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Between hope and failure: What influenced the United States–EU agreement on clean steel?

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Abstract

In the 2020s, multilateral cooperation in both the climate and the trade regimes is increasingly contested. Countries are often turning to industrial policy instruments with a unilateral and protectionist focus. Against this background, we examine the Global Arrangement on Sustainable Steel and Aluminum (GASSA), which was proposed by the United States and the EU in 2021 to strengthen the decarbonization of the emissions-intensive steel sector as well as harmonize international trade. This study provides a systematic qualitative analysis of the factors that have influenced this initiative and made it ultimately fail. We show that GASSA had strong economic and trade-related incentives, such as the privileged access to steel markets of the EU and United States. Yet, we also demonstrate that in this case, political obstacles as well as structural differences in the steel sector have been more important, creating a gridlock for the negotiations. This study examines a practical case of (failed) decarbonization cooperation and provide empirical evidence for political factors that have an impact on whether a cooperation is launched or not. This analysis can also help in the assessment of other cases, as the study lays the conceptual groundwork for further systematic comparisons. Lessons learned here could be the basis for policy recommendations to make minilateral cooperation more successful.

Keywords: Global climate governance; Climate club; International cooperation; Industrial decarbonization; Steel Sector; Trade tariffs; U.S. and EU climate policy; CBAM

1. Introduction

In the tenth year of the Paris Agreement's anniversary, the optimism for multilateral climate policy is crumbling. At the same time, the international trade regime is facing increasing contestation. Especially industrial sectors, such as steel, are at the heart of decarbonization efforts but also face multiple geopolitical conflicts and suffer from flawed cooperation in international trade. Countries are increasingly turning to industrial policy instruments with a unilateral and protectionist focus. Most prominently, the European Union, has launched its Carbon Border Adjustment Mechanism (EU CBAM), a measure that puts a carbon price on imports of energy-intensive products, such as steel. Though the EU CBAM could, in theory, provide overall climate benefits (Zhang et al. 2024; Newman 2022; Elkerbout et al. 2024), it also has provoked strong opposition in those EU trading partners who might face increased costs (Erdogdu 2025). The U.S. government of Donald Trump has introduced tariffs of 50% on steel and aluminum imports (TWH 2025).[1] Although they do not have an environmental purpose, they will change international trade, put pressure on the whole steel market, and ultimately alter the setting for green growth, clean technology, and industrial decarbonization (Farmbrough 2025; O'Neil and Huesa 2025)

[1] This number is subject to changes and regional variations. The announcements made by the U.S. government between January –June 2025 have varied strongly, therefore the initial overall number is mentioned here, without regard for potential trade deals etc. https://www.bbc.com/news/articles/cn93e12rypgo

These developments come at a time when cooperation in both international climate and trade policy is urgently needed. Advancing climate change exacerbates the need for rapid decarbonization, which in turn requires political conditions that guarantee stability and long-term conditions for sectors such as steel to go 'green', as well as international trade relations that support the creation of a market for green products. This includes a minimum degree of global harmonization and coordination.

At this moment in time, it is especially important for science and academics to expose and communicate the benefits of international cooperation. Research that examines under what conditions cooperation works well and what barriers lead to its failure is ever more important. Therefore, with this study, we revisit a case of attempted minilateral cooperation as an example for an initiative to decarbonize the heavily emitting steel industry while strengthening international trade. We look at the negotiations for a Global Arrangement on Sustainable Steel and Aluminum (GASSA), which was proposed by the United States and the EU in 2021[2]. GASSA was meant to become part of the solutions for decarbonizing the steel industry as well as establishing new trade rules among the United States, the EU, and potentially further partners (TWH 2023). The steel sector is responsible for 7% of global CO_2 emissions (IEA 2023). Although this initiative was ended in 2025 by Donald Trump's government, this case analysis can still provide us with relevant insights to learn from and knowledge to be applied to future cooperative initiatives. An agreement between the United States and the EU that would give decarbonized steel priority access to their domestic markets has not only environmental benefits but would ultimately strongly affect other steel trading partners, like China, Brazil, or South Korea, as well (Hall 2024).

In order to break down the complex problem of climate change into smaller portions, countries tend to reunite like-minded allies and initiate cooperation in mini- or even bilateral formats, which later can expand into larger alliances or clubs. Such cooperative alliances promise not only to make quick(er) progress on industrial decarbonization, as they could negotiate common objectives, rules, and policies (Falkner, Nasiritousi, and Reischl 2022), but they could ultimately help overcome new rivalries and harmonize international standards. Climate cooperation and alliances among countries have been the subject of intense study. Such research often focuses on climate clubs and alliances (Nordhaus 2015; Widerberg and Stenson 2013; Falkner et al. 2022); countries' cooperation in the UNFCCC context; or collaboration on specific instruments, such as carbon pricing (Mehling 2007; Sterk, Mehling, and Tuerk 2009; Haites 2014; Unger 2021). Especially (potential) cooperation among superpowers such as the EU, China, and the United States has received attention (Tagliapietra and Wolff 2021). Hermwille et al. (2022) suggest a climate club especially for green steel.

Nonetheless, a research gap exists with respect to empirical data and the evaluation of practical cases for minilateral cooperation (Koppenborg 2025). Especially, we found that there is a lack of studies that examine under what conditions clubs and minilateral cooperation emerge. There is a need for more knowledge about how they are negotiated and under what conditions countries go beyond loose forms of exchange and may agree on more binding forms of cooperation, such as common rules for industrial decarbonization. In particular, for cooperative initiatives that focus on industrial collaboration, we know little about what specific interests and priorities member countries pursue. What are the factors that enable and/or restrain minilateral climate cooperation?

[2] The first proposal was made by the U.S. government under Joe Biden.

To answer these questions, after a brief introduction of the methodology, this study starts with a literature overview, extracting arguments from minilateral cooperation, climate alliances, and international relations. This conceptual section proposes five factors that influence the negotiations for minilateral cooperation: 1) benefits; 2) domestic policy preferences; 3) political structures and processes; 4) sectoral structures and stakeholders; and 5) international developments. The empirical part provides a brief background description of the steel sector and GASSA and then examines the negotiations on GASSA, based on the proposed five-factor framework. This is followed by a concluding discussion of GASSA's prospects and generalizable aspects of minilateral cooperation.

