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Green Industrial Policy and Trade:

The European Green Deal and the Green Industrial Plan in Comparison to the Japanese GX (Green Transformation) Initiative

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Table of Content

List of Tables

List of Figures

Executive Summary

The need for economic recovery after the COVID 19 pandemic and the energy price shock in the aftermath of Russia's invasion of Ukraine, in combination with China's economic rise and the green industry transition have propelled the US to set up large scale industrial policy programs such as the Inflation Reduction Act (IRA) and the Chips Act. In a global race for economic leadership in green industries, other polities, such as Japan and the EU/Germany, have reacted with devising their own strategies for a green industrial transformation.

The green industrial transformation involves not only building up green industries and greening the existing ones but should rather be understood as an active and holistic transformation of the economic base towards a sustainable state. This also includes policies directed at the labor market, i.e., increasing the productivity of green service jobs, thereby creating a sustainable foundation for the livelihood of broader populations. Additionally, in times of global climate crisis, it is paramount to analyze and plan all potential measures with consequences for other polities in mind.

In this GJETC Topical Paper, the study team discusses the history and recent literature on industrial policy to give policymakers the background knowledge necessary to design successful industrial policies. Additionally, we examine current industrial policy measures of Japan and Germany/the EU in comparison to each other as well as to China and the USA.

All polities seek to advance their position in what is perceived as a global competition towards technological and economic leadership in key sectors of the future green economy. In all cases, industrial policy offers a mix of 'carrots', i.e., financial benefits in various forms such as direct subsidies, tax breaks etc., 'sticks', i.e., connected obligations, regulations, etc. and the institutional set up of the implementation process. The biggest difference can be found in the extent to which governments are making use of 'sticks'. Here, Western governments tend to follow a 'derisking' approach, i.e., fewer conditionalities, centered around creating beneficial investment conditions for private capital, while China is on the opposite site of the spectrum, heavily relying on public financing and making systematic use of more rigorous 'sticks'.

Judging by past cases of successful economic development through industrial policy, there is serious doubt about the potential of such a 'derisking approach', due to the significant role that 'sticks' played in all successful cases. By relying heavily on 'carrots', governments put the speed of the transformation into the hands of private capital, whose main job is to seek profitability, not to fulfil other societal goals. Additionally, this approach is likely to lead to distributive outcomes that infringe on the capacity of the weakest members of society to engage in seeking a sustainable lifestyle. This is not only valid within a polity, but also on the global scale, leading to further capital transfer from governments of the Global South to private enterprises from the Global North. To overcome this, governments in the Global North need to start engaging in a reformation of the global and, in the case of Germany first and foremost, domestic macrofinancial architecture to create the fiscal space necessary to engage in the needed state-led green transformation process.

Concerning the question of 'how' industrial policy should be designed to achieve its set out goals, based on the literature on best practice examples, we find that the key lies in designing the institutionalized relationship between public and private actors in a collaborative and

organic process, involving not only policies in form of ‘carrots’, but crucially also ‘sticks’. Such institutions might entail public development banks, one-stop shops and other entities that should be designed to support receiving enterprises throughout the transformation process. That means not only providing subsidies, but also regular check-ups, provision of information and constant reevaluation.

To enable public institutions to fulfil this function, the existing green taxonomies need to be built upon, developing quantitative and qualitative KPIs to measure the process made that entail a large variety of climate impacts connected to the specific sector of the business in question.

In times of heightened geopolitical tensions, we recommend for developed countries such as Japan and Germany to further their efforts in advancing climate clubs, putting the ‘common but differentiated responsibilities and respective capabilities’ (DBDR-RC) principle at the forefront of club design.

1 Introduction

In recent years, industrial policy in general, and particularly green industrial policy has gained momentum in many countries around the world. It appears that the year 2022 saw the trigger point for this development, although the roots lie deeper in the ground. In 2022, the COVID 19 pandemic, which had been raging rampantly, began to abate, and the world's stagnant economic activity began to come back to life. Just then, Russia invaded Ukraine, causing energy supply to tighten and prices to soar. This crisis triggered a reaffirmation, particularly in Europe, of the importance of strengthening their own energy security in addition to climate change countermeasures, a common global issue. At the same time, the U.S. took these global shifts as reason to launch a series of industrial policies aimed at fostering green industries that could contribute to climate change mitigation targets, foster energy security, and strengthen its position as an economic powerhouse vis-à-vis China. Europe and Japan have responded by announcing industrial policies aimed at strengthening their own industrial power and economic growth, resulting in a battle for industrial supremacy in a carbon-neutral society.

Industrial policies are all government measures aimed at changing societies' economic base. Therefore, green industrial policy is any policy in which the government seeks to actively influence the economy towards the green transformation. This includes greening existing industries, as well as building up new green industries. But it goes further, also including policies directed at changing the composition of the labor market towards green services and building up of international cooperation towards green value chains and the materials needed.

Each country's industrial policy differs in terms of the scale of support, methods, and progress, depending on the circumstances of each country. For Japan and Germany, referring to the measures and achievements of other leading countries will contribute to the realization of global warming countermeasures and the strengthening of industrial competitiveness in the future.

Against this background, this report aims at giving policymakers working on industrial policy strategies an overview of both recent developments and learnings that can be taken from the vast economic literature on industrial policy. This is not a simple checklist of necessary steps to be taken but rather meant to give an understanding of the complex conditions and underlying principles impacting the successful implementation of industrial policy.

Chapter 2 sets the stage by looking at the history of industrial policy and the debate around it. From historical best practices, key learnings can be taken on the common denominator of successful industrial policy, the design of the public-private relationship. Further, the Chinese and US examples inform us about the potential external consequences, increasing the confrontational geopolitical status quo. Next, Chapter 3 outlines the industrial policies being pursued in Japan and the EU/Germany, and then briefly compares the characteristics of the industrial policies of the US, China, Japan, and the EU/Germany. Chapter 4 then goes on to further elaborate on the critical issues faced by Germany and Japan when strategizing for their industrial policy approaches in the current situation. Structural shifts in industry-labor relations, the competitive nature of industrial policy on a global stage, and macrofinancial institutions need to be considered, and possibly reformed to enable successful industrial policy. Finally, in Chapter 5 we conclude by giving concrete recommendations for policy makers designing industrial policy in Germany and Japan.

2 Concepts and backgrounds of industrial policies in both countries

This chapter aims at setting the scene for the following analysis of Japan's and Germany's industrial policy approaches. To achieve this, chapter 2.1 proposes answers to the questions of what industrial policy is, how it has been discussed in the past and what types of policies have been proposed in this context. Over the past decades, industrial policy has been a topic that was shunned in public, political and intellectual discourse, while governments never entirely abstained from using industrial policy measures to promote chosen industries in their countries. Today however, it has become a hot topic again, legitimizing a wider implementation of connected policies. Chapter 2.2 will attempt to give an explanation as to how this change has come about, building on an analysis of the recent developments in China and the USA.

2.1 History and concepts of industrial policies

The key to understanding industrial policy and its reemergence in recent years lies in the question of the role of states in the economic activity of their constituencies. This question has been at the heart of both intellectual debate and intrastate political struggle regarding the economy for millennia, as the Chinese 'salt and iron debates' during the warring states period over 2000 years ago show (Helleiner, 2021). Back then, government officials and consultants discussed the state engaging as an active player in markets of core goods such as salt and iron for the economy of the time, buying when supply is high and selling when it is low and thereby acting as a balancing force in the price mechanism (ibid).

Today, Juhász, Lane and Rodrik (2023, p. 4) define industrial policy as *"those government policies that explicitly target the transformation of the structure of economic activity in pursuit of some public goal. The goal is typically to stimulate innovation, productivity, and economic growth. But it could also be to promote climate transition, good jobs, lagging regions, exports, or import substitution."*

2.1.1 The debate on the effectiveness of industrial policy as an ideological struggle throughout history

With the creation of academic political economy in Europe around the turn of the 19th century, three distinct ideologies emerged. Liberalism proposed 'laissez-faire', a small state that leaves matters of the economy to the private sector and markets, to produce the most welfare for society. On the other hand, Marx, who was well-versed in the liberal political economy of the time, took a completely different perspective, focusing on the distribution of ownership of the means of production, value creation, distribution, and power through the economic process. It was the Neomercantilists who took the position of a counterpart to liberalism in questions of the economic involvement of the state (Helleiner, 2021). Some key early figures were the American founding father Alexander Hamilton, the German Friedrich List, or the American Henry Carey. Just as liberalism and Marxism, neomercantilism spread around the globe at a time of dominance of Western thought. In contrast to the former two, however, the latter was a lot less dogmatic from the start. Even though most importantly List and Carey produced texts that were

picked up around the globe, those were never seen as 'foundational texts' like Adam Smith's *Wealth of Nations* and Karl Marx's *Das Kapital*. As neomercantilist ideas were discussed in other parts of the world, this occurred sometimes, but not necessarily, with knowledge of those Western thinkers. On the contrary, when questions of state-led economic development emerged, especially East Asian thinkers and policy makers drew on a rich tradition of endogenous thought (ibid). This led, again in contrast to liberalism and Marxism, to a very diverse set of ideas, goals, and policy proposals to be discussed in different parts of the world during that time. They still can be seen as one ideology as Helleiner proposes through his definition of neomercantilism as *"a belief in the need for strategic trade protectionism and other forms of government activism to promote state wealth and power in the post-Smithian age."* (ibid)

Under this framework, scholars and politicians argued for different sets of policies, depending on the specific circumstances of their respective home countries at the time, the common denominator always being strategic state activism targeting fundamental changes in the economic base. Those could be protectionist measures to grow infant industries during 19th century industrialization in, i.e., the US or Germany, export-promoting measures of, i.e., the East Asian afterwar period, or the strategic build-up of the solar industry in China including onshoring of the supply chain (ibid).

This history of ideas, and the definitions of industrial policy and neomercantilism proposed, shed light on the continuities from Neomercantilism in the 19th century to advocation of industrial policy in the 21st century, or more generally the argument for and specification of state involvement through industrial policy. In contrast to competing ideologies, it is inherently situational, i.e., with the overarching goal of economic development through state activism, different sub-goals were formulated, and different measures were proposed.

The definition of neomercantilism shows its embeddedness in the 19th and early 20th century world economy by specifically mentioning trade protectionism. During that period, the British Empire had taken a hegemonic position in a globalizing economy through industrialization and as such enforced free trade policies wherever it could. As liberalism argued, this was in general and for all countries the best way to achieve economic development, however, it neglected the fact that the British Empire itself had used trade protectionism to get into a hegemonic position. List described this as "kicking away the ladder", and many others at the time argued that at the initial stage of development, trade protectionism was necessary to enable industrialization.

Further down the line, the definition of contemporary industrial policy includes aspects such as the green transition and good jobs. "Green" being understood as a synonym for environmentally benign and compatible with the goals of sustainable development. While liberalism took the stance that its arguments were universal, i.e., that it is always beneficial for the economy as a whole when state power is curbed, when the state is not allowed to engage actively in markets, those arguing for a more proactive state involvement did not do so, always debating in their own specific context.

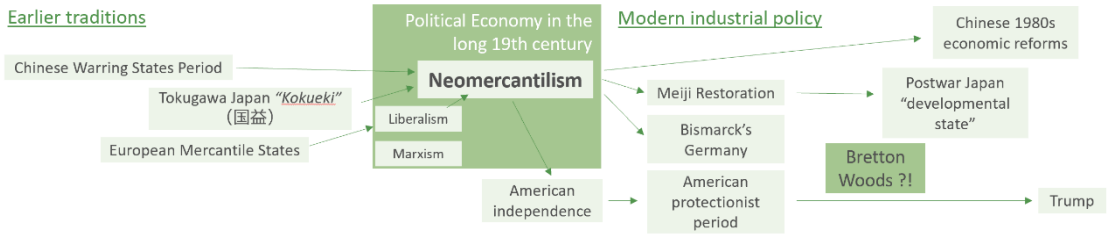

Figure 2-1: Roots of industrial policy - neomercantilist ideas around the world

This 19th century divide, centered around the question of state involvement, marks the beginning of a debate in the field of economics, formerly political economy, that persists to this day[1]. As such, industrial policy has been discussed primarily focused on the question of 'whether', not 'how' it is to be implemented to lead to the aspired results (Juhász, 2023). Considering the history of this debate shows that the question of 'whether' industrial policy is to be carried out, is deeply rooted in an ideological divide regarding normative presumptions about the optimal size/role of government. This also explains why the topic has been largely ignored in the policy discourse over the past decades. During the neoliberal period between the early 1980s and the financial crisis of 2008 (Evans, 2013) the liberal position, arguing against state involvement, was hegemonial. Only after the immense market failures of the financial crisis, with existential challenges such as climate change mitigation coming to the forefront and shifts in geopolitical power structures, this hegemony was broken up.

Apart from the question of the effectiveness of industrial policy, another major objection to it, then and now, has been that it is to be seen as economic nationalism and thus putting nation-states on a trajectory towards conflict. However, as stated above, neomercantilist ideas were situational and took this into account to varying degrees. While some were only focused on their own countries' wellbeing, others saw it as the way to achieve global prosperity (Helleiner, 2021).

As we find ourselves in a situation where all major states, from China to the US, EU and Japan, have proposed and started to implement industrial policy measures, the key question for this Topical Paper does not need to be about 'whether' industrial policy can produce the aspired results, but 'how' Japan and Germany are to implement it to achieve the desired results. How can state activities help to transform economies towards climate neutrality, successfully transforming its energy basis, while at the same time keeping up global cooperation in times of heightened geopolitical tensions and contributing to solving global problems like climate change?

[1] It is the same question that stands at the core of the debate around fiscal policy and the debt brake. In the end, what this boils down to is the question of who is allowed to command real resources. Is the government allowed to create/borrow money in order to command resources i.e. for the green transition? Or is that an infringement on liberties of private individuals (i.e. economic elites), as now they cannot command these resources (Mitchell, 2019)
This also explains, why the topic has been out of public discourse for the past decades, i.e. the neoliberal period (see also growth model perspective).

2.1.2 The effective design of industrial policies – lessons from the economic literature

Apart from trade protectionism, other forms of government activities, discussed by Neomercantilists were controls on foreign investment/management of foreign capital, the import of skilled labor, state-owned enterprise, social policies, national economic planning, and multilateral cooperation/institutions (Helleiner, 2021). All of these have been used at different times in different places since these debates started in the 19th century, their success being highly contingent on their embeddedness in local structures, institutions, and the relationship between state and business communities (Juhász, 2023).

These conditionalities aside, it is useful to get an overview of different policies, that can be categorized as industrial policy. At different times, some policies were discussed, and others neglected. For example, trade tariffs were central in the geopolitical context of the 19th century and still discussed in the middle of the 20th century, but continuously lost in importance after WWII (ibid).

Today, the fact that the exchange across product, service, capital and data markets has an irreversible, global dimension of impacts, has added an unavoidable need for strategic policy design and international cooperation on achieving the necessary goal of transforming the world's economic base. In conjunction with the globalization of ecological crises, this has led to an increasing transgression of "planetary boundaries" (Rockström, 2009). The global community, represented by the United Nations, has responded to this, for example, by adopting the Sustainable Development Goals (2015) and the UNFCC (1992) and, in particular, with the Paris Agreement (2015). These and other international regimes have created partially binding and quantified key objectives and framework conditions for national policy. This particularly applies to the climate protection policies of leading industrial nations such as Japan and Germany. We argue that the decarbonization of all sectors and the associated structural change of an entire economy within a few decades is no longer conceivable without a forward-looking and goal-oriented social-ecological transformation led by an activist state, engaging in strategic industrial policy.

The following taxonomy shows that industrial policy is usually a combination of tools that regulate the relationship between state and private enterprise, entailing such that try to incentivize (carrots), such that exert control (sticks), and such that create the institutional environment for targeted sectors to grow (Estevez, 2023). Extended studies on the success of East Asian models of industrial policy during the second half of the 20th century show, that the conditions for long-term positive effects lie in balancing a top-down approach in setting societal goals for economic development and the necessity to incorporate the knowledge of the private sector in matters of implementation in a bottom-up fashion. The problem of the top-down part of the equation lies in a possible lack of information, leading to misallocations, while the bottom-down part leaves industrial policy vulnerable to be captured by special interests, again resulting in misallocations of the capital to be invested. The design of this relationship is the crucial variable for the success of industrial policy (Juhász, 2023). Therefore, a taxonomy like the one shown below is useful to understand the combination of different factors that regulate the state-economy (or public-private) relationship by using tools designed to both incentivize desired, and curb undesired economic activity while embedding both in a coherent institutional setting.

Taxonomy	
Carrots (to stimulate desired productive activities)	• Investments in strategic human capital and workforce development (education, training, apprenticeships, etc.) • Investments in innovation: research, development, deployment, and demonstration • Grants • Preferential loans, forgivable loans, and loan guarantees • Public venture capital • Public-private partnerships • Tax credits/direct pay for producers and consumers • Advance market commitments in government procurement and strategic stockpiling of critical goods • …
Sticks (to curb undesired productive activities)	• Taxation (of undesirable activities) • Product- or industry-wide regulatory measures (e.g., regulation of pollutants in manufacturing, agriculture, energy, etc.; price regulation; transparency, emissions, or technology adoption standards) • Performance requirements for recipients of public investment (subject to revocation of funds) • Trade and investment regulations (e.g., tariffs, carbon border adjustments, performance requirements for foreign investors) • Financial sector, Labor, Corporate governance, Antitrust regulations • Nationalization, public equity stakes, and public management of critical industries • Litigation
Enabling Institutions	• Institutions that fulfill industrial strategy functions (e.g., prospective research; vision-building; mission-setting; sectoral, geographic, and socioeconomic targeting of investments; and public and stakeholder engagement, evaluation, oversight, and accountability) • Coordination bodies to ensure coherence among existing institutions • Public development banks • Public research, education, and innovation institutions • Public enterprises

Table 2-1: Taxonomy of industrial policies[2]

[2] Source: Estevez, 2023, p. 7

One best practice example that shows how such an embedded process design achieves impact can be found in the long-standing US ARPA (Advanced Research Projects Agency) model. The model was first created as D-ARPA to technologically advance the US weapons industry in competition with the Soviet Union, but showed significant economic spillover effects, as it was fundamental to the development of technologies such as the Internet and GPS. Since then, the model has been applied to other sectors such as Energy and Health (ARPA-E and ARPA-H, respectively) (Juhász, 2023).

The key to its success can be found in exactly that aforementioned design of the relationship between state and industry. The central figure is the program director, who is not a government official but rather a professional from academia or industry. This figure serves in his or her position for a set term of three years and is mainly responsible for keeping up the constant flow of information between the agency and businesses. (S)he picks the private projects to be subsidized and constantly reevaluates the progress being made, sets, and rebalances goals, and most critically, supports the distribution of information and problem-solving (ibid).

This goes to show that it is necessary to view the implementation of industrial policy as an organic process, with constant recalibration, flow of information between goal setting and planning on the government agency's side and feedback on trial and error from the implementation side of private businesses, at its core.

Another critical point in the debate around industrial policy has always been geopolitical competition and economic nationalism. States making successful use of industrial policy will impact power-relations between states. This is often seen as unfair competition by rivals. To maintain a baseline of global cooperation, combating the rise of geopolitical tensions, history shows that multilateral institutions are key.

The negotiations related to the early Bretton Woods show that in general, it is possible for different parties with diverging interests to agree on a framework that might benefit all. However, geopolitical struggle, competition between the most powerful nations can be a hindrance and lead to the implementation of unequal institutions. This is something to be wary of in the current situation (cf. Blue Box "Bretton Woods").

One principle, formalized in the Rio Declaration at the UN Conference on Environment and Development in 1992, to account for the unequal power structures that may put the world on a curse towards confrontation instead of cooperation is the principle of common but differentiated responsibilities and respective capabilities (CBDR-RC). The CBDR-RC was developed in the context of climate clubs to tackle concerns around equity in the architecture of such clubs, based on two guiding concepts. First, the common responsibility of all states in protecting the global environment through climate change mitigation and second, the differences in circumstances, i.e., historic responsibilities as share of a state's contribution to the current global heating and most importantly, their actual economic capacity to actively engage in the much-needed transformation (Hall, 2024).

Bretton Woods

The Bretton Woods negotiations on the creation of a global economic order began during WWII, encompassing 44 nations, both industrial powers and countries from the Global South. This diversity of nations and thereby interests is what makes those early negotiations interesting. During the war, voices from less industrialized regions were not to be dismissed, as especially the Latin American countries alone represented 19 of the 44 participating nations. Representatives from China and Latin America, India (even though still a colony at the time) and Ethiopia, argued for multilateral institutions that enabled member states to pursue neomercantilist policies. To them, state involvement was a necessary tool for economic development, at that time clearly identified as industrialization. Their major demands centered on multilateral financial institutions with a clear mission set on enabling state-led development using capital controls, exchange-rate-adjustments as well as the provision of short-term loans for balance of payment support. Even though the negotiations centered on monetary and financial issues, these countries made clear the additional need for multilateral trade institutions that would allow the countries to implement strategic trade protections to support infant industries. While such an orientation of the multilateral institutions to come had support from the US and seemed possible at the time, the end of WWII marked a significant turn in US opinion on the matter in the advent of the Cold War. The institutions that were eventually implemented after the war diverged from the requests by developing countries, leaving less room for state-led development, the use of industrial policies that these countries deemed necessary.

Helleiner, 2021

2.2 Geopolitical factors leading to the re-emergence of industrial policy

To states such as Germany and Japan, it is useful to understand how the current reemergence of industrial policy, or more broadly the legitimacy of economic state activism has come about. Neomercantilism emerged at a time when economic competition between states became the major playing field of their power struggle. This was due to a structural change in the economic base of the most dominant states, i.e. Britain's industrialization. Rival states, such as the US, and later Germany and Japan, then saw it as necessary to engange in an active approach to their own industrialization, in order to improve their position relative to the most productive economies (Helleiner, 2021).

Today, we find ourselves again in a situation, where humanity faces the need for major structural transformation; this time due to the necessary move away from fossil fuels. At the same time, the rise of China to the status of an economic powerhouse relative to the US and its allies in the G7, has created geopolical tensions. At the GJETC scoping workshop, held in November 2023 in preperation for this Topical Paper, we asked our experts, which of these two aspects they find to be more at the core for the current reemergence of industrial policy. While both aspects were deemed important, geopolitical competition was clearly seen to be the main driver.

This goes to show that economic transformation, be it in the 19th century due to industrialization or today due to threats by climate change or new challenges such as digitalization (e.g., universal application of AI), is not seen as sufficient reason to mobilize political majorities for more ambitious state involvement. While some scholars and politicians of the neomercantilist tradition have always argued for industrial policy in its own right, for example to create good jobs for its working population (ibid), it appears that the competition with rivaling states is the necessary condition to build the internal political coalitions in order to implement industrial policies.

As we found industrial policy to be highly contingent on interstate competition for power, it is inherently worthwhile to examine the approach formulated by competing states. Therefore, taking a closer look at the variations of industrial policy implemented by the two major global powers, China and the US, is worthwhile for two reasons. For once, even though specific measures cannot be adapted one by one from a different context, especially the case of China's rise to its geopolitical position can be learned from as an effective practice example for the design of industrial policies in general. Additionally, in terms of the current transformation and the subject of this paper, we can learn more about the conditions for successful policy design from the specific approaches targeted at building up green industries and greening existing sectors.

Green Economy – Green Industry

A green economy is an economic model aimed at objectives of environmental, social and economic prosperity, which in theory should lead to a decoupling of growth from environmental externalities. Critical to achieving these goals are the greening of existing sectors, as well as the build-up of green industries.

Green industries are usually defined through taxonomies, which are being developed by a growing number of states and government bodies. However, most of these taxonomies are not detailed enough when it comes to job creation and broader economic impacts, as they focus on regulatory frameworks, while missing out on the economic potential of a green transition. Additionally, as so-called transitional activities are often a point of political contention, these need to be treated flexibly, classified in a way that enables policy makers to regularly update the taxonomy. Lastly, the whole value chain is crucial to decide whether an activity can be classified as sustainable (cf Blue Box on Value Chain Law, Ch. 3.2).

Richard and Lambert, 2023

2.2.1 China's utilization of industrial policy in its economic rise

For China's state led development approach, anchored in its institutional history, three tools of industrial policy were essential. First, China has made significant use of direct subsidies, be it in form of direct state funding, tax cuts or low-interest loans, directed primarily at SMEs. Albeit the total amount spent is not open to the public, it is estimated that China has spent over 300 billion USD in this form since 2015 (Terzi, 2023). Studies observing firm-level data have shown that in highly competitive industries subsidies and tax cuts directed at production were more beneficial

than tariffs and loans. Furthermore, a study of the Chinese shipbuilding industry showed production and investment subsidies to be more effective than entry subsidies (Juhász, 2023). While these are interesting data points to consider, it is necessary to keep in mind, that these results occurred in the specific context of the Chinese political and economic system. In this, the second major pillar of Chinese industrial policy has been state-backed enterprises, which might come in the form of public state-owned firms or private state-linked firms, in which party representatives take up leadership roles. This public-private relationship is especially beneficial to the firms, as it eases their access to subsidies or cheaper loans, giving them a competitive advantage in global markets (Terzi, 2023). Lastly, China actively sought to enable transfers of technology and know-how into the country. To achieve this, China came up with a new approach to foreign direct investment (FDI). While earlier developmental states, such as postwar South Korea or Japan limited foreign capital (Juhász, 2023), China took a path of making use of FDI by requiring foreign companies to enter joint ventures with Chinese firms when doing business in the country (Terzi, 2023). China did not develop by 'picking winners', i.e., making the right choices regarding what industries to promote (although they surely did in many cases), but rather by designing the relationship with the private sectors in a strategic and long-term oriented manner (ibid).

Additionally, once sufficiently capitalized, Chinese public and private enterprises started to invest in overseas firms, often moving supply chains to China, to acquire the additional know-how needed to promote its critical domestic industries (ibid). Furthermore, while China's one-party system is highly centralized in some regards, it is important to note that it has granted considerable autonomy to the provincial level to develop their own best practices that could then, in turn, pioneer as frontrunners (Rodrik, 2024).

As environmental issues became more and more critical, China began to target its developmental efforts in a direction of decarbonization in the early 2010s. With Xi Jinping taking over leadership, for the first time the Chinese Communist Party (CCP) developed specific action plans for promoting renewable energies and green industries. In 2021, the CCP published its 'Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithfull Implementation of the New Development Philosophy', formally stating its goals of carbon peaking by 2030 and neutrality by 2060, entailing a targeted 80% of non-fossil sourced energy consumption. This was seen as a win-win strategy for industrial policy in terms of general economic development, as it would both combat climate change and open up new markets for Chinese firms (Altun, 2023).

As these policies have been largely successful, e.g., creating the by far largest industry for manufacturing photovoltaic modules, China has put itself not only in a dominant market position, but also gained control over large parts of the entire value chain (IEA, 2022). With China being seen increasingly as a hostile geopolitical threat instead of a friendly competitor, this dominance in value chains critical for the transformation is seen as a crucial vulnerability for competing actors such as the US, the EU, or Japan, enticing the current wave of industrial policies, such as the IRA.

One aspect of China's policies towards securing crucial value chains has been the creation of its global infrastructure project, the Belt and Road Initiative (BRI). Under the BRI, China effectively builds the infrastructure necessary to supply its domestic industries in other countries. This has

worked through loan agreements with these countries, effectively having the Chinese Government paying Chinese companies to build the infrastructure, with the loans being paid back in the future by returns from the now enabled growth in the specific sectors critical for the value chains of the Chinese industry. Lately, however, these agreements have been adapted to utilize local companies in the construction of infrastructure projects instead of Chinese to further benefit the economy of receiving countries.

China on the global stage – the Belt and Road Initiative (BRI)

Even though the BRI is mainly focused on infrastructure investments, it is worth examining it here briefly, as such investments are foundational for any industrial policy.

It was established by China in 2013 and by now encompasses a total of 149 countries (Statista, 2024), including the majority of countries in the so-called Global South, accounting for 60% of the global population and 40% of global GDP (Yu, 2024).

The initiative rests on five pillars, namely policy coordination, connectivity, financial integration and people-to-people exchanges, as promoted by the Chinese leadership and aims at building up infrastructure, such as roads, railroads or ports, but also energy plans and digital communication facilities (ibid).

China has been criticized from multiple directions since the inception of the BRI, mainly for engaging in debt-trap diplomacy. While there clearly have been cases, in which countries receiving infrastructure investments through the BRI have been left discontent with the conditions, especially when signed by former administrations, the bottom line is that over the years the BRI has gained, not lost, popularity in the Global South, as more and more countries have joined (9 since 2021 according to Statista). The only two countries that have left the BRI are Italy and Argentina, after right wing governments have come to power.

Additionally, econometric modelling of the impact of participation in the BRI has shown to significantly increase economic complexity of the receiving countries (Yeung, 2024). With economic complexity being one of the main goals for industrial policy, the BRI can be seen as an example for multilateral cooperation on industrial policy to learn from.

With these new developmental targets and its learnings from earlier industrial policy design, China in recent years managed to gain dominant market positions in critical sectors of the green economy, such as photovoltaics and batteries. This has put the former sole superpower, the US, in a position where it not only abstractly lost power to China in relative terms, but also very specifically finds itself with critical vulnerabilities regarding green industries and their supply chains.This holds true not only for the US, but also other strong economic blocks such as the EU or Japan.

2.2.2 Green Industrial Policy in the United States of America

As a reaction to the rise of China, the US under former President Trump has started to move in a protectionist direction reacting to the abstract power struggle, practically engaging in an open trade war (Sider, 2020). The American (and other's) discontent with Chinese industrial policy has

long focused on the practice of required joint ventures for foreign enterprise wanting to set up business in China. As this practice had been set up by China with the goal of knowledge transfer, it necessarily clashes with Western legal customs on intellectual property. It was only in 2017 though, when then president Donald Trump under his political program of "America First" opened an investigation with the World Trade Organization (WTO) into such practices, claiming significant harm to US private enterpise and shortly after introducing the first tariffs specifically on Chinese imports (ibid).

Then, the pandemic uncovered vulnerabilities for the US economy in critical sectors, which were further amplified by the following inflationary shock being triggered by supply chain issues. This series of shocks led the current Biden administration to implement two major industrial policy packages, the Inflation Reduction Act (IRA), as well as the Chips Act. In combination, these were aimed at a multitude of goals, such as the immediate recovery of the economy, tackling the supply chain issues uncovered during the crisis, as well as leading the US towards a path of decarbonization, supporting the build-up of green industries.

The main instrument for that is the IRA, with estimations of the total amount of funding being directed to clean tech, manufacturing and clean energy production ranging between USD 400 and 750 billion (SVR, 2023). It entails a large variety of tax credits, loan guarantees and direct payments for tax-exempt organizations. Additionally, in the Chips Act, the state uses grants and tax credits in order to promote the domestic production of semi-conductor chips, one of the critical base products shown vulnerable to global supply chain issues, as they were mainly produced in Asia. It is noticeable, that these two measures differ in a crucial aspect, namely the possibility of the state to discipline or exert control on the private sector. While the IRA is held very open, offering companies benefits without much specification, benefits from the Chips Act come attached with strict conditions, such as prior due diligence, operational milestones, or restraints on share buybacks (Gabor, 2023).

This is interesting from the perspective of the taxonomy introduced in 2.1., as the US is implementing one measure with, and the other without 'sticks'. It is worth taking note here, that the IRA, being broadly targeted at promoting many kinds of green industries, is the one without disciplinary tools, while policy makers included those in the Chips Act, targeted at promoting one specific industry (ibid).

These developments have brought industrial policy back to the forefront of economic policy debate, creating a situation in which the EU and Germany, Japan and other nations feel the need to revise their own industrial policy strategies to not be left behind in the development of green industries. However, with everybody seemingly understanding that industrial policy is made necessary by geopolitics and global competition, states have to handle two main challenges: Not only do they need to design their industrial policy to achieve its absolute goal of transforming their economic base, but also do it in a way that is conducive to international cooperation, not further escalating competition to a point were it might become hostile and violent. The next chapter will take a look at the Japanese and EU/German responses.

3 Existing Industrial policies in Japan and Germany

Japan has made two international commitments to address global climate change: to reduce greenhouse gas emissions by 46% until FY2030 and to become carbon neutral by 2050. Amid these efforts, Russia's invasion of (the) Ukraine in February 2022 caused a marked inflation of energy prices on a global scale, and energy prices soared in Japan as well due to the rising price of fuels (e.g. especially LNG) and the tight supply and demand of electric power. This energy crisis has made Japan aware once again of the fragility of its energy supply system and the challenges it faces in terms of energy security.

In response to this situation, countries in Europe, including Germany, and the United States have been moving to secure stable energy supplies by expanding the use of renewable energy sources. In addition, the United States and Europe are accelerating their efforts to achieve an early transition to a decarbonized society by supporting investments that lead to decarbonization in the power generation, industrial, transportation, and residential sectors.

3.1 Existing policies and governance structures in Japan (GX Transformation)

Japan has relied on fossil energy for much of its energy supply and almost all of its fossil energy has been imported from overseas. Given this situation, Japan has been active in research and development of technologies related to decarbonization, particularly energy conservation, and has technological advantages in many areas. In the future, Japan will need to overcome the challenges of ensuring a stable energy supply and decarbonization by leveraging the accumulated expertise of the private sector, while moving away from excessive dependence on fossil energy. This effort means the shift to a sustainable, clean energy-centered industrial and social structure, namely 'Green Transformation' ('GX') and it is what Japan is aiming for.

Acceleration of GX has the potential to serve as a catalyst to put the Japanese economy back on a growth trajectory and is expected to lead to enhanced industrial competitiveness and economic growth in Japan. With that in mind, we will now examine the current initiatives set out by the Japanese government.

(1) Formulation of GX Basic Policy

In February 2023, the Cabinet approved the Basic Policy for the Realization of GX ('GX Basic Policy') based on discussions at the GX Implementation Council and other councils at various ministries and agencies since July 2022. The GX Basic Policy is based on the following two pillars, and states that the necessary legislation will be enacted to realize GX.

- Efforts for GX based on securing a stable energy supply

  Based on the basic concept of contributing to global decarbonization through the realization of GX and strengthening Japan's industrial competitiveness and economic growth, the government will support R&D, capital investment, and demand creation for GX in various key areas, including thorough energy conservation, the use of renewable energy as a main power source, nuclear power, hydrogen, ammonia, and others. The following 22 areas are expected to be targeted for investment.

Target Areas	
Hydrogen/Ammonia	Zero Emission Ship
Battery Industry	Bio plastic
Steel Industry	Renewable Energies
Chemical Industry	Next generation network (grid and coordinating power)
Cement Industry	Next Generation Innovative Reactor
Pulp & Paper Industry	Transportation
Automotive Industry	Infrastructure
Resource Recycling	Carbon-recycled fuel
House/Building	CCS
Investment for Digital with aim for decarbonization	Food, agriculture, fishery Industries
Aircraft Industry	Local community etc.

Table 3-1: Target areas for GX[3]

- Execution of the growth-oriented carbon pricing initiative

The following policy package will be developed and implemented to realize and implement the 'Growth-Oriented Carbon Pricing Initiative' and investment promotion measures to achieve economic growth and decarbonization at the same time.

① Support upfront investment by utilizing GX Economic Transition Bonds

To meet Japan's international commitments to reduce greenhouse gas emissions, strengthen Japan's industrial competitiveness, and achieve economic growth at the same time, investment ('GX investment') will be required in various fields where the scale of this investment is estimated to exceed 150 trillion yen over the next 10 years. To realize large-scale GX public-private joint investment, the government decided to raise funds through the issuance of 'GX Economic Transition Bonds' to support upfront investment of 20 trillion yen.

JPY 50T for energy supply side	JPY 100T for energy demand side
Energy Transformation • Renewable Energy: JPY 20T • Next-G Network: JPY 11T • Next-G Innovative Reactor: JPY 1T • Hydrogen/Ammonia: JPY 7T • Carbon Recycled Fuels: JPY 3T • CCS: JPY 4, etc.	**Life related area: JPY 60T** • House/Building: JPY 14T • Automobile/Battery: JPY 34T • Digitalization for decarbonization: JPY 12T **Industries: JPY 70T** • Material Industries: JPY 8T • Automobile/Battery: JPY 34T • Digitalization for decarbonization: JPY 12T • Zero Emission Ships: JPY 3T etc.

Table 3-2: Scale of GX Investment[4]

[3] Source: METI, 2023, p. 10
[4] Source: METI, 2023, p. 29

②Introduction of the growth-oriented carbon pricing initiative

Carbon Pricing (CP) is a policy approach to change the behavior of carbon emitters, such as power generation companies and manufacturers by putting a price on carbon. The growth-oriented carbon pricing initiative aims to reduce emissions and achieve government targets (Nationally Determined Contributions, NDC) by raising the huge amount of funds needed for GX investment and by implementing measures to change the behavior of carbon emitters. Carbon pricing must be implemented based on the availability of alternative technologies and their impact on international competitiveness, or it may have a negative impact on the Japanese economy and lead to the transfer of production outside of Japan (carbon leakage). Therefore, these initiatives will be introduced after a period of intensive efforts for GX, rather than to introduce them immediately. It is assumed that revenue through the surcharge on fossil fuel importers and the emission allowance auction system described below will be used to finance the GX Economic Transition Bonds.

i) Emission trading

Emission trading is one of the policies to promote the reduction of GHG emissions. Japan is moving toward the establishment of an emissions trading scheme with the implementation of the 'Technical Demonstration Project for a Carbon Credit Market' by the Tokyo Stock Exchange (TSE) starting in September 2022. Based on the results of the project, TSE announced the official opening of the carbon credit market in October 2023. The market will begin as a voluntary trial transaction by member companies of the GX League[5], with full-scale operation scheduled for FY2026.

ii) Surcharge on fossil fuel importers

A levy on carbon is planned to be introduced as a uniform carbon pricing scheme for carbon emissions to provide incentives for GX not only for large amounts of GHG emitters but also for a wide range of other industries. Specifically, a levy based on carbon emissions will be introduced around FY2028 for importers of fossil fuels such as oil and coal. The levy will be introduced at a low cost at the beginning and will be raised in stages.

iii) Emission allowance auction system

To promote the decarbonization of electricity, an emission-allowance-auction-system for power generators will be introduced gradually starting around FY2033. This will require power generators to procure allowances in proportion to their emissions, and to subject those allowances to auctioning. The plan is to start with free allowances and gradually decrease the number of allowances (increase the ratio of paid allowances).

③Utilization of new financial instruments

To realize over 150 trillion yen in public and private joint GX investments over the next 10 years, the power of private financial institutions and institutional investors are needed in addition to 'GX Economic Transition Bonds'. The Japanese government will promote the development of a domestic market for environmentally friendly business-specific finance

[5] A government-led framework for GX to be launched in 2023, led by a group of companies that can boldly take on the challenge of transitioning to carbon-neutrality and win in international business. As of January 2023, approximately 680 companies are members, and these companies account for more than 40% of Japan's CO2 emissions.

('Green Finance') and strengthen efforts to deepen international understanding of investments and loans for transitioning carbon-emitting business activities to decarbonized ones ('Transition Finance').

In addition, since there are cases in the GX sectors where the technology and demand are highly uncertain and risks cannot be taken by private finance alone, the government will work to share knowledge between the public and private sectors to establish a financial approach that combines public and private financing (blended finance).

④International Strategies, GX in SMEs

The realization of GX in Asia, which accounts for half of the world's GHGs, is very important for solving global climate change issues. To contribute to the realization of GX in Asia, Japan has set up the 'Asian Zero Emission Community (AZEC)' concept, and through the 'Asian Energy Transition Initiative (AETI)' will support the formulation of a roadmap toward the realization of decarbonization and provide financing through government agencies such as JBIC, NEXI, and JOGMEC.

Japanese SMEs support about 70% of employment in Japan and account for about 20% of Japan's total GHG emissions. To help SMEs achieve GX, the government plans to support companies in calculating their emissions and making capital investments that contribute to renewable energy and emission reductions. The government will also strengthen human resource development and support systems for SME support organizations.

(2) Legislation

The GX Promotion Law and the GX Decarbonized Power Source Law were enacted in May 2023 to realize the GX Basic Policy, which was approved by the Cabinet in February 2023.

The GX Promotion Law stipulates that the government shall formulate a strategy for the comprehensive and systematic promotion of GX (the 'GX Promotion Strategy'), and based on that the strategy also stipulates the issuance of GX Economic Transition Bonds, the collection of fossil fuel levies, and the collection of contributions for the allocation of emission allowances to power generation companies, and also establishes the GX Promotion Agency, which serves as a window for support for GX-related projects.

The GX Decarbonization Power Source Act revised related laws to (1) maximize the introduction and expansion of renewable energy and (2) promote the utilization and decommissioning of nuclear power generation. With regard to (1), the law provides for grants at the start of construction for grid improvements that contribute to the promotion of renewable energy use and establishes a new purchase price system for additional investment in existing photovoltaic power generation facilities. In addition, the new law will strengthen business discipline and temporarily suspend FIT/FIP grants to those who violate related laws and regulations.

The new law also sets the operating period of nuclear power reactors at 40 years and allows an extension of the operating period up to 60 years on the condition that certain standards are met.

(3) Progress: upfront investment support through GX Economic Transition Bonds

The first public offering of GX Economic Transition Bonds will be called 'Climate Transition Bonds' and took place in February 2024, raising close to 1.6 trillion yen. The Climate Transition Bonds have already been certified by an external evaluation agency, and the funds raised will be distributed to projects that contribute to the shift to renewable energy as the main power source, utilization of nuclear power, and promotion of hydrogen and ammonia introduction, as described below. The redemption source is expected to be the proceeds from the fuel levy (to be introduced in FY2028) and the emission allowance auction system (to be introduced in FY2032).

Target Areas for GX		Business Model
Structural Transformation of the Manufacturing Industry	✓	Development and introduction of innovative technologies such as hydrogen-fueled direct reduction steelmaking, conversion to a carbon-recycling production system, etc.
GX in the transportation sector	✓ ✓	Support for introduction of next generation vehicles Development of demonstration aircraft for next-generation aircraft, support necessary for the diffusion of zero-emission ships, etc., etc.
Carbon Recycle/CCS	✓	Support for research and development on carbon-recycled fuels, etc.
Promoting Energy Conservation	✓	Installation of insulated windows, etc.
Making renewable energy the main source of electricity	✓	Expanding introduction of next-generation solar cells (perovskite) and floating offshore wind power, etc.
Next Generation Innovative Reactor	✓	Next-generation innovative reactors incorporating new safety mechanisms
Hydrogen/Ammonia	✓ ✓	Establish supply chains domestically and internationally Promote R&D and introduction of hydrogen production from surplus renewable energy, etc.
Electricity and gas market development	✓ ✓	Promote zero-emission thermal power plants Development of submarine DC power transmission, etc.

Table 3-3: Examples of funding through GX Economic Transition Bonds

Source: METI, 2023, p. 29

3.2 The EU Green Industrial Plan

In Dec 2019, the EU agreed on the **European Green Deal** that stipulates that the EU will become climate-neutral until 2050. As a result, the EU committed to put in place measures in order to reduce the Greenhouse Gas (GHG) emissions by 55% until 2030 (as compared to 1990) in the areas of financing, energy supply, energy efficiency, transport, trade, industry, as well as agriculture. To support countries that are particularly prone to the challenges of transformation, a sum of 100 billion EUR has been provided to support them in their efforts to make their economies emission-free.

To buffer hardships of regions whose economies are more dependent on fossil fuels, the **Just Transition Mechanism** creates financial incentives (150 billion EUR from 2021-2027) to support the transition to more climate-friendly economic sectors.

Regulation (EU) 2020/852 (**Taxonomy Regulation**) of June 18, 2020, created the world's first "green list" for sustainable economic activities – a new common classification system with uniform terminology that investors can use when they want to invest in projects and economic activities with a significant positive climate and environmental impact. The regulation aims to generate the necessary financial means for the EU become climate neutral by 2050.[6]

In addition, the EU established the **Carbon Border Adjustment Mechanism** (CBAM) to prevent competitive detriment related to products imported from non-EU-countries that are not bound to EU regulations. It also seeks to prevent industries from shifting their production sites to other countries with lower standards (cf blue box on the CBAM).

In July 2021 then, the European Commission introduced the **Fit for 55-package** presenting a set of revised and new EU directives and regulations to pave the way for measures aiming at the goals inscribed in the European Green Deal.

The *Green Industrial Plan*, published in February 2023, aims at an acceleration of the transformation processes (instead of introducing protectionist measures) for industry and manufacturing by pushing for industrial capacity for clean technologies. The plan is based on four main pillars: (1) Predictable, coherent, and simplified regulatory framework, (2) faster access to sufficient funding, (3) building-up skills and (4) open trade for resilient supply chains.

The following four sections 3.2.1 to 3.2.4 will expand on these four main pillars.

6 It had been discussed controversially whether or not to include natural gas and nuclear energy into the benchmark system and by that identify them as environmental sound. Germany was among the opposing Member States.

CBAM

On October 1, 2023, the EU regulation 2023/956 on the introduction of the Carbon Border Adjustment Mechanism (CBAM) entered into force. With the goal of putting a fair price on the carbon emitted by the production of carbon-intensive goods entering the EU, the CBAM requires that the same carbon price is paid for the greenhouse gas emissions of certain imported goods as in the European Emissions Trading System (EU ETS). In that way, the EU wants to stimulate industrial production in non-EU countries to become cleaner while also ensuring the competitiveness of EU industrial production.

By confirming that a price has been paid for the embedded carbon emissions generated in the production of certain goods imported into the EU, the CBAM will ensure the carbon price of imports is equivalent to the carbon price of domestic production, and that the EU's climate objectives are not undermined. The CBAM is designed to be compatible with WTO rules.

While the definitive regime of the CBAM will only start in 2026, the transitional phase already started in October 2023 to gradually introduce the alignment of CBAM with the phase-out of the allocation of free allowances under the EU Emissions Trading System (ETS) to support decarbonization of EU industry.

The CBAM is intended to replace the current measures against carbon leakage: the free allocation of EU ETS allowances and, in the future, financial compensation for indirect costs of the EU ETS in electricity prices. Initially, it will apply to imports of certain goods and selected precursors whose production is carbon intensive and at most significant risk of carbon leakage: cement, iron and steel, aluminum, fertilizers, electricity, and hydrogen. With this enlarged scope, CBAM will eventually – when fully phased in – capture more than 50% of the emissions in ETS-covered sectors. The objective of the transitional period is to serve as a pilot and learning period for all stakeholders (importers, producers and authorities) and to collect useful information on embedded emissions to refine the methodology for the definitive period.

Following the transitional phase between October 2023 and end of 2025 with simplified reporting obligations; from 2026, importers will have to purchase and surrender CBAM allowances corresponding to the embodied emissions of the imported goods. The CBAM price is based on the average EU ETS auction prices of the previous week. The obligation to surrender CBAM allowances will gradually increase as the free allocation to EU producers of the goods in question is reduced. By 2034, free allocation for these products will cease completely and the CBAM obligation will apply to 100% of embodied emissions.

Imports from countries participating in or linked to the EU ETS will be exempted. Other countries could be exempted if agreements ensure a higher level of effectiveness and ambition in the decarbonization of a sector.

UBA, 2023; EU, n.d.

3.2.1 Predictable, coherent, and simplified regulatory framework

Within its communication from February 2023, the European Commission pointed out that "[t]he EU has traditionally relied on a strong regulatory environment for setting conducive conditions for business, for providing quality employment for our workforce and a high level of protection of our environment." (European Commission, COM (2023) 62 final), 2023, p. 3). To accelerate the transition to a green industry, the EU put in place the **Net-Zero Industry Act** providing a simplified regulatory framework to quickly deploy the manufacturing capacity for products such as batteries, windmills, heat pumps, solar, electrolysers as well as carbon capture and storage technologies.

Against the background of setting specific goals for 2030, the Act enhances the predictability of permitting processes by defining time limits for different stages and reinforcing the administrative capacities of the Member States, e.g., by setting up one-stop-shops to be contacted by investors and industrial stakeholders. In addition, the Net-Zero Act identifies net-zero supply chain projects of strategic interest, in which the Member States can participate.

To make the acceleration of manufacturing green technologies possible, the EU also strongly emphasizes the need for affordable and sustainable energy. Here, the REPowerEU plan together with the Electricity Market reform are considered important steps to empower the Net-Zero Industry Act. In this context, the EU also points out the relevance of the EU regulatory framework for batteries ensuring competitiveness and resilient value chains for battery production as well as the Ecodesign for Sustainable Products Regulation. Finally, market transparency is considered important to provide reliable information to the end users.

As part of the Net-Zero Industry Act, regulatory sandboxes will foster rapid experimentation and disruptive innovation to test new technologies. They shall also facilitate the processes of authorization/certification for placing products in the market. To stimulate the demand for net-zero products at large scale, the EU proposes public procurement, concessions and incentives to business and end users to use net-zero technologies based on sustainability and circularity.

With the Critical Raw Material Act (CRMA) the EU seeks to ensure the access to critical raw material that is vital for manufacturing net-zero technologies and products by diversifying sourcing and by recycling raw material to lower the EU's dependence on highly concentrated supplies from third countries. This strategy also contributes to creating (quality) job opportunities and strengthening the transition to a circular economy. To this end, strengthening international engagement and reducing overall dependence on raw materials via recycling and reducing material is considered important.

Finally, a strong energy infrastructure that allows for secure supply with energy is considered crucial to foster the transition to a green industry. In this context, the full coverage of the Trans-European Transport Network (TEN-T) with charging and refueling infrastructure and development as well as the strengthening of a European hydrogen backbone grid together with the extension of smart electricity grids on the Trans-European Transport Network for Energy (TEN-E) is put focus on.

The key components of this pillar are summarized in the following table.

Parts/Initiative	Brief explaination	Concrete measures
Net-Zero Industry Act	Supporting industrial manufactoring capacity and strategic and multi-country projects in net-zero products (batteries, windmills, heat pumps, solar, electrolysers as well as carbon capture and storage technologies) by faster permitting and developing European standards.	- Defining time limits (frames?) for different stages - Reinforcing administrative capacities (one-stop-shops) - Identify net-zero supply chain projects
Critical Raw Materials Act	Ensuring access to critical raw material vital for manufacturing net-zero technologies and products	- Strengthen the reduction annd reuse of material - Establish raw material clubs
Affordable and sustainable energy	Massive speed-up and scale-up of renewable energies → Simpliying the aid for the deployments of renewable energy (cf REPowerEU and Electricity Market Design).	i.a.REPowerEU, Electricity Market Design, RED III; Energy Effficiency Directive
Electricity Market Design[7]	Delivering affordable electricity while preserving security of supply	Cf. GJETC study on Electricity Market Design 2024
Energy infrastructure	- Full coverage of TEN-T networks - Extending and strengthening smart electricity grids - Foster the TEN-E networks	- Clean Tech Europe Platform - Clean Energy Industrial Forum

Table 3-4: Key components of the EU Green Industrial Plan

3.2.2 Speeding up access to finance

As a response to the pressure the EU experiences because of the subsidies abroad that cause unlevel playing fields, the acceleration of investments is considered crucial to foster the transition processes. In addition to private funding, national funding and EU funding are seen important to stimulate the processes. At least temporarily less stringent state aid regulations and thus the possibility of setting up specific support programs for the Member States, such as for relocation of companies are considered as supportive measures.

In the attempt to support the development and deployment of key technologies by speeding up access for investors to Member State finance even further than under the Green Deal, the EU competition policy provides tools "while preserving the integrity of the Single Market and respecting EU's international obligations" (European Commission, COM (2023) 62 final), 2023, p. 8). A very important tool to remedy the negative effects by the Russian war of aggression was put into place by the **Temporary Crisis and Transition Framework (TCTF)**, which allows Member States to grant aid in a more flexible manner. A revised TCTF now encompasses four areas of actions:

- Simplification of aid for renewable energy deployments
- Simplification of aid for decarbonizing industrial processes by e.g., allowing aid by reference to standard percentage of investment costs

[7] The Electricity Market Design Reform has been analyzed by another GJETC study team in the project term 2023/2024.

- Enhancement of investment support for production of strategic net-zero technologies
- Providing more targeted aid for major new production projects in strategic net-zero value chains taking into account global funding gaps.

The TCTF "would aim to ensure a level playing field with other jurisdictions and within the internal market, targeted to those sectors where a third-country delocalization risk has been identified, and proportionate in terms of aid amounts. The TCTF would enable Member States to put in place schemes to support new investments in production facilities in defined, strategic net-zero sectors, including via tax benefits" (European Commission, COM (2023) 62 final), 2023). The median approval time for projects considered within the TCTF has been 19 days.

Finally, the State Aid rules have been revised via the Green Deal General Block Exemption Regulation, which increases the flexibility for Important Projects of Common European Interest (IPCEI) related to measures in key sectors (hydrogen, carbon capture and storage, zero-emission vehicles, and energy performance of buildings), scope of investment aid for recharging and refueling infrastructure as well as facilitating training aid for skills.

In addition to the above-mentioned national funding, the Green Industry Plan will be accomponied by EU budget that prevents fragmenting the Single Market due to differentiated financial support between the Member States and ensures that the green transition is streamlined across the Union by avoiding gaps between the funding for the transition to net-zero industry. The following table provides an overview of the EU funding types.

Program	Brief explanation
InvestEU	Catalyzing private investment in EU priority areas (European Investment Bank (EIB), European Investment Fund (EIF), European Bank for Reconstruction and Development (EBRD) and 14 other implementing partners) and selected projects such as (a) RDI of battery techologies, (b) critical raw materials recycling, (c) demonstration plants for manufacturing materials in the supply chain of electric vehicles battteries, hydrogen propulsion technologies, innovative advanced biofuels plants ….. → simplified procedures to ensure timely delivery on the objectives of the Green Deal industrial policy
REPowerEU	Additional funding to the Recovery and Resilience Facility (RRF) to green industry, support EU net-zero industry projects, and to assist energy-intensive industries in the face of high energy prices. → one-stop-shop for permittance of renewables and net-zero projects, tax breaks, investment in skills
Innovation Fund	Supporting the first-of-a-kind development of technologies and solutioins to decarbonize the energy intensive industry, boost renewable energ and energy storage as well as strengthen net-zero supply chains.
European Sovereignty Fund	Mid-term solution to cover investment needs = Preserving "*critical and emerging technologies relevant to the green and digital transitions*" (COM (2023) 62 final).

Table 3-5: Types of funding by EU programs

These four instruments are considered to be geared under one roof to provide fast and targeted support where it is most needed. In the meantime, the European Sovereignty Fund is functioning as an interim solution: It aims to ensure that the EU is up to the front in the race of developing and producing critical and emerging technologies.

In addition to the national funding, private funding is considered “key to unlock investment for the net-zero industry” (European Commission, COM (2023) 62 final), 2023, p. 7).

Furthermore, the revenues deriving from the EU emissions trading scheme (ETS) must be used by the Member States for climate actions, which might encourage them to invest in net-zero technologies and by that further stimulate the transition to a green industry in the EU.

While the overall total of the measures enshrined in the Green Industrial Plan is not yet entirely specified, it is estimated to be comparable to the volume of the IRA and amount to approximately EUR 600 bn (SVR, 2023).

3.2.3 Enhancing skills

To realize the transition to a Green Industry in the EU, an increase of skilled workforce will be indispensable. It is estimated that the battery industry alone will need an additional 800 000 workers by 2025. Building on existing programs such as the European Skills Agenda, the European Education Area, and the European Pact for Skills, this third pillar of the Green Industrial Plan focuses on the up-skilling and re-skilling of the workforce while also paying attention to diversity dimensions such as gender and age.

The up-skilling and re-skilling is not constrained to citizens of the EU Member States but also aims at third-country workforce. In this context, the recognition of qualifications should be facilitated. At the same time, people from one Member State might be encouraged to work in another Member State to fill in the needs.

A number of EU funding types is already available to support the above-mentioned skill-enhancing measures, among them (1) European Social Fund+ (ESF+) with EUR 5.8 bn, (2) European Regional Development Fund (ERDF), (3) Just Transition Mechanism (JTM) with EUR 3 bn and (4) the Recovery and Resilience Facility (RRF) with about EUR 1.5 bn.

3.2.4 Trade and resilient supply chains

Within the fourth pillar of the Green Industrial Plan, the EU aims at making trade work for the clean transition by fostering global cooperation. The latter will be continued by:

- Continuous support of the World Trade Orgaization (WTO)
- Advancing the EU’s network of Free Trade Agreements
- Developing alternative formats of cooperation with partners, such as The Trade and Technology Council with the US, the EU-US Task Force on the Inflation Reduction Act
- Cooperating with partners in Africa through the Sustainable Investment Facilitation Agreements (SIFA) supporting investments in the region while integrating socio-ecological standards
- Partnerships under Global Gateway
- Other partnerships around the globe

In addition to these forms of cooperation, some new initiatives the Green Industrial Plan foresees are:

- Critical Raw Materials Club
- Clean Tech/Net-Zero Industrial Partnership

- EU export credit strategy (including EU export credit facility and enhanced coordination of EU financial tools)

3.3 Existing policies and governance structures in Germany

In addition to the Green Industrial Plan of the EU that is significantly impacting the German industry, the German Ministry for Economic Affairs and Climate Action (Bundesministerium für Wirtschaft und Klimaschutz: BMWK) introduced a so-called industry strategy in October 2023. Similarly to the Green Industrial Plan of the EU, the strategy also aims at an industrial development that is in line with the German climate protection goals while at the same time ensuring its resilience in light of the worldwide developments and crisis (BMWK, 2023).

To improve the economic resilience, the ministry aims at preventing companies from moving their production sites to other places by improving the local/site conditions. Furthermore, the diversification of raw materials and the use of prefabricated parts should further ensure that the manufacturers can continue operation in times of crises such as the pandemic or Russia's war against Ukraine that let to disruptions within the supply chain.

The German Industry Strategy focuses on four areas to realize a climate-neutral renewal of the German industry, similar to the four pillars of the Green Industrial Plan of the EU, namely:

- Subsidies for the net-zero transition of the energy-intensive raw materials industry
- Acceleration of approval procedures
- Increasing the skilled workforce
- Putting in place new technologies

One important supporting factor for the strategy has been the Climate and Transformation Fund (Klima- und Transformationsfonds: KTF) that is supposed to finance, i.a., a number of policies to support the decarbonization of the industry. Following the decision of the Constitutional Court to partially deny the use of the money foreseen for the fund, some of these policies have come to a halt. To still enable the policies as originally envisioned, the suspension of the debt brake has also been discussed but, for the time being, dismissed (cf. Blue Box 'Debt Brake', Ch. 4).

Established instruments to implement the four pillars include the Energy Efficiency Program and the carbon contracts for difference. The first (Energy Efficiency Program) supports enterprises to reduce the fixed (running) costs by improving energy efficiency. To enable investments for energy efficiency, the KfW banking group (Kreditanstalt für Wiederaufbau: KfW) provides loans at low interest rates and supports the development of renewable energies.

Aiming at an acceleration of the phasing-out of fossil fuels in energy-intensive industries while also enabling the transition to green production, the German government introduced funding the conversion projects through Carbon Contracts for difference (CCfD). "All companies reducing CO_2 emissions and converting their production to climate-friendly production will be eligible to benefit from this program and be able to receive grants independently from their production sizes, therefore including small and medium-sized companies" (IEA, 2023). Countering investment insecurities related to the emission trading scheme (ETS) through

buffering price volatility, this instrument improves the investment environment for the energy-intensive industries and thereby supports the transition to a green industry (DIW, n.d.). Over a period of 15 years, industries will receive compensation for the additional costs deriving from higher standards to reduce the Greenhouse Gas (GHG) emissions within the production process; however, if the low-carbon process turns out to be cheaper than the standard process, they will have to pay back the difference. A double-digit billion budget is expected to be allocated by the federal government for this scheme (IEA, 2023).

While the supply of critical raw materials that are needed, i.a., for the green industry transformation is high on the agenda of both German and EU industrial policy, both are also aiming to make supply chains in general more sustainable in environmental and also in social terms. At both levels, supply chain legislation is now in place; the following blue box provides some detail.

German and EU Supply Chain Laws

While often EU jurisdiction is affecting German legislation processes, in the case of the so-called Supply Chain Law it has been Germany pioneering with the implementation of the Supply Chain Law, which was enacted on January 1, 2023.

The aim of this law is to improve the protection of human rights and the environment in global supply chains. It is not about implementing German social standards everywhere in the world, but about complying with basic human rights standards such as the prohibition of child labor and forced labor as well as key environmental standards such as the prohibition of drinking water contamination.

Companies in Germany also bear responsibility for this. They must ensure that human rights and environmental standards are observed in their supply chains. The law sets out clear and enforceable requirements for companies' due diligence obligations and creates legal certainty for companies and those affected (BMZ, n.d.). While the law originally targeted companies with more than 3,000 people, since January 1, 2024, all companies with 1 000 people and more are affected by the law.

Following its enactment, discussions commenced on the EU level to adapt similar regulations on the EU level as well. In March 2024, the European Council adopted the compromise text, and in April 2024, the European Parliament followed.

In some respects, the draft goes beyond the supply chain law that has been in force in Germany since last year. At EU level, for example, it is envisaged that companies will be liable for breaches of due diligence, which is excluded under German law. Companies with more than 1000 employees and more than 450 million euros will be subjected to the Law (Tagesschau, 15.03.2024).

3.4 Comparison, characteristics and focal points set in different regions

In this section, we would like to focus on and compare the characteristics of the previously mentioned Japanese, EU/German, U.S., and Chinese industrial policy strategies.

There are two main characteristics of U.S. policies. First, the scope of support is broad, including not only investment and manufacturing, but also purchasers of EVs, etc. The methods of support are also diverse, including tax credits, credit guarantees, and direct benefits. The support is subject to domestic content requirements, such as limiting parts procurement, manufacturing, and products to the domestic market, and this has attracted investment, including from overseas, with the aim of providing large-scale support.

Second, at the time the IRA was enacted, the total amount of support as well as the benefits to be enjoyed in each of the areas covered by the support were clearly stated in concrete and detailed terms, and this has had a significant effect in encouraging companies to take action. In other words, the specifics of the benefits to be received, such as the rate and duration of the tax reductions, make it easy for potential recipients to consider the effects on actual business, thereby facilitating corporate decision-making. This is evidenced by the fact that investment plans in the U.S. have been announced one after another since the early stage of the Act's enactment.

China has long used subsidies as a basis for fostering domestic enterprises, and under the industrial policy “Made in China 2025”, launched in 2015, for example, subsidies are provided not only to state-owned enterprises but also to a wide range of companies, including private enterprises, focusing on the 10 priority areas designated in the policy. The subsidy may be used to cover deficits, R&D, and capital investment or to cover losses or for research and development and capital investment. Although it is difficult to ascertain the overall and detailed figures of subsidies, some studies suggest that a significant amount of money has been invested, totaling as much as US$ 300 billion since 2015.

In Japan, the “Sector-specific Investment Strategies” for the priority sectors identified in the GX Basic Policy were finalized in December 2023 and the outline and timeline of the scale of investment and measures for each of the targeted sectors have been finalized. Under the strategy, Japan government will introduce tax incentives for the products that contribute to the reduction of greenhouse gas emissions, such as electric vehicles and SAF, which cover not only the initial investment but also the manufacturing stage. GX Transition Bonds, which will serve as a catalyst for joint public-private investment of 150 trillion yen, are issued one after another since 2024, and the funds obtained from these bonds will be used to promote upfront investment.

On the legislative front, the Cabinet approved two bills on hydrogen and CCS (Hydrogen: Hydrogen Society Promotion Bill and CCS: CCS Project Bill) in February 2024. The Hydrogen Society Promotion Bill aims to promote the supply and use of low-carbon hydrogen in the steel, chemical, mobility, and power generation industries, which are difficult to decarbonize, thereby encouraging the realization of GX in these sectors. The CCS Project Bill will establish a licensing system for storage and exploratory drilling rights, and business and security regulations for storage operators and carbon dioxide pipeline transportation business. It aims to improve the

business environment for private companies to start CCS business in Japan by 2030. Both policies are scheduled to be enacted after deliberation in the current Diet session.

Compared to the IRA of the USA, it can be said that the GX-related policies are, overall, a well-balanced combination of support and regulation with reference to the preceding IRAs, and the concrete implementation of the systems is currently underway.

The EU Green Industrial Plan as well as the German Industry Strategy foresee to expand the production capacity for clean technologies and products. To this end, the EU provides a total of EUR 600 bn to incentivize industries and push for the speed up of transformational development. At the same time, high priority is put on the secure provision with respective raw materials needed for the production as well as a stable energy supply based on clean energy sources through e.g., the REPowerEU funds. Apart from the goal to transform the EU industry into a climate-neutral one, the EU Member States also seek to reduce their dependence on third countries. Thus, one integral part of the strategy is to improve the recycling rate of products to reduce the overall demand of critical raw materials. To fill in the gap, the EU then seeks to establish raw material clubs between EU Member States and third countries, which shall ensure a stable provision with the raw material needed for the green production processes. Finally, to realize the shift, attention is also paid to the increase of workforce in the respective fields.

Similarly, Germany also prioritizes the stable energy supply for the German industries to continue operation with a particular focus on expanding the use of renewable energy sources wherever possible. In line with the EU Green Industrial Plan, the facilitation of the approval processes is playing an important role in accelerating the development of new products and technologies deemed important for the decarbonization and its respective infrastructure. Together with the reduction of bureaucratic barriers, financial incentives are aimed at accelerating the processes. Measures to increase the necessary workforce are equally taken into account.

Although the EU Green Industrial Plan as well as the German Industry Strategy both suggest to mainly focus on incentives (carrots) instead of regulation and punishment (sticks), it is important to keep in mind that there are already a number of directives and regulations in place on the EU level pushing for increased efforts among the EU industries to become climate neutral.

With the CBAM put into place and the EU Supply Chain Law implemented, the EU will further increase the standards of products entering the EU and by that possibly making it easier for companies to produce climate-friendly products within the EU. Whether these measures put the competitiveness of the EU's single market at risk or foster it, as they are intended to, remains to be seen.

4 Industrial policy for the 21st century

In chapter two we showed that industrial policy is about much more than state subsidies for domestic industries. While greening existing industries and building up new green sectors is fundamental, it is not in itself sufficient for a sustainable transformation. Crises of liberal democracy and geopolitical tensions threaten to undo the efforts being made towards sustainable industries. Therefore, a just transition, both from a perspective of national social integrity and global fairness, can only be achieved by taking a broader look at the possibilities of democratic strategizing for state interventions in the domestic productive base (Juhász, 2023).

4.1 Industrial policy for a holistic sustainable development

The key aspect of this broader look lies in the understanding that industrial policy in the 21st century cannot be confined to measures directly targeted at the (green) industrial sector. As seen in the definitions given in chapter 2, industrial policy has always been targeted at the whole productive base.

Over the past decades deindustrialization, defined by a decline in the share of employment in the industrial sector (relative to mostly the service sector), has fundamentally challenged previous notions of economic development. Historically, a shift from the agricultural sector to the industrial sector has been the main driver of economic development, as low-skilled workers were able to perform highly productive jobs (Rodrik, 2024). This enabled not only building up domestic industries but also put these workers into the position to achieve a middle-class lifestyle (Juhasz, 2023). Over the past decades due to technological advances (i.e., automation, but also global logistics), the composition of industrial labor has, however, shifted massively from the low-skill and labor-intensive characteristics responsible for its conducive role in past developmental processes. As jobs here have gotten more and more capital- and skill-intensive, they have ceased to function as such a ladder into the middle class (Rodrik, 2024).

These developments have led Rodrik and other prominent economists to call for an industrial policy targeted at the service sector. Here, it is argued, targeted policies such as job-specific training, technologies that complement and empower workers, or better tailored regulations, can significantly enhance productivity in this sector, thereby creating what developmental economists call ‘good jobs’ (Juhász, 2023).

By no means are those meant as a substitute for other policies targeted at building up green industries and greening existing ones. It is however seen as a crucial addition, that is especially necessary for the holistic development of Global South economies (Rodrik, 2024).

Onshoring crucial industries like semiconductor manufacturing might be reasonable in light of geopolitical tensions, but it will not contribute much to employment, as it is not labor- but capital- and skill-intensive, thereby not creating good jobs in the quantity needed for substantive development (Juhász, 2023). Subsidies for such businesses, to the extent that they are higher than needed to cover the cost difference between ‘green’ and ‘fossil’ technologies or to compensate for the difference to investment conditions elsewhere, will end up flowing directly into the pockets of their shareholders, benefiting only a few. This is the case with many green subsidies, which shows that while these investments are necessary, it is just as crucial to either

flank them with measures increasing productivity in the service sector, i.e., creating good jobs, or to try and design the subsidies with such distributional effects in mind. An example here are bans on share buybacks for firms being subsidized through the US Chips Act (Gabor, 2023).

On a further note, an industrial policy that is only focused on domestic manufacturing goals is at a high risk of engraving the confrontational state of geopolitics. We thus propose broadening the scope, looking at industrial policy from a perspective of a fundamentally just transition, which includes the creation of good jobs and the respect for other environmental and sustainability criteria, not only domestically but also in partnering countries from the Global South (Rodrik, 2024), could be a way to solve this dilemma.

Following Estevez' 2023 policy brief for the Roosevelt Institute, we suggest viewing "Every industrial policy" as "de facto an environmental policy, a distributional policy, a natural resources policy, a labor policy, etc.". Accordingly, "efforts to influence the goods and services we produce don't just influence which industries survive and thrive and which decline […]. Each policy influences existing power relations and distributional outcomes […] "(Estevez, 2023, p. 9). These factors are true not only on the domestic but also on the international level.

4.2 Industrial policy as a tool to advance multilateral cooperation

Another adjustment of perspective is necessary for policymakers when conceptualizing international climate politics. Currently, the dominant position in academia and policy making is to look at the issue through the lens of a collective action problem, meaning that the main driver of political non-action in the field is the fear of free-riding, i.e., states that do not take actions benefiting from the actions of those players that are willing to act on climate politics, thereby incentivizing non-action. Albeit being the dominant view at the moment, there is surprisingly little evidence to back up the claims of the model (Aklin, 2020). This suggests that the free-riding effect has been largely exaggerated in international climate politics.

Aklin et al. (2020) suggest that a more promising approach could be to view the problem of climate in-action through a lens of distributive effects and possible conflicts, and back this up empirically. Distributive conflicts can be seen domestically, as democratic contingencies and special interest groups shape the success of climate action, as well as internationally, with players that benefit from the fossil fuel-based status quo working towards slowing down or outright hindering the fundamentally necessary transformation of humanities' energy base (ibid). The authors propose to change perspective from paying too much attention to prospective free-riders, but instead focusing more on players that are willing to engage in transformational politics and try to learn from good practice examples worldwide. The rationale of perceiving the problem as a distributive conflict assumes that the solution lies in increasing the relative power of those that are invested, economically and/or politically, in the green transformation (ibid). This is useful both on a domestic level, for example by increasing the number of people working in green industries, directly benefiting from the transformation and strengthening their political agency, and on the international level by creating 'clubs of the willing', increasing their agency and relative power through multilateral institutions, as has already been put into place through the initiation of climate clubs.

This process of strengthening the position of actors that are engaging in the transformation is further supported by the fact that particularly the cost of renewable energies has fallen so much that they are now cheaper than the use of fossil and nuclear fuels, leading to somewhat of a paradigm shift in the evaluation of green investments. As a result, a race for being the winner in the transformation to renewable energies, electrification technologies such as BEVs, and eventually also hydrogen and its derivatives has emerged. It can also be seen from the perspective that it is necessary to reduce energy costs for industry through the expansion of renewables (cf. chapter 3.3). This new paradigm contributes to the potential of distributive conflicts in transformative climate policies and politics.

The rise of China as probably the most important player in global value chains, especially concerning green technologies, has created geopolitical tensions with the US and ushered in a trend towards onshoring critical processes. However, this process of onshoring is highly confrontational and threatens to leave lower-income countries behind, while the major powers struggle for economic supremacy (Karkare, 2023). Such a confrontational approach is less beneficial to solving global problems; thus, the alternative could be to build e.g., the aforementioned clubs of the willing, i.e., climate clubs with a clear goal of enabling Global South countries to develop into self-sufficient green/sustainable economies that can become reliable alternatives to China in the global value chain. One good framework for designing such climate clubs in a way that is responsive to current geo-economical inequalities, enabling the pursuit of this goal, is the principle of 'common but differentiated responsibilities and respective capabilities' (CBDR-RC), as introduced in chapter 2.1.3.

The key to implementing the CBDR-RC framework lies in differentiation, with three main operationalizations being listed in the literature. First, climate clubs adhering to the CBDR-RC principle can differentiate in terms of central obligations. Such obligations are usually framed in terms of mitigation commitments and differentiated through a categorization of club members by the developmental status of their economy, i.e., their capacity to engage in mitigation efforts. Second, differentiation can be operationalized in terms of implementation. Implementation is monitored through the submission of regular reports, facilitated through the provision of information, financial and technical assistance, and enforced through punitive consequences for non-compliance. All three of these aspects can be again differentiated according to the state of economic development. This way, less developed countries are given more time to submit their reports, are made sure to receive information, financial and technical assistance from more developed countries, and excluded from punitive actions, with those only applying to the stronger economies who bear more responsibility and are more economically capable to fulfill their commitments. The last point of differentiation picks up on the provision of assistance and further emphasizes the current inequality in terms of financial and technological means. It argues for the free transfer of these two crucial factors from the developed to the developing world (Hall, 2024).

Curiously, this is one major aspect of the undeniably successful Chinese development strategy described in chapter 2.2.1 and at the same time the main point of contestation from the US, starting the current trade war. The free dissemination of critical technological know-how has negative implications on the profitability of global corporations, mostly from developed nations, relying on copyright enforcement. However, it appears necessary for developing nations trying

to increase the productive capacities needed to engage in climate mitigation on the one hand, but also to develop industries that can in time emerge as alternatives from China as suppliers in critical value chains. What this boils down to is a conflict between short- and long-term interests for developed nations. We argue, that in the interest of a globally just transition, developed nations should adopt the more long-term stance, find pragmatic solutions for the short-term copyright-related issues of their corporations, and focus on enabling a green economic development for countries in a currently disadvantaged position.

Consequently, when further conceptualizing such climate and resource clubs and considering the current geopolitical tensions, it is important to fully understand and incorporate the perspective and needs of the Global South. Currently, lower-income countries need to be enabled to reach holistic economic development, not just continue to be in a dependent position as resource exporters (Karkare, 2023). One major issue such countries are facing right now is a large debt crisis inhibiting them from creating sufficient fiscal space to engage in proactive development processes. After decades of developmental politics dominated by the Washington Consensus, tying loans to austerity politics, countries of the Global South find themselves in dire straits. As the loans are denominated in foreign currency, such countries face constant pressure to produce enough raw goods for export to cover the interest payments, while not being able to spend on domestic productivity-enhancing projects such as infrastructure (Karkare, 2023). Considering the colonial historical background, Thomas Piketty suggests that debt cancellations would be the most effective and fairest solution to the problem of how to enable development of former colonized nations in the Global South.

However, this might not appear politically realistic at the moment. Therefore, a just transition approach as described above, i.e., designing multilateral institutions and climate clubs from a developmental perspective, should be pursued. The literature reviewed for this Topical Paper suggests that this will be beneficial not only for the receiving nations, but in the long term also for developed nations such as Germany and Japan, and most importantly is necessary to enable Global South countries to proactively engage in their decarbonization process. Building such institutions solely based on their ability to produce critical raw materials for the Global North's energy transformation, as it was done in the past with the effect of outsourcing low value-added production and securing only cheap imports of unprocessed resources (Karkare, 2023), will again in the future prove to be short-sighted. Financing them through the currently dominant mechanisms of derisking for private capital and the corresponding development cooperation framework will not be enough (ibid). Instead, the respective states must be enabled to build up their political agency, fiscal space must be created for themselves to engage in strategic industrial policy. A holistic development needs to be the goal. Next to solving the financing issue and enabling the flow of investments into increasing the productive capacity of their economies, it is important that these investments are directed to the build-up of infrastructure, the build-up of high value-added industries processing raw goods such as critical minerals (ibid), as well as good jobs (Rodrik, 2024). Furthermore, as seen in the Chinese example, knowledge and technology transfer is needed to achieve development. Lastly, all policies designed with these goals in mind also need to consider market access and integration, for example by linking them to the African Continental Free Trade Area (AfCFTA) or meeting current and future import standards set by other actors such as the EU (Karkare, 2023).

CBAM from an African (and Global South) Perspective

"While the focus of recent analysis has been on the potential negative effects of external measures of the CBAM, less attention has been paid to what is needed to ensure these schemes contribute to decarbonisation and industrial development outside of the EU. In theory, if accompanied by investment in the technological upgrading of CBAM affected developing countries, the scheme could in fact produce a much-needed boost for African industrialization and increase market access of key African producers to the EU (Oguntoye et al. 2023). Some major economies, for instance India, are responding by developing their own carbon credit certification (Sen 2023) that would allow them to collect rather than transfer revenues due to carbon taxes. Others, like Morocco, that have fairly ambitious decarbonisation plans in place, instead could seek to take advantage of future niche markets for green industrial goods (Leila 2023; Oguntoye et al. 2023). The EU's gradual rollout of the CBAM also entails a transition phase, which could allow partner countries to position themselves vis-à-vis a greener EU market, and possibly even negotiate directly with the EU (EC 2023e; Scott and Moens 2023).

But the unilateral introduction of the CBAM with limited consultation or guarantees for a mutually beneficial implementation strengthens the perception that African countries are an afterthought in the EU's global decarbonisation agenda. Despite the global benefits of reducing carbon emissions in a cost-effective way, the EU's efforts are therefore likely to face considerable further resistance from developing countries."

Karkare, 2023, p. 12

4.3 The macrofinancial framework of industrial policy

Finally, alleviating financial restraints is not only crucial to overcome barriers for the Global South, but also has been a contested debate in high-income countries. The approach discussed in this paper, underscoring the importance of 'sticks' or disciplinary tools to enlist private capital into pursuing broad societal goals, stands in contrast to the current derisking framework, i.e., using state funds to take risks from private investments onto public balance sheets. This derisking approach has become the dominant paradigm in the industrial policy strategies of developed economies such as the US or the EU (Gabor, 2023).

While a full analysis of the derisking state would break the scope of this paper and might be more suited for a hypothetical follow-up paper on the macrofinancial framework needed to enable the green transformation, it is still worthwhile to briefly examine Gabor's argument here. The distinct characteristic of the derisking state is that it organizes the state-capital relationship to be dominated by private capital (ibid). Based on the developmental economics literature examined in this paper, no successful developmental effort has ever been achieved with private-public relationships designed in this way – be it industrialization in 19th century UK, US, Germany or Japan, the post war economic miracles of Germany, Japan or South Korea, innovation in the US tech sector during the Cold War, or the recent economic rise of China. All historic cases of successful industrial policy followed the reverse logic. In these, governments have been the crucial actor, formulating development strategies for public benefits directly financing such

measures, often through state ownership, and when enlisting private capital in their efforts, heavily relying on what we here referred to as 'sticks' (Juhasz, 2023; Terzi, 2023; Alkin, 2020).

As for the reasons for the current dominance of the derisking framework, Gabor goes on to criticize the underlying 'ordoliberal' economic theory, which by focusing on market failures and artificially replicating the price mechanism without discipline to private capital, ends up undermining its own goal of enabling the functioning of market mechanisms through the disorderly expansion of private capital accumulation. Additionally, the derisking framework is deeply embedded in the institutionalized macrofinancial order, i.e., central bank 'independence', or rather its singular focus on inflation/price stability. In this order, it appears to policymakers that derisking is the only way to mobilize the capital needed for a green transformation (Gabor, 2023).

Germany is the country in which this macrofinancial architecture is most firmly enshrined in its institutions, having included the debt brake into its institution in 2009. With needs for transformative investment skyrocketing in recent times, this has led to massive debates on this institutional arrangement being a massive roadblock for investments and needing to be either reformed or entirely abolished. Following, and to conclude this subchapter, we would like to present to the reader an input on this debate by the German economist Prof. Rudolph Hickel (cf Blue Box).

The German debt brake: a threat to the energy transition and climate protection

In 2009, the so-called 'debt brake' was incorporated into the German constitution. The debt brake stipulated that the previous 'golden rule' that public investments can be financed by borrowing on the financial markets no longer applies. Since the introduction of the debt brake, the federal government has been allowed to take on debt amounting to no more than 0.35% of nominal gross domestic product, while not differentiating between consumption and investment expenditure (this year approx. € 1 billion). The constitution grants exceptions only on two occasions: in the event of 'natural disasters' or 'extraordinary emergencies'. Only then, the government can take measures that may be financed via the credit markets. However, financing measures via the credit market must be well justified by the government and such emergency loans must be repaid within a 'reasonable period of time'. The coronavirus crisis and the massive rise in energy prices due to Russia's war in Ukraine, were ruled as such an 'extraordinary emergency'. But the climate crisis was not regarded as such by the Federal Constitutional Court in its ruling of 25.11.2023.

A severe consequence under the debt brake regime is for example: long-term and credit-financed public investment programs for the future as part of a Green Deal and for structural change for decarbonization are currently not possible under the constitution. Yet, a study by the Handelsblatt Research Institute (HRI), estimates the investment required to achieve climate neutrality in Germany to be at over €1.11 trillion by 2045. In such fundamental ecological and social transformation processes, however, the pre-financing of investments - such as the accelerated introduction of renewable energies - should be made possible. This is because the cost-reducing and refinancing-relevant benefits of these investments accrue later and ensure that the loans can be refinanced.

The justification for the introduction of the debt brake in 2009 was brought forward by a political majority at the time, which argued that inherent to German parliamentarianism was the dynamic of a wasteful economy financed by credit. This would ultimately burden future generations with an interest and repayment burden that could no longer be financed. This refutable hypothesis paved the way for the exit from an actively formative financial policy.

In the meantime, however, not only have global geopolitical conditions changed as a result of the Russian war of aggression against Ukraine, and climate change worsened, but also have the economic competitive situation and Germany's role in the world changed dramatically since 2011 as a result of multiple crises. At around 66% (2022), Germany's debt ratio is relatively low compared to the USA (around 120%) or Japan (around 217%). The debt brake, and thus the ban on borrowing, has led to serious postponed financial burdens. Since then, even highly relevant reinvestments in the economy's capital stock have been avoided and thus serious future burdens have been created as a result. In addition, the state fails to make urgent modernization investments.

Against this background and due to the current financing problems of the German federal budget, criticism of the debt brake has increased significantly. Essentially, three central points of criticism are raised against the debt brake:

1. The debt brake contradicts the principle of intergenerational justice as it makes it more difficult to finance long-term climate protection programs. Investing in climate protection programs is a contribution to the 'intertemporal protection of freedom' of future generations, this means that the high future costs of failing to implement climate policy today would not be burdened on them. According to an epoch-making landmark ruling by Germany's highest court in March 2021, unilaterally shifting the burden of greenhouse gas mitigation to the future is contrary to the German Basic Law.
2. Investments in climate protection programs, would, for instance, accelerate the expansion of renewable energies; or to promote a green hydrogen economy, which has a high self-financing effect. Without such basic programs, a productive development of the economy as a whole in the future will no longer be possible. Macroeconomic analyses show that through the subsequently generated revenues and due to the macroeconomic multiplier effect of such investments, interest and repayment of public initial investments can be refinanced.
3. In terms of public infrastructure (e.g. the expansion of rail and communication networks), in Germany there is a great deal of pent-up demand, and this should be done quickly so that the productivity of the economy can be strengthened in the direction of climate protection. In addition, the German economy in general suffers from a lack of productive investments compared to the overall economic savings volume. This balance deficit lack could be best offset by credit-financed government initial investments towards a green transformation of the economy. In view of the gigantic credit-financed investment programs of other industrialized countries (such as the Inflation Reduction Act in the USA), this is also important for the competitiveness of the German economy. In short, our verdict is that continuing to adhere to the debt brake would be a brake on Germany's future. What is needed is a 'special fund for climate, digitalization and infrastructure' to be incorporated into the constitution in the amount of up to EUR 500 billion over ten years.

Professor Dr. Rudolf Hickel, Institute for Labor and Economics, University of Bremen, 2024

Apart from the historic precedence, Gabor argues, that industrial policy financed through a derisking logic cannot achieve the public goal of a fundamental and most crucial, timely, green transformation. When only 'carrots' are involved and private capital dominates the public-private relationship, the pace of decarbonization is being outsourced to private capital. This way, shifting profit opportunities lead to more and more disorderly expansion, with the first results of the IRA as a perfect example. Between August 2022 and May 2023, 74% of the funds claimed by private firms went into the battery industry, 14% into electric vehicles and less than 10% into renewable energy. This led to the rather undesired result of the massive expansion of production of large EV trucks instead of public green mobility. Additionally, she points out the distributional consequences of privatization and commodification of public goods, that work against any ambitions towards a 'just' transition. Lastly, it is an enabling factor for the entrenchment of neocolonial patterns, systemically facilitating the transfer of resources from the Global South to the Global North both directly via commodities trade and capital flows (Gabor 2023).

Taking this critique seriously, a fundamental redesign of macrofinancial institutions would be necessary in order to enable the financing of a globally just transition. Especially the rather complicated European institutional arrangements, however, are hard to reform due to the path dependencies of ordoliberal economic thinking being enshrined in governing institutions. Doing something similar on an international level, with institutions such as the World Trade Organization (WTO) and the International Monetary Fund (IMF), might appear impossible, even if enough critical actors could be convinced of its necessity, but even here we see change on the horizon, as the IMF support for a global minimum tax for corporations shows (IMF 2024).

However, developing recommendations for a reformation of the macrofinancial architecture lies outside the scope of this paper. At this point, we aim at creating awareness for the problem at hand and want to mark this aspect as a crucial field for further research.

5 Conclusion and Policy recommendations for Japan and Germany

Building on the literature discussed in this paper, as well as the status quo in the respective countries, we offer the following policy recommendations to improve the existing policy framework for transformative industrial policies of both countries.

First and foremost, it is imperative that policy makers understand industrial policy as a tool for governments to actively influence the whole economic base of society. This entails the industrial sector, where both **building up new green industries** and **greening existing ones** is paramount. But it also entails policies targeted at other sectors, such as services. This is necessary to create sufficient **good jobs**, that are both in compliance with climate targets and improve the livelihood of populations in times when global trends command a shift of labor from the industrial to the service sector.

A systemic perspective is key. It is crucial to analyze how each policy directed at one goal interacts with other societal goals. For example, subsidies for green industrial development are generally to be seen as beneficial but always come with **distributional effects**. Such effects need to be analyzed beforehand and taken into consideration when designing a policy.

What industries, sectors and specific businesses are subsidized is important for the green transformation of the economy. **All subsidies must be directed at inherently green projects, adhering to ambitious taxonomies**. Achieving the goals of a specific subsidy, however, does not rely on governments making the right choices on which projects the subsidy is given to, i.e. guessing correctly beforehand which project will develop into a profitable business case. The success of industrial policy is not decided by the government's ability to 'pick winners', but rather in the **design of the institutions regulating the relationship between public goals and private enterprise**. It is crucial to understand transformation as such, but also specifically if actively strategized for through industrial policy, as **organic processes**, relying on steady communication between stakeholders. One possible good practice example, that should be further analyzed for possible adaptation, is the US ARPA program.

One aspect of this relationship design is the combination of **incentives and obligations**. Financial incentives alone will not suffice to successfully realize the transformation towards a green industry. Therefore, the so-called **sticks are fundamental in addition to the carrots** that both Germany and Japan are focusing on – either through regulations (e.g., increasing standards) or by setting negative financial incentives.

A crucial role could lie with **public investment banks**. Governments should (re)evaluate the institutional processes to optimize them for the design principles mentioned above, focusing on the relationship between the cooperating parties. This would be useful both for building up new green industries, as well as greening existing ones, and could be specifically targeted at SMEs, which make up a large part of both the Japanese and the German economies.

Additionally, **the support measures** taken in the key sectors should be specified, spelled out explicitly and made accessible to a broader public, but particularly to the relevant stakeholders. This could be done via the establishment of **one-stop shops** at which all relevant information is provided.

Apart from this most important aspect, to successfully implement green industrial policies in the EU/Germany and Japan, **taxonomies defining what 'green' means** under the specific framework conditions of our countries are needed. The currently existing taxonomies are a step in the right direction, but also politically contested. They are however already a useful basis on which to **develop KPIs** to use in the institutions managing subsidy and transformation processes.

Quantitative and qualitative analysis of the policies' effectiveness is needed which allows the stakeholders within the institutions and sectors to make adjustments, through e.g., additional regulations and securing financial resources to improve the effectiveness of the policies.

In the case of Japan, the design and accountability of a **carbon levy system** that takes into account the burden and steering effect on consumers' needs will have to be considered. If the levy is e.g. directly transferred by utilities to the electricity bills of the customers, it can be a barrier to promoting electrification. In addition, it has a regressive impact on available income, affecting lower-income groups more strongly. On the other hand, higher electricity prices reflecting external costs of climate change are an incentive for households and industry to save energy and switch to renewables if possible. Thus, a more balanced system design is needed that takes both effects into account. Here, the experience from Germany's carbon pricing system and the discussions related to the so-called 'Climate Rebate' ('Klimageld'), repaying a part of the revenues from carbon pricing by a fixed amount to all or at least lower-income consumers, can help Japan to design a respective system. In addition, when using the revenues to fund financial incentives under the GX transformation, it will be advisable to ensure that lower-income households will also benefit from the subsidies.

When it comes to **financing the green transformation** through industrial policy, it is clear that huge amounts of money will be needed to command the resources necessary. In the current debate centered around derisking, the state is conceptualized as to supply prefinancing to incentivize private investments. This framework has severe negative effects on distribution and potentially the speed of the transformation. A more state-led approach is needed, but also comes at a higher cost for public balance sheets. On the other hand, there is much evidence that the additional income and public wealth generated by these investments into the productive base and infrastructure are the necessary preconditions for high-value economic activity in the future. Thus, **deficit spending for climate mitigation investments** will not only be necessary but also a promising option for welfare generation. Especially in Germany, the counterproductive debate on the so-called debt brake (see Chapter 4.3) should be settled by a political compromise between conflicting views of the parties.

Apart from the necessary changes that have to take place in the respective industries towards an increased in-take of renewable energies as power source, increasing the **recyclability** of products and striving for production processes and products that do less harm to the environment is needed. Highly promising towards a green industrial policy is **the combination of the policy mix for climate mitigation with strategies heading for an intensified Circular Economy**. Scenario analyses (UNEP/IRP, 2020; Pauliuk, 2021; Acatech, 2021) have demonstrated that by an integrated policy approach it will be easier to keep the 1.5-degree target within reach and thus smoothen the green transformation processes.

Keeping in mind global dynamics and value chains, we recommend continuing the progress made in establishing multilateral **climate clubs**. In this, implementing the **CBDR-RC framework**

should be the highest priority to enable a globally just transition. This might sometimes entail conflicts with private businesses' short-term interests but will be beneficial to all parties in the long term. Instead of intensifying the competition with China for natural resources from the Global South, Japan and Germany should prioritize economic development in the Global South to create more options for the supply of resources critical to the green transformation.

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