

International dimensions of industry decarbonization: Elements of international cooperation approaches

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SNAPFI STUDY

EU

*International dimensions
of industry decarbonization:
Elements of international
cooperation approaches*

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List of Acronyms

AMSA	ArcelorMittal South Africa
APP	Asia-Pacific Partnership on Clean Development and Climate
BOF	Basic Oxygen Furnace
CBDR-RC	Common But Differentiated Responsibilities and Respective Capabilities
CCfD	Carbon Contract for Difference
CCS	Carbon Capture and Storage
CCU	Carbon Capture and Utilization
CCUS	Carbon Capture, Utilisation and Storage
CDM	Clean Development Mechanism
CO2	Carbon dioxide
CSP	Clean Steel Partnership
EAF	Electric Arc Furnace
EII	Energy Intensive Industry
ETF	Enhanced Transparency Framework
ETS	Emission Trading System
EU	European Union
GCCC	Global Cooperation in the Climate Commons
GDP	Gross Domestic Product
GHG	Greenhouse gas
ICF	International Climate Finance
LeadIT	Leadership Industry Transition
LKAB	Luossavaara-Kiirunavaara Aktiebolag
NDC	Nationally Determined Contribution
ODA	Official Development Assistance
OECD	the Organisation for Economic Co-operation and Development
PAT	Perform, Achieve and Trade
R&D	Research and development
SAIL	Steel Authority of India Limited
SD-PAM	Sustainable Development - Policies and Measures
ULCOS	Ultra-Low CO2 Steelmaking
UNFCCC	United Nations Framework Convention on Climate Change

Executive summary

Growing greenhouse gas emissions from the industry sector represent major challenges for policy and industry actors if the global temperature targets of the Paris Agreement are to be met. This is particularly true for the situation of emerging economies, where most of the industrial growth is expected in the coming decades and where the industry sector plays a major developmental role in terms of economic growth, employment and the provision of industrial goods.

This research assesses the role of international climate finance (ICF) in the light of the principles for the global cooperation in the climate commons (GCCC) based on the example of industry decarbonization. These principles are mainly related to the international reciprocity of mitigation contributions and the associated roles of trust, transparency and agreed upon rules. Viewed internationally as an important means of implementation to advance industry decarbonization by emerging economies and developing countries, we find that till date, ICF is mostly modeled on ODA principles. Furthermore, it is characterized as a transfer instrument for support between donor and recipient countries.

Our analysis shows that ICF can play impactful roles for enhanced GCCC in the industry sector, provided that certain design features are adjusted for the programming of ICF. These adjustments are mostly related to four elements. First, there is the need to connect ICF contributions to domestic progress of climate policy in donor countries if reciprocity of mitigation contributions is intended (dubbed reversed conditionality). Second, establishing formal implementation links between ICF and political levels within countries is a way forward for the making of informed decisions on enhanced mitigation contributions and therefore, for enhancing reciprocity. Third, an important enabling factor for GCCC is to enhance access to technological and regulatory progress of donor countries for emerging economies. Fourth, the support for research and development (R&D) collaboration and implementation of innovative finance instruments, for instance, international carbon contracts for difference (CCfDs), is a necessity, but requires upscaling of ICF contributions for the industry sector.

Taking the steel sector as an example, we find that steel decarbonization initiatives are at very early stages, in particular when considering the situation of emerging economies. This makes it a compelling case for ICF because of the need to provide significant capital, which is necessary for changes in technology and production processes, but also to support R&D cooperation and international expert networks. The steel sector case study underlines our propositions on how ICF can contribute to enhanced GCCC: both sides, donors and recipient countries, can increase global mitigation contributions and donor countries can grant access to technological and regulatory progress towards decarbonization of the steel sector to emerging economies' policy actors and industry representatives (ICF to enhance reciprocity of mitigation contributions).

We find evidence that international top-down approaches such as harmonized carbon prices are possibly only feasible, if combined with a bottom-up approach: ICF can support development of industry decarbonization policy mixes in emerging economies and provide finance (for instance through CCfDs). That way, ICF can provide important bottom-up elements towards establishing level playing fields, as often called for in the literature and real-life policy processes.

For ICF to play that role, particularly in the steel sector, certain issues need to be addressed. First and foremost, suitable ICF instruments such as CCfDs are needed. Currently, definitions and standards, of what constitutes low-carbon (or green) steel are not available but needed because only then consumers are informed about their choices. For the latter point in particular, but also to establish suitable decarbonization policy mixes such that ICF finds conducive implementation environments, political will is needed.



CHAPTER ONE —————>

Introduction

Rising greenhouse gas (GHG) emissions are not the only concern to policy makers when considering the industry sector. Industries – especially the basic materials sub sector – produce goods that are traded and consumed both domestically and internationally, and therefore are important drivers of development, as it is stated in the Lima Declaration (2013, Paragraph 2):

“Industry increases productivity, job creation and generates income, thereby contributing to poverty eradication and addressing other development goals, as well as providing opportunities for social inclusion, including gender equality, empowering women and girls and creating decent employment for the youth. As industry develops, it drives an increase of value addition and enhances the application of science, technology and innovation, therefore encouraging greater investment in skills and education, and thus providing the resources to meet broader, inclusive and sustainable development objectives”

Hence, addressing emissions of GHG from the industry sector is as much a developmental as well as a climate policy issue. Additionally, the industry sector is characterized by several transnational processes and related effects such as international trade, supply and value chains, and – with regards to climate aspects – the potential of industries to relocate internationally in case industry leaders consider national policy frameworks inconducive. This phenomenon is known as carbon leakage (European Commission, 2010).

The fact that industries are rather bound by technologies, products and their markets, and much less by national boundaries, has led researchers and policy actors to conceptualize sectoral approaches in the context of international climate policy and the United Nations Framework Convention on Climate Change (UNFCCC) early on. The central objective was to establish a level playing field which transcends national boundaries, and which should enable conducive market conditions for low carbon industrial products. Such conceptual proposals were frequently coupled with recommendations to introduce international carbon pricing mechanisms such as the Clean Development Mechanism (CDM) (Fujiwara & Egenhofer, 2008), or international emissions trading (van Asselt et al., 2009). Sectoral approaches of such types were with few exceptions (e.g., Asia-Pacific Partnership on Clean Development and Climate (APP)) not implemented due to a lack of agreement in the UNFCCC negotiations.

A more recent strand of literature deals with the concept of climate clubs, where a coalition of countries pursues the decarbonization of industries by establishing club rules such as agreed sanctions for non-complying members, as well as agreements on beneficial outputs such as level playing fields for green industrial products. Much of the climate club literature stems from the disciplines of international economics and is based on assumptions about incentives and disincentives of participating actors, as well as on the rational decision-making process for or against membership in such clubs.

The literature has so far failed to deliver a detailed overview of the situation of emerging economies when it comes to the industry's status of decarbonization, connected challenges and potentials, as well as to the policy environments in which it operates. Further, the role of international climate finance (ICF) and Official Development Assistance (ODA) for industry decarbonization, considering the transnational features described above, has yet to be addressed. Another new area which we are covering here is the connectivity with the Paris Agreement process, in particular a vision of upscaling mitigation contributions towards net zero and the role of the industry sector therein. We intend to address these gaps by analyzing the so far undescribed contribution of international cooperation (including ICF) towards enabling global collective action in the climate commons – using the industry sector as a case study.

The latter point is important because of the past history of Common But Differentiated Responsibilities and Respective Capabilities (CBDR-RC), and the difficult climate negotiations it entailed on fair mitigation contributions for one side, and international support and finance for the other side. Those two sides were not brought together in the industry sector. Hence, we want to understand:

- › How do industries interact transnationally through the lens of climate policy between the European Union (EU) and third countries (emerging economies)?
- › What are the prerequisites for industry decarbonization to succeed in emerging economies?
- › What are possibilities for donor countries such as the EU to support decarbonization abroad?
- › Under what conditions can ICF play a facilitating role towards fair shares of mitigation contributions and global cooperation in the climate commons (GCCC) in the industry sector?

Our aim is to contribute to the literature by proposing a concept for international support and ICF, which effectively advances industry decarbonization, and supports GCCC. The particular focus of the study is the industry sector, and it includes a detailed case study of the steel sector. A set of propositions for the effective linking of the two levels (1) implementation of ICF and international support and (2) GCCC for industry decarbonization complements this. These propositions build on core enabling factors for global cooperation such as reciprocity of contributions, trust, transparency, communication and rules (for instance, Ostrom, 2010; Carattini et al., 2019).

The primary target group of this research report are government representatives of EU and respective member states such as Germany in charge of designing ICF and related support programs: our aim is to suggest novel design options for ICF for industry decarbonization. Furthermore, we aim at government and industry representatives of emerging economies, as the principal partners for ICF negotiation and implementation. The third target group is the research community in the area of international cooperation for industry decarbonization, and global cooperation in the climate commons.



CHAPTER TWO —————>

Research design and methods

The research design consists of a combined approach of comparative case studies and a more general review of industry decarbonization in the EU and emerging economies. Through an abductive approach, we derive our propositions from empirical findings. In the light of both rising global GHG emissions and the increasing industrial production of emerging economies, we focused on a selection of countries: the EU, India and South Africa. For a more in-depth case study approach, the steel sectors in South Africa and India were chosen because these two cases allow a comparative approach: both feature an economically important steel industry, but with different dispositions in terms of climate policy goal setting. These case studies allow us to gain more detailed information and conclusions, which we use to enrich the general review and the propositions.

We put these two cases in contrast with the industry sector climate policy in the EU to analyze and better understand how developed countries and emerging economies could cooperate internationally. On the one hand, our research is explorative, as its aim is to identify which aspects and elements play a role in the transnational dimension of industry decarbonization. On the other hand, we develop initial propositions and an analytical framework (chapter 5), thus resorting to a deductive approach.

In terms of methodology, we combine a literature review and expert interviews to obtain qualitative data. The literature review includes academic and non-academic publications as well as policy documents, both international and national. The interviewees were selected based on a stakeholder mapping and embody all relevant segments, i.e., government, private sector, international organizations, finance, and academia. Table 2 provides an overview on the conducted interviews.

The qualitative data is complemented with quantitative data: the latter gives an overview on GHG emissions, economic and social significance of the industry sector, as well as on international flows of ICF and industry trade. We use a qualitative coding method to build the propositions by identifying narrative elements through a refining process, using the primary data contained in the interview transcripts and review results (DeCuir-Gunby et al., 2011).

CHAPTER THREE —————>

**Industry in the context
of international and
national climate policy**

Before taking a closer look at some of the aspects of the industrial sector, the definition of the concept we will be using should be clarified. The term “industry” has broadened up considerably in the past decades to include all types of economic activities (i.e., the banking industry). However, the definition we will be working with is a narrower one: “the industry sector consists of mining and quarrying, manufacturing, construction, and public utilities (electricity, gas, and water)” (World Bank Group, 2021a).

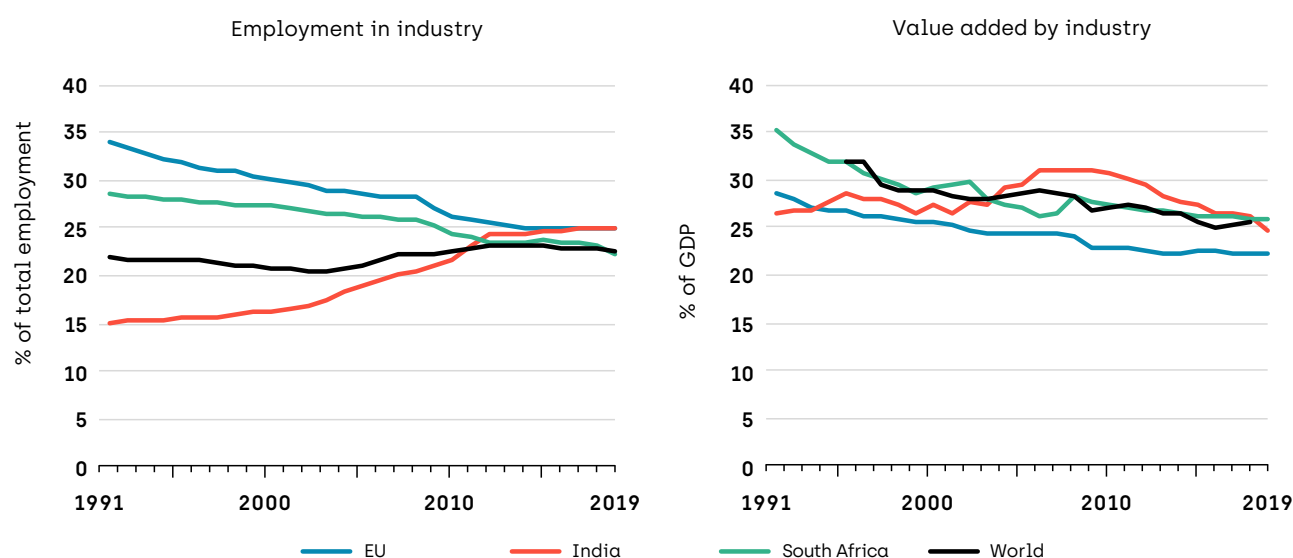
The importance of industry in the economic development of a country became apparent at latest with the industrial revolution at the end of the 19th century. Industrialization not only drove economic growth and technological innovation, but also coincided with a series of socio-economic and political ameliorations (Bairoch & Kozul-Wright, 1998). Amongst others, industry has since then “contributed to higher export potential, better standards of living, and more jobs” (Manufacturing Institute and Deloitte, 2015: 2).

As this study will focus mostly on the industrial sector within India, South Africa and the EU, we here look at some specific numbers for these countries. The reasons for the choice of countries will become apparent in the next section when we explain it in more detail.

Figure 1 illustrates the central socio-economic role of industries within India, South Africa and the EU. In all countries, industry accounts for approximately one quarter of both employment and value added to the economy (as percentage of Gross Domestic Product (GDP)). For the EU alone, this corresponds to more than 30 million jobs. Additionally, the European industrial sector is responsible for 90% of EU exports (German Federal Ministry for Economic Affairs and Energy, n.d.).