The objective of this study is to examine a practical case of (failed) decarbonization cooperation, providing evidence for political influencing factors. Lessons learned from this analysis of minilateral cooperation (i.e., GASSA) can help in the assessment of other cases, including giving policy recommendations to make future cooperative initiatives potentially more successful. The authors collected new data on GASSA, a case of proposed minilateral cooperation, which had not been studied by academics previously. It offers a conceptual framework of five indicators that can be applied to further systematic comparisons. The insights gained with this paper can not only make an academic contribution, they could also support political decision-makers in choosing and designing cooperative climate initiatives.

2. Methodological approach

The analytical part is based on a qualitative case study. Conceptually, it takes aspects from existing literature on cooperative climate initiatives and clubs and combines them with factors that condition negotiations and cooperation conceived in international relations theories. These aspects are clustered around an organizational framework of five factors or indicators: 1) benefits; 2) domestic policy preferences; 3) political structures and processes; 4) sectoral structures and stakeholders; and 5) international developments, discussed in more detail below. Theoretical concepts and existing academic work guided the authors' creation of these indicators, which in turn helped to focus the research and evaluate the data collected for the case (the GASSA negotiations) (Corbin and Strauss 1990).

The examination of a specific case is typically used to gain in-depth knowledge of social patterns or a social process and to answer 'how' and 'why' questions (Yin 2002). GASSA was chosen for the case study because it displays many of the challenges industrial decarbonization faces today, yet it had shown the potential for politically meaningful cooperation. Even starting the negotiations and an ongoing exchange between two of the world's largest emitters, the United States and the EU, could help bring the global community towards a common understanding of clean steel.

The data was gathered, first, in a desk research-based content analysis of grey literature of reports, press releases, media news, and blog articles. Second; empirical data was collected during September 2022 – November/2023 in 27 interviews, explorative talks, and thematically related events in the United States and Germany, online and in person, with experts from Think Tanks, NGOs, public/governmental institutions, private sector representations, academic institutions. An anonymized list can be found in the appendix, organized by realization date and numbered chronologically. Interviews are referenced as Data+no. Interviewees were selected according to the 'focused interviewing' method (Merton 1987), based on their role, expertise, and expected knowledge on the negotiations on GASSA. Both, interviews and content analysis were evaluated based on the above-named five indicators

The method selected for this process was expert interviews for qualitative social sciences (Pickel and Pickel 2003; Meuser and Nagel 1994; Mieg and Brunner 2004). The interviewer followed an in-depth, semi-structured interview guide (Brinkmann 2014) with a narrative focus, aimed at gaining rich and detailed information, and included open and explorative questions that allowed the interviewee to elaborate on answers and opinions (Rubin and Rubin 2011). This method is especially suitable for the qualitative and explorative character of this study because it helped deal with the situation that the negotiations for GASSA were not public but politically sensitive and held behind 'closed-doors'. Hardly any government documents were published to inform about their progress, as at the time of interviewing, the outcome of GASSA was still open.

To step from data collection to evaluation, interview notes and transcripts were coded. First, a broad organization of the interview material was realized to mark the data in a first reading. Second, codes based on the categories established with the five indicators were applied in the second examination of the documents (manually, without the use of software). Responses were not weighted against each other or ranked, as rather the interplay of the arguments raised by interviewees was important. The data gained in the interviews was compared against grey literature assumptions.

The qualitative and explorative approach was chosen because it allows for a higher degree of flexibility and openness compared to quantitative approaches. This is especially relevant here because, at the time of writing, GASSA was relatively new and still experienced dynamics and quick changes. Further, as the GASSA negotiations remained unconcluded, they required a cautious approach that considers the regions' motives and their domestic political circumstances.

Some uncertainties exist with respect to the chosen method of qualitative social sciences research. The collected data is to some degree subjective, as it includes opinions of the interviewees, and also grey literature can contain scientifically not-examined developments. Further, this small-scale research cannot include all possible experts and insights. For this reason, it is also difficult to test causal relations. Although this study suggests that the political factors framed here influenced the negotiations of GASSA, and it shows that many sources agreed on the arguments brought up here, it is difficult to argue which factors were the 'most important.' E.g., further variables, such as political deprioritization of green technology investments, could have made the U.S. government of Trump 2.0 cancel the efforts on GASSA.

To improve certainty, the crosscheck with arguments from other experts and grey literature sources was particularly important. Nevertheless, it can be argued here that the overall purpose of such explorative research is to collect different (also subjective) positions and create first hypotheses with empirical data, which in future research can be systemized and tested on more cases. Last but not least, it is important to note that the empirical analysis was realized before the second government of Donald Trump came into office in 2025 and cancelled the negotiations on GASSA. The case study is nevertheless relevant as it can provide learnings for future similar endeavors.

3. Minilateral climate cooperation and international relations

Minilateral forms of cooperation have received attention mostly in view of a slow UNFCCC process; for example, after countries were unable to reach an international agreement at the Copenhagen UNFCCC conference in 2009 (Keohane and Victor 2010; Nordhaus 2015; Widerberg and Stenson 2013). Another peak of attention on club-like

cooperation occurred when it became clear that countries' contributions would still not achieve the Paris Agreement's objectives (Falkner et al. 2022; Unger and Thielges 2021; Stern and Lankes 2022). The main argument for starting climate cooperation with few countries or even bilaterally is that a select group of actors might better accelerate the progress on a particular (climate) issue and go beyond the policy process carried out in larger contexts such as the UNFCCC (Unger and Thielges 2021). Decision-making processes are faster, and non-compliance can easily be excluded (Nordhaus 2015). In our approach, 'minilateral' cooperation includes approximately two to five members.

At the beginning of every attempt at international cooperation stand the negotiations on its terms and design. Because much of the success (or failure) already lies in its conception, it is thus fundamental to look at what circumstances, motivations, and conditions bring countries to the negotiation table and ultimately agree to an alliance. Based on an adaptation of the conceptual approach of Unger (2021), we suggest the following framework to explain what drives or restrains minilateral climate cooperation.

