein, we propose that distancing does not need to end at hybrid entities and indirect forms of control but can also encompass the public support of entirely private companies by mobilizing extraterritorial institutions. We term this mobilization of extraterritorial institutions to support the activities of private firms that are aligned with state projects "flanking." For instance, domestic lead firms might transfer profits or commodities from abroad back home and, hence, contribute to achieving geoeconomic goals. Hence, foreign states might rely on fully private companies to create distance among themselves and the corporation in the eyes of the state hosting the strategic coupling, which an indirectly SOE could not offer. Distancing can be especially useful in geopolitically sensitive contexts, such as in postcolonial contexts, in which firms might not want to be associated with the state where they are headquartered, for example, because of the state's colonial heritage.

In the literature, different forms of extraterritorial state action to flank domestic lead firms in strategic coupling processes abroad can be found. These flanking efforts encompass the development of infrastructures and military interventions, diplomacy, and sanctions (Glassman 2011), product and labor standards (Alford and Phillips 2018), as well as bilateral trade agreements and other forms of market integration, or tariff regimes and protectionism (Smith 2015; Curran, Nadvi, and Campling 2019). In other works, more specific functions, such as landownership, economic planning and management, strategic and portfolio investing, redistribution, and knowledge generation are emphasized (Werner 2020; McGregor and Yeung 2022).

In order to provide a more concise view on extraterritorial state action, we propose three mechanisms of extraterritorial agency through which state actors can influence strategic coupling in the following section.

2.3 Three mechanisms of extraterritorial agency

We argue that states can extraterritorially shape the competitive dynamics and risk environments that drive firms according to the GPN 2.0 approach (Coe and Yeung 2015). These competitive dynamics encompass the management of costs and capabilities, adhering to market and financial imperatives, and minimizing risk exposure. We propose—in a non-comprehensive manner—to distinguish three mechanisms of extraterritorial agency, including asset creation, de-risking, and market creation. While asset creation can particularly support how firms manage costs and capabilities, de-risking addresses the risk environment and improves financing conditions, while the creation of new markets changes market imperatives as newly created markets gain in relative importance to established markets.

2.3.1 Extraterritorial asset creation

The concept of regional assets describes the human, technological, and institutional resource base of a region. Regional assets encompass "natural assets (covering resources); infrastructural and material assets; industrial assets (covering technology and firm competencies); human assets in the shape of labour skills, costs, and knowledge; and institutional endowments of rules, routines, and norms" (MacKinnon et al. 2019: 122). Regional assets can be more generic or more distinctive in nature. For example, generic regional assets include cheap regional energy resources, labour surpluses, and the availability of industrial sites which drive down production costs (MacKinnon 2012). In comparison, more distinctive regional assets, such as specialized pools of knowledge and expertise, and a well-trained regional labor force can contribute to the capabilities of a firm. Therefore, regional assets are at the core of the GPN framework and allow regions to attract investments (Yeung 2015). Hence, extraterritorial asset creation constitutes a means to increase the competitiveness of regions in competition for foreign direct investment.

GPN studies have increasingly adopted a dynamic understanding of regional assets (McGregor and Coe 2021; Fu and Lim 2022), according to which the "state and other actors" can improve the regional

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asset base "through dynamic and strategic processes of asset creation and destruction" (McGregor and Coe 2021: 7). In this vein, we argue that states cannot only alter the domestic asset base but also modify and create assets abroad to alter the preconditions of strategic coupling (cf Ospina Peralta et al. 2015).

For instance, foreign state-led exploration activities can discover natural resources (Adamson 2021) and spatial development initiatives can create infrastructural assets (Tups and Dannenberg 2021), including ports (Blanchard and Flint 2017). States can also foster knowledge, skills, and technology transfer via research cooperation and training programs, thereby creating human and industrial assets (Pandey, de Coninck, and Sagar 2022). Lastly, improving the institutional environment, that is, creating institutional assets, is a conventional aim of international development cooperation and widely practiced (Booth 2011).

An improved regional asset base as a result of extraterritorial asset creation may strengthen the bargaining position of regions vis-à-vis lead firms in strategic coupling processes. Hence, regional institutions might be able to negotiate more beneficial terms of strategic coupling for regional development (Coe and Yeung 2015). Therefore, regional institutions will be interested in receiving support in asset creation by extraterritorial institutions, which those extraterritorial institutions can leverage in state-state negotiations to influence the decision-making of regional institutions.

