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Drivers and Limits of the Geoeconomic Turn in EU Infrastructure Policy

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Abstract

In recent years, the EU has increasingly applied state-interventionist practices to initiate and implement infrastructure policy projects. This stands in stark contrast to a phase of liberalization of infrastructure networks and services accompanying European integration and fiscal consolidation and infrastructure decay during the euro crisis. This article argues that the new state interventionism is strongly driven by the changing global constellation of a "new triad competition" where the EU is increasingly competing over infrastructures with the US and China. As a consequence, EU infrastructure policy undergoes a geoeconomic turn that aims to control transnational value chains and related political-economic spaces. Drawing on concepts of critical geography and international political economy, the article outlines the core features of this geoeconomic design logic of infrastructures and contrasts it with complementary or competing ones. The article substantiates these arguments by analyzing EU decision-making on two cases of high-tech infrastructure in the fields of communication and energy: the federated data infrastructure Gaia-X and the Hydrogen Strategy. Both cases provide evidence for the geoeconomic turn in EU infrastructure policy. Yet, the analysis also highlights that the turn is at times supported but also hampered by a capitalist logic that is reflected in the positioning of European and non-European businesses, as well as the EU's reliance on private action. Furthermore, it illustrates that an ecological and a social-integrative design logic to key infrastructures are largely subordinated. The conclusions reflect on the discrepancy between the EU's geoeconomic agenda and its less far-reaching implementation.

Keywords

European integration; European Union; Gaia-X; geoeconomics; global competition; hydrogen; infrastructure policy

1. Introduction

On the European level, infrastructure policy has moved to the forefront of the political debate. The EU nowadays sees the strategic development of infrastructure as a necessary response to contemporary challenges. From an ecological perspective, it views the active shaping of its energy and transportation networks as a prerequisite for reaching its goal of climate neutrality. From an economic perspective, state-directed impulses are meant to overcome a decade of what has largely been a stagnating and imbalanced European economy. Most central to this article are the EU's geoeconomic motives: its position in a "new triad competition" with the US and China forces the EU to engage in global competition over the strategic control and economic potential of infrastructures (Abels & Bieling, 2023a). This has resulted in a more strategic infrastructure policy that hitherto received considerably less academic attention than the EU's shifts in industrial policy (Lavery, 2023; McNamara, 2023) or trade and investment (Meunier & Nicolaidis, 2019; Schmitz & Seidl, 2023).

This article analyzes recent developments in EU infrastructure policy, asking how key infrastructure initiatives come about and which logics and political alliances drive them. It argues that the EU is engaging in a more state-interventionist infrastructure policy that aims to control transnational value chains and related spaces: land masses, oceans, airspace, and outer space, even cyberspace. Triggered by the changed global constellation, the geoeconomic turn in EU infrastructure policy represents a structural phenomenon that is increasingly shaping the European agenda. In practice, progressing from agenda-setting and planning to decision-making and implementation, other political interests and design logics influence the extent to which the geoeconomic turn takes shape. Most centrally, we find the geoeconomic logic to be in parts supported but also hampered by a capitalist logic that determines the positioning of European and non-European businesses contributing to initiatives, as well as the EU's persisting reliance on private actors. The article substantiates these arguments by analyzing EU decision-making on the federated data infrastructure Gaia-X and its Hydrogen Strategy.

It proceeds as follows: the second section specifies the structurally changed historical context and indicators of the geoeconomic turn in EU infrastructure policy. The third section draws on critical geography and international political economy to outline a geoeconomic design logic that views infrastructure policy as both a means to secure control and access to essential networks as well as to expand economic production. It relates this logic to other competing and complementary design logics: a capitalist, an ecological, and a social-integrative one. The fourth section analyzes the logics and alliances driving the geoeconomic reorientation empirically. We take a look at two central initiatives in the field of communication and energy: Gaia-X and the Hydrogen Strategy. The conclusion reflects on the implications of the findings.

2. The New State-Interventionism in EU Infrastructure Policy

Following the global financial crisis and subsequent crises, the global and European political-economic landscape underwent significant changes. The dominance of neoliberal concepts seems to have waned, while protectionist and state-interventionist strategies are becoming more widespread (Babić et al., 2022; Roberts et al., 2019). The new state interventionism seeks to enhance control over transnational value chains that appear to be at risk: either because certain actors can weaponize them by restricting or

preventing flows (Farrell & Newman, 2019) or because accidents or crises might disrupt or permanently damage established networks of commercial cooperation.

For the last decades, the EU strongly relied on export activity and a largely market-liberal globalization strategy to maintain its international position. Yet, in response to a series of crises, the EU has geared its policy areas towards safeguarding and strengthening the resilience of value chains (Rosén & Meunier, 2023). Aside from security, energy, and trade policy, this particularly concerns infrastructure and industrial policy. Infrastructure policy primarily aims to improve connectivity, i.e., the circulation of resources, goods and services, money, knowledge, people, etc. It includes all efforts that seek to maintain, develop, and regulate infrastructures within and beyond a political space. In practice, infrastructure policy and industrial policy often go in the same direction (see Figure 1).