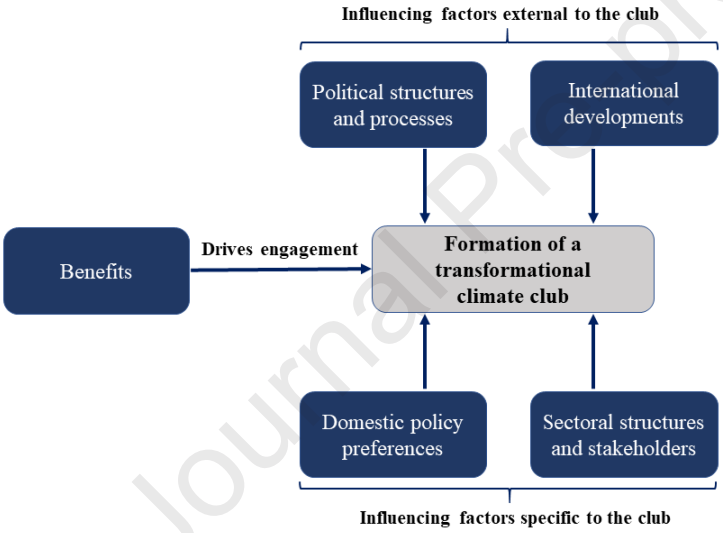

Fig. 1: Conceptual framework of five influencing factors based on (Unger 2021; Gürtler et al. 2019)

Based on literature, etc., on cooperative climate initiatives and clubs, and international relations theories, we created the following five factors. They can act as push as well as detaining factors, are dynamic over time, and their interplay, rather than just one single factor, determines the outcome of cooperation initiatives.

(1) Benefits. The formation of minilateral cooperation depends on the benefits that negotiation partners expect. At the very beginning of every cooperation stands the question of what parties gain by becoming (and staying) members. The creation of exclusive benefits (e.g., market access, trade benefits, technology access, exemption from taxes) is the main purpose of club cooperation (Falkner et al. 2022; Potoski 2017; Sælen 2016). Though many of these economic advantages can be exclusive to cooperation partners members, no country can be excluded from the benefit of avoiding global warming. Cooperation can also provide nonmaterial or difficult-to-monetize benefits, ranging from capacity building to technology dissemination, trust, and prestige (Potoski 2017). As an example, prestige could be gained if the cooperation distinguishes the partners as technological frontrunners.

Ultimately, cooperation is also pushed if 'side payments' and co-benefits in other (than climate) areas are created (e.g., trade, air quality, and health improvements) (Unger and Thielges 2021; Putnam 2017). Actors weigh potential gains and losses as well as the expectations of other actors' behavior against each other (Keohane 1984). The thesis framed here is that actors cancel a cooperative endeavor such as GASSA if they think that they will obtain more benefits without cooperation (Braun 1999) or if the expected benefits do not surpass the obstacles.

(2) Domestic policy preferences influence negotiations and the formation of minilateral cooperation. What domestic policy preferences does the cooperation (i.e., GASSA) have to satisfy, which technical dimensions are required, and with which existing policies need to be made compatible? Literature analyzes how compatible and comparable climate policy approaches of different countries are (Aldy, Pizer, and Akimoto 2017; Pauw et al. 2018). E.g., for carbon pricing, authors argue that the technical compatibility of the design features of the different domestic policies can make cooperation (i.e., the linking of carbon pricing systems) complicated because they mask domestic preferences (Mehling 2007; Sterk et al. 2009; Haites 2014; Unger 2021). Aspects such as different visions on targets or emissions accounting procedures, must be harmonized. If the cooperation were to contain binding provisions (e.g., tariffs, taxes, and bans), these could interfere with domestic climate policies and might require technical harmonization. The expectation framed here is that domestic (climate) policies can support but also obstruct cooperative initiatives such as GASSA; e.g., if they are perceived as technically challenging or not compatible (Unger 2021).

(3) Political structures and processes influence negotiations and the formation of minilateral cooperation. In international relations research, academics have noted that broader characteristics of the domestic political system and the political processes can have an influence on countries' behavior in cooperation. For example, the legislative procedures, the decision-making rules, and existing laws (Risse-Kappen 1991) and the electoral cycle. The legal procedures for the ratification and conclusion of an agreement, such as the type of parliamentary or congressional majority that is needed, play a role because they affect the availability of options that guarantee domestic adoption (Putnam 2017). Academics who look at international cooperation endeavors for carbon pricing also suggest that the legal form of the agreement affects the negotiations (Mehling 2007). International treaties are legally the most binding form, but usually require legislative consent. More informal Memoranda of Understanding (MOUs) build on implementation through domestic rules to become binding (Mehling 2007). The expectation framed here is that political structures and processes such as congressional majorities can push a cooperation initiative such as GASSA or detain it; e.g., through the outcome of new elections, or changes in the political administration and subsequently the regulations, etc. (Unger 2021).

(4) Sectoral structures and stakeholders influence the negotiations and the formation of minilateral cooperation. Theory suggests that the interdependence of governments with political parties, domestic public authorities, the private sector, civil society actors, international organizations, and the public plays an important role in international cooperation (Moravcsik 1997; Putnam 2017). Stakeholders seek to shape governmental priorities in a way that maximizes their own interests (Checkel 2008) in order to put policies into place. Especially private sector groups have more power to pressure governments, as they can threaten to close production plants (Gründinger 2012).

Further, sectoral structures define the assets and interests of stakeholders and influence sector-specific actor constellations (Giddens 1984; Hay 1995). For industrial sectors such as steel, production methods and

technologies, but also the availability of recycled materials currently in use, determine the carbon intensity per ton of produced steel. They define country-specific starting points for decarbonization and the cost competitiveness of domestic producers vis-à-vis foreign competitors. The expectation framed here is that stakeholders or sectoral disparities can obstruct or push a cooperative initiative such as GASSA (Unger 2021); e.g., if these stakeholders expect that they will lose income or market advantages through the cooperative initiative.