2.3.2 *Extraterritorial de-risking*

Besides creating regional assets abroad, states can alleviate companies from the demands of private financiers and de-risk investments in foreign territories, thus incentivizing strategic coupling in those territories. Risks hinder companies from investing in certain locations and translate to higher financing costs because financiers will require higher returns on their investments to take on financial risks (Sweerts, Longa, and van der Zwaan 2019).

De-risking refers to practices which aim to improve the overall risk-return profile of an investment and, thereby, the investment's financing conditions (Gabor 2021). De-risking has become "immensely powerful" (Gabor and Sylla 2023: 2) as various government programs, such as the Inflation Reduction Act in the US or the European Green Deal, pursue a de-risking approach to enable private investments in strategic sectors like renewable energy. However, governments do not only de-risk investments in strategic sectors on their territory but also extraterritorially.

Two forms of de-risking can be distinguished: policy de-risking, that is, measures to reduce underlying investment risks, and financial de-risking, that is, underwriting private risks with public funds (Steckel and Jakob 2018). Particularly, the latter type of de-risking has become the subject of critical discussions for two reasons. On the one hand, when states take on risks from the private sector while not benefiting from successful investments, they socialize risks while privatizing returns (Mazzucato 2018, 2016). On the other hand, the uneven (fiscal) capacities of states in the Global North and South imply uneven capacities to engage in financial de-risking, which could reproduce uneven development globally (Gabor 2023).

De-risking efforts are particularly important for capital-intensive investments, for example, in large-scale infrastructures, where financing costs can amount to a considerable share of total costs (Ochieng and Papadaki 2020). Moreover, de-risking efforts are often necessary in new fields of technology and industrial sectors that are characterized by a difficult business case or long-term investments (Mazzucato 2018, 2016). Lastly, risks are more pronounced in emerging markets and places with which investors associate (socio-political) risks, for example, Global South countries (Steckel and Jakob 2018; Sweerts, Longa, and van der Zwaan 2019).

Regarding the actors of extraterritorial de-risking, development banks play an important role (Gabor 2021). Development banks are usually majority-owned by national governments, which ensures their high creditworthiness and enables them to raise large amounts of capital on financial markets which can be offered at low interest rates to foreign governments (Shapiro, Vecino, and Li 2018). Hence, development banks constitute important extraterritorial institutions that flank private companies. Moreover, export credit agencies are an established institution undertaking de-risking efforts, for example, by offering export credit guarantees and political insurances that aim to address political risks, while facilitating access to potential export markets (Gianturco 2001; Felbermayr and Yalcin 2013).

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2.3.3 Market creation

Lastly, states can create markets which offer companies new business opportunities in the direction of economic development that is aligned with the interests of states. For example, new fields of technology might promise economic or socio-ecological benefits, such as employment opportunities or lower greenhouse gas emissions. To be able to create markets, states need to assume a more strategic and proactive role than only correcting market failures (Mazzucato 2018, 2016).

However, correcting market failures, for example, by pricing or regulating negative market externalities, such as greenhouse gas emissions, might be a necessary part of creating new markets, for example, for climate-neutral technologies. In addition, states are crucial for market creation for various reasons. First, states are involved in the standardization of commodities (Coe and Yeung 2015: 56) and negotiate with other states to lower bilateral import tariffs, thereby enabling suppliers and buyers to trade across territories at competitive prices (Smith et al. 2014; Curran, Nadvi, and Campling 2019). Second, market creation requires long-term, strategic investments by states in the research and development of new commodities, for example, technology, and often hinges on place-based incentives to support their commercialization, for example, by subsidizing the production and consumption of these commodities in different places (Walker 2024). Third, states often finance and co-develop the necessary infrastructures underpinning (international) trade. Hence, they can shape the scale at which market participants can trade goods, as exemplified by the extension of gas pipelines (Bridge and Bradshaw 2017; Walker and Klagge 2024). Fourth, market creation also encompasses the creation of market operators, for example, trading institutions (Chandrashekeran 2022). Lastly, through public procurement, states actively create demand (Edler 2016).