FIGURE 1

Employment (left) and GDP (right) share of the industrial sector

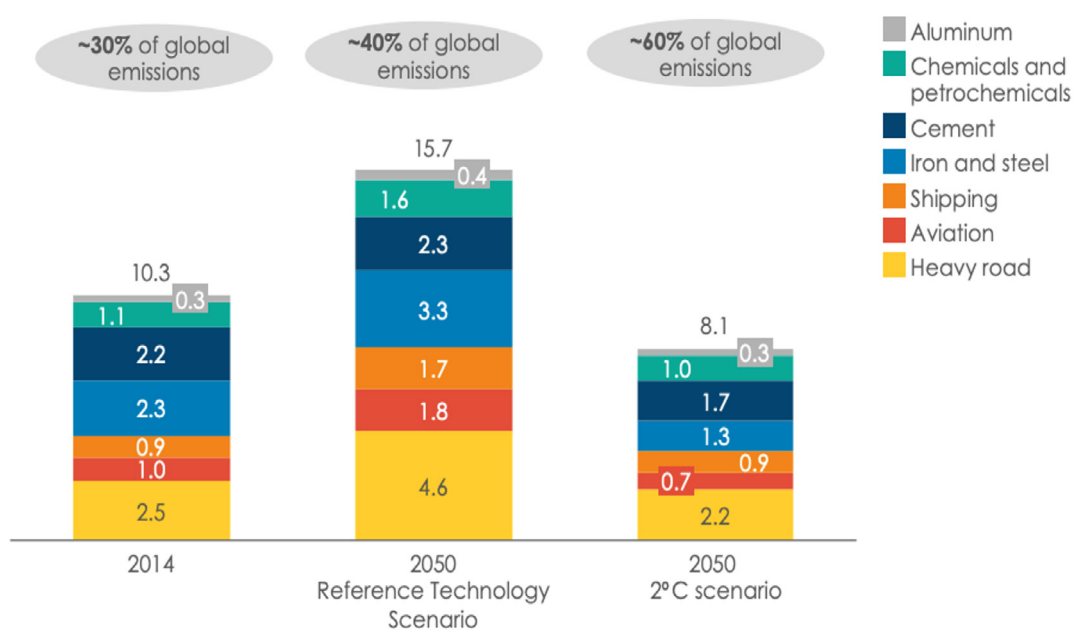


Source: World Bank Group, 2021b; World Bank Group, 2021c.

Next to those socio-economic characteristics, industry also has a major impact on the environment. The industrial sector, contributing to approximately one third of global GHG emissions, is one of the major sources of such emissions. If business goes on as usual, industry could end up accounting for the biggest share of emissions by 2050 (Bellona Foundation, 2018). This would imply an increase of current industry emissions by up to 50% (Energy Transitions Commission, 2018). This problem is even more acute for emerging economies, where industrial emissions have been rising sharply in the past 30 years. Those trends are laid out in Figures 2 and 3.

FIGURE 2

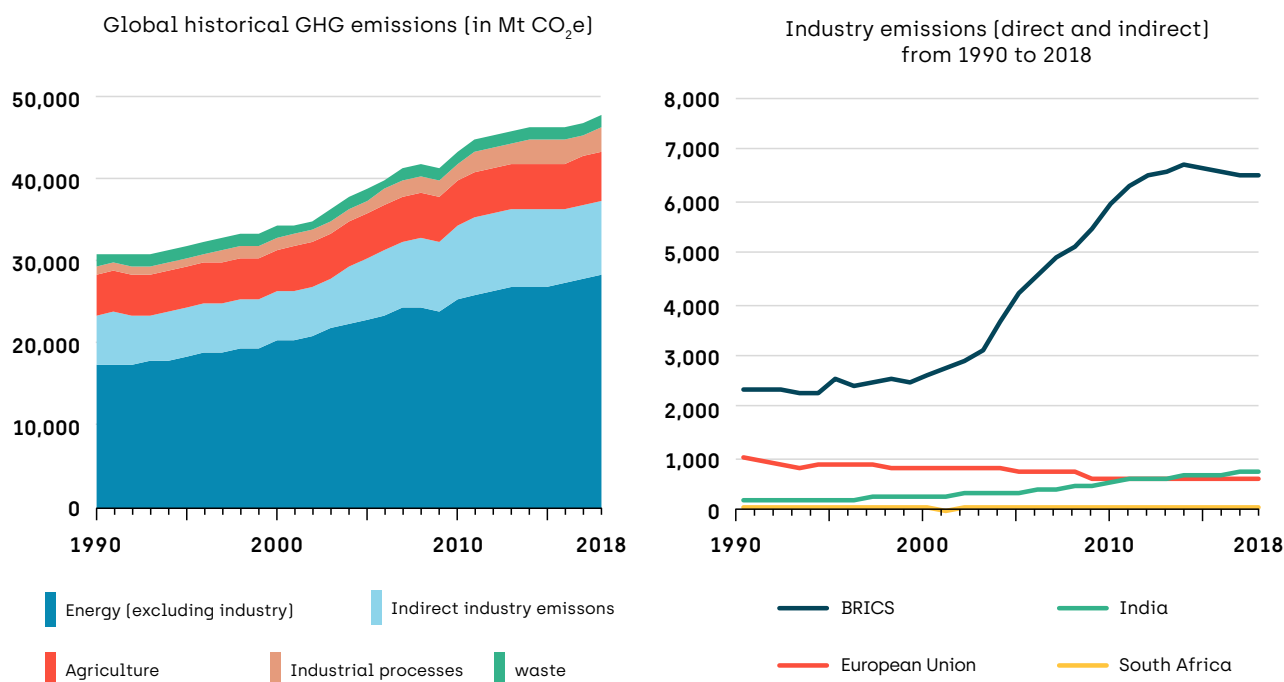
Direct and process emissions from industries according to reference and 2°C scenarios



Source: Energy Transitions Commission, 2018.

FIGURE 3

Overview on historic emissions from all sectors (left) and industry emissions (right)



Note: Indirect industry emissions are defined in terms of energy use in manufacturing and construction.

Source: Climate Watch, 2021.

While such findings and observations rather unequivocally call for imminent mitigation in the industrial sector, the steps that have been taken so far vary substantially from one country to another (Shawoo & Johnson, 2019). Table 1 lists India's, South Africa's and the EU's policies and regulations with regard to industry decarbonization as well as their respective Nationally Determined Contributions (NDCs). Of the three countries, two have so far introduced a carbon pricing mechanism: the EU and South Africa. However, both are still criticized for their low prices that do not provide enough incentives for industry to become greener (Fallmann et al., 2015; PwC, 2021).

India, on the other hand, like most developing and emerging economies, has not yet implemented any type of generalized country-wide carbon pricing mechanism. Typically, those countries fear the additional burden on their economy even more than developed countries (Bataille et al., 2018; World Bank, 2021).

Nevertheless, India has implemented several policies and regulations directed at the industry, most notably the Perform, Achieve and Trade (PAT) mechanism. These measures have led a study of the Stockholm Environment Institute to classify India among only 6 countries whose NDCs scored "high" in terms of bridging the gap to low-carbon-emissions transitions in industry. The "high" score was awarded to NDCs which specified transition measures for industry that were "detailed and comprehensive enough to constitute something akin to an industrial transition map" (Shawoo & Johnson, 2019).

The other countries that achieved this high score were China, Indonesia, Japan, Morocco and Uruguay (ibid.).

The EU too has come forward with plans to complement its Emission Trading System (ETS). In December 2019, the EU announced its European Green Deal, amongst others raising its ambitions for the 2030 emissions reduction goal and targeting carbon neutrality by 2050 (European Commission, 2019a). Following this announcement, the Commission also presented the New Industrial Strategy, which aims at helping to decarbonize the industry in view of the net zero target (European Commission, 2020a).

TABLE 1

Industry sector in NDCs of India, South Africa and the EU

Country	Main targets of the NDCs	Industry decarbonization targets in the NDCs	Policy measures and private initiatives aimed at reducing emissions in the industrial sector
India	India plans to reduce the emissions intensity of its economy by 33-35% until 2030 (baseline 2005).	India's NDCs contains two sections of interest, each of which details policy action taken by the government (Government of India, 2016): 1. Enhancing energy efficiency in industries 2. Abatement of pollution Both contain specific measures addressing the industry (see column to the right).	Policy measures (mentioned in NDC): <ul style="list-style-type: none"> › Perform, Achieve and Trade (PAT) › Zero Effect, Zero Defect › Continuous Emission Monitoring System › Common Effluent Treatment Plants › Fly Ash Utilization Policy › Zero Liquid Discharge Further policy measures: <ul style="list-style-type: none"> › Coal"cess" tax › Revised tariff policy › National biofuels policy › National mission for electric mobility
South Africa	South Africa pledged to peak its emissions between 2020 and 2025 and to reduce them in the 2030s. This would correspond to an increase in emissions of 17-78% above 1990 levels by 2030.	NDC does not mention any industry transition measures (Government of South Africa, 2021).	Policy measures: <ul style="list-style-type: none"> › Carbon price › Integrated Energy Plans › National Energy Efficiency Strategy › Biofuels industrial strategy
EU	The EU committed itself to reducing its emissions by 55% by 2030 (baseline 1990) and to become carbon neutral by 2050.	NDC does not include detailed measures for industry transition (at least not at the subnational level) (European Commission, 2020a).	Policy measures: <ul style="list-style-type: none"> › New industrial strategy › ETS › European Hydrogen Strategy › Green Deal

Source: Climate Action Tracker, 2021; European Commission, 2019a; European Commission, 2020a; Shawoo & Johnson, 2019.

The gap which becomes apparent when looking at the inclusion of industry decarbonization measures into NDCs reflects policy makers fears of consequences of unilateral climate action (Böhringer & Alexeeva-Talebi, 2011). We will thus continue by looking at alternative cooperative approaches, through which countries can approach industry decarbonization.



CHAPTER FOUR —————>

**The case for international
cooperation for industry
decarbonization**

In this section, we argue that international cooperation is necessary for decarbonization of industry. First, we will analyze the literature on international aspects of the industry decarbonization; second, we will revisit the existing publications on sectoral approaches and climate clubs; third, we will present literature on the connections between ICF, ODA for industry mitigation and GCCC. Last, we will provide a short insight into commonly used finance instruments, which shall serve as a basis for our propositions.

We will argue here that the existing literature underlines the international character of industry decarbonization, which makes it a particularly attractive case for transboundary policy proposals. In specific, we will investigate sectoral approaches and climate clubs. In recent years, large numbers of publications dealt with ways to address international risks of industry decarbonization, such as carbon leakage and industry relocation, and analyzed options to address them (for instance, through carbon border adjustment mechanisms). Three areas were identified as relevant gaps in the literature.

First, the linkages of ICF and ODA-based support with the industry sector have so far been under-researched. Yet, understanding them is crucial in determining how international support can contribute to the decarbonization of industry sectors in emerging economies.

Second, the literature analyzing climate policies in the industry sector, in particular when it comes to providing a systemic understanding of the full policy context in emerging economies, is scant. This is a relevant gap as a deeper understanding of this situation would allow us to identify better options for linking ICF and industrial decarbonization policies, thereby increasing effectiveness of support.

Third, the integration of the industry sector into national climate and development policy frameworks gathers momentum, but lags behind compared to other sectors. Amongst others, this is driven by the fear of carbon leakage and loss of competitiveness, which has so far inhibited climate action in the industry sector in both developing and developed countries. It raises the question, under what conditions countries would increase their nationally appropriate mitigation shares in the industry sector, and what role ICF and international support can play to facilitate such processes. The literature review did not identify any publications on this topic; hence we took up these central questions for our research.

4.1 International aspects of industry decarbonization

When comparing the status of policy development for mitigation in the industry sectors with respective emission trends, a significant space for increasing ambitions of climate targets becomes discernible (Shawoo & Johnson, 2019). Why do governments struggle so much in implementing stringent policies in the industrial sector?

Essentially, the answer lies in the transnational characteristics of the industrial sector. For one thing, trade makes the industry a highly international playing field: nearly one quarter of all steel products are traded internationally (World Steel Association, 2020). This is true, even though it should be noted that some industries, such as the cement industry, have a stronger domestic focus (Lehne & Preston, 2018). Similarly, the supply and value chains of single companies are laid out across countries and even continents (Hermwille, 2019). A lot of companies are transnational up to the degree that certain sub-sectors, such as, for example, the South African steel sector (Barnard, 2015), have become heavily internationalized. This underlines the importance of company internal climate policies. Many of the transnational companies have headquarter driven policies, which in turn are important parameters for the national policy making processes in the countries in which they operate.

It has been argued for the above reasons that industry decarbonization can be most effectively addressed by transboundary policy approaches in combination with domestic policy mixes. Unilateral policies and actions are perceived to be difficult due to the socio-economic importance of the sector and related concerns of losing competitiveness as well as the looming risk of industry relocation if stringent climate policies are introduced (Victor et al., 2019; Hermwille, 2019). This has earned industry the title of the hard to abate sector (Singh et al., 2020).

While the above concerns and risks were brought as arguments into real-life policy discourses, the literature reveals a more nuanced picture as we show in the following section.

Indeed, the literature seems to suggest that the impact of environmental regulations on relocation seems to be negligible at most. Smarzynska (2002) points out that rather than the laxer environmental regulations in developing economies, it is their economic growth that attracts foreign companies. Additionally, in most cases, the abatement costs would be insignificant compared to those costs incurring through relocation from industrialized countries into developing economies: tariffs, transport costs, labor productivity, volatility in exchange rates and political risk (Oikonomou et al., 2006). More specifically, Ederington and Minier (2003) underline that heavy industries are capital intensive, which makes it more costly to move than for industries which are not bound by capital intensive production sites and hence more mobile.

Some empirical evidence has shown that individual sectors, such as cement or steel, may suffer short-term loss of competitiveness due to environmental regulations (Martin et al., 2016; Dechezleprêtre & Sato, 2017; Joltreau & Sommerfeld, 2019; Venmans et al., 2020). However, looking at consequences of the introduction of the EU ETS, there have so far been no observable effects on the competitiveness of industries or on their relocation (Branger et al., 2016; Naegele & Zaklan, 2019).

Overall, this does not draw a convincing case for the severity of the leakage risk. However, one should note that the results so far provided are sketchy at best. For one thing, those effects might not yet be observable because environmental policies have not been stringent enough so far (Evans et al., 2020). Even in the cases where emission trading systems have been established, industrial actors have largely been granted allowances to cover their emissions for free.

The question thus is: what would happen once carbon pricing policies become truly ambitious? Another caveat of the current research is that none of it analyses what would happen in emerging economies. Therefore, results should be interpreted with caution.

4.2 Sectoral approaches and climate clubs

Looking at the complications that the decarbonization of the industrial sector entails, sectoral approaches and climate clubs have been proposed as solutions to facilitate the process. Their main idea is to focus the setting of environmental targets on some key sectors or between some key actors in order to simplify negotiations and get better chances at achieving an agreement. While the idea of sectoral approaches or climate clubs is not new, this shift in perceptions and responsibilities since the Paris Agreement provides a new context for them.