(5) International developments build fundamental conditions for negotiations and the formation of minilateral cooperation. International relations authors argue that the international regime, its structures, and the setting of norms, procedures, or the priorities exercised by other jurisdictions are part of the explanation for why cooperation happens or not (Milner 1992; Keohane 1984; Moravcsik 1997). In simple terms, it matters not only how cooperation partners behave but also how other states act. For industrial sectors such as steel, e.g., international trade and global production capacities, excess capacity could push actors to cooperate on initiatives such as GASSA.

All five factors have overlaps and are somewhat interlinked; i.e., occasionally, empirical data can support two or more indicators. For example, factor (4) and factor (1): Stakeholders may also influence the benefits a negotiating country expects from the cooperation. In the following, the results of the analysis of the empirical data show how the five factors manifested in the case of GASSA.

4. Evaluation

The transatlantic proposal for a Global Arrangement on Sustainable Steel and Aluminum

Steel, a sector that was responsible for approximately 2.7 $GtCO_2$ in 2022 (approximately 7% of global CO_2 emissions), is not on track to reach net zero emissions by 2050 (IEA 2023). Global carbon intensity has stagnated, and total emissions have risen due to higher demand (IEA 2023). There is arguably a lack of progress in fundamental-transformative changes and deep decarbonization (Data no. 14). Steel has a strong presence in our day-to-day lives, for instance, in cars or buildings. It also has a security dimension, due to its importance in the defense industry. It holds strong interdependencies with other sectors and diverse supply chains for climate-friendly technologies. Hence, the socially and culturally perceived value of the steel sector goes beyond its economic contribution (Data no. 14).

Several options exist to reduce emissions in the steel sector, including the increased use of renewable energy and efficiency improvements in the production process, the application of new production methods based on hydrogen and Carbon Capture and Storage (CCS), and the use of recycled steel. In 2021, approximately 30% of the total metallic production input came from steel scrap (WSA 2021). Governments in the United States and the EU are increasingly investing in projects that replace fossil fuels with hydrogen in the process of reducing iron ore (Data no.17) (European Investment Bank 2024). Many private enterprises promise the introduction of near-zero or fossil-free steel[3]. Yet, most technologies are not at the stage of market readiness or large-scale implementation; e.g., green hydrogen will likely be introduced at commercial scale in steelmaking processes in the mid-2030 (IEA 2020). The production of green or near-zero steel is estimated to cost 10%–50% more than

[3] SSAB promises ‘near zero fossil free steel’ on https://www.ssab.com/en/company/about-ssab/the-earth-calls-for-action.

conventionally produced steel (IEA 2020) and does not have a qualitative advantage. Overall, the establishment of green steel requires large state and private investments and support structures.

The decarbonization challenges are exacerbated by the 'playing field' determined through international trade and competition. Approximately 25% of the global steel production is traded internationally. The largest crude steel producers are China (54%), India (6.6%), Japan (4.7%), the United States (4.3%), Russia (3.8%), Korea (3.5%) and Germany (2%) (WSA 2023a). While China is also the world's number one exporter of steel, the United States and the EU are the two largest importers (followed by China) (WSA 2022). Additionally, the sector faces strong global overcapacities (estimated 33% excess of demand in 2022 (OECD 2023; WSA 2023b)). The international competition leads to a situation where some countries fear that companies could relocate to countries with more favorable investment conditions (e.g., with less stringent environmental regulations). To avoid the phenomenon of carbon leakage, they have strong incentives to protect investments in green steel production and to strengthen the domestic industry. On the one hand, these concerns make the decarbonization of steel a challenging political endeavor. On the other hand, they build momentum for stronger cooperation among those countries and actors who are willing to engage more in steel decarbonization than others (Data no. 8, 11). The proposal of GASSA can be seen in light of these circumstances.

The United States and the EU proposed a 'Global Arrangement on Sustainable Steel and Aluminum' (GASSA) in 2021. Originally, GASSA was not motivated by climate concerns but was born out of a trade conflict between the United States and the EU. In 2018, then U.S. President Trump installed tariffs on U.S. imports of steel and aluminum (25% and 10%, respectively), arguing that they threatened national security, based on Section 232 of the Trade Expansion Act of 1962 (European Commission 2025). This led to a conflict with the EU, which responded with retaliatory measures (European Commission 2025) in the form of EU tariffs on U.S. exports and a formal dispute against the United States under the WTO (GoG 2020). Under the following U.S. government, the parties agreed on temporary tariff-free quotas for European imports. GASSA had been suggested as the pathway to a permanent solution (European Commission 2021).

GASSA aimed at addressing the conflict around Section 232 tariffs and the competition in the global market, but also the decarbonization of the steel and aluminum industries. This includes negotiating carbon intensity standards, supporting the production of green steel and aluminum, and creating a green steel and aluminum market. Partners also plan to refrain from 'non-market practices' and work against such practices from other countries (European Commission 2021). Yet, GASSA was framed as a global solution. U.S. President Biden advertised GASSA as a potential global club for green steel (Swanson 2022), even though no official announcement about other potential partners was made.

Negotiation partners met several times, for example, under the U.S.–EU Trade and Technology Council (European Commission n.d.). Proposals for the design of GASSA have been exchanged (Valero and Nardelli 2023; Harris 2023; Manak and Kopans-Johnson 2023). By the set initial deadline of October 2023, negotiations were still gridlocked and postponed until January 2024 (Valero and Nardelli 2023). Then, partners further prolonged the above-described temporary rule for Section 232 tariffs and GASSA negotiations until the end of 2025 (Sadden and Coyne 2023; Gijs and Aarup 2023; European Commission 2023a). When realizing the empirical analysis for this study, the outcome of the GASSA negotiations was still open (Manak and Kopans-Johnson 2023). However, at the time of writing, the second government of Donald Trump of 2025 has reinstalled and increased the tariffs.

5. What factors influenced GASSA negotiations?

5.1 What benefits did the negotiating partners expect from GASSA?

For the EU, the permanent cancellation of the US' Section 232 tariffs and/or the creation of some sort of free trade agreement was a central motivation to pursue the negotiations (Data no. 7, 14, 16, 21, 25) (European Commission 2025). Calculations estimated that the initially, in 2018, imposed tariffs were worth a 6.4 billion EUR in EU steel exports (Moens and Overly 2023). In the EU, the abolishment of the Section 232 provisions would support industrial output and save costs (Data no. 22, 25). Also the United States clearly expected economic benefits from this cooperation (TWH 2023). First, experts calculated that the original Section 232 tariffs had been overall more harmful to the U.S. economy. Although capacity utilization initially grew for steel, at the same time metal prices for domestic manufacturers and the downstream industry increased (Bown and Russ 2021). Thus, their abolition and the absence of tariffs/costs induced by Section 232 would provide economic benefits. Second, both parties expected benefits from avoiding a new trade conflict that could have resulted from reinstalled U.S. Section 232 tariffs (GoG 2020) and EU retaliation measures[4] as well as the possibility of unilateral decarbonization rules for steel. These expected benefits pushed both parties to the negotiation table (CRU Consulting 2022; Rimini et al. 2023; Moens and Overly 2023; European Commission 2023b; Valero and Nardelli 2023; Hall 2024) (Data no. 19, 26). The United States also named clean energy industrial bases, industrial investment, and job creation as further expected benefits (TWH 2023).

For both the United States and the EU, increased transatlantic cooperation on trade, carbon taxation, and the development of common markets for sustainable steel were GASSA's main promises (Rimini et al. 2023; Kaufman et al. 2023; European Commission 2023b; WTO 2022) (Data no. 7, 19, 20). GASSA could involve preferential market access to its signatories while excluding those that are not members and building up a forum that reduces trade frictions (Data no. 6). Also, GASSA could help protect investments in clean steel (Data no. 19), as it would impose restrictions (e.g., tariffs) on 'dirtier' steel production, thus boosting the competitiveness of clean steel (Swanson 2022; Harris 2023) or at least limit 'dirtier' steel to GASSA members markets. In general, GASSA presented a chance to promote joint measures to support reliable demand for green steel (Hermwille et al. 2022; Kumar et al. 2023) and help the creation of a clean steel lead market. Furthermore, both the United States and the EU saw a benefit in addressing global steel overcapacity production (European Commission 2023a).

GASSA would have linked trade and climate-related issues and created co-benefits: only starting the negotiations had already led to efforts to improve and harmonize Measurement, Reporting, and Verification (MRV) of steel emissions. E.g., the U.S. Trade Representative tasked a major assessment of greenhouse gases in the U.S. steel sector (OUSTR 2023). Common U.S.–EU procedures could inspire followers in other countries and ultimately create a global standard for MRV in the steel sector. GASSA would have sent a global signal (Kaufman et al. 2023), showing off the decarbonization commitment of two of the world's largest steel consumers. It could foster a technology transfer partnership and support exchange on innovation in green steel technologies (Data no. 5). Most of these benefits would ultimately accelerate industrial decarbonization and mitigate global warming.

[4] Under the second Trump Administration in 2025 this concern resurfaced, when a new trade conflict broke out after the United States reinstalled the Section 232 tariffs.

5.2 With which domestic policy preferences did GASSA have to be reconciled?

The United States and the EU have proposed two opposing design approaches for GASSA. Essentially, the U.S. model foresaw a production process-independent and technology-open standard (Rimini et al. 2023). Concretely, this proposal would have installed a threshold at the U.S. maximum carbon intensity level (Tucker and Meyer 2023) (Data no. 2, 12,19).[5] Non-members with a 'dirtier,' more emissions-intense steel production would have had to pay a tariff when importing to GASSA members. GASSA members would have paid a lower tariff than outsiders if their steel exports to other members have a higher carbon intensity than the threshold (Harris 2023; Janzen, Sprinke, and Sigurgeirsson 2023). This approach would shield relatively dirty steel plants in the United States and limit costs for the U.S. steel industry. The U.S. proposal also contained provisions to cope with steel overproduction and against 'non-market practices' such as subsidies that are perceived as unfair (Kaufman et al. 2023).

However, the EU would have preferred to see the United States implementing a Carbon Border Tax Mechanism (CBAM) and connecting GASSA to the EU's CBAM (Data no. 7, 16, 19, 21, 23, 25, 26) (Harris 2023; Kaufman et al. 2023), ideally based on some form of domestic carbon pricing. The CBAM is one of the EU's flagship climate policies, which already covers steel imports. It was referred to as the EU's main concern in the GASSA negotiations (Data no. 16, 19, 21, 23, 25, 26). Under the EU CBAM, companies initially only have to report their GHGs. From 2026 onwards, they will have to purchase CBAM certificates based on their products' embedded carbon and equivalent in price to those in the EU Emissions Trading System (ETS). As the EU CBAM will go hand in hand with the phase-out of free allowances to emit CO_2 in energy-intensive industries still granted under EU ETS, it is politically sensitive. It stands for the EU's hopes to decarbonize the hard-to-abate industries more rapidly both within the EU and abroad (Data no.7). Any rules and especially tariffs negotiated under initiatives such as GASSA will also have to be made technically compatible with the EU CBAM (Kleimann 2023) (Data no. 7) to avoid undermining the EU ETS (Marcu et al. 2024). For example, questions would be how far U.S. companies would still have to buy credits under the EU CBAM or whether they would get exempted; how international companies covered under both instruments would have to comply; and whether GASSA's fees would be cheaper than those levied under the EU CBAM. The fear of technical incompatibilities was likely one cause for a more hesitant EU position (Harris 2023).

It remains ambiguous what role the EU CBAM played in the GASSA negotiations from a U.S. perspective. Although, at the time of writing, in the United States several proposals for domestic CBAM-like instruments existed, the United States did not want to base GASSA on the EU CBAM policy approach (Kleimann 2023). Some experts argued that the United States even pursued an exemption from EU CBAM as part of GASSA (Janzen, Sprinke, and Sigurgeirsson 2023; Rimini et al. 2023) (Data no. 19, 26), although this has been ruled out by the EU (Data no. 16, 21). Other experts argued that concerns about the EU CBAM have not been very strong in the U.S. steel industry, possibly due to the fact that U.S. production is already less carbon intensive than that of the EU (Data no.13, 18, 21) and that only a small share of U.S. exports would fall under the EU CBAM (CRU Consulting 2022; Moors 2023). Ultimately, only once companies have to start buying CBAM's emissions credits in 2026 will it be clear what costs a U.S. or other non-EU company will face under the EU CBAM.

[5] A first proposal installed the threshold at a country's average carbon intensity in the steel sector.

The timing of the EU CBAM and its implementation were likely another factor hampering GASSA negotiations on the EU side. It was the EU's priority to make the EU CBAM start and work (Harris 2023) (Data no. 7), a process carried out with the same timeline as the original GASSA deadline in October 2023. Thus, many of the EU's resources and capacities have been invested in this internal process (Data no. 6,21). It might simply have been easier to make the CBAM operational and satisfy the political expectations that accompany this flagship policy first, before agreeing to a new tariff scheme (Harris 2023). In general, experts have argued that for the EU, GASSA's potential climate benefit was likely more important than for the United States (Data no. 23, 26).

Additionally, domestic policies on the U.S. side played a role. The adoption of the Inflation Reduction Act (IRA) in 2022 demonstrates that then, the United States' priorities were on setting tax incentives, subsidies, and standards rather than carbon pricing measures (Data no. 2, 7,10). Carbon pricing or carbon border taxes, though frequently discussed in the US, were not deemed politically feasible and are not being pursued by then-President Biden (Narassimhan, Koester, and Gallagher 2022; Tucker and Meyer 2021). The United States then showed a strong desire to become a green technology leader and protect domestic industries (Data no. 7, 19). The IRA also set incentives for the steel sector, e.g., projects that employ innovative production methods such as clean hydrogen (Department of Energy 2024). After the IRA's launch, many voices criticized that EU products, such as electric vehicles, were excluded from the IRA's benefits, such as the tax credits (Data no. 3, 7, 8). This created a more antagonistic environment for the GASSA negotiations, and some experts have suggested that the EU saw GASSA as an opportunity to become eligible for IRA subsidies (Rimini et al. 2023) (Data no. 7, 21).

5.3 Which political structures and processes influenced the GASSA negotiations?

In this case, institutional structures and political processes affected governmental choices and thereby influenced the negotiations for GASSA. First, the legal form that partners envisioned for GASSA built the basis of their negotiation positions. GASSA could have been based on an international treaty. Although this is a strong option as it includes binding political provisions, it would have entailed a difficult decision-making process, as it requires the consent of the U.S. Congress and the EU bodies. Thus, a less formal agreement, such as a MoU, seemed more feasible (Data no.18). In the United States, this could have been realized by keeping Section 232 as a basis for GASSA (Manak and Kopans-Johnson 2023) (Data no. 19, 21, 26). In that case, it is likely that the U.S. Congress would not have to consent to the amendment (Tucker and Meyer 2023; Tucker and Meyer 2021; Swanson 2022) (Data no. 18, 19). However, the EU preferred the abolishment of Section 232 (Data no. 11, 14) (Harris 2023; Janzen et al. 2023; Manak and Kopans-Johnson 2023) or to be permanently exempted from such import tariffs.

Second, for GASSA, the timing of political cycles in the United States and the EU also played an important role. Although both parties were initially motivated to adopt GASSA quickly (as originally planned, in October 2023) (Data no. 7), other political processes took precedence on the political agenda. The public debate in the United States was dominated by the presidential elections in November 2024 (Data no. 8). Experts argue that the 'election battle' and the need to win 'swing voters' constituencies had dampened the Biden government's willingness to make decisions that could increase costs, i.e., rising prices for steel products (Data no. 23).

While the rotating EU presidencies do not have comparable power, EU parliamentary elections and the renewal of the European Commission in 2024 had a general influence on EU climate and energy policymaking, including industrial decarbonization of the steel sector.

5.4 How did sectoral structures and stakeholders in the steel sector enable or constrain negotiations?

Possibly the most important factor that influenced the GASSA negotiations was that the steel sector's structures are very different in the United States and the EU and created unequal starting positions for decarbonization. Overall, the United States performs better in terms of CO_2 emissions (average emissions intensity 2021: United States: 0.42-1.24 and EU: 0.81-1.97 tCO2/t) (CRU Consulting 2022). This is because most U.S. companies produce their steel with the electric arc furnace (EAF) technology (68% of the Unites States' crude steel production) (CRU Consulting 2022) and largely based on the recycling of scrap steel. If the energy input is based on renewable energies, this can be reduced even further. EAFs emit roughly only one-third of the emissions from the Blast Furnace Technology (BF). BFs produce primary steel from iron ore traditionally based on coke and coal and are extremely emissions intensive. In the EU, more plants have a production based on BF (61% of the crude steel production) (CRU Consulting 2022).

In principle, both U.S. and EU industrial groups argued that regulations should be as harmonized as possible across countries, for instance through the implementation of the same MRV systems (McMahon 2020) (Data no. 5, 6). Several EU steel sector groups welcomed the efforts around GASSA in general (Wirtschaftsvereinigung Stahl 2023; EUROEFER 2021).

Nevertheless, concerns existed on both sides of the Atlantic that GASSA's standards could be arbitrary (Data no. 6). Low(er) carbon intensity-EAF producers, the majority in the United States, generally favor a 'one-fits-all' carbon intensity-based standard that is independent of the steel production technology (Data no.6) (Harris 2023; Kleimann 2023). BF producers, who are majorly based in the EU's strong steel-producing countries like Germany, favor a sliding scale or a multiple-standards approach that distinguishes between scrap-based and primary steelmaking (Data no. 6) (Harris 2023; Kleimann 2023) (Harris 2023; Allwood 2022). The United States thus proposed the above-described technology-agnostic standard, while the EU preferred a sliding-scale technology-specific standard (Data no. 21) (Kleimann 2023). These divergent positions made defining net-zero steel and a common standard difficult (Data no. 25) (Allwood 2022). In the EU, industrial steel groups feared that if GASSA was designed according to the U.S. proposal, they would face additional costs and competitive disadvantages (Data no. 25) (Harris 2023). If these rules were to be connected to eligibility criteria for governmental subsidies or procurement programs, some companies might also be excluded from these market opportunities.

Decarbonization measures, such as GASSA, played into the fear of steel factory closures and built on existing fears of job losses (Data no. 11, 21), as well as inflation in the United States and EU countries like Germany (Data no. 18) (Harris 2023). The situation was further exacerbated by the lines that divide steel-producing and downstream industries (Data no. 23). While steel producers benefit from rules that limit low-cost imports (e.g., from China, such as Section 232 tariffs), downstream manufacturers seek to keep steel prices as low as possible (Data no. 23).

Industrial lobbying is strong, tends to receive much attention from the media, and influences the political agenda of the government (Data no. 23). For instance, experts have argued that then U.S. President Biden's government

feared upsetting steelworkers and voters in the states of Michigan, Wisconsin, and Pennsylvania, because they were considered crucial in the elections (Data no. 8, 23) (Harris 2023).

Environmental groups seem not to have been very involved in the GASSA negotiations. However, the fact that they pushed for stronger and transparent decarbonization regulation in the steel sector in general (Schreck, Kobiela, and Wolf 2023) (WWF Finland 2023) might have supported the governments' pressure to adopt GASSA. Some experts have questioned, in general, whether GASSA could provide a significant measurable climate change mitigation benefit and whether it could become an environmentally enforceable policy (Data no. 14).

5.5 Which international developments affected the GASSA negotiations?

Potentially several developments that can be expected in the future may deliver a generally beneficial environment for cooperative initiatives such as GASSA. The growing global emissions pressure steel-producing countries to more strongly engage in efforts to decarbonize this hard-to-abate sector (Data no. 5, 6) and the lack of progress in the multilateral climate and trade regimes can incentivize countries to seek more bi- and minilateral forms of cooperation (Data no.11). At the same time, the availability of scrap steel, renewable energies, methodologies that involve CCS and hydrogen, and policies for the phaseout of fossil fuels play a role (Data no. 6, 17). Additionally, knowledge about measuring and accounting for steel emissions and stronger awareness of climate change in the private sector enable a more attractive playing field for the decarbonization of steel.

On the other hand, international cooperation is increasingly shaped by geopolitical constellations, most importantly the rivalry between China and the United States. The U.S. government perceives China's policy instruments, its large capacities for both steel production and many of the downstream sectors' supply chains (e.g., electric cars) as unfair and dangerous (Data no. 1, 2, 3, 5, 11, 15). Confronting China's influence was a main motivation for U.S. engagement in GASSA (Data no. 1,2, 5, 8, 9, 11,19,21,26). The United States wanted to fight low prices and excess production in China's steel sector by concluding an agreement that excludes China (Data no. 1,5) (Manak and Kopans-Johnson 2023; Lawder and Blenkinsop 2023; Hall 2024). However, European governments and industrial groups favored a more cautious approach that avoids direct confrontation (Data no. 7, 24).

In a similar vein, the EU remains committed to the rules of the international trade regime, while the United States was more willing to take action that circumvented existing rules (Rimini et al. 2023; GoG 2020) (Data no. 8,11). At the heart of this stands the World Trade Organization's (WTO) stipulation that countries' trade rules cannot discriminate against 'like' goods, e.g., steel plates, from other countries and that no country should be favored (Data no. 2, 5, 6, 8). Whether GASSA would have complied with this rule or not ultimately depends on its precise technical design. Yet, the EU highlighted the issue of WTO-compatibility as a concern in the negotiations (Rimini et al. 2023) (Data no. 5, 6, 8, 11, 21).

Table 1 Overview of conceptual influencing factors and their manifestation in the GASSA negotiations

Influencing factor	Manifestation in GASSA negotiations
Benefits	Avoid a trade conflict, create a clean steel market, protect green investments, harmonized MRV, signal for commitment to decarbonization

Domestic policy preferences	Different GASSA design proposals, (in)compatibilities between domestic climate policy approaches (CBAM, IRA)
Domestic structures and processes	Legal framing and decision-making procedures (i.e., keep vs. abolish U.S. Section 232 rules), US and EU electoral cycles, political majorities
Sectoral structures and stakeholders	Differing sectoral structures in terms of steel-making processes (EAF vs. BF) and their carbon intensities, opposing interests between steel interest groups
International Developments	Political pressure to decarbonize the steel sector, lack of progress in multilateral forums, availability of innovative technologies, geopolitical rivalry between China–USA, steel over production, WTO rules

6. Quo vadis, GASSA?

6.1 Prospects for GASSA and reflections on the research approach

The discussion above has provided details about why, although the USA and the EU both brought high expectations on what GASSA could achieve to the negotiations, these efforts faced many political barriers even before the second Trump U.S. government ended the negotiations.

Although the potential benefits of this cooperation were significant—ranging from avoiding a renewed Unites States–EU trade conflict to privileged market access and the joint promotion of green steel technologies—the negotiations gridlocked over the design of GASSA. At the heart of this impasse stood fundamentally different political priorities. They resulted from different positions about what is domestically acceptable as a basic concept for GASSA. The USA wanted a common tariff based on a technology-agnostic standard, a domestic basis in Section 232 rules, and a policy that charges external producers and ultimately excludes China. The EU preferred a solution that would easily align with the EU CBAM and EU ETS, and it wanted to distinguish between different steel production technologies. These proposed GASSA designs touch on domestic sensitivities: In the EU, the CBAM is tied to the credibility of the EU's (self)-image as a climate policy frontrunner and its most important source of power on the international stage, access to its single market. The U.S. proposal reflects at that time a struggle between developing a climate policy that protects domestic industries and jobs and that feeds the bipartisan narrative of confrontation with China, on the one hand, and the then administration's interest in rebuilding common ground with traditional allies, on the other.

Similar to what research found for the linking of carbon pricing policies, the technical details, i.e., whether a technology-agnostic vs. a multiple standards-approach is required, masked a discussion on potential winners and losers in both regions. They led to domestic distributional concerns, e.g., because (mostly EU-based) BF steelmakers feared that the USA (and EAF steelmakers) could gain better conditions under GASSA. Opposing stakeholder positions increased antagonism between the USA and the EU. In addition, the 2024 elections in the USA pushed decisions on GASSA from the political agenda. Even then the possibility of a government change towards a second Trump administration had a negative influence, because it was already expected that he would terminate the negotiations and reinstall his original Section 232 tariffs. For GASSA, all of these differences outweighed the potential benefits.