Cycles of infrastructure and industrial policy in the EU have been historically correlated. In the post-war era, national industrial and infrastructure policy activities were guided by Keynesian concepts of state interventionism (Bulfone, 2023). Governments selectively built and modernized infrastructures according to domestic industrial structures. It was only in the 1980s and 1990s that the EU developed a significant infrastructure policy. During the process of integrating the internal market, transnational capital advocated for the enhancement of cross-border infrastructures (Balanyá et al., 2000). At the core of this agenda was the Trans-European Networks (TEN) initiative, which sought to coordinate the expansion and interlocking of European transportation, energy, and communication infrastructures. Network-related infrastructures such as post, telecommunications, rail, gas, and electricity were liberalized, and sector-specific directives drove the organizational separation of infrastructure and service providers. The TEN strategy has successively been extended to neighboring regions, including Eastern Europe, the Caucasus, and the Mediterranean region. It continued in the 2000s but became increasingly securitized due to the rise of international terrorism and cybercrime. The concept of "critical infrastructures" gained prominence during that time, as the EU focused more strongly on monitoring and preventing new infrastructural risks (Council directive 2008/114/EC of 8 December 2008, 2008).

During the euro crisis, however, the EU intensified its market-liberal approach to infrastructure policy. Public-owned energy and transportation infrastructures in crisis countries were often sold below market value to consolidate national households. In addition, the EU's management of the euro crisis forced those

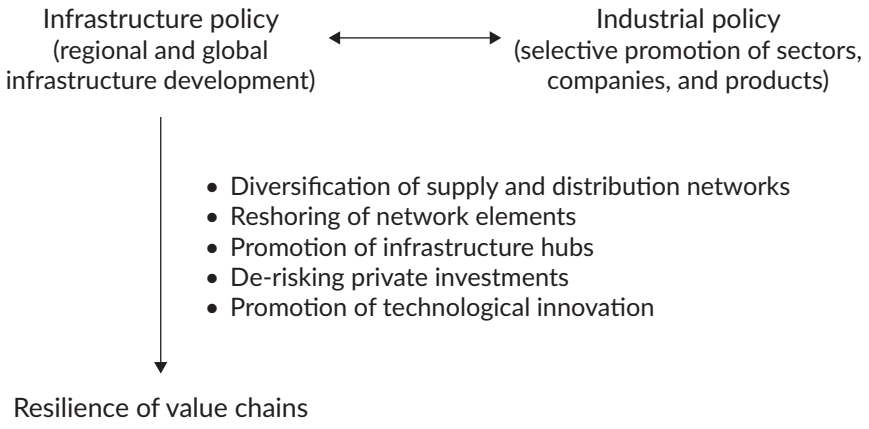

Figure 1. Intended effects of infrastructure policy.

member states most affected by the crisis to cut back on infrastructure-related investment. Figure 2 outlines the substantial economic divergences these decisions created within the EU regarding investments in communication, energy, and transport infrastructure development. Data for 2007 serves as an index value. Productive investment only includes assets that are materially produced, which subtracts land purchases and natural resources and excludes residential buildings. It highlights that budget cuts in the Southern periphery had strong negative effects on public investment in transportation and energy infrastructures, where private investment was insufficient to compensate for this. This undermined the productive capacity of those economies and contributed to economic divergences between member states.

In the aftermath of the financial and euro crises, internal and external factors contributed to an upgrading and reorientation of infrastructure policy. Internally, the member states were under pressure to promote re-industrialization and counteract the legitimacy crisis of the integration project. The "infrastructure push" (Ougaard, 2018) was an attempt to compensate for the infrastructure gap that resulted from market forces' failure to allocate available resources towards infrastructures under crisis and non-crisis conditions. Externally, the EU's position within an intensifying "triad competition" (Abels & Bieling, 2023b) with the US and China created pressure to modify the European approach to infrastructure development. The privatization of publicly owned infrastructures during the euro crisis opened the door to foreign ownership of essential European transport and energy networks. While the EU had hoped for some time to benefit substantially from China's global infrastructure initiatives and the modernization of routes between Asia and Europe, Beijing's central role in and control over these networks led to calls for increased economic sovereignty on behalf of the EU (Leonard et al., 2019). The US seemed to be several steps ahead. Under President Biden it implemented a transformative economic agenda that built on large-scale infrastructure-relevant programs such as the Infrastructure Investment and Jobs Act and the Inflation Reduction Act, subsidizing the development of US-based technologies and infrastructures.