During the period of negotiating for the Kyoto protocol successor agreement, the prevailing notion was still one of a top-down global agreement, where targets would be agreed upon on a global level and somehow allocated to (groups of) countries. In addition, the CBDR-RC principle was still adhered to. International emission trading and flexible mechanisms (for instance, CDM) were then viewed as connectors between countries' emission reduction efforts (Fujiwara & Egenhofer, 2008). This changed after the failure of the COP 15 in Copenhagen: following COP 15, Parties to the UNFCCC agreed on a more bottom-up process and on formulating NDCs, which resulted in a mosaic of different (nationally determined) targets, policy approaches and instrument choices. While the CBDR-RC principle is still present, its interpretation has become much more flexible and has effectively been replaced by a process of "self-differentiation" through which groups of countries emerged as a consequence of the NDC formulation (Pauw et al., 2019). Differences between countries are now additionally determined by reporting requirements. Further, there is a differentiation between countries which are supposed to provide climate finance, technology transfer and capacity development, and those, which are supposed to receive such means of implementation (ibid.).

The literature contains mostly conceptual work on sectoral approaches and climate clubs, while empirical research on transboundary policy initiatives is scarcer. Literature on climate clubs in particular – building on the discipline of international economics – assesses options and conditions for countries to join clubs as a balance between club benefits (for instance, access to green markets) and sanctions for non-members which are non-compliant to club rules. The central idea is to overcome the problem of international free riding by agreeing on international prices on carbon and on further club rules (Nordhaus, 2015). Subjecting the industry sector to this strand of literature (Oberghassel et al., 2020), authors have recommended to go beyond agreements on international carbon prices (and hence establish level playing fields to address competitiveness concerns). As noted elsewhere, the introduction of carbon prices will likely not be sufficient to enable the transition of whole industries (Åhman et al., 2020) and additional measures should contain cooperation on research and development, international finance, and transfer of technologies (Oberghassel et al., 2020).

The literature reveals that climate clubs are also very controversial. Mainly, their lack of political legitimacy has made them hard to defend, as this has resulted in little support from the political elite and the general public (Gampfer, 2016). In addition, looking at the few tentative approaches that can be qualified as clubs, Andresen has found that club members have so far not demonstrated a better climate policy performance (Andresen, 2014).

The second type of cooperative partnership we will look into is the sectoral approach. Åhman et al. (2017) present two dimensions along which sectoral approaches can be defined: approaches with respect to technology and approaches with respect to trade measures. The first can include transfer mechanisms, the promotion of innovation and the development of new zero emission technologies. The latter refers to the implementation of measures such as a carbon border adjustment or carbon clubs. Their main aim is the levelling of the playing field and the avoidance of unfair protectionism (ibid.). Note that climate clubs are a subset of sectoral approaches.

Previous propositions range from radical ideas such as the Japanese “carve-out” model (ibid.) – in which separate targets would be introduced specifically for Energy Intensive Industries (EIs) and where the responsibility would be entirely shared between Annex 1 and non-Annex 1 countries – to softer concepts, such as Sustainable Development - Policies and Measures (SD-PAM) mechanism (Winkler et al., 2002), in which the sustainability goals and targets would be entirely focused on the individuality of each country and where the costs would be carried by developed countries.

Nevertheless, there have only been few implementations of such sectoral approaches so far, mostly in the early 2000s. In the EI sector, initiatives were taken in the aluminium sector, by the International Aluminium Institute, in the steel sector, by the International Iron and Steel Institute (today’s World Steel Association), and in the cement sector, by the Cement Sustainability Initiative (Egenhofer, 2008). Mainly, those approaches aimed at data gathering, the setting of energy efficiency goals and the making of policy proposals.

Another notable attempt for a sectoral approach, which has also been coined as a climate club, is the APP that brought together Australia, Canada, China, India, Japan, South Korea and the US and included industry specific task forces (Karlsson-Vinkhuyzen & van Asselt, 2009). Announced in 2009, it did however not last much more than 5 years.

These attempts for climate clubs and sectoral approaches can give us an idea of what factors promote cooperation within those frameworks. Hovi et al. (2016) argue that the initiation must come from the right constellation of actors, ideally powerful actors such as the EU or the US. In the case of the APP partnership, the initiation by the US was certainly an important factor for other joining countries. The more powerful the country that makes the offer is, the harder it is to refuse (Karlsson-Vinkhuyzen & van Asselt, 2009). Further, to convince reluctant countries, there should be sufficiently large incentives: “the combination of conditional commitments and a club good is highly conducive for fostering effective climate clubs” (Hovi et al., 2016: 6).

Finally, and quite intuitively, there should not be any important disputes in dimensions outside of the climate discussion, i.e., countries should be on relatively good terms (ibid.). Karlsson-Vinkhuyzen and van Asselt (2009) assume that it is indeed the ideological similarities of the Bush and Howard governments that helped in moving the APP deal forward.

The literature on climate clubs and sectoral approaches points out the advantages of such approaches in terms of political dialogues and in terms of possible structures to advance international carbon prices, but does not address the question, how such international policy approaches can assist in other policy objectives of the policy mix required to enable just industry transitions. Therefore, we turn the focus on ICF and international assistance - dealt with in a separate strand of literature - in the next section.

4.3 Overview on ICF and ODA for industry mitigation

While there is a significant body of literature on ICF and assistance for emerging economies, including for transitions in the energy sector (e.g., Marquardt et al., 2016; Peake & Ekins, 2017), much less has been written on the options to support just industry transitions. Studies on the topic point out the central role of finance to cover the often-substantial costs, which are incurred by switching technologies and production methods towards decarbonization (Bataille, 2020).

A large role is described for the international finance institutions: transitioning the economy to net-zero emissions will require trillions of dollars (Baraldi et al., 2021). While the public sector alone cannot provide this financial assistance, the private sector largely refrains from engaging because of the high risk associated with those investments (especially in the heavy industry) (ibid.). Thus, the net zero transition requires strong collaboration between the public sector, finance and the industry (Anstey et al., 2021). Since a large chunk of the industry sector is located in emerging economies (i.e., the steel industry), the role of ICF in this interplay is essential (World Steel Association, 2020). This has become more acute, now that economies are still reeling from the pandemic and that priorities of developing countries have shifted towards developmental needs (United National Environment Programme, 2020). Following the strong shift in international development finance towards phasing out of coal financing in recent years, a normative call would be that donor and international finance institutions agree on a needed stop for financing carbon-intensive industries.

In their case study on policy approaches to decarbonize the Indian heavy industry sector, Singh et al. (2020) identify a range of needs for ICF and assistance. In this process of decarbonization, it is central that an overall coherent policy package, explicitly targeting industry decarbonization, be put in place. Specific needs for assistance include, among others, support in enhancing demand for green industrial products domestically and abroad, the creation of cross-sector bridges with uptake sectors such as transport and the introduction of green public procurement.

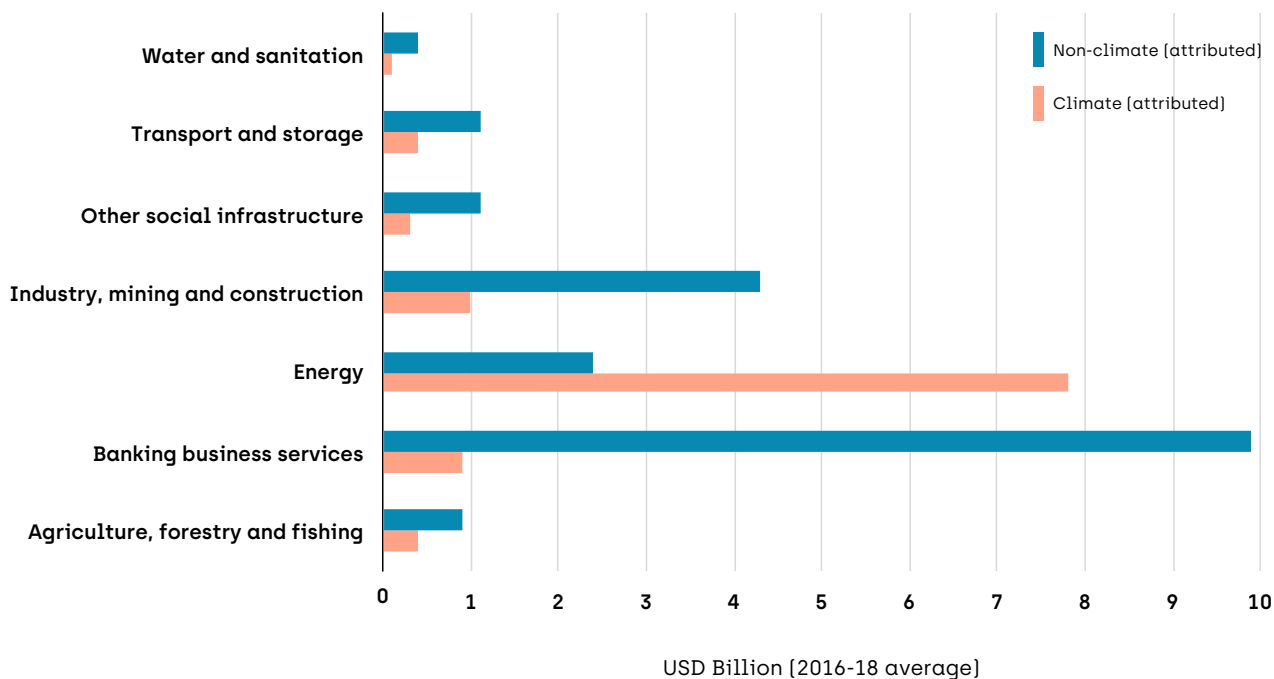
Abatement technology development and deployment, as well as the closely linked introduction of risk sharing mechanisms and blended finance instruments, need to be financed. International support can also lead to the development and implementation of pilot and demonstration projects. This list highlights the need for an intimate connection between policy development, the private sector, ICF and related international support.

However, relatively little support focuses on the greening of the industry so far. As of this day, only scarce data is provided on the status quo. While large amounts are spent through ODA or ICF on either supporting the development of industry or protecting the environment through various measures, there is no detailed data on the total amount of finance flowing into the decarbonization of industry.

According to the Organisation for Economic Cooperation and Development (OECD) (2020), between 2016 and 2018, approximately 1 billion USD were mobilized per year by the private sector for climate-related purposes in the industry sector. This is more than four times less than what was mobilized for non-climate related purposes in the industry sector – and this is without considering that, according to the authors, the non-climate attributed part of the finance flows may be underestimated (OECD, 2020). Figure 4 also highlights the fact that climate attributed finance mobilized by the private sector mostly focuses on energy.

FIGURE 4

Private finance mobilized by sector and year

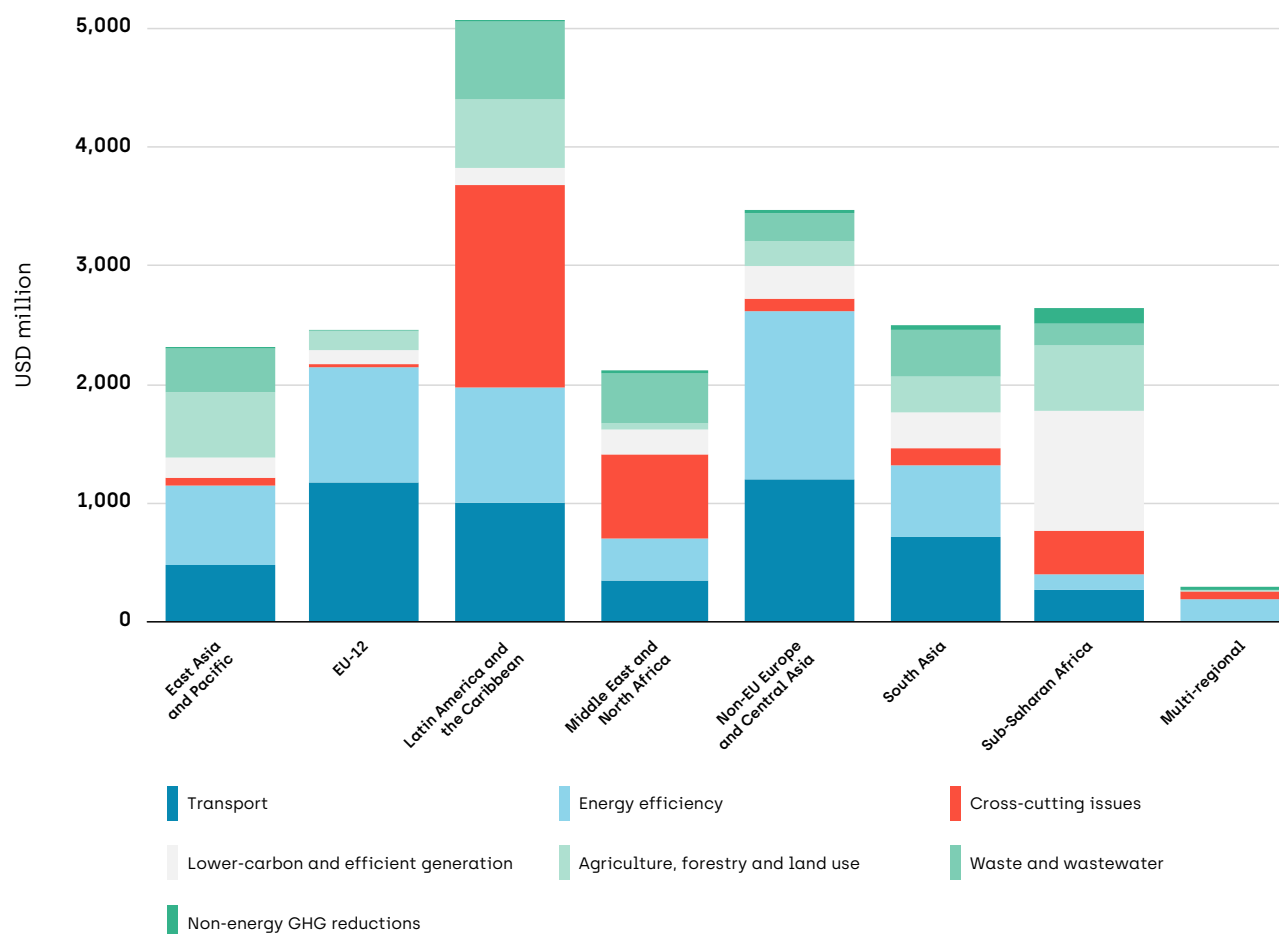


Source: OECD, 2020.

Finance provided by multilateral development banks for mitigation sketch an even more compelling picture. The amounts spent on industry, manufacturing and trade are barely discernible in Figure 5. Recent estimates of climate finance flows for the two countries of our case study, India (CPI, 2020) and South Africa (CPI, 2021), reveal that specific figures for the industry could not be disaggregated now (India), while for South Africa, the share of finance flows into the industry sector is likely less than 1 %.

FIGURE 5

Mitigation finance by Multilateral development banks, 2018



Source: African Development Bank et al., 2018.