GASSA is nevertheless a very interesting example to study, as it still might have relevance for future cooperation for clean industrial production. Both the (potential) benefits and barriers that, in this case, came up during the negotiations can figure as 'lessons learned' for future minilateral cooperation on industrial decarbonization and motivate further research. For example, turning restrictive or, as 'unfair', perceived policies (such as Section 232 tariffs) into a cooperative solution could act as a motivator and merits more investigation in future case studies. At the same time, the interaction of cooperative initiatives with existing (climate) policies is very complex and requires detailed, case-by-case attention. The main merit of the here applied five-factor framework is that it can organize practical findings, support finding generalizable findings, and thus systematize future case comparisons. Future research could also involve a larger sample of cases, which would allow for the inclusion of quantitative elements. While the framework serves well as a tool for qualitative analyses, this methodological approach also has some uncertainties, as its small-scale set-up cannot include all possible experts and insights. Thus, in principle, it is possible that further factors have influenced the negotiations on GASSA. We find that even when strong economic benefits are expected, as in the case of GASSA, domestic political interests and structural conditions can pose formidable obstacles. This finding is in line with results from the broader literature on international cooperation: even in minilateral cooperation formats, domestic policy priorities, structural aspects, and stakeholders strongly influence the negotiators' positions and will ultimately decide over the formation of a cooperation. At the heart of this are fears that a deal could offer stronger advantages for one of the negotiating parties while disadvantaging the other. The finding that structural elements of the political system precede climate and environmental benefits is underscored by the fact that in the end GASSA was ended by the U.S. government turnover.

6.2 Outlook

During the negotiations for GASSA, the USA and the EU still seemed to have common motivations for GASSA, in spite of their apparent gridlock; namely, the desire to cooperate and find common a standard or other type of measurement for decarbonized steel. However, this situation has changed and the USA has turned its back on a common approach to climate policy and decarbonization. For steel, this is especially grave. Not only has the USA put a tariff on steel imports, its foreign policy approach and behavior has also put a break on global efforts to create a common playing field among the largest steel producers and consumers and ultimately worldwide better conditions for clean steel, such as the kick of a lead market. The lack of globally accepted standards for clean steel inhibits progress in clean steel making. Although many public and private sector alliances[6] have started to create such common standards for clean steel, no formal agreed commitments from countries to apply one standard or definition exist (Data no.6) (WTO 2022).

Therefore, if negotiations on a similar cooperative initiative such as GASSA or a 'club for clean steel' were to be taken up again in the future, the focus could lie on finding a common definition or threshold for clean steel, as an important first step (Rimini et al. 2023) (Data no.19, 21, 25, 26). The (failing) GASSA negotiations have also shown that a crucial activity before launching a more formal agreement will be that countries cooperate on the technical details and collect better information about steel related emissions, comparability of decarbonization

[6] For example: Global Forum on Steel Excess Capacity, Breakthrough Agenda, First Movers Coalition, Mission Innovation (MI)Net Zero Industries, Steel Zero

approaches, and costs. This would provide a better basis for agreement. There are many other aspects minilateral agreement could focus on, such as managing excess capacity (Marcu et al. 2024).

Further, the question of how a bilateral approach would move to a global arrangement and which members should be part of it is crucial (Unger and Quitzow 2024). Any agreement that restricts or facilitates trade in the steel sector between these two large markets will have an effect on other countries, because of the highly international exposure of steel trade. Our analysis for GASSA has shown that the USA wanted to exclude China (Hall 2024), while the EU's position on this is less clear. However, for global climate change mitigation, decarbonizing the Chinese steel production is crucial (Kaufman et al. 2023), because, as was shown above China is by far the largest producer and exporter of steel. Moreover, excluding China would further increase existing tensions or further unilateral measures. Other potential member candidates of interest to the USA and EU for a larger steel club were Canada, the UK, or Japan (Data no. 19, 21), or other large exporters like South Korea (WSA 2022; Choi 2023). However, it would also be essential to include other countries from the Global South, such as India, Indonesia, or Brazil (Data no. 2, 3, 5, 6, 7, 26), who are poised to become important centers of industrial development, and possibly to design specific rules for them. A cooperative agreement on clean steel that limits access to the EU and U.S. markets and possibly other potential G7 member countries could be perceived as coercive and as a challenge to their legitimate economic interests (Data no. 5).

Another important question left open in our analysis is whether the discussed options for GASSA would indeed result in the desired mitigation of climate change. Some critical voices argued that GASSA's incentives might not be strong enough to drive companies to actively start reducing emissions, especially in countries like the USA, which already have a low carbon intensity (Data no.14) (Kleimann 2023). Minilateral cooperation for clean production helps industrial decarbonization only if it were adopted with an ambitious set of binding rules and strict enforcement.

Ultimately, GASSA can be seen as a failure of minilateral cooperation. The factors above explain why negotiations could have succeeded, but then stalled and ultimately were cancelled. The case features the typical challenges that we face in climate governance and the decarbonization of industrial sectors, where often geopolitical interests supersede technical and climate benefits. It also shows that when clean energy or climate measures are linked to trade policy, the topic becomes politically more sensitive. While the (possibly stronger) importance of international trade can give decarbonization a push, it can also make it an easy victim to broader geopolitical concerns, financial and sectoral structures. In a global trade landscape, the absence and failure of such agreements as GASSA leads to more protectionist and unilateral policy approaches and a more conflictive atmosphere around green technology markets. This contradicts what we need to mitigate global climate change, namely, a fast and collaborative development of clean industrial sectors. Last but not least, a further topic to be researched is the question in how far the failure of a transatlantic steel alliance could incentivize stronger ties between Asian countries like China and the EU.

Declaration of competing interest

The authors declare no conflict of interest.

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Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐ The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

The authors report there are no competing interests to declare.