McGregor and Yeung (2022) have recently argued that states can contribute to extraterritorial market creation. Not only do states, through economic diplomacy, negotiate for domestic firms to access foreign markets (Jaklič and Šešum 2019), they can also assist in developing the necessary infrastructure underlying markets in foreign territories, exemplified by China's Belt and Road initiative (Flint and Zhu 2019), or stimulate demand for domestically produced goods abroad (Edler 2016). In addition, states can contribute to the creation of trading institutions abroad. For instance, technical and juridical assistance by development agencies has stimulated the creation of a wholesale electricity market in Vietnam (Do et al. 2020).

Summarizing our conceptual approach, we distinguish three drivers of extraterritorial state engagement, encompassing the concerns of social forces, geopolitical threats, and geoeconomic competition. From this perspective, we understand the decarbonization rationale as a state project driven by social pressure for climate action, energy security concerns, and economic development goals to varying, nationally-specific degrees. The decarbonization rationale can motivate state actors and extraterritorial institutions to unite under a decarbonization state project, which stimulates extraterritorial state engagement. In this case, extraterritorial institutions flank public or private companies in their strategic coupling efforts abroad through three mechanisms: extraterritorial asset creation, de-risking, and market creation (cf Fig. 1). These three mechanisms, however, are strongly interrelated and can reinforce each other.

3. Methodology

We developed our analytical framework in an iterative process of reviewing literature and analysing empirical data about a planned US$10 billion investment by the joint venture Hyphen in an export-oriented green hydrogen and ammonia production facility in Southern Namibia, near the town of Lüderitz. Hyphen plans to transform the green hydrogen into green ammonia for easier transport, which prospective buyers, such as the German energy utility RWE, could either use directly or reconvert. Hyphen consists of the German renewable energy and hydrogen project developer Enertrag and the British investment company Nicolas Holdings. The project is currently in the planning and development phase which for hydrogen projects of this size take 3–6 years. Afterward, project developers take the final investment decision, followed by a construction phase of 1-2 years, and an operation phase, which should last at least three decades to be economical (Engelmann and Rohrmeier 2022).

In light of the explorative nature of the research question, we applied a qualitative research design. To understand the agency of German extraterritorial institutions in the strategic coupling process of Hyphen, we conducted a field trip between February and April 2023 to Namibia's capital Windhoek

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and to Lüderitz, resulting in twenty-nine semi-structured interviews with seven Namibian government representatives (NAMGOV), including high-ranking officials, five German extraterritorial institutions (GEREX), fifteen international and Namibian companies, and two civil society organizations (Table 1). In addition, the analysis draws from interviews with German actors (GER) conducted in Germany, including interviews with three Enertrag employees, Brandenburg's regional development agency, two German policymakers involved in the development of the German hydrogen strategy, the German subsidy mechanism for non-European hydrogen projects, H2 Global, and two employees from the German Development Cooperation (GIZ). The majority of the interviews were conducted in English and lasted approximately 60–90 min. They were recorded and transcribed. One interview was conducted in a group, two online, and one could not be recorded due to confidentiality concerns. In the latter case, we took detailed notes and supplemented with recall transcripts later.

The data collection approach also included policy documents (particularly the German and Namibian hydrogen strategies BMWi 2020; Ministry of Mines and Energy of Namibia 2022), site visits, conference attendances, and the observation of a German business delegation organized by the Economic Development Agency of the German state of Brandenburg, where Enertrag's headquarters are located. A qualitative content analysis of all the material was conducted, as described by Kuckartz and Rädiker (2022).

4. The German state's extraterritorial agency in Hyphen's strategic coupling process

We start the analysis by providing background information about the strategic coupling process between the Namibian government and the green hydrogen project developer Hyphen, which was flanked by the German state (Section 4.1). The following sub-sections further scrutinize, first, why the German state is engaged in the hydrogen industry in Namibia as part of its energy transition (Section 4.2). We then identify the extraterritorial institutions that support Hyphen's GPN and how they coordinate among themselves. Lastly, we explain the extraterritorial agency mechanisms that have influenced Hyphen's strategic coupling process (Section 4.3).

4.1 Extraterritorial agency in the strategic coupling process

In June 2021, the Namibian government published a public request for proposals to develop a first large-scale, export-oriented green hydrogen project in a concession zone in the Tsau ǁKhaeb National Park. The concession zone includes around one-fifth of the park's total land area (NIPDB 2021). The park stretches from Lüderitz, in the South of Namibia, to the South African border. Tsau ǁKhaeb is an unpopulated historical mining area, owned by the state (Nangolo 2012) and hosts the country's best renewable energy resources (IEA 2019).

The Australian hydrogen company Fortescue Future Industries, Hyphen, and the South African petrochemical company Sasol received high rankings for their project proposals (The Presidency of Namibia 2022). Yet, although both Fortescue and Sasol represent large, diversified companies that could have invested considerable equity, the Namibian government instead declared Hyphen to be the preferred bidder. The decision-making process was criticized by a civil society organization, which claimed that the evaluation process was not transparent and questioned why the joint venture, consisting of the medium-sized Enertrag (annual turnover €250 million) and Nicholas Holdings, a rather unknown holding, investment, and project development company, should be the preferred bidder (IPPR, 2022).

Our understanding of extraterritorial agency and the benefits of state-private cooperation can explain why choosing Hyphen as the preferred bidder has two advantages for the Namibian state. On the one hand, Enertrag's involvement in the consortium ensured continuing support for Namibia's green hydrogen industry by the German state, which had already invested considerably in Namibia at the time of the tender (see Section 4.4). In comparison, neither Sasol's nor Fortescue's bids were supported with comparable extraterritorial efforts by their home states. On the other hand, the relatively small size of the two companies invested in Hyphen and the European Investment Bank's (EIB) concessional loan ensured that the Namibian state could acquire shares in the Hyphen project (NAMGOV1). Hence, extraterritorial agency is relational insofar as it depends on the capacities of other, competing foreign

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Table 1. Summary of German extraterritorial institutions.

German extraterritorial institutions in Namibia					
Policy field	Foreign Policy	Climate politics and export promotion	Development cooperation	Research and Development	Public Financing
Ministries	German Federal Foreign Office (AA)	Ministry for Economic Affairs and Climate Action (BMWK)	Federal Ministry for Economic Cooperation and Development (BMZ)	Federal Ministry for Education and Research (BMBF)	Federal Ministry of Finance (BMF)
Implementing organizations	German Embassy in Windhoek; GIZ	German Export Promotion Agency (GTAI), Federal Institute for Materials Research and Testing (BAM)	German Development Agency (GIZ)	Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL)	German Development Bank (KfW)
Supporting state-linked actors	Political foundations (Hanns Seidler, Konrad Adenauer, Friedrich Ebert), Research institutions (Fraunhofer, ISOE), Business association (AHK)				

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states to assert their interests, as well as host states to amplify asset creation, de-risking, and market creation efforts or conduct these efforts themselves.

Following more than a year of negotiations between Hyphen and the Namibian national government, the two parties signed a Feasibility and Implementation Agreement (FIA) in May 2023. The FIA grants the Namibian government the opportunity to acquire a 24 per cent equity share in the project (Hyphen and Government of Namibia 2023), thus sharing both investment risks and benefits. On the one hand, the shares of the Namibian state would increase its value capture if the project is realized and operates successfully. On the other hand, if the project fails after the investments have been realized, the Namibian state would need to service its debt to the EIB, which would prove difficult given Namibia's state budget of less than €4 billion (IPPR and Hanns Seidl Foundation 2023). In addition, Hyphen has committed to procuring 30 per cent of goods and services locally and filling 90 per cent of jobs with Namibians throughout the construction and operational phases (Hyphen and Government of Namibia 2023). Reaching these very ambitious goals will crucially depend on the German state's extraterritorial agency, particularly the creation of an educated Namibian workforce, as we explore in the next sections.

4.2 Decarbonization as a rationale for the German state's engagement for green hydrogen in Namibia

The German state's extraterritorial engagement in Namibia's green hydrogen industry can be explained as an interplay of the three drivers introduced earlier: social pressure for climate action, economic development opportunities, and energy security concerns. Facing very limited oil and gas resources and economic stagnation due to the oil price crises of the 1970s, social forces emerged in Germany in the late 1970s that warned against pollution, dependence on fossil fuel imports, and nuclear accidents (Krause, Bossel, and Müller-Reißmann 1980). With the formation of the Green Party, these social forces gained a political voice in local and national parliaments. Opposition to nuclear power spawned the development of wind, solar, and hydrogen technologies by private entrepreneurs and companies from powerful industrial sectors, such as automotive, mechanical engineering, and chemicals, offering necessary capabilities (Rechsteiner 2021; Walker, Becker, and Klagge 2021).

The intersection of environmental and energy security concerns with opportunities for economic development created a strong political force that increasingly gained hold in the German State. Hence, from the 1980s onwards, first federated state governments, then the national government adopted policies supporting green hydrogen and renewable energies (BMWA 2005; von Hirschhausen 2018).

By 2010, Germany had become a world market leader in the production of renewable energy and hydrogen technologies, which represented a significant growth factor for peripheral areas in East Germany (Brock, Sovacool, and Hook 2021). While the national government decided to phase out nuclear power in 2011 after the Fukushima accident and, thereby, increasing demand for alternative energy sources, the German renewable energy market showed the first signs of maturation due to increasing political resistance from citizens dwelling in the vicinity of renewable energy installations (Walker 2022) and industrial associations and labor unions associated with fossil fuels (Prinz and Pegels 2018). Hence, it became increasingly apparent that the potential for domestic renewable power generation was insufficient to satisfy German energy demand (Walker 2022).

Social pressure for decarbonization persisted and growth opportunities for renewable energy technology abroad opened up. On the one hand, German renewable energy lead firms started to explore new business fields, for example, green hydrogen production to store renewable electricity, and project development abroad to access new markets (Franz and Vogel 2015). The corporate history of Enertrag exemplifies these developments. Headquartered in one of the structurally weakest regions of East Germany, the company developed its first green hydrogen project in Germany in 2011. Driven by a stagnating market in Germany, in 2017, Enertrag entered the growing southern African renewable energy market (GER1). The German national government, the government of Enertrag's federated home state Brandenburg, and Brandenburg's regional development agency see support for Enertrag as a means to address the region's political and economic challenges and hope that Enertrag will transfer part of the value it captures abroad back to its home region (GER5).

On the other hand, the German Ministry of Economic Affairs commissioned the German Development Cooperation (GIZ) to investigate whether green hydrogen imports from regions such as Southern Africa could substitute fossil fuel imports and, thus, contribute to energy security in the face

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of the twin challenges of decarbonization and nuclear phase-out (Interview GER6, GER7). Energy security concerns became even more pressing when Germany sanctioned fossil fuel imports from Russia to use its purchasing power in the trade war that resulted from the outbreak of the Russia–Ukraine war. Consequently, the German national government is interested in accessing Namibia's worldclass renewable energy resources to friendshore energy production (Kalvelage and Tups 2024). However, extraterritorial engagement in Namibia takes place in a sensitive geopolitical context, due to the colonial history of the two states. 30,000 ethnic Germans live in Namibia, resulting in strong German extraterritorial institutions but also in diplomatic tensions caused by claims for reparation (Melber 2022). In the next section, we show how the German state's ambition to import green hydrogen from Namibia cumulates in a coordinated state project.

4.3 Unified extraterritorial support for a private company

The intersection of different state drivers in the decarbonization rationale facilitates the emergence of state projects as state actors with different political mandates can unite behind a common goal for different reasons. Importing green hydrogen is an example of a state project that is shared by various political parties across subsequent legislative periods. The German National Green Hydrogen Strategy (BMWi 2020) is an expression of this state project and five German ministries[1] are currently working on a hydrogen import strategy that further guide the political mandates of extraterritorial institutions (BMWK 2024).

The state project of green hydrogen imports requires coordination between the German and the Namibian states, among different government levels, and encompasses various extraterritorial institutions. In August 2021, the German Federal Minister of Education and Research had already signed a joint communiqué of intent to establish a hydrogen partnership with Namibia, which the Green Party Minister for Economic Affairs signed in 2022 (BMWK 2023). The partnership represents the national-level strategic platform to coordinate the activities of different German ministries and the extraterritorial institutions they control in Namibia and to negotiate the German State's involvement in Namibia's green hydrogen industry with the Namibian government.

These state-state negotiations encompass the potential use of the German State's extraterritorial agency, for example, its ability to create regional assets. They have improved Hyphen's position vis-à-vis its competitors for access to Namibian land because the German state can offer the Namibian government benefits that private companies cannot offer (see Sections 4.1 and 4.4). The German Embassy in Windhoek represents a classic extraterritorial institution organizing and executing such negotiations (cf Jaklič and Šešum 2019) and is assisted by further extraterritorial institutions (cf Table 1).

The German extraterritorial institutions in Namibia are composed of ministries from different policy fields, implementing organizations, which the ministries control directly, and supporting state-linked organizations that are formally independent but strongly aligned with the state (Table 1). Implementing organizations primarily support Hyphen within the political mandate that the policy field defines. For example, the Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL) offers resource exploration services, the Federal Institute for Materials Research and Testing (BAM) material science capabilities, and the German development bank (KfW), which is jointly owned by the German federal and federated states and controlled by the German Ministry of Finance (BMF), supports green hydrogen projects in acquiring (grant) financing from international donors (Parkes 2023). Hence, extraterritorial institutions can take over tasks from the private companies they support, ie, securing their financing.

A number of state-linked actors is active in Namibia: the German Chamber of Commerce Abroad (AHK) represents German corporate (trade) interests and is co-funded by BMWK and GTAI. Similarly, political foundations such as Hanns Seidel, Konrad Adenauer, or Friedrich Ebert are strongly aligned and funded by German political parties. They contribute to building technology legitimacy in Namibia and offering information services for German policy makers. Last, German research institutions, such as Fraunhofer or the Institute for Social-Ecological Research (ISOE), are largely dependent on German government funding and provide socio-technical research services, e.g., regarding technology testing or stakeholder engagement.

[1] The Federal Ministry for Economic Affairs and Climate Action, the Federal Ministry of Education and Research, Federal Ministry for Economic Cooperation and Development, the German Federal Ministry of Digital and Transport, and the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection.

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Besides this horizontal coordination across various policy fields, the German national government also coordinates its extraterritorial activities vertically, with the German federated states that are active in Namibia which, however, only have limited resources for extraterritorial engagement. More importantly, the German national government coordinates with the EU. In October 2022, the EU Commission President and the Namibian President announced the EU-Namibia Strategic Partnership in sustainable commodity value chains and renewable hydrogen. As part of the partnership, the *Global Gateway Initiative*, the EU's equivalent of the Chinese Belt and Road initiative (Heldt 2023) will invest €1 billion to mobilize funding for infrastructure, capacity building, research, and regulatory changes, partly in support of Hyphen (see 4.3, 4.4).

German extraterritorial institutions flank private companies like Hyphen because the German state cannot participate through direct ownership[2] in GPNs for green hydrogen. Historically, the German state has never controlled major energy SOEs compared to other European states (Karlsch and Stokes 2003). Hence, for the German state, as an example of a coordinated market economy (Weiss 2021), organizational distance from Hyphen resulted from a lack of alternatives. Hence, the nationally specific institutional context defines the state's extraterritorial engagement. However, in the postcolonial context of German-Namibian relations, the organizational distance between Hyphen and the German state also constitutes an organizational advantage as it has increased the trust and confidence of the Namibian state that it remains in control of the strategic coupling process (NAMGOV1, see 4.4). In the next section, we analyse the different forms of support with which German extraterritorial institutions shape the strategic coupling process.

4.4 Mechanisms of extraterritorial agency in postcolonial contexts

The German state's extraterritorial engagement intends to improve Hyphen's cost-capability ratio and financing conditions in Namibia, so that the company can produce green hydrogen at a competitive cost there. To this end, German extraterritorial institutions worked towards extraterritorial asset creation, extraterritorial de-risking, and market creation (Table 2).

Extraterritorial asset creation started with the exploration of Namibia's natural resources. In 2020, the German Ministry of Education and Research (BMBF) commissioned SASSCAL to evaluate Southern Africa's, including Namibia's, renewable energy resources and the potential to produce green hydrogen in the region (GEREX4). As a result, "*[e]veryone involved became aware that Namibia has perfect location conditions and could become a hotspot for green hydrogen production*" (GEREX1).

Extraterritorial asset creation is particularly necessary because Namibia is only sparsely industrialized and, hence, lacks crucial industrial assets and human resources. In order to address skills and technology shortages, the BMBF and the EU made €40 and €25 million, respectively, available in grants to the Namibian government to fund five green-hydrogen pilot projects in August 2021 (BMBF 2022; Gabor and Sylla 2023). These projects are much smaller than the Hyphen project, are dispersed throughout the country, and provide opportunities for the creation of a domestic green hydrogen market, R&D, human resource development, and green industrialization. Due to their smaller size, their development is much faster. They contribute to the creation of industrial and human assets in Namibia, which both the Namibian state and Hyphen can harness in the coupling process later on.

To create human resources, the BMBF also funds the development of the Green Hydrogen Research Institute at the University of Namibia and pays German hydrogen experts to teach there. Similarly, the BAM runs a scholarship program, which gives Namibian Ph.D. students the opportunity to pursue their studies in Germany (NAMGOV2). Besides skills transfer, these asset creation efforts garner political support for the green hydrogen industry: "*We would like to capacitate the Namibian youth in regard to green hydrogen and anchor technical expertise and knowledge here in Namibia. (…) We (…) want to use this programme to create excitement among the Namibian youth for green hydrogen*" (GEREX1).

Lastly, the Hyphen project depends on the creation of infrastructural assets. Among them is the construction of a new port to import wind turbines and other technological components and export ammonia (Kinyua 2023). Moreover, the peripheral town of Lüderitz has a population of around 15,000 people, but Hyphen envisages employing around 15,000 people during construction and 3,000 people in operation. Therefore, Lüderitz will need to invest in urban development to accommodate workers

[2] While there are discussions in Germany about increasing state ownership in the energy sector, there are no initiatives yet to create a state-owned hydrogen multinational.

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Table 2. Overview of mechanisms of extraterritorial agency, empirical examples, and executing extraterritorial institutions.

Mechanisms of extraterritorial agency	Activities	Involved extraterritorial institutions
Asset creation	• Analysis of green-hydrogen production potential • Green hydrogen pilot projects • Research program • Infrastructure development	• SASSCAL (Southern African Science Service Centre for Climate Change and Adaptive Land Management) • BMBF (Ministry of Education and Research) • BAM (Federal Institute for Materials Research and Testing) • German Embassy
De-risking	• Funding of national green hydrogen strategy • Special hydrogen envoy • Concessional loan	• BMBF • BMWK (Ministry for Economic Affairs and Climate Action) • EIB, KfW (European Investment Bank, German Development Bank)
Market creation	• H2 Global funding mechanism • Carbon border tariff (CBAM) & regulation for green-hydrogen use	• GIZ (German Development Agency), BMWK • EU

and their families. To this end, the German Embassy has granted the local council €5 million to develop a new urban development plan (German Embassy Windhoek 2023).

Extraterritorial de-risking has two main objectives: the mitigation of policy risks and the reduction of financial risks. To develop a stable regulatory and political environment in Namibia, the BMBF has funded the Namibian green hydrogen and derivates strategy to integrate green hydrogen into the long-term economic planning of the Namibian government (Ministry of Mines and Energy of Namibia 2022). Moreover, various extraterritorial institutions from the German state and the EU provide technical and legal assistance to the Namibian government. Among them, for example, is a special hydrogen envoy who was appointed by the Minister of Economic Affairs (BMWK 2022).

Extraterritorial de-risking in Namibia also addresses financial risks (cf Gabor and Sylla 2023). These de-risking efforts are necessary because Hyphen is a private company and, hence, the German state does not vouch for the company's finances directly, as it would for an SOE (cf Gabor 2021). Hydrogen production in Namibia faces unfavorable financing conditions due to the perceived risks that investors associate with Namibia and other Global South countries (Parkes 2023). To reduce Hyphen's dependence on more expensive private finance, the EIB has granted the Namibian government a €500 million concessional loan to invest in the Hyphen project.

Lastly, *market creation* is crucial to address (economic) offtake-risks and to drive corporate investments abroad, as market development constitutes one of the corporate drivers identified by Coe and Yeung (2015). To stimulate international market development, the German national government instructed the GIZ to develop the H2 Global funding mechanism. Through the mechanism, several ministries subsidize the gap between the best price that green hydrogen producers offer and the highest price that buyers in Germany are willing to pay in a double auction. HINT.CO will then offer long-term purchase agreements to producers like Hyphen to provide them with the necessary investment security to bring export-oriented green hydrogen projects to financial close (GEREX2). In this way, the national government contributes to the creation of a global hydrogen market and provides valuable financial assets for project developers that are located in states like Namibia which cannot provide subsidies.

In addition, the EU has decided that European industries which already use hydrogen made of fossil fuels today, such as the refinery, chemicals, and metals industries, will be obliged to use at least 42 per cent of green hydrogen by 2030 (Erbach and Svensson 2023: 6). Hence, the EU has effectively created a potential export market that green hydrogen projects in countries such as Namibia can target. Since green hydrogen is still uncompetitive with fossil fuels on a cost basis, the EU has also passed a new tariff scheme (CBAM) for the import of energy-intensive products which should shield European industries from foreign competitors that have lower production costs since they do not need to use green

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hydrogen (Erbach and Svensson 2023). Thereby, the EU has consolidated the market for low-emission products and, by extension, demand from European industries for green hydrogen.

International market creation efforts complement attempts to foster hydrogen offtake in Namibia via the funding of pilot projects described above. In this sense, different mechanisms of extraterritorial agency are interrelated and address corporate drivers in interrelated ways, reinforcing each other when combined successfully.

5. Conclusion

We contribute to the GPN literature engaging with the extraterritorial agency of the state in strategic couplings abroad (McGregor and Coe 2021). While previous contributions have foregrounded geopolitics as a driver of state involvement (Glassman 2011; Kalvelage and Tups 2024), we have argued that geopolitical drivers can intersect with other drivers (geoeconomic and social-ecological concerns) to culminate in rationales of state action, in our case decarbonization, which motivate states to engage with other states and selected GPN actors to achieve strategic couplings abroad.

Acknowledging that bargaining in strategic coupling processes can encompass foreign states (Smith 2015; Lim 2018), we have expanded the strategic coupling framework by proposing the term "extraterritorial institutions". Extraterritorial institutions provide a conceptual distinction from the established concept of regional institutions (Yeung 2015) which helps to understand how states can flank strategic coupling processes abroad.

In addition, we have deduced three mechanisms through which the state, but potentially also other actors, can shape competitive dynamics and risks and, subsequently, influence firm behaviour to achieve couplings instead of decouplings (Blažek and Lypianin 2024; Pavlínek 2024). These mechanisms are extraterritorial asset creation, extraterritorial de-risking, and market creation. Thereby, we offer a conceptual—albeit not comprehensive—understanding of extraterritorial state agency in GPNs.

Our study shows that decarbonization presents a rationale for extraterritorial state engagement in strategic coupling processes, as the German state (and the EU) have mobilized considerable resources to support green hydrogen development in Namibia. While Germany depends on renewable energy imports to decarbonize (van de Graaf et al. 2020), future research on extraterritorial state action could explore different rationales for extraterritorial state action in varying contexts. For example, a focus on energy transition minerals (Bridge and Faigen 2023) or low-carbon technologies (Kleimann et al. 2023) in cases where countries do not rely on renewable energy imports would be useful. At the same time, the energy transition provides an opportunity for countries to decouple from extraterritorial fossil fuel resources and, in this sense, provides ample opportunities to research decoupling processes in the face of the decarbonization rationale (Blažek and Lypianin 2024).

Our focus on the flanking of a lead firm's activities in Namibia by the German state (and the EU), complements but also complicates the literature on state capitalism (Lim 2018; Alami and Dixon 2022). While our findings reflect the strong role of the state in contemporary capitalist development, we have shown that states might take over certain roles from (fully) private companies, for example, financing, and strategically use private companies for their ends. Hence, our research points to the need to expand and critically reflect on the –already controversial—boundaries of the state (Alami and Dixon 2022). States might cooperate with private firms in sectors in which they do not control SOEs, as is often the case particularly in coordinated market economies like Germany (Weiss 2021). Cooperation with private firms can even be an organizational advantage in sensitive geopolitical, for example, postcolonial contexts, as part of a distancing strategy (cf McGregor and Coe 2021).

The case study reflects the importance that GPN research should engage more with the urgent need for decarbonization, since the restructuring of global energy GPNs is already underway (Coe and Gibson 2023). But even beyond decarbonization, the findings call for reflection on the drivers behind the formulation of state projects in different contexts—and why and how different state projects lead to different forms of extraterritorial state action. Building on our approach, we think that future research could, first, develop a more comprehensive picture of the mechanisms through which the state—but also other actors such as private financiers (Newell and Paterson 2010)—can shape firm-level drivers. Second, future research could focus on the response of host states to extraterritorial agency, analyzing why and how they reinforce or impede coupling attempts by foreign states. Third, we did not elaborate in more detail what type of strategic coupling and (regional) value capture

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trajectories might result from extraterritorially flanked couplings, not least due to the methodological limitation that we observed a coupling process in its early stages. Fourth, it will be useful to examine how GPNs subject to extraterritorial agency interact with other, perhaps competing, GPNs. In this respect, the hydrogen industry will continue to be an insightful object of research for economic geographers.

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