This global constellation contributed to an increasingly geoeconomic orientation of central infrastructure initiatives. The European Economic Security Strategy warns of "risks [that] can occur along the entire value chain," concerning, among others, the "physical and cyber security of critical infrastructure" as well as the "weaponisation of economic dependencies" (European Commission, 2023a). Key documents such as the New Industrial Strategy (European Commission, 2020a) and the EU's Digital Strategy (European Commission, 2020b) seek to reduce dependencies regarding access to critical infrastructures and technologies,

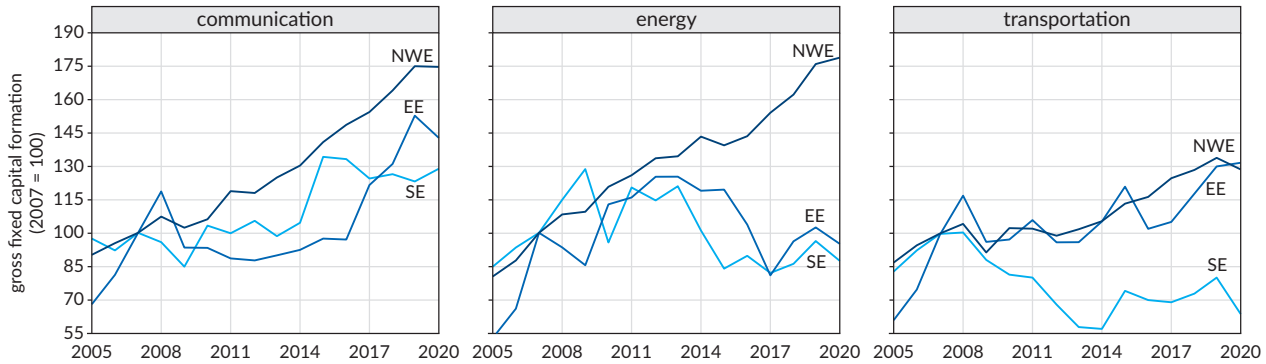

Figure 2. Productive investment in different sectors for European regions, 2005–2020. Notes: EE = Eastern Europe; NWE = Northern/Western Europe; and SE = Southern Europe. Source: Own calculations based on Eurostat.

particularly in the fields of energy and communication. The Important Projects of Common European Interests (IPCEI) exploit legal exemptions in the EU's state aid rules to promote business endeavors related to geoeconomically relevant technologies, such as battery development, cloud infrastructure, and hydrogen. In response to the Covid-19 pandemic, the Recovery and Resilience Facility (RRF)—an EU fund with a volume of about €750 billion—was designed to accelerate infrastructural transformation through public investment. Finally, with a more global outlook, the EU announced its Global Gateway initiative in 2021, which is supposed to make available up to €300 billion in financing for infrastructure projects in Africa, Latin America, and Asia until 2027 (Heldt, 2023).

3. Design Logics of Infrastructure Policy

Infrastructures are socio-technical networks that include material or digital facilities and their connections and enable the circulation of goods, services, people, energy, and data across space (Larkin, 2013). In principle, therefore, infrastructures also enable the organization and provision of public goods, including mobility, communication, education, and so forth. However, they are also associated with negative side effects, including their ecological and social impact as well as financial costs.

Infrastructures are the product of different forms of infrastructure policy where political influence is exerted at several points: in the planning, production, financing, and regulation of infrastructures. Overall, infrastructures are political, as they are subject to competing or complementary design logics, backed by different social interest groups and alliances. In the EU, in addition to the Commission and national governments, non-state actors such as think tanks, transnational corporations, and business associations are involved in the formation of infrastructure policy. Each of these actors is guided by a specific set of political objectives and ideas related to the design and operation of infrastructures. We schematically differentiate between four design logics that can, depending on the issue at hand, be mutually reinforcing or competing:

1. The *geoeconomic design logic* is the one central to this article. It corresponds to the changed global constellation and seeks to organize infrastructures in a way that enables the control of transnational value chains. Within the EU, the geoeconomic logic is primarily promoted by the European Commission and select national governments, in cooperation with think tanks operating at the intersection of European trade, competition, and foreign policy—e.g., the European Council on Foreign Relations or the Center for European Policy Studies—as well as some sectoral business associations, while umbrella associations are more hesitant.
   Geoeconomics is distinct from geopolitics. While in a narrow or instrumental understanding, it can refer to the utilization of economic tools, such as sanctions in geopolitical (sometimes even military) conflicts, geoeconomics in a more comprehensive form constitutes politics that strive to control transnational value chains for the purpose of expanding national production, safeguarding economic autonomy, and gaining a competitive edge over global rivals. Infrastructures play a crucial role in this. Networks generate patterns of dependency and allow actors in control of critical hubs to exploit this for territorial or social control (Farrell & Newman, 2019). This includes the instrumentalization of extant infrastructures, but also the strategic planning, financing, and regulation of new ones, for security aims and the control of spaces. The geoeconomic shaping and operation of infrastructural networks also serves to expand economic production, as infrastructures constitute the physical and digital linkages between economic spaces, determining the pathways and speed through which their exchange takes place. A geoeconomic

design logic thus views infrastructures not just as powerful tools of coercion or information-gathering, but also as prerequisites of consolidating transnational value chains and of economies' inclination to expand geographically (Abels & Bieling, 2023b). Accordingly, infrastructure policy is geared towards outperforming competitors in the race for key markets and technologies.

2. There is a *capitalist design logic* that displays some significant compatibilities with the geoeconomic one. These concern above all the productive facet of geoeconomics that corresponds with establishing specific "spatio-temporal fixes" (Harvey, 2003). Infrastructure policy aims to fix capitalist development by anchoring and embedding it materially and channeling financial resources into fields of investment that are crucial for improved economic connectivity. Yet, the capitalist logic is not confined to geoeconomics but focuses on two intrinsic aspects: macro-economically on stabilizing the economy and micro-economically on promoting productivity and enabling profits. Thus, at the EU level, this logic is commonly promoted by the European Commission (above all by the Directorate-Generals for the Single Market, Competition, Industry, and Trade), financial investors, and all kinds of lobby groups and business associations, including the European Industry Round Table and BusinessEurope. Infrastructure development presents investment opportunities where large volumes of capital are mobilized and channeled into projects with a long-term perspective. It is related to the prospect of future profits for companies utilizing infrastructures and those involved in establishing and financing them. This may imply tensions with the geoeconomic logic, as profit-seeking actors such as transnational corporations, financial investors, and associated political forces have incentives to prioritize and promote not those projects of the highest geostrategic value but those that generate the highest returns.
3. There is also an *ecological design logic* that aims to optimize the energy and climate balance of infrastructures and the connectivity generated by them. Against the backdrop of the climate crisis, this design logic has gained importance practically and discursively. It has been articulated primarily by environmental movement organizations as well as green parties and has been taken up and transposed into a modernization strategy by business actors, other political parties, and state apparatuses (Haas et al., 2022). As current debates on renewable energies, hydrogen, or the expansion of rail networks illustrate, issues relating to the generation and supply of energy and mobility are at the center of many infrastructure policy considerations. The ecological design logic is reflected in concepts for an innovative transition policy, entailing a comprehensive infrastructural reorganization embedded in the broader discourse on sustainable development.
4. A *social-integrative design logic* aims to improve democratic control, participation, and social cohesion (Foundational Economy Collective, 2018). It is frequently articulated by trade unions, including the European Trade Union Confederation, consumer associations, and social movements. This logic views infrastructures as prerequisites for the provision of essential public goods. It thus pushes for the development of social infrastructures in the fields of childcare, education, and housing, but also for the general availability, affordability, and accessibility of infrastructures in the fields of energy, communication, and transport. In addition, the logic is characterized by calls to compensate or ease the consequences of rapid structural change via the flanking of infrastructural programs with employment programs, vocational training, and further measures.

The outlined design logics and the alliances that promote them have been stimulated and shaped by recent crisis dynamics. There are some practical compatibilities between logics, yet they are frequently subject to minor or major conflicts of objectives. As the analysis in Section 4 demonstrates, all logics impact EU infrastructure policy to some degree, but some design logics articulate themselves hegemonically.

4. Analyzing EU Policy on High-Tech Infrastructures

4.1. Methods and Material

Seeking to understand what logics and alliances are driving the new state interventionism in EU infrastructure policy, this article takes a closer look at the development of two central high-tech infrastructure projects: the federated data infrastructure Gaia-X and the Hydrogen Strategy. We chose these two cases as they are representative of two major infrastructural fields: communication and energy. Hence, comparing the findings will help us identify larger dynamics of EU infrastructure policy instead of remaining limited to a certain field. In addition, both the processing of European data as well as the energy transition are central issues in which current debates over the control and autonomy of European value chains intersect. The two projects, Gaia-X and the Hydrogen Strategy should be viewed as elements of the new state-interventionist phase in EU infrastructure policy. As both are rather recent initiatives, they are still in the planning and early implementation phases: Gaia-X was announced in 2019 and the Hydrogen Strategy was agreed on in 2020.

The analysis seeks to identify and compare in a structured manner the geoeconomic context, the intervening logics and alliances, and the policy outcomes of both projects. It builds on data from official documents, position papers, and media reports to reconstruct the underlying constellations. Non-state actors, particularly business actors, are becoming part of the organizational structure of the infrastructure projects as they progress. Negotiation processes are also becoming more opaque and public records by the involved parties more scarce. We collect available documents and statements made by central state and business actors—companies and associations—involved in both cases and present the most significant in the following analysis.

Gaia-X is characterized as a communication infrastructure, whereas the Hydrogen Strategy concerns the field of energy. Due to their geostrategic, ecological, social, and economic relevance, the previously outlined design logics have a role to play. These design logics constitute an admixture of material interests and ideational preferences, which relevant state and non-state actors pursue and find their expression in their contribution (or resistance) to specific infrastructural initiatives. The self-positioning of actors is cross-checked with media reports and academic studies to approximate the relevant design logics and their proponents.

4.2. Gaia-X

4.2.1. Geoeconomic Context

Cloud services are central building blocks of a digitizing economy. They allow companies and consumers to access and use the storage and computing capacities of central providers according to their current demand and without having to set up designated data centers. The flexibility in utilizing these services—being able to assign high capacities to individual processes—has made them indispensable tools for digital applications such as the training of machine learning models as well as the processing of vast amounts of data generated by autonomous vehicles or smart cities. Cloud services rely on the setup of infrastructures in the form of data centers at strategic locations and their physical connection via ties, such as fiber optic cables.

Cloud providers benefit from economies of scale, as larger providers will get better deals on hardware and software and can optimize the costs of networks and personnel. Consequently, centralization effects in the cloud sector contributed to the concentration of traffic and data access. Several big players became increasingly influential. Subsidiaries of Amazon, Microsoft, and Google have a combined market share of around 65%, making cloud services a segment mostly controlled by US tech firms. In light of global competition, the US government has leveraged its position as a global cloud services hub. In March 2018, it passed the US Cloud Act, which grants US law enforcement access to electronic data held by domestic providers even if the data is stored on servers located outside the US.

For the EU, this has raised concerns about the dependency of European states and businesses on essential infrastructures provided by US firms, about data security, and conflicts with the EU General Data Protection Regulation (Autolitano & Pawlowska, 2021, p. 11). In 2019, initiatives for a more autonomous cloud sector in the EU resulted in a proposal by the German Ministry of the Economy (BMWi), closely coordinated with the French Ministry of Economy, to set up an EU-based infrastructure called Gaia-X. The initiative, which German Minister of Economy Peter Altmaier praised as a "moonshot" and a "gold standard for cloud services" (Koch et al., 2020), would be coordinated by a non-profit association seated in Brussels, while national Gaia-X hubs were to be set up in participating member states. As of now, the organization consists of 377 members. It operates via its board of directors, consisting of management staff from participating organizations. Board members have to be headquartered in Europe. It is currently headed by Catherine Jestin from Airbus. It also includes representatives from companies such as Deutsche Telekom and Orange as well as large European and national business associations. EU actors earmarked substantial funds for the project, with the Commission aiming to contribute €2 billion (Obendiek & Seidl, 2023, p. 1319). In 2023, they set up a designated IPCEI called Next Generation Cloud Infrastructures and Services (CIS), which is supposed to fund initial industrial use cases with a volume of €3.5 billion.

4.2.2. Intervening Logics and Alliances

In the early phases of the initiative, the form Gaia-X would eventually take was still subject to debate. The logics and alliances involved in the formation of political decisions on Gaia-X were pulling in different directions. A geoeconomic logic addressed both the EU's external dependencies and productive potentials. It viewed Gaia-X as a way to make Europe more autonomous in its access to and regulation of essential cloud infrastructure, while also highlighting the potential of securing a share of the cloud market and related value chains for European companies.

Thierry Bretton, former CEO of the French tech firm Atos and, since 2019, Commissioner for Internal Market in the von der Leyen Commission, has been criticizing non-European providers and demanded European data to be stored and processed in Europe (Manancourt, 2020). The BMWi took up his arguments, criticizing the lock-in effects that made it hard to migrate data away from US providers and warning that this dependency could negatively affect the EU's economy "in the event of political conflicts" (BMWi, 2019, p. 8). The geoeconomic argument was that an independent EU cloud infrastructure would decrease the foreign leverage over European companies and, by extension, states, and increase the EU's autonomy and capacity to act.

Such territorial arguments have also been reflected in statements from national business associations. The Federation of German Industries (BDI) and the French employer federation MEDEF have been strongly

supportive of the initiative from its inception, associating with it an acceleration of "sovereign digitisation" and "leadership in the digital economy" (BDI & MEDEF, 2020). VOICE, Germany's largest umbrella organization of IT-using companies, warned that "Europe cannot and must not assume that US or Chinese providers will pursue…the interests of our companies" and that US and Chinese data regulations would endanger data security and promote industrial espionage (VOICE, 2019). Bitkom, a large association of the German digital economy, which is represented on the board of directors at Gaia-X, has viewed the project and the calls for digital sovereignty as a "German and European response to US threat scenarios," while stressing the need to "revitalize the partnership with the US" (Bitkom, 2020). Ultimately, state actors and business organizations, mostly national ones, promoted a geoeconomic logic and expressed the expectation that Gaia-X could reduce external dependencies and make the EU more competitive technologically and economically.

The geoeconomic logic was in parts complemented, yet eventually overshadowed by a capitalist one that viewed Gaia-X in terms of productivity and profit-seeking, enabling business activity and new business models that would help Europe catch up in the digital economy. This logic has been part of BMWi's initial reasoning for Gaia-X as well: European companies, particularly SMEs, would remain skeptical about the costs of cloud usage and resulting dependencies, which means that "innovative ideas are less likely to be translated into new business models" (BMWi, 2019, p. 8). At a conference, Marco Alexander Breit, senior official of the BMWi responsible for Gaia-X, referred to Europe's lack of an innovation hub comparable to Silicon Valley, viewing Gaia-X as an opportunity to create such a hub digitally (Baur, 2023, p. 16).

Large European industry associations discussed Gaia-X in a similar tone. Digitaleurope, a major trade association of the digital technology industry, is represented on Gaia-X's board of directors. It largely refrains from addressing Gaia-X in terms of global rivalry, focusing more strongly on "jobs, innovation and economic growth" and calls for public de-risking of private investments in the cloud industry (Digitaleurope, 2021). What unites large tech-centered associations like Digitaleurope, Bitkom, or CISPE is that their membership is open to non-European companies. Digitaleurope and Bitkom both represent the interests of Amazon, Apple, Google, Microsoft, Intel, and Huawei as their members. The organizational structure of Gaia-X stipulates that only European-based companies are authorized to sit on the decision-making body, the board of directors. However, the fact that Digitaleurope, Bitkom, and CISPE are represented there has also brought US tech companies and other non-European organizations to the table. The European companies working on Gaia-X are often partnering with or in a dependent relationship with these firms, which has given non-European capital a strong leverage in working groups as well (Goujard & Cerulus, 2021). In effect, the geoeconomic orientation of the project has been toned down. Government actors were hardly able to counteract this. Gaia-X's organizational structure and the dominance of private actors in the initiative strongly reflect the desire of member states to make this "a project of the industry for the industry" (Obendiek & Seidl, 2023, p. 1321). Private companies—both European and foreign—made use of this hands-off approach by the member states to shift Gaia-X's design logic further towards the advancement of their profit interests and the stabilization of their business models via public funds.

A social-integrative logic has been essential to the project in the initial phase but has been less pronounced since. The safeguarding of European data and the free choice of cloud services for users have been stressed as central objectives of Gaia-X. All participating providers are expected to fulfill standards in line with European regulations on data protection. However, documents published by private contributors seldom

refer to the accessibility or affordability of services or their societal benefits. VOICE has criticized that Gaia-X as an organization almost exclusively features the supply side—cloud providers, associated industries, and their representatives—instead of user associations (VOICE, 2019).

The ecological design logic plays only a marginal role, even though cloud infrastructure has a substantial impact on the environment and the climate. Data centers emit a lot of waste heat and consume vast amounts of electricity. In the political debate, the ecological relevance of the project is mostly addressed in ways that frame renewable energy systems and the circular economy as potential beneficiaries of Gaia-X (BMWi, 2020).

4.2.3. Policy Outcome

As a consequence of the gradual amendment of a geoeconomic logic by a capitalist one, Gaia-X remains one of the EU's major state-initiated infrastructure projects, yet its form has changed over time. The initiative has argued that "once more, our continent is in danger of losing out in one of the core sectors for the economic development of the century," but that a European cloud hyperscaler would "engage in a futile attempt to compete for market share in mass business with the dominant platforms of the Americans and Chinese" (Gaia-X, 2022). What was originally discussed as an "AI-Airbus" has been transformed into an "ecosystem" connecting certified cloud providers. Gaia-X now envisages to rather standardizing cloud providers in Europe, binding them to European rules and standards, and preventing lock-in effects.

This reshaping of the initiative has gone hand in hand with a discursive and political shift towards attenuated geoeconomic ambitions to which several factors have contributed: internal conflicts between companies over organizational details; a retreat of state-interventionism after the initiation phase; and the influence of non-European actors from cloud provider giants, like Amazon Web Service to US-military associated firms like Palantir.

4.3. Hydrogen Strategy

4.3.1. Geoeconomic Context

Hydrogen is seen as an energy carrier with great potential. It has been the subject of research for some time and is at present mainly produced from gas or coal—so-called "grey" and "brown" hydrogen—or obtained as a by-product of industrial production. However, the high technological and material requirements, security risks, and considerable costs associated with producing, storing, transporting, distributing, and using hydrogen, have limited its use (Lebrouhi et al., 2022). This now appears to be changing due to new energy sources, especially renewables ("green" hydrogen), and more efficient electrolysis or hydrogen extraction, combined with carbon capture and storage ("blue" hydrogen). The change is contingent on the provision of a suitable infrastructure linking production and use to establish a functioning hydrogen market.

In recent years, this development has gained momentum, initially in the context of the European Green Deal (Haas et al., 2022). Hydrogen represents an option for mitigating the large fluctuations in renewable energies, especially solar and wind power, through storage. It also represents a way of replacing fossil fuels with alternative fuels in industries, such as steel and chemical, as well as in heavy freight transportation such as trucks and ships. The EU is working to expedite this transition. The Hydrogen Strategy (European

Commission, 2020c) has announced ambitious targets to be achieved by 2030: the European increase of electrolysis capacity from below one gigawatt to 40 gigawatts and the production of 10 million tons of clean hydrogen annually. The development of hydrogen infrastructure in addition to newly built pipelines and refueling stations, also includes the conversion of the existing gas infrastructure (pipelines, storage, liquefied natural gas terminals) and the establishment and connection of regional hydrogen clusters.

The geoeconomic dimension of the Hydrogen Strategy is significant. The EU is competing with the US, China, and Japan for global technological leadership across all elements of the hydrogen value chain (Van de Graaf et al., 2020, p. 4). This competition also involves the definition of specific standards for production, storage, and transport in international forums and organizations. Additionally, the EU aims to achieve its targets by importing green hydrogen. The REPowerEU plan proposes the import of 10 million tons per year starting from 2030 (European Commission, 2022). For this purpose, it suggests the establishment of three major hydrogen corridors through the Mediterranean, the North Sea area, and Ukraine (as soon as conditions permit). The Russian attack on Ukraine has further emphasized the geoeconomic orientation of EU energy policy (Siddi & Prandin, 2023). This is also reflected in the manifold activities through which the EU aims to achieve control over all components of the hydrogen value chain.

4.3.2. Intervening Logics and Alliances

The emerging hydrogen market is more heterogeneous, flexible, and decentralized than the international gas market. This is partly due to the complex nature of the hydrogen value chain, open to manifold forms of influencing. Consequently, companies from different business sectors, in cooperation with state agencies, try to expand the capitalist design logic in their interest (Van de Graaf et al., 2020, pp. 2–3): by pushing for the technical, financial, and regulatory promotion of a particular type of green, blue, or grey hydrogen or by facilitating infrastructure projects that allow the handling of specific forms of hydrogen—gaseous, compressed, or liquid. Companies compete for specific transition pathways to improve their respective profit expectations by locking in practices corresponding to their business model. This applies above all to hydrogen-affine operators of gas pipelines organized in the European Hydrogen Backbone (EHB) initiative and individual gas companies organized in Hydrogen Europe, highly effective EU lobbying organizations (Corporate Europe Observatory, 2023, p. 7). Companies from other fields of energy production, logistic firms, financial actors such as banks and investors, as well as research centers and think tanks also make a case for hydrogen. They are organized in the European Clean Hydrogen Alliance (ECHA), set up in 2020 to actively support and implement the EU's Hydrogen Strategy. The close cooperation within ECHA changes the form of governance of the project as it allows the EHB, Hydrogen Europe, and financial investors to lobby European decision-making from within.

The capitalist design logic largely corresponds with a geoeconomic design logic that focuses on controlling the different components of the hydrogen value chain. This control is both inward and outward-oriented. The inward orientation relates to the attempt to secure energy supply through a more comprehensive infrastructure: new hydrogen pipelines, upgraded gas pipelines, more storage, additional fueling stations, etc. Time and again, Hydrogen Europe (2024, p. 6.) has proposed a series of measures that would make a strong and resilient pan-European hydrogen infrastructure operational. In line with this, the EU has promoted a couple of projects, using wind power from the North Sea and Baltic Sea area and solar power from Spain and Portugal for a trans-European hydrogen grid. This is complemented by an outward orientation that aims at

both technological leadership in the field of hydrogen and clean hydrogen imports from neighboring regions, above all from African countries, such as Morocco, Algeria, and Mauretania (Weko et al., 2023). The geoeconomic design logic is promoted by supranational state agencies, such as the Commission and the EIB, member states, as well as the aforementioned lobbying organizations. The latter strongly welcomed and supported REPowerEU (EHB, 2022). Hydrogen Europe, in cooperation with other European energy and key material suppliers, calls with urgency for an "EU Clean Industrial Deal," meaning "a real and tangible Industrial Policy covering the full supply chain…to ensure Europe does not drop out of the world's clean technology race" (Hydrogen Europe, 2023, p. 1). Furthermore, business actors make use of international fora like the African-Europe Green Energy Initiative or bilateral diplomacy to prepare outside investments in hydrolysis capacities, pipelines, and shipping routes.

A social-integrative design logic can only be identified to the extent that additional investments also create employment opportunities and thus implicitly activate the consent of employees and trade unions. Compared to this, the ecological design logic plays a much stronger role. The aim of decarbonizing the European and global economy is mentioned in all documents and strategy papers and state and business actors play the climate card frequently. At the same time, the ecological design logic is also articulated by associations and networks of the environmental movement who have become increasingly critical of the so-called "hydrogen hype" (Corporate Europe Observatory, 2023, p. 3). They emphasize the limits and problems of a modernization approach that regards hydrogen as a technology that serves to rescue fossil energies and corresponding modes of production and living (Haas et al., 2022, pp. 255–256). Also, they fear that the EU's foreign hydrogen infrastructure investments will generate new forms of "green land grabbing" and ecological harm, for example in water-scarce regions (Claar, 2022).

4.3.3. Policy Outcome

Critical voices are not absent in discussions about the hydrogen strategy. They are few, however, compared to the powerful actors organized in the ECHA that cooperate very closely with the Commission and EU member states. As a result of this cooperation, decarbonization efforts are increasingly reframed and subsumed to the criteria of profitable investment and geoeconomic control. The reorganization and securitization of energy provision after the Russian attack on Ukraine also impacts the EU's Hydrogen Strategy. The aim to achieve control of the whole hydrogen value chain is tangible in the strategy paper and related documents, such as Global Gateway (European Commission, 2021) or the Critical Raw Material Act (European Commission, 2023b). Practically, control should be achieved by a gradual but planned extension of the hydrogen infrastructure. Financial resources for investments are mobilized by the RRF or as part of IPCEIs—a second wave of 35 individual projects in 2023 is explicitly dedicated to hydrogen infrastructure.

EHB outlines how, from its members' perspective, the gradual improvement and extension of the hydrogen infrastructure should continue until 2030 to reach the goals of REPowerEU (EHB, 2023). Their report focuses on EU-internal infrastructure but includes some links to neighboring regions. EU bodies, national agencies, and private actors like energy companies and transmission operators have been trying to build external links for some time now, negotiating international standards for hydrogen production, transport, and use to facilitate investments and hammering out specific projects (Weko et al., 2023). The EU hopes that Global Gateway will expedite such initiatives, as additional financial resources should stabilize the profitability expectations of private investors; and, eventually, contribute to geoeconomic control.

5. Conclusion

The findings of our analyses support the overall argument that European infrastructure policy has, in recent times, been increasingly driven by the changed global constellation and that it takes a more state-interventionist form to reach European objectives. Both Gaia-X and the Hydrogen Strategy are representations of this trend. In their planning stage, they reflect a geoeconomic logic that seeks to reduce external dependencies and guarantee control over and access to transnational value chains. However, as the project reaches an implementation phase, in both cases a capitalist logic that prioritizes the realization of profits on the part of European businesses complements (hydrogen infrastructure) or even overshadows (cloud infrastructure) the geoeconomic one. In both cases, a social-integrative and an ecological design logic are largely sidelined and become subordinated. This is particularly remarkable in the case of the hydrogen strategy where there is an immediate effect of infrastructure policy on the carbon footprint.

The findings do not imply that the geoeconomic logic behind the projects vanishes or that it served only as a discursive device. As is apparent in the new state interventionism of recent years, the EU infrastructure policy has indeed changed in light of global pressures, and both Gaia-X and the Hydrogen Strategy are an expression of this. In the two cases, the geoeconomic and capitalist logics display substantial complementarities, which drove the project forward. Yet, particularly in the case of Gaia-X, the capitalist logic has become more dominant and limits the transformative potential. While France and Germany, the initiators, showed strong interest in an autonomous European cloud infrastructure, this ambition has proven at odds with the private character of financing, operation, and organization of the project.

The extent of geoeconomic control the EU strives for seems to decrease in the case of Gaia-X, while it remains prominent in the hydrogen strategy. Whereas in the case of the latter, it is primarily European lobbying organizations that influence the formation of infrastructure political decisions, with Gaia-X non-European businesses, first and foremost US-American oligopolistic tech firms, got a substantial say in the process due to the hands-off approach of European member states. This confirms the assumption that European infrastructure initiatives which could become globally competitive provoke external interference by competitors such as the US, who exploit internal divergences and reluctance to hinder the process, leveraging their business ties with European companies (Abels & Bieling, 2023a). It also highlights that the EU runs the risk of infrastructure policy failure as geoeconomic and geopolitical objectives are often insufficiently aligned with the interests of business elites (Hameiri & Jones, 2023).

The EU's infrastructure policy is currently in flux. We are witnessing the beginnings of a more state-interventionist era where initiatives and the allocation of resources are increasingly the product of political planning instead of being left to market mechanisms. Yet, at times, the EU's intergovernmental structure as well as its non-aligned business fractions act as a brake on the emerging geoeconomic turn. The EU frequently relies on private investment in light of tight public budgets and on business impulses to realize infrastructure projects. This reliance poses strict limits to the geoeconomic orientation of infrastructure policy as well as the EU's overall ability to compete globally.

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Conflict of Interests

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