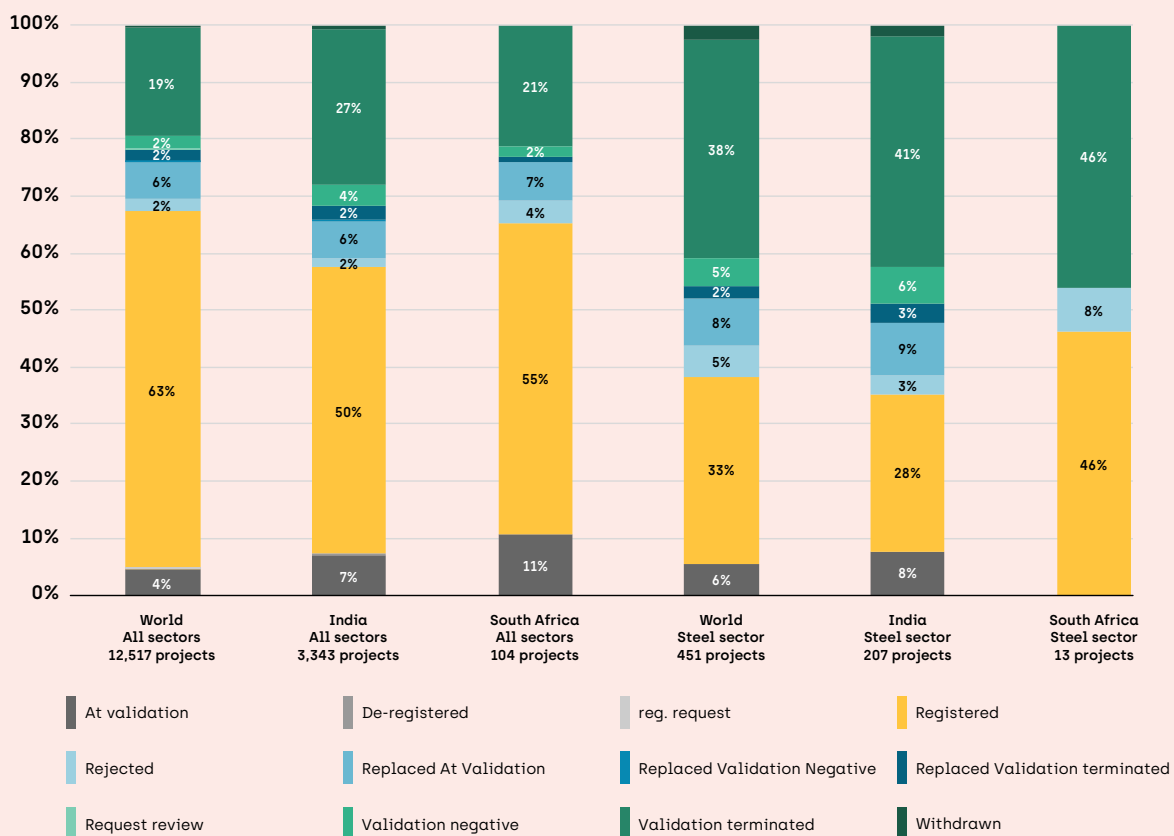
In regard to a particular form of climate finance, carbon finance via the CDM, the box below provides an overview on CDM finance for mitigation projects for the steel and iron sector.

BOX

The figure presents the status of CDM projects as of 1 May 2021. The figure attests that out of CDM projects submitted for all sectors of the world, about 33% do not achieve the successful registration of certified emission reductions (CERs). This figure is 42% and 35% for all CDM projects initiated in India and South Africa, respectively. When it comes to the analysis of the CDM projects in the steel and iron sector, at a global level 62% do not reach the successful finish, with similar figures in the steel and iron sector of India and SA of 65% and 54%, respectively. The reasons for such poor performance in the iron and steel sector is not sufficiently clear, because there is no clear correlation between such performance and available in the database characteristics of the projects. For the steel sector projects in South Africa, the credit buyers were from the Netherlands and Australia. For the steel sector projects in India, the credit buyers were from the UK, Switzerland, Norway, and Sweden.

FIGURE 6

Status of CDM projects as of 1 May 2021



Note: the projects assumed under the iron and steel sectors were those related to iron & steel, iron & steel heat, coke oven, coke oven gas.

Source: author analyses based on UNEP DTU Partnership (online), CDM pipeline overview, URL: <https://www.cdmpipeline.org/> (consulted 21.05.2021)

The above graphs point out the huge gaps that exist both in the data and in finance for industry decarbonization itself. Our aim is to contribute to the literature by pointing out ways in which finance can support industry decarbonization and the international cooperation that is a necessary precondition for it.

We can conclude from the literature review that the publications on international policy approaches - mostly partnerships, climate clubs and sectoral approaches - and those related to ICF and assistance contribute differently to identifying options on how the transnational dimensions of industry decarbonization can be addressed. A third strand of relevant literature, on the GCCC, features a number of promising connections to the former two and is presented in the next chapter. Let us now proceed with the analytical framework, after which we will look at specific ways in which the transition in the steel industry can be accelerated through international cooperation and ICF.



CHAPTER FIVE —————>

The analytical framework: combining GCCC and ICF

International climate finance can be understood as a transfer of assistance measures from developed to developing countries intended to support mitigation and adaptation measures that will address climate change (UNFCCC, 2021). Under the UNFCCC, developed countries have committed to mobilize 100 billion USD annually from 2020 onwards (Skovgaard, 2017), which is interpreted to come from both public and private sources. Yet, it is widely acknowledged that a lack of definitions on what counts as climate finance and on how to account for and report on the respective flows contributes to considerable uncertainties, whether these amounts are met, as well as to diverging views on which activities they are flowing into (Roberts et al., 2021).

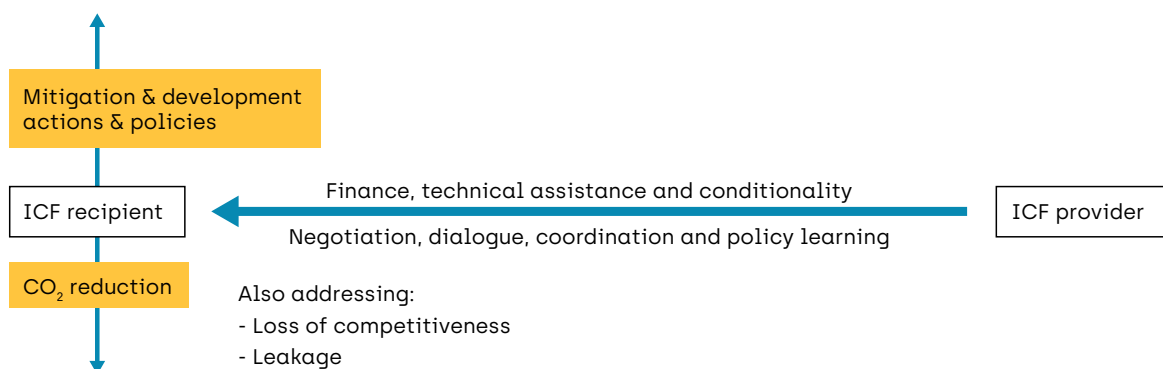
Even though never agreed upon in the UNFCCC process, international public climate finance is channeled and disbursed through many of the same systems as ODA and informal agreements exist that ICF is to follow similar principles as ODA (Ellis et al., 2013). According to the OECD-facilitated Busan partnership (OECD, 2012), the following key principles for effective climate finance were set up:

- › Partner countries’ ownership: recipient countries should be able to use the finance based on their strategic objectives. Stand-alone projects should give way to integrated programs with national policies and plans.
- › Alignment of donors with partner countries’ systems: climate finance should be channeled through national systems. The setting up of parallel systems should be avoided.
- › Harmonization of donor’s programs: donors should ensure coherence of climate finance across ODA programs and coordinate contributions.

Applying the principles outlined above, a model can be drawn, in which ICF contributes to the implementation of climate and development policies, based on the needs of the recipient country (Figure 7). In such a model, the ownership over the policies and actions supported by ICF is held by the recipient country, who, in respect of national sovereignty, can define its own appropriate sustainable development paths (Winkler & Dubash, 2016). Taking a further step towards strengthening national ownership, the modality of direct access by developing countries is regarded as an important means to safeguard that priority setting and policy decision making remain as spheres controlled exclusively by developing countries.

FIGURE 7

Stylized model of ICF flows for industry decarbonization



The literature does not provide examples in which ICF agreements between providing and recipient countries were made conditional upon the amount of mitigation efforts by developing countries. Even though this is understandable in the light of the difficult negotiation history under the UNFCCC and the CBDR-RC, a significant number of developing countries' NDCs contain conditionalities. These conditionalities make mitigation contributions contingent on – among others – the provision of ICF (Pauw et al., 2020). In practice, foreign influences and impacts of support on domestic policy processes were detected and subsequently modelled by researchers (Steinberg, 2003; Bernstein & Cashore, 2012; Jodoin, 2017). The spheres of interaction between national and international actors and institutions when implementing ICF and ODA are oftentimes subject to preoccupations by developing countries: political and economic influence seeking, technology export interests and a hidden agenda are some of the criticisms overshadowing bilateral and multilateral cooperation.

Nevertheless, we argue that concepts for and approaches to ICF can be fruitfully combined with a second – and thus far unconnected - thread of literature: the body of scientific work on the options and conditions for GCCC. Combining these two strands might allow an assessment of options through which ICF can enhance GCCC, and in the scope of our paper, more specifically so in the industry sector.

5.1 Global cooperation in the climate commons [GCCC]

Ostrom (1990) developed a set of institutional rules for governing collective action as a means to sustainably manage common pool resources. This made it possible to move beyond the tragedy of the commons situations, to which global climate change is no exception (Cole, 2015). Cooperation in the area of climate commons is key to overcoming such situations, and contrasts with the typical assumption that agents act strictly in their own interest (Högl, 2018). Enabling factors for such cooperation are communication and trust, rules and fairness, reputation and reciprocity (ibid).

Given that Ostrom developed her theories - according to which people would cooperate to manage common pool resources sustainably - mostly on local levels, a more recent strand of research has sought to understand under what conditions such cooperation could also occur on the global level. Cooperation on this level implies that countries contribute mutually to the mitigation of climate change, while minimizing free riding, a problem that would occur if a country decided not to cooperate but instead benefit from mitigation efforts of others (Carattini et al., 2019). The same authors have found that many of the enabling factors established for the management of common pool resources on a local level become weaker on the global level: "As the size of the ensemble becomes larger, the feedback mechanisms become weaker. Relatedness declines, reciprocal altruism becomes less of a force, recognition and reputation less effective." (ibid.: 21).

Drawing on empirical evidence, a number of factors enabling GCCC emerge. First, reciprocity of mitigation contributions plays a significant role. That is, a country is expected to be more inclined to pledge emission reductions if it expects that others follow suit, or if in turn it follows others which have already pledged their commitment. Second, associated with this aspect of reciprocity, there is the factor of peer influence and international learning, leading to the diffusion of climate policy targets. Third, disillusion about the effectiveness of centralized, top-down international climate agreements have led to the adoption of polycentric climate governance approaches (Jordan et al., 2015): it is now widely assumed that the solution to the global dilemma of climate change rests within a bottom-up structure of national contributions. Effectively, this is the way in which the Paris Agreement was designed. Contrasting with previous arrangements, it combines a bottom-up structure (i.e., every country can decide of its own contributions) with a built-in "peer pressure" in the form of global stock-take events every five years.

Furthermore, we assume that global cooperation is enabled through trust and communication between actors, even though this is challenged by the frequent rotation of personnel on the international relations scene and by the thus resulting anonymity (Carattini et al, 2019). As the negotiation positions around fair shares of contributions have shown, perceptions of fairness play an important role: countries are more willing to make mitigation pledges, if they deem such contributions to be fair in the light of historic and present responsibilities, capabilities and development statuses.

The outcomes of enhanced GCCC would be the increase of contributions in the form of mitigation pledges – in our paper, this refers to contributions by the industry sector. Here, a vision of upscaling shares of the industry sector in countries' NDCs towards net-zero GHG emission targets, which are increasingly announced for mid-century, shall serve as a leitmotif (Black et al., 2021).

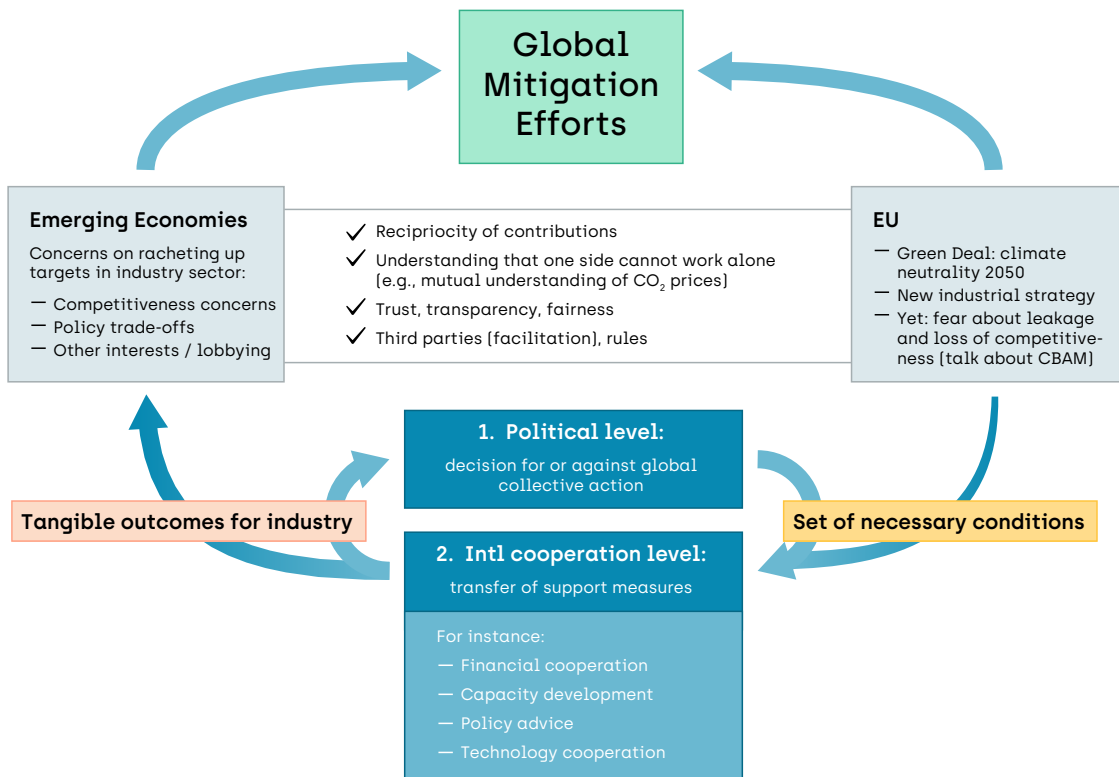
5.2 Combining ICF and GCCC

In figure 8, we conceptualize the connections between the ICF level and the political level, where decisions for or against contributing to global climate mitigation are taken. The implementation level of ICF or climate change related ODA mostly refers to the public administration with its ministries and agencies. However, it also comprises non-state actors such as the private sector, which is very important in financing the transition of the industry sector.

In the political-administrative reality of most governments, there are numerous linkages between the two levels, even though the absence of formal connecting mechanisms to coordinate them vertically is a frequent source of policy failure (Adam et al., 2019). The industries are connected to the government institutions through associations, lobby and advocacy groups, but also through the implementation of public policies and programs, or, in certain circumstances, through voluntary agreements or public-private partnerships for mitigation (Fekete et al., 2021).

FIGURE 8

Overview on the analytical framework, including the combination of ICF and GCCC levels in the industry sector



Source: own elaboration

In Figure 8, the international support through the provision of ICF is conceptualized as an additional enabling factor. As such, it is commonly referred to in the literature on cooperation in the global commons and collective action (Jagers et al., 2020). It is an additional enabler, if it can contribute to enhancing the reciprocity of mitigation contributions, overcoming inhibitions and barriers, increasing understanding that no side can solve the climate change problem alone, and raising levels of trust, transparency and fairness. These are presented as general propositions in the following chapter.

Ocean currents seen from space
by NASA



CHAPTER SIX —————>

Results from interviews and case study

We developed codes¹ on the basis of the primary data obtained through interviews (for an overview, see the annex), the case study and literature reviews. These codes were refined in an iterative process until certain patterns emerged. Through this process we developed the propositions, which we will present below.

The information which we obtained enabled us to contribute to the existing literature on ICF, climate clubs, sectoral approaches and GCCC. The propositions which we elaborated build a narrative that connects elements of the literature review and of the interview statements, highlighting ways in which international cooperation could be enhanced towards decarbonization of the industry, particularly in the steel producing industry.

¹ For instance, “Interviewee mentions reciprocity is not part of current ICF designs” or “Understanding of policy mixes for industry decarbonization in partner countries is key for effective ICF implementation” as examples for advanced codes.

Hot rolling a steel bloom
by Martinelle



CHAPTER SEVEN —————>

Case study: Steel sector

The case study constitutes the first part of our results. It will lay out a short analysis of industry decarbonization for the Indian, the European and the South African steel sectors. The aim of this is to get a clearer understanding of the specific elements that are necessary for decarbonizing the steel industry and to bring forward concrete steps for ICF to support a just transition. In this section, we will start by presenting the current situation of the steel sector, investigate what green steel production entails, and end by zooming in on the situation in our three regions of interest. Possible measures to promote international cooperation will follow in the section containing our propositions.

7.1 The steel sector and its characteristics

It is enlightening to first look at the steel sector as a whole, in order to better understand each country's individual situation. The steel sector shares many characteristics with other typical industry subsectors. For one thing, steel production is capital intensive and requires very specific installations. These are both large and costly, which implies that investment cycles are long and prevent the immediate take up of new technologies (Rayner et al., 2018). Currently, there exist two relatively widespread types of furnaces in which steel can be produced: the Basic Oxygen Furnace (BOF) and the Electric Arc Furnace (EAF), making up respectively 71% and 29% of total steel production worldwide (ECORYS, 2008; World Steel Association, 2020). In the BOF production process, 75% of the raw materials come from the hot metal produced by the blast furnace process (in which both coke and coal are used) and the remaining 25% are scrap (Yang et al., 2014). In the EAF process, most of the time, 100% of the raw materials used are scrap (ibid.). There is also a rarer production process (approximately making up 5% of total steel production), which uses direct reduced iron in EAFs (World Steel Association, 2020).

Another important characteristic of the steel sector is the longevity of its products. The average steel product has an expected lifespan of about 35 years (Cooper et al., 2014). In addition, steel products have the quality of being 100% recyclable and, according to the American Iron and Steel Institute (2021), "steel is the most recycled material on the planet". Steel thus has a notable potential for green concepts such as the circular economy approach (World Steel Association, 2015).

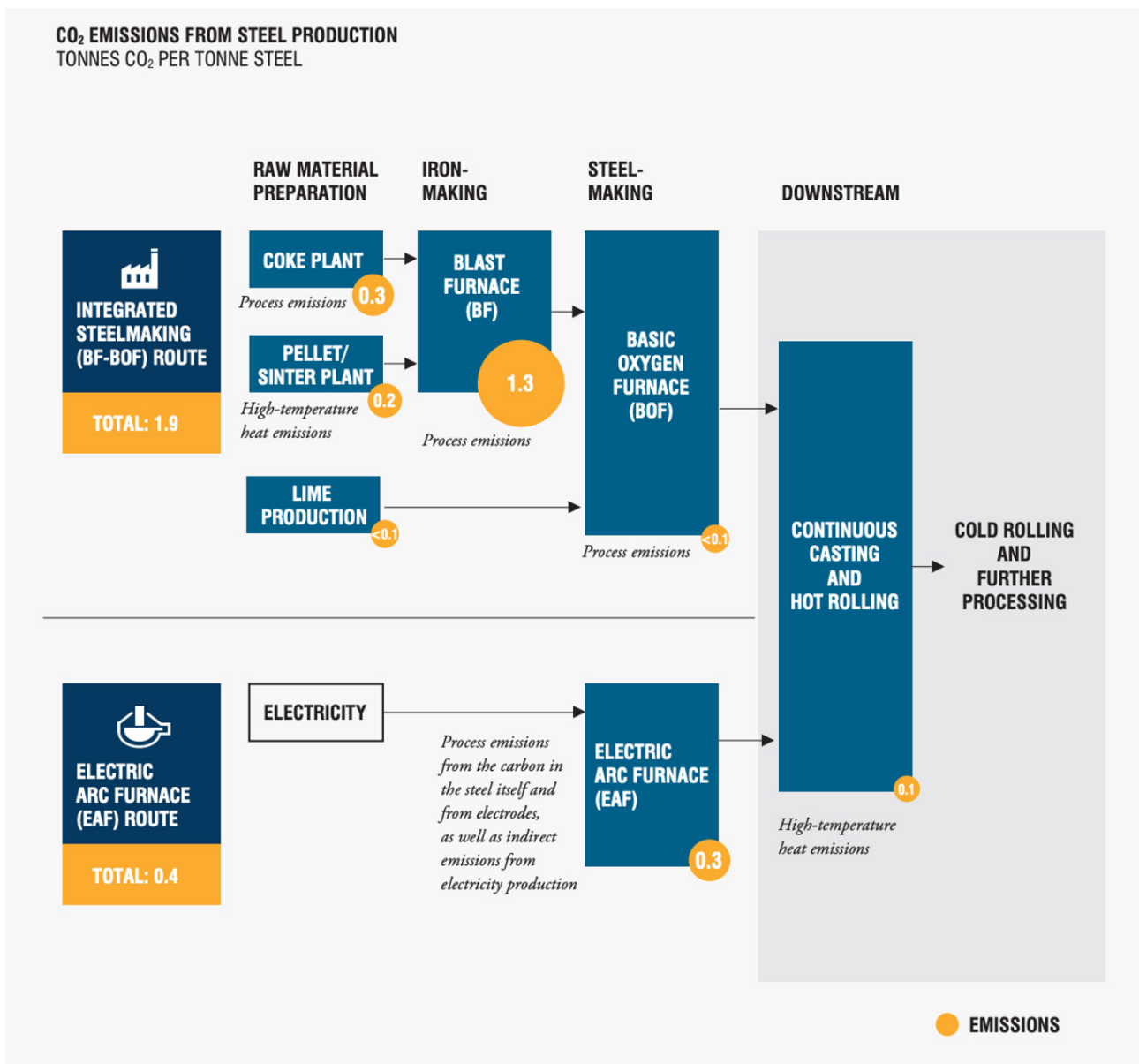
On top of this, it is important to note that the steel sector operates in a truly international field. Next to its transnational production chains and corporations, about one quarter of steel products is traded between countries (World Steel Association, 2020). These transnational links have made the steel sector highly competitive, which implies that the price for steel products is settled at a global level (Branger, 2016). Carbon leakage (i.e., following the implementation of stricter environmental regulations) thus is a major fear for policymakers in this sector (EUROFER, n.d.).

7.2 Decarbonization in the steel sector

In this context, what would decarbonization imply? Figure 9 summarizes the two main steel production processes as well as their respective emissions. It shows that the main problem lies in the production of virgin steel, that is the transformation of iron ore into steel. The use of steel scrap (i.e., recycled steel) in EAFs is far less problematic and can contribute to a significant emissions reduction. If this process is run with carbon free electricity, emissions could be made to go as low as 0.1 t carbon dioxide (CO₂) per ton product (Material Economics, 2019).

FIGURE 9

CO₂ emissions incurring in the process of steel production



Source: Material Economics, 2019.

In the light of this, Hermwille (2019) distinguishes three possible approaches to the decarbonization of steel: the reduction of demand through enhanced material efficiency and material substitution, the development of technologies to produce zero emission primary steel and moving towards circularity of materials. The latter can relatively easily be achieved through focusing on the production of more secondary steel through EAFs running on carbon free electricity. However, this is already being done to a certain extent and steel scrap is by far insufficient to cover current global demand – let alone the expected increased demand from emerging economies in the next decade (ibid.). Thus, if the steel sector is to be decarbonized, there is a need to also look into other pathways.

The second possibility is the reduction of demand. The main idea behind this is to find a way to develop products that are qualitatively speaking the same as the ones currently produced by the steel industry, but that require less steel (ibid.). Yet, this too will be insufficient to significantly reduce emissions from the steel industry on its own (Material Economics, 2019). Thus, there is the need for the development of technologies that produce carbon free primary steel (Lechtenböhmer et al., 2016).

From there, “two main routes to deeper cuts from steel production [are left]. The first is to use direct reduction, replacing the carbon in fossil fuels with electricity (for energy) and with hydrogen (for the reduction of iron ore). The second is to capture nearly all of the carbon and reprocess or store it in ways that permanently prevent release to the atmosphere” (Material Economics, 2019: 84).

The barriers currently standing in the way of a transformation towards decarbonization of the steel production can be summed up as follows (Rayner et al., 2018). First, there is a lack of availability of decarbonization technologies. While deep decarbonization routes are currently being explored by major steel producers (e.g., Buckley, 2020; Evans, 2020; Tata Steel, 2020), both the hydrogen-based steel making, and the carbon capture and storage programs are still at early stages. So far, they are available only on pilot scale and most technologies are not expected to be available on a broader scale before 2025-2030 (International Energy Agency, 2020; Vogl et al., 2021).

Second, there is a lack of technological innovation. This can be explained through the above-mentioned length of investment cycles in the steel industry, which prevents breakthrough technology deployment (Rayner et al., 2018). This is coupled to the fact that industry research and development (R&D) spending is relatively low (Wesseling et al., 2017).

Third, technology development inherently bears large capital expenditure risks. Since not all technologies end up being successful, yet still require a large up-front investment, those kinds of investments raise high degrees of uncertainty (Hermwille, 2019). This is even more so because demand for low carbon steel is still relatively low (Hoffmann et al., 2020).

Fourth, due to the sector’s highly international orientation, the steel industry has been able to dodge stricter environmental policies. As mentioned earlier, policy makers fear that these will lead to loss of competitiveness or even carbon leakage (German Council of Economic Experts, 2019).

Last, the tracking of end-use raw materials is hampered by the complexity of the steel sector's global value chains, making recycling more difficult (Rayner et al., 2018).

Now, before looking at ways in which those barriers may be overcome, which we will do following up to our propositions, let us look at the three regions of our case study and how they fit into the global picture.

7.3 Steel production in India, South Africa and the EU

Worldwide, approximately 1800 million tons of steel are produced on a yearly basis (World Steel Association, 2020). The biggest producer, China, is on its own responsible for more than half of this amount. India, the second biggest producing country, lags far behind China with its 111 million tons production per year. However, the country has set itself the goal of more than doubling its steel production (i.e., reaching 230 million tons) by 2030 (India Brand Equity Foundation, 2020). These numbers are comparable with those of the EU, which produces 158 million tons per year (World Steel Association 2020). In contrast, South Africa has a much less developed steel sector and its yearly production amounts to approximately 6 million tons. This still makes South Africa the 27th largest producer worldwide and second only to Egypt on the African continent.

In Table 2, we summarized the most important trade relations of and between India, South Africa and the EU. It shows that while some links exist between the three countries, they are not central trade partners.

TABLE 2

Trade relations in the steel sector between India, South Africa and the EU

Exports/Imports (Mt)	EU (2019)	India (2019)	South Africa (2019 if not specified)
Semi-finished and finished steel products, imports	40.2	8.9	1.1
of which	2.2 from India (only finished steel products)		1.6% from France (2016) 2.5% from Spain (2016)
Semi-finished and finished steel products, exports	27.8	13.4	4.3
Semi-finished and finished steel products, net exports	12.4	4.5	1.5

Interestingly, the steel landscapes in those three countries are quite different. The South African steel sector, for example, is fully dominated by transnational corporations: “ArcelorMittal South Africa (AMSA) [...], as the only company operating blast furnaces in South Africa, is responsible for the majority of basic iron production, as well as supplying 80% of local flat steel requirements and 52% of local long steel products” (Barnard, 2015). Further, 59% of South African steel is produced in BOFs – the remainder is produced in EAFs with scrap as a raw material (World Steel Association, 2020). It might also be noted, that while South Africa only produces about 6 million tons of steel per year, its net yearly exports correspond to 1.2 million tons – about a fifth of its production (ibid.)

In terms of sustainability, South Africa's major steel company, AMSA, has followed up on the group's decision to become carbon neutral. However, AMSA's yearly report underlines that this will mainly be driven by the group: “[AMSA] will benefit from research and the sharing of best practice being done by the group to achieve the 2050 target” (AMSA, 2020: 39). The company is yet to set itself CO₂ reduction targets for 2030, which it has announced are “likely to be modest as [its] reliance on coal can only be phased out over the longer term” (ibid.: 41). One of the factors hampering the greening of its processes, the company claims, is its reliance on electricity from Eskom, the largest electricity producer in South Africa, who generates most of its power using coal (ibid.).

The Indian steel sector stands very much in contrast to the South African one. Not only does the first produce approximately 20 times as much as the latter, but it is also composed of a very different type of companies. The Indian steel landscape can be narrowed down to its three biggest companies: Steel Authority of India Limited (Steel Authority of India Limited (SAIL)), a mostly state-owned and purely Indian company; Tata Steel, one of the biggest transnational companies next to ArcelorMittal; and JSW, an Indian company that has been establishing a transnational presence in the past decade (Singh et al., 2020). All three companies are among the biggest steel producers worldwide (World Steel Association, 2020). With such a large production, it might be surprising to see that India mostly consumes its steel domestically and only has net exports of 4.5 million tons – of which 2.2 tons are exported to the EU (EUROFER, 2019). Finally, it is interesting to note that most of India's steel production (56%) is produced in EAFs, compared to only 44% in BOFs.

The only Indian steel company to yet have formulated a carbon neutrality goal is Tata Steel, who plans to achieve this as a group by 2050. Here again, the target was formulated for Tata Steel Europe before it was extended to the whole group (Tata Steel, 2020). In order to achieve this, Tata Steel India has taken several steps, including the adoption of an internal carbon price. Yet, it has also made clear that it is not possible for the company to finance a Carbon Capture, Utilization and Storage (CCUS) plant at present, due to the high cost of such technology (Singh et al., 2020). SAIL and JSW have also announced sustainability measures for their respective companies (e.g., afforestation initiative or resource reutilization), but none on the lines of deep decarbonization.

Finally, let us take a closer look at the EU's steel sector. It is a rather particular case, as the EU itself was originally created as the European Coal and Steel community, back in 1952 (Trappmann, 2015). Indeed, less than 40 years ago, Europe was the biggest steel producer in the world (ibid.).

This has changed now with the booming of Chinese steel production, even though the EU still holds a large share of the market (World Steel Association, 2020). In the EU, the main technology is the BOF, which accounts for 59% of the steel production – the rest is produced with scrap in EAFs (ibid.). The EU is internationally dependent, as it imports 40 million tons of steel per year (almost a fourth of its total production), making it a net steel importer (approximately 12 tons per year) (ibid.). This is reflected in the EU's steel making landscape, which is dominated by transnational corporations such as Tata Steel or ArcelorMittal (Trappmann, 2015). However, some less international companies, such as Thyssenkrupp, also still belong to the world's biggest producers (ibid.).

Regarding the environment, the European steel sector can be seen as the most progressive (EUROFER, 2019). Major European steel makers, including ArcelorMittal Europe, Tata Steel Europe, Thyssenkrupp and Voestalpine have led the way in announcing their aim to become carbon neutral by 2050 (Buckley, 2020). In order to achieve this, those companies have all taken first steps. ArcelorMittal, for example, launched its XCarb project in March 2021, through which, amongst others, it intends to introduce green steel certificates (ArcelorMittal, 2021). These aim at passing the higher incurred steel production costs of new sustainable technologies onto the customers, who then have the benefit of being able to report their scope 3 emissions. The implementation of a so-called innovation fund for R&D into breakthrough technologies and a range of recycled and renewably produced products (scrap use in EAFs running on renewable energy) are two other initiatives within the Xcarb project (ibid.).

Meanwhile, Tata Steel Europe has established its Hlsarna pilot plant in IJmuiden, in the Netherlands (Tata Steel, 2020). Hlsarna is one of the promising breakthrough technologies which have been identified by the Ultra-Low CO₂ Steelmaking (ULCOS) group in 2004 (Meijer, 2018). In addition to this, Tata Steel is currently working on the development of CCUS technologies in collaboration with other steelmakers (Tata Steel, 2020).

Thyssenkrupp, the German steelmaker, has also taken rather serious steps towards carbon neutrality: it is currently running a test program with hydrogen at its Duisburg-Hamborn site, as well as a Carbon Capture and Utilization (CCU) program, Carbon2Chem, through which CO₂ is transformed into chemicals that can then in turn be used as raw materials within the chemical industry (Bastian, 2019; Buckley, 2020).

Further projects undertaken by the European steel industry include SSAB Europe's Hybrit, on which it collaborates with Luossavaara-Kiirunavaara Aktiebolag (LKAB) and Vattenfall to produce fossil free steel (ibid.). So far, these decarbonization efforts are only happening on laboratory and pilot scale, but its inclusion into the Leadership Industry Transition (LeadIT) group makes it of particular interest to us, as the group is led by India and Sweden together (Stockholm Environment Institute, 2021).

Despite this commitment from the European steel industry, it should be noted that none of the above-mentioned projects has yet passed the pilot phase (Vogl et al., 2021). Full scale deployment of a carbon neutral technology can be expected at earliest in 2026 for ArcelorMittal, 2025 for Hybrit and Thyssenkrupp and 2024 for Tata Steel (ibid.).

Table 3 summarizes the most important sustainability steps taken by the biggest companies in India, South Africa and the EU.

TABLE 3

Biggest steel producers of South Africa, India and the EU, including their mitigation and sustainability policies

Country	Companies	Sustainability measures
South Africa	ArcelorMittal South Africa	<p>Pledge: Group target to become carbon neutral by 2050</p> <p>Measures: Apart from annual sustainability reporting, AMSA mainly emphasizes its reliance on the group: “ArcelorMittal South Africa will benefit from research and the sharing of best practice being done by the group to achieve the 2050 target” (AMSA, 2020)</p>
India	SAIL	<p>Pledge: 23% reduction in CO2 compared to 2007</p> <p>Measures:</p> <ul style="list-style-type: none"> › Technology upgrading › Afforestation
	JSW	<p>Measures:</p> <ul style="list-style-type: none"> › Resource reutilization › Establishment of a climate action group
	Tata Steel India	<p>Measures:</p> <ul style="list-style-type: none"> › Coke dry quenching technology › Top recovery turbine technology › Internal carbon pricing
Europe	ArcelorMittal Europe	<p>Pledge: Group target to become carbon neutral by 2050</p> <p>Measures:</p> <ul style="list-style-type: none"> › Hydrogen DRI route (e.g., XCarb) › Smart Carbon route › Pilot plant for Carbon Capture and Storage (CCS) in Dunkirk
	Tata Steel Europe	<p>Pledge:</p> <ul style="list-style-type: none"> › Carbon neutral by 2050 › 2030 emissions reduction of 30% in UK and 40% in Netherlands <p>Measures:</p> <ul style="list-style-type: none"> › Pilots for CCS and hydrogen in Ijmuiden (i.e., Hlsarna) › Plan to produce approximately 100'000 tons of Steel per year in this low carbon plant in Ijmuiden
	Thyssenkrupp	<p>Pledge: Carbon neutral by 2050</p> <p>Measures:</p> <ul style="list-style-type: none"> › Pilot in Duisburg-Hamborn: hydrogen in blast furnace › Direct reduction plants starting 2024 › CCU project: Carbon2Chem › By 2022: expectation to produce 50'000 tons of CO2 neutral steel (4% of its total production) › By 2030: 3 million tons (25% of its total production)
	SSAB Europe	<p>Pledge: Fossil free by 2045</p> <p>Measures:</p> <ul style="list-style-type: none"> › Hybrit pilot running in collaboration with LKAB and Vattenfall: demonstration phase starting 2025

Seeing how decarbonization is still at very early stages in the steel sector, both in terms of technology and of policies and regulation, we will argue that there is a large role to be played by ICF in supporting the transition to low carbon steel production on policy levels as well as on technical levels. This is especially the case since most decarbonization initiatives have so far taken place within the EU and since emerging and developing countries will need support to achieve their transition in a fair way. In the following sections, we will advance some propositions for the designing of such ICF.



CHAPTER EIGHT 

**Propositions:
How ICF could effectively
support cooperation in the
industry climate commons**

The linkages between the ICF level and the political level in the industry sector which our research has brought forward as being the most likely to make GCCC effective are described in the following section. Reciprocity of contributions stands out as the principal enabler of global cooperation. Reciprocity is strengthened by mutual trust, an improved understanding of the needs for cooperation, communication and transparency. Those concepts will build the basis for our first set of propositions. In a second set of propositions, we will address the factors that need to be in place for ICF to generate positive impacts on global cooperation. The idea behind this is that reciprocity is considered as the main factor to enable global cooperation from an international point of view, and that implementation is the key factor on domestic levels. These factors are intertwined, but for the sake of structuring the text, we present them in a sequence.

8.1 Factors related to reciprocity of national contributions to global mitigation of climate change

Reciprocity of efforts and contributions is the most important enabler of global cooperation (Ostrom, 2010; Högl, 2018). It builds on a mutual understanding, trust, and communication (ibid.).

To include the factor of reciprocity into the design of ICF, we propose to create a reciprocal link of conditionality of contributions between countries that are providing ICF and countries that are receiving it². This would imply that countries which intend to provide ICF would be obliged to connect contributions to their domestic climate policies and respective progress, for instance, through R&D on zero emission technologies, testing and bearing risks of technology deployments and of changing production processes. In other words, conditionality would entail that donor countries would have to demonstrate their own domestic progress in terms of climate mitigation when providing ICF. That is, donors would need to ensure that their own climate ambitions are increased in the process of providing ICF to other countries.

Furthermore, provider countries should allow access to these processes and facilitate technology transfer. This could be done by tapping into innovative sources of climate finance, with domestic policy instruments such as consumption charges on high-carbon products and services. The international and political visibility as well as the gain of reputation associated with this would act as the main motivation for provider countries. This factor of reciprocity operates on the principle that ICF needs to be connected to the domestic progress of climate policy implementation in the donor countries so that a reciprocity of contributions becomes comprehensible.

² Thus far, conditionality is a (controversial) element of most ODA, but it is also included in the majority of developing countries' NDCs, who make enhanced mitigation contributions dependent on ICF, technology transfer and related support.

Technically, this can be achieved through, for instance, linking support to the reporting instrument of the UNFCCC, in which various steps towards the implementation of mitigation targets are described (biennial reports). Another way to achieve this could be the organization of international peer review meetings to assess the progress of the reciprocity of contributions and proportionally, of the ICF provided.

Findings from the interviews

A basic requirement for this proposition of reciprocity of contributions would be that both sides, the country providing ICF, as well as the recipient country, are motivated by the very process of designing, agreeing and implementing ICF to increase their mitigation contributions in a fair and adequate amount. To understand this better, we must look into motivations of donor and recipient countries.

The interviews have revealed that a distinction needs to be made between drivers which unfold and have impacts on the reciprocity of contributions during ICF implementation, and the political decision-making process of such contributions. These currently appear separately. For instance, donor agency X might make grants available for the decarbonization of an industry subsector, which may lead to higher sales of low carbon products. This is not directly connected to technological and regulatory progress on domestic levels in the donor country, even though recipient countries and industries may be granted access to respective knowledge and expertise (16). It is also not connected to enhanced contributions by the recipient country, because related political discourses and decision-making processes are taking place in different venues.

Yet, there seems to be a momentum to build such connections with technological and regulatory progress in donor countries. A strong argument for emerging economies to participate in international cooperation is gaining access to regulatory and technological know-how on industry decarbonization (7, 16). It is important that the provided expertise yields an added value, and in that way, that the motivation of these countries is directly connected to regulatory and technological progress in the country which provides ICF (Germany, in the case of the interviews). It was stated by a representative of an international partnership on industry decarbonization (16) that recipient countries – industry and government actors – are motivated to join a partnership, if it implies gaining access to both technological know-how and finance. However, cooperation only materializes, if added value in the form of expert knowledge is visible. In this case, the interviewees referred to Germany's expertise in the field of renewable energy and to how this increased developed countries' interest in cooperation.

Often, donors mostly work with the provision of finance and support, which is disconnected both from technological and regulatory expertise and the amounts of domestic mitigation contributions (for instance in the case of bilateral and multilateral development banks) (3,10,16). Yet, if ICF is to enhance reciprocity of mitigation contributions, such connections should be made and ways identified, how motivations and interests of donors could be used so that higher contributions can be made.

Several interviewees (1,6,7,15) confirmed that countries would refrain from international cooperation, if a strict set of rules - or even sanctions for non-compliance with such rules - were to be applied. For cooperation to work well, participation needs to be voluntary and based on mutual interests. In particular, this implies that, to enhance the reciprocity of contributions, the interests of partners need to be examined: are they leading towards higher mitigation commitments? And if yes, how can these interests be further catered to?

There seem to be two sides to this: on the one hand, the literature asserts that donors are directly motivated to provide more ICF if there is an anticipation of technology exports or when international climate agreements, which make domestic contributions binding, are ratified (Kim, 2019). On the other hand, a discussion is needed, to determine up to which point this momentum of technological progress and associated domestic mitigation contributions can be used and from which point onwards it would mostly benefit industries in donor countries by enhancing exports.

According to a global cooperation model involving a reciprocity of contributions, it appears that two areas of work remain in the context of ICF. First, it is necessary to have an open discussion on how and up to which level the strategic interests of donors (technological progress, exports, dissemination of regulatory and technological know-how) can be used as a driver towards increased mitigation contributions of donor countries. Second, it is essential to find ways in which the currently prevailing separation between the implementation level of international cooperation and the political decision-making level can be overcome. This was illustrated by interviewees from academia and the government, who stated that, at the implementation level, different ministries are responsible for industrial policy and international climate policy. These ministries are usually not involved in the same international cooperation instruments, nor mandated to discuss amounts of domestic mitigation contributions (1, 7).

Findings from the case study

An illustration for this proposal can be found within the steel sector. Considering the EU's front-runner position in terms not only of low-carbon technology, but also of corresponding policy measures for the steel sector (i.e., the New Industrial Strategy), the EU is a very valuable partner for South Africa as well as for India.

Indeed, on the one hand, the EU is currently the main site for most technological pilot projects (Vogl et al., 2021): be it Tata Steel's Hlsarna plant in Ijmuiden (The Netherlands), ArcelorMittal's CCS pilot in Dunkirk (France), Thyssenkrupp's Hydrogen test program at its Duisburg-Hamborn (Germany) site, Hybrit's pilot for the production of fossil-free steel at its plant in Luleå (Sweden), or even Voestalpine's plasma smelting reduction technology, which is currently being tested out in Donawitz (Austria). On the other hand, the EU has announced it intends to support its steel sector to achieve a deep decarbonization through the EU Strategy on Clean Steel. Within this policy-frame, the Clean Steel Partnership (CSP) is set to be implemented at latest by 2022. As such, the partnership will mainly focus on supporting the development of new technologies as well as companies who wish to transition their production mode to a less carbon intensive one (European Commission, 2020b).

This expertise within the steel sector, both in terms of technology and of policy thus builds a good basis for ICF support, since other countries are likely to be attracted by the available knowledge and by the possibility of exchanges.

Further, the EU's commitment to becoming carbon neutral by 2050, as well as the detailed plan it has put forward to achieve this, should make it credible that the EU intends to ratchet up its own commitments. Within the steel sector, the CSP intends to implement "at least 2 demonstration projects leading to 50% CO₂ emission reduction [by 2027 and to] 80-95% [emission reduction] by 2050, ultimately achieving carbon neutrality" (ibid.). While there is potential for further action (i.e. tightening the ETS in the steel sector or setting specific standards for steel decarbonization), the credible long-term commitment to lowering emissions within the steel sector is a good starting point for reversed conditionality in the EU's ICF provision. Other important steps towards increased climate action would also include more international plans. So far, such perspectives have been let out of the European Steel Strategy or the CSP.

Now, turning to the other side. Both the Indian and the South African NDCs state that their commitment and ambition raising in terms of climate action is partly conditional on international support: i.e., "[the] successful implementation of INDC is contingent upon an ambitious global agreement including additional means of implementation to be provided by developed country parties, technology transfer and capacity building following Article 3.1 and 4.7 of the Convention" (Government of India, 2016: 30). Similarly, "South Africa's NDC is premised on continued effective multilateral cooperation [...], and the provision of support [...] by developed countries and others in a position to do so" (Government of South Africa, 2021: 27). According to theories on GCCC, this makes those countries conditional cooperators and therefore very propitious for GCCC.

Concrete steps on how this conditionality could be played out in the steel sector should focus first and foremost on technology. As pointed out earlier on, important barriers for the transition to low-carbon steelmaking include the unavailability as well as the costs of innovative technology (Hermwille, 2019). For these to be overcome not only in the EU, but also in South Africa and India, it is essential that ICF includes R&D, technological support and capacity building. First steps in this direction have been taken by the Indian-Swedish led LeadIT group, which had been joined by SSAB, its joint venture, Hybrit, and Thyssenkrupp, three of the most progressive steel companies.

However, this is not all. In parallel to this technological support, ICF will also need to provide policy expertise. Indeed, with concerns about loss of competitiveness, a certain amount of expertise will be required to draw up roadmaps for the steel sector, and potentially even include it in the NDCs. Further elements, which can contribute to enabling reciprocity of contributions are the support of international knowledge networks, trust, communication and transparency, as elaborated in the following sections.

8.1.1 International epistemic communities and policy diffusion for industry decarbonization approaches

This proposition is based on the assumption that the reciprocity of contributions requires a mutual understanding of policy makers and industry leaders that national efforts towards the decarbonization of the industry are needed, which in turn is only possible and meaningful, if other countries understand these necessities as well. Accordingly, we argue that international peer learning facilitates the adoption of climate policy in the industry sector. Fankhauser et al. (2016) identify the role of policy diffusion as a major driver for climate policy adoption among major economies, outweighing other factors such as signing up to an international treaty, or hosting a UNFCCC conference. Such policy diffusion processes could be facilitated via ICF, by supporting the development of networks of knowledge-based experts (epistemic communities) and providing access to them. Provided a mutual agreement already exists, capacity development can also contribute to enhancing the use of policy diffusion processes and making related knowledge available to policy makers and industries.

Hence, we hypothesize that ICF in the form of technical support can contribute to GCCC by acting as a communication and information channel to further the understanding that global cooperation is necessary, for example, through international exchanges of policy actors and experts.

Findings from the interviews

We observed that industry related climate policy is a transnational process, involving the implication of company headquarter policies on how the company policies play out on domestic levels (see ArcelorMittal case in South Africa). In addition, the momentum and visibility generated by high-profile initiatives and partnerships such as Mission Possible, LeadIt and others, appears to have effects on domestic policy processes. Many of these initiatives include activities related to policy diffusion and the engagement with networks of international experts and policy actors on best practice exchanges. These transnational policy processes are an important element for GCCC because they effectively allow the tapping into the oftentimes advanced company internal policies and practices (4,5), integrating these as experiences in domestic policy processes, and that way benefit from international expert knowledge.

In relation to the dynamics of such epistemic communities, interviewees from international organizations and expert networks (6,15) stated that in the past, there has been limited demand for expert knowledge on technological and regulatory aspects of industry decarbonization by emerging economies. So far, it has been mostly donors who contributed to the epistemic communities and the uptake by other governments has been somewhat hampered by the institutional fragmentation: in most cases, the ministries of industry acted as main partners, while the ministries of environment (in charge of climate policy) were not involved. However, according to the same sources, two factors have led to an increase in demand in the last couple of years: the entry into force of the Paris Agreement and the example set by the EU in greening the COVID-19 recovery package.

In relation to the expertise itself, it was commonly stated that uptake by countries was much better, if climate policy in the industry sector was framed in the context of just transitions, and if it was based on empirical evidence of success and feasibility. The latter point again underlines the role played by donor countries, not only in terms of providing support, but also by setting real examples for industry decarbonization.

Findings from the case study

The transnationality of the steel sector makes it a perfect application field for epistemic community exchanges. Amongst others, this can be observed in multinational corporations' climate policies. ArcelorMittal, for example, first announced its plans to become carbon neutral within Europe before extending its commitment to the entire group (ArcelorMittal, 2020). This kind of trickle-down mechanism is central to obtaining a meaningful commitment in other countries. AMSA, though it does not per se have as strong commitments as the company's headquarter in Luxemburg, will be able to benefit from the R&D ArcelorMittal currently performs in the EU. Similarly, Tata Steel, after having committed to becoming carbon neutral in Europe, has announced its plans to also build test sites for the trial of new technologies in India (Tata Steel, 2020).

In particular, the fact that practically all low-carbon technologies are currently developed and tested within the EU makes exchanges of knowledge and technology primordial for the just transition of the sector - especially for locally restrained actors who, unlike AMSA or Tata Steel India, are not able to benefit from company internal knowledge exchange. For these cases, the support for a low-carbon transition needs to be provided almost entirely through ICF. The LeadIT³ group, jointly established by the governments of India and Sweden with the support of the World Economic Forum, serves as a good illustration. Within its frame, expert exchanges between the Indian steel sector and the Swedish Hybrit project are planned as soon as COVID-19 restrictions permit travelling again (15). While few other exchanges have taken place at such an international scale, an understanding of the importance of collaboration seems to have trickled through to steelmaking companies. At its plant in Ijmuiden, for example, Tata Steel is currently leading further research into the HIsarna technology in collaboration with other major steelmakers, including ArcelorMittal, Thyssenkrupp and Voestalpine (Tata Steel, 2020). Similarly, ArcelorMittal has recently joined other companies, such as Vattenfall or Shell, in a so-called green hydrogen network. These are just a few examples among the many initiatives currently happening.

It is important to note that these exchanges are not only beneficial on a strictly technical level, but also on a policy level. Indeed, amongst others, the LeadIT group for example focuses on the elaboration of roadmaps for individual sectors, which in turn can prove useful to policy makers. Thus, a common understanding for the necessity of emissions reductions is brought forward.

3 See <https://www.industrytransition.org/> for more information

8.1.2 Trust, rules and transparency as basis for reciprocity of contributions

ICF can promote mutual trust. In the field of industry decarbonization, two areas were identified, where the development of trust plays a role. Trust can be developed through the implementation process of ICF, as well as through trustful working relations of policy actors engaged in decisions on the level of international mitigation contributions by the industry sector.

Findings from the interviews

Interviewees from finance institutions confirmed that mutual trust can be developed through ICF if countries are mutually reliable and engaged in the long-term (3). For that to happen, it should be demonstrated that both sides implement programs as agreed. Additionally, providers should, to the extent to which it is possible, guarantee that ICF continues flowing reliably in the medium to long term. ICF can further support trust building, provided the support does not come with a hidden agenda, e.g., if ICF is used as a measure to enhance technology exports, a tool for undue foreign influence seeking or the setting of unidirectional conditionality on the basis of power inequalities between the negotiating parties. Trust can be developed between policy actors on the implementation level of ICF, which mostly corresponds to the public administration, and corresponding working levels in the industries (11).

Along with the development of trust, the support of international communication channels should advance mutual understanding. In that way, communication is essential for all other factors described here. It can be coupled with regular diplomatic exchanges on a more technical level.

A few aspects which highlight the importance of enhanced transparency for GCCC emerged from the interviews and the literature. These refer to transparency of international support itself, and the role of the UNFCCC process, more specifically, the Enhanced Transparency Framework (ETF) and the Global Stocktake process. In relation to the UNFCCC processes, two other central factors come into play as enablers of GCCC: first, the importance of agreed rules, and second, transparency as a foundation of trust between parties involved in GCCC.

In the ETF, the reporting on delivered and received amounts of ICF is mandatory, but information on the impacts of ICF on improved climate policy performance, and thus enhanced contributions to GCCC is not required. We argue that this constitutes a gap, which needs to be addressed if ICF is to be a contributor to enhanced GCCC. This factor is less related to the way in which ICF is implemented, or which impacts it produces on industries and policy processes, but rather, to how ICF is reported under the UNFCCC transparency framework so as to establish higher degrees of trust between parties involved.

What can ICF deliver to enhance trust through its implementation process? It has proven a common understanding among all interviewees that a steady, reliable and sustainable flow of ICF and related assistance is almost synonymous with trust building. This has been a topic of the ODA literature as well (OECD, 2009). This refers to general principles of agreeing, implementing and evaluating international assistance projects, but not yet to the specifics of trust as an enabler for enhanced GCCC.

In terms of the legitimacy of international rules as a basis for GCCC, interviewees across all institutional affiliations have stated governments currently do not wish to establish additional rules for cooperation other than the UNFCCC. At most, rules for the delivery and implementation of ICF may apply, but not in terms of binding rules for goal setting and achievement (11,15,16). Instead, several interviewees pointed to the existing ETF and the potential for alignment with related rules and modalities.

8.1.3 By taking a bottom-up perspective, ICF can act as an enabler of a level playing field

A shared understanding that no single country can act alone is another prerequisite for enhancing reciprocity, and hence for the willingness of countries to cooperate in determining appropriate mitigation contributions (upscaling industry contributions towards net zero). The transition to net zero in the industry will likely incur costs and risks on firm level, as well as country-wide economic consequences in the medium term, which we see reflected in policy makers' concerns of carbon leakage and industry relocation.

It is a standard assumption in the international economic literature that global carbon prices are an important factor to enable a level playing field, and hence, a necessary precondition to cooperate in the climate commons by introducing equal prices for the industries on a transnational level (Nordhaus, 2015; van den Bergh et al., 2020). This is based on the idea that industries and individual countries would suffer negative economic consequences, in the case unilateral policies and actions, such as the introduction of a high carbon price, were taken (Mercator Research Institute on Global Commons and Climate Change, 2020). Climate clubs are proposed as structures to address these problems and to introduce carbon prices for all participating countries (Nordhaus, 2015). Much of the literature is based on assumptions of established rules for club members, agreements on membership benefits and obligations as well as minilateral arrangements based on coalitions of the willing (Hovi et al., 2016). In practice, no climate club was established as of 2021 (Unger & Thielges, 2021), but similar transnational governance arrangements, revealing much softer governance approaches, such as the Under2 Coalition⁴, the Mission Possible Partnership⁵ or the We Mean Business Coalition⁶ (among others) were created. In addition, international carbon prices are highly fragmented and very low (Nordhaus, 2019), and the political feasibility of agreeing on high international carbon prices is assessed as a major challenge (Hovi et al., 2016).

4 See <https://www.theclimategroup.org/under2-coalition> for more information.

5 See <https://missionpossiblepartnership.org/> for more information.

6 See <https://www.wemeanbusinesscoalition.org/> for more information.

Findings from the interviews

Our findings suggest a modified way of thinking about an international level playing field for the decarbonization of the basic materials industry. Interview results point to the importance of a bottom-up perspective, involving perceptions of fairness and the recognition that a policy mix is required on the domestic level of countries as a pre-requirement for “level playing fields”, in which the industry can produce and trade profitably.

Accordingly, we argue that ICF can contribute significantly to both areas in a bottom-up way. This implies that it needs to take the perspective of domestic policymakers, who may decide on certain policy approaches based on what appears to be a fair arrangement, and what policy mixes are most conducive to achieve the various policy objectives in the national industry sector.

First, the required policies will have to go beyond carbon pricing systems and related policy mixes will have to be specific to individual countries (2,4,5,11,12). This includes specific policy approaches which may support the early adopters of low carbon industry products, for instance, steel up takers in the automobile industry. Other policy instruments that were mentioned related to public procurement regulations (11), and innovation support policies for creation of niche markets (5). Interviewees confirmed the important role a carbon pricing policy can play both nationally and internationally, but that it needs to be coupled with other policies, including the choice of suitable finance instruments for the industry, on the level of domestic policies. ICF - especially in the form of technical assistance, policy advice and capacity development - can make contributions here (2, 16, 17).

Secondly, fairness also relates to the topics of CBDR-RC and - connected to that - the provision of ICF according to article 9 of the Paris Agreement. Accordingly, ICF can contribute to establishing a sense of fairness for policy decision makers and industry leaders, if it is made available through international finance institutions or bilateral development banks (3,10). Finance instruments play a big role in this context and the next section explains this further.

Findings from the case study

Our choice of countries underlines the case for bottom-up policy mix approaches that do not focus first and foremost on implementing a common carbon price. Realistically speaking, the latter would be a hopeless attempt without further considerations of the domestic preconditions in both India and South Africa (5,9,11). For instance, it is one of India’s central economic goals to triple its steel production by 2030 (India Brand Equity Foundation, 2020). In this context, a just transition will entail much more than just a carbon price, which at this stage will be likely considered as unfair in the first place if it is not complemented with additional supporting measures. Even though South Africa has already implemented a carbon price in 2019, its perspective is unlikely to be much different, especially in the wake of the COVID-19 pandemic. Indeed, its current carbon price is comparatively low and the heavy industry players (steel companies included) enjoy basic tax-free emission allowances of 70% (National Treasury of South Africa, 2018). Here, the role of ICF instruments such as Carbon Contracts for Difference (CCfDs) becomes very interesting and will be made explicit in the next section.

Through ICF, a more common ground (i.e., the much-discussed level playing field), upon which further measures such as the implementation of a carbon pricing mechanism would stand a chance, could thus be prepared.

8.2 Factors related to the implementation of ICF in recipient countries

The following factors play a role on the implementation level in recipient countries and mostly follow the principles of effectiveness of international support, which is why they require that donors adhere to those. In particular, the points we deemed relevant for industry transitions are the following.

8.2.1 Ensure integration of the industry sector in the NDC

Considering the institutional fragmentation in many countries, several interviewees highlighted the need for an integration of the industry sector within domestic climate and developmental policy frameworks (3,4,6). In particular, this is connected with the need to establish linkages with the NDC processes and related policy prioritization of climate in countries. Hence, we hypothesize that international support for industry decarbonization is effective, if adequate political and policy support is given by host countries. While emerging economies have taken up climate policy targets and comprehensive policy approaches since the last decade, the industry sector is oftentimes not yet strongly integrated, as the NDC stocktake (Table 1) shows. Hence, a necessary precondition for industry decarbonization and just transitions is a conducive policy framework and the integration with national climate policy frameworks.

Learning from interviews with both donor agencies and government representatives, this integration of the industry sector into the NDCs is a politically delicate issue: it requires political dialogues, and involvement of the industries itself (2,16). The addressing of finance gaps (see respective section above) and the insurance of the technological feasibility of the mitigation measures in the industry sector are further conditions (16). In summary, while ICF can support the integration of the industry sector into the NDC on technical-administrative levels, an adjustment of the NDC towards higher ambition levels is a politically sensitive topic and respective political decisions are taken on higher levels. That way, this factor is connected to the primary factor of enhancing reciprocity of contributions.

8.2.2 Improve coordination between private sector, public policy processes and the finance sector

For ICF to generate a positive impact on industry decarbonization, and in its consequence also for improved GCCC, certain coordination issues need to be addressed.

Interviewees from the finance sector stated that the linkage between policies and finance is crucial for successful industry decarbonization initiatives: for instance, public regulations in a country may set the standards for technology benchmarks and therefore be of guiding power to the companies. In such situations, donor countries may consider granting low interest finance (ICF) for companies aiming to achieve these standards (3). In a number of cases, existing governmental regulations need to be adjusted to the new challenges of decarbonization, and implementation enforced stronger – under these preconditions ICF finds conducive environments (1,3).

In this context the establishing of coherence among donor institutions and the act of coordinating them may prove to be a challenge. To overcome it, individual financial institutions and donor agencies must move forward in a coordinated manner. While this is rarely the case because of the individual interests of these agencies, it would be needed to move from pure project-based financing towards broader, more coordinated approaches. Handling this may require moving beyond working levels of implementation by engaging high visibility political agreements, possibly involving heads of states.

A second area of coordination and possibly perhaps convergence may come about due to the need for the finance sector to agree on definitions and standards of what industry decarbonization means. Such standards and definitions should also help address risks of lowering benchmarks for decarbonization, by introducing objective metrics. Interviewees stated that while a very diverse mosaic of standards and definitions might not be conducive, a 100 % harmonized taxonomy is neither realistic, nor desirable (3).

From the above, we can infer that for industry decarbonization to be successful, following both individual policies and finance instruments as well as donor agencies and finance institutions requires coordination. Such coordination processes may also help overcoming fragmentation often occurring between policy and institutional communities of finance, industry and climate policy. Through such processes, gaps or ambiguities in the policy framework for industry decarbonization may also become visible and thereby addressed through ICF resources.

8.2.3 Support to just transitions in the industry sector

Learning from interviewees and the literature alike, ICF should support just transitions in order to minimize harmful effects both on directly and indirectly affected actors. This factor is associated with fairness, as transitions must unfold in a socially acceptable way, and thereby require a balancing of environmental, social and economic motives. ICF will contribute to enhancing the cooperation

in the climate commons if funders recognize the need for a balancing and negotiation process between segments of the industry and society, as well as for climate objectives. Furthermore, ICF needs to contribute to outcomes which can credibly underline the technical and economic feasibility of just transitions in order to convince policy actors and political decision makers. To achieve this, implementable concepts for a just transition of the industry, combined with successful pilot projects, can be supported by ICF. Combining environmental and social policy objectives will allow bringing the two policy agendas closer together and henceforth make them more acceptable for decision makers (2, 6).

Findings from the case study

The steel sector plays a major role in countries' economies and thereby makes just transition inevitable. In the EU, for example, the steel sector employs 327'000 people and is accountable for 1.5% of the GDP (European Commission, 2019b). In India, the steel sector contributes to more than 2% of the GDP and approximately employs 20'000'000 people around the country (India Brand Equity Foundation, 2017). This clearly underlines the socio-economic importance of this sector, and thus justifies taking a more encompassing approach to its decarbonization. To this end, the ICF and the policy levels can work together to ensure a just transition is doable. This is even more so in the wake of the current pandemic, which has hit both South Africa and India to their core (Beyer et al., 2021; German Institute for Global and Area Studies, 2020).

8.2.4 Finance instruments as the principal enabler for industry decarbonization

Suitable finance instruments are needed for industries to be able to cover the substantial investment costs of the transition (technology upgrades, switching production methods). These play a central role in assisting countries and respective industries to make the transition towards climate neutrality: agreements on ICF between donors and recipients are not only fundamental for implementation on firm level, but also for global cooperation in the sense that they establish senses of fairness and trust (11).

Typically, it is believed that traditional finance will not be enough to decarbonize the industry sector, where the capital required is both "patient"⁷ and risky (D'Orazio & Popoyan, 2019; Young, 2018). With the acknowledgement that trillions of dollars are needed to transition the economy to net zero has come the understanding that "finance, industry and the public sector must work together to lay the foundations of a new multi-stakeholder financing ecosystem" (Baraldi et al., 2021). Traditional financing instruments will need to be thought over and there is an urgent call for new, innovative mechanisms: just transition requires significant investment, favorable market developments for low carbon steel and other industry products, as well as the addressing of risks (6, 8). Here, our intention will not be to give an exhaustive list of such innovative instruments, but much rather to name a few approaches that were highlighted by interviewees.

⁷ This denotes long term capital. When investing in such technologies, a long term perspective is required before returns on that capital incur.

Amongst others, there has been an increased focus on options for blended finance - that is, for ways in which the public sector can incentivize investments from the private sector (Choi & Seiger, 2020). The main idea of blended finance is for the public sector to reduce the risks and barriers encountered by investors by, for example, taking the first-loss piece (Horrocks, n.d.). Blended finance has been practiced for several decades now and comprises a multitude of instruments, but it experienced a true revival in the past 5 years (Choi & Seiger, 2020).

Similarly, green bond markets or green climate funds have recently been at the center of attention. In the industrial sector, green bonds offer the advantage of pooling green projects, which may otherwise be hard to find/define for the individual investor (Anstey et al., 2021). This is particularly important in countries in which reporting norms are relatively low, which is the case for many developing countries, where a large chunk of the industry is situated (ibid.). Climate funds, which oftentimes also include green bonds, are similarly important instruments. The Green Climate Fund, for example, having so far raised USD 4.9 billion, currently stands at the center of multilateral climate finance (Green Climate Fund, 2021). As such, green funds can prove essential for the EU in raising other countries' interest for a partnership (7).

To round up this section, we will introduce Carbon Contracts for Difference (CCfDs), an instrument which has gained a certain traction in the years since 2014. Essentially, CCfDs pay out the difference between the price of emission allowances and the additional costs incurred by low-carbon technology, on the one hand incentivising companies to abate their emissions and on the other hand reducing the investor's uncertainty (Bundesministerium für Wirtschaft und Energie, 2020).

So far, this instrument has mostly been used as a complement to carbon prices, but it is not inconceivable to use it on its own (implying a carbon price of zero, i.e. fully paying for the additional costs incurred by low-carbon technology). Another option would be to use implicit carbon prices (13). Seeing as many developing countries have not yet implemented carbon pricing mechanisms, it is important to explore those options further (9). CCfDs could prove particularly promising for the industry sector, as they incentivize the transition towards low-carbon technology. Not only do they compensate for low and volatile emission prices, they also reinsure the investor and further reinforce the credibility of the government's commitment to long-term policy goals (Richstein & Neuhoff, 2019).

While there have been examples for the use of CCfDs in domestic energy sectors, for example (Anstey et al., 2021), one proposition which arose from our interviews was the possibility of financing CCfDs internationally in countries where the government would otherwise be reluctant to take on such costs itself (13). Note that the implementation of such instruments, if carefully planned, should not impinge on the local government's motivation to introduce carbon prices. Obviously, the revenues a government could collect from a carbon pricing mechanism would remain a major incentive. However, since the CCfDs would decrease with increasing carbon prices, one might run into a zero sum game situation. Therefore, one could think of attaching an additional agreement to the initial one, in which ICF providers would agree to reallocate the funds saved through the introduction of a carbon price to other projects.

Further, by providing CCfDs as an ICF instrument, conditional upon the implementation of a carbon price, they can make the introduction of such a mechanism (or even the raising of carbon prices, in cases in which they already exist) more acceptable for developing countries (13). In this way, CCfDs could help by creating a fairer global framework, which would have repercussions on trust, which would in turn allow for true reciprocity of contributions.

While these are some examples that we have encountered in our research, there are more general aspects to ICF which need not be left out. Through a bottom-up approach on domestic policy levels, triggering social and market interventions, ICF can make important contributions: it can help raise the awareness of policy makers on green policies in the industry sector (6,8). If a low carbon transition is to be triggered, climate policy needs to play a bigger role in the industry sector in the first place (2, 5). This integration of the industry sector into the national climate and development policy frameworks was mentioned by a number of interviewees as an important task to enable a just transition (11).

Findings from the case study

Just as for the industry in general, those innovative instruments are central in the provision of ICF within the steel sector. Through such instruments, the investors' aversion to investing into low-carbon steelmaking technology, which, as mentioned earlier on, is seen as risky both because of the current relatively low sustainable steel demand and the lack of experiences with such technologies, can be overcome⁸. In view of the massive investments required for the just transition of the steel sector, there is the need for bringing private capital into the loop. For this to be achieved, blended finance is inevitable. That is, the public sector will have to take away some of the risk currently included in investing in green steel. A plethora of instruments is available for this, ranging from first-loss piece strategies to green public procurement or guarantees.

CCfDs, which we have already addressed in a slightly more detailed way in the previous part, are also suitable in the scope of this case study. In particular in South Africa, where a carbon price has already been implemented, CCfDs could prove a very effective instrument to ratchet up South Africa's relatively low carbon prices, while also ensuring that carbon leakage is less of a concern for domestic policy makers. Thereby, it could give the country more space for making sure the transition occurs in a just way and simultaneously provide better conditions for reciprocity of contributions. On top of this, CCfDs could provide essential incentives for South African steel producers to significantly reduce their emissions by switching to low carbon technologies and act as an insurance for investors, taking away large parts of the uncertainty that currently reigns on markets. In India, the government has also announced it would be looking into a carbon pricing mechanism but has not yet presented concrete measures (Climate Action Tracker, 2021). CCfDs could play a major role here in making the implementation of a carbon price less controversial for domestic policy makers and thereby accelerating the process at which climate contributions are made.

8 Finance instruments can help overcome investor's possible skepticism to invest in low carbon technologies. This skepticism may come about because investors may consider it risky because (1) of low demand, (2) of the little experience with technology so far. Finance instruments can help (1) in making the production less costly: thus addressing the low demand indirectly (the cheaper green steel becomes, the higher its demand), (2) in taking away some of the risk for the investor (i.e. through guarantees, first loss pieces, etc.).

This interplay between the policy side and the technical side is essential. From there, policies and finance can be coordinated in a way to produce the most mitigation.



CHAPTER NINE —————>

Conclusions and policy recommendations

In the following we present a number of conclusions from of the study. The first set of conclusions refers to enhanced global cooperation for industry decarbonization, and the second set to the steel sector in particular.

1. Conclusions to enhance global cooperation for industry decarbonization

Industry decarbonization is not yet incorporated to its full potential in many NDCs, but the growing number of net-zero pledges – both from developed and developing countries – add momentum and rationale for national policy actors to do so. Hence, there is a justification to speak about the scaling up of mitigation contributions towards net-zero industries by both country groups. This builds the case for connecting (I) GCCC (collective action) and (II) the technical / financial support level (ICF).

Connecting the two levels of cooperation in the GCCC and in international support seems principally feasible. However, the connections are currently inhibited due to real-life political concerns, mostly related to loss of industry competitiveness, leakage, and non-integration of competing policy goals for the industry sector (productivity, economic performance, social aspects and climate change).

We have found that the reciprocity of contributions - donors' as well as recipients' contributions to global climate change mitigation via efforts to decarbonize the industries – and associated trust are thus far overlooked items in the design of ICF and ODA based support. Such elements, found by eminent experts to be crucial for global cooperation in the climate commons, are not found in current approaches for ICF or carbon pricing initiatives or the novel carbon border adjustment mechanism by the EU.

It emerged from the study that a formal implementation link between the ICF level and the political decision-making level on decarbonization policies is usually not available. This is because most governments do not have strong vertical coordination mechanisms between political and administrative levels of policy implementation. The establishment of such vertical mechanisms will be important as a primary instrument for connecting ICF to the political level, where cooperation in the climate commons is decided. Achievements and impacts of ICF implementation need to be communicated in a vertical way to political decision makers, who decide for or against a global mitigation contribution – or on the appropriate amount of the contribution.

As a way forward towards higher mitigation contributions in the industry sector, this study proposes to recall the theoretical foundations for cooperating in the global commons and develops a set of propositions how ICF can support these.

While the propositions which we established in chapter 8 need to be developed further through additional research, it will also be important to take a step out of research and to establish a dialogue with political decision makers. Indeed, up to a certain degree, the propositions should be understood not only as a product of research, but also in a normative way: if ICF is to make a contribution to improved GCCC, then a few modifications may be necessary. These relate to the following items.

First, for policy makers in donor countries, there is the need to connect ICF contributions to domestic progress of climate policy if reciprocity of mitigation contributions is intended (dubbed reversed conditionality). The focus of donor governments should thus not only be on the provision of funds for ICF, but also on demonstrating (and supporting) domestic technology progress and raised levels of policy ambition. Particular attention should be drawn to this in the course of negotiations with receiving countries.

Another important role for donor countries to promote GCCC is to enhance the access of emerging economies to their own technological and regulatory progress. Amongst others, this implies going against the often-strong protectionist tendencies in the industry sector and supporting the establishment of reliable international epistemic communities.

Secondly, for international institutions, establishing formal implementation links between ICF and political levels in countries is a way forward to making informed decisions on enhanced mitigation contributions and, consequently, on enhanced reciprocity.

Thirdly, and this concerns multilateral development banks just as much as donor countries, the support for R&D collaboration and implementation of innovative finance instruments, for instance international carbon contracts for differences is a necessity but requires the upscaling of ICF contributions for the industry sector.

Further, there is a need for those actors to make broader use of innovative climate finance instruments, potentially taking the first steps in trying them out. This should be made using a bottom-up perspective. Undoubtedly, addressing the above items requires political will to lead an international conversation about raising mitigation contributions in a reciprocal manner. This has proven very challenging in the past and has been a major source of complications in the international climate negotiations. Nevertheless, a new perspective may emerge if the role and design of ICF contributions for the industry sector are considered. Revising the design of ICF instruments so as to be more conducive for GCCC may require bold political decisions as well - above all on the side of the donor countries.

2. Specific conclusions for the steel sector

In particular, we derived the following conclusions for the steel sector.

First, steel decarbonization initiatives are at very early stages, in particular considering the situation of emerging economies. This makes it a compelling case for ICF because of the need to provide the significant capital which is necessary for changes in technology and production processes, but also to support R&D cooperation and international expert networks. The steel sector case study underlines our propositions, how ICF can contribute to enhanced GCCC: both sides, donors and recipient countries, can increase global mitigation contributions. In addition, donor countries can grant emerging economies' policy actors and industry representatives access to technological and regulatory progress towards the decarbonization of the steel sector to (ICF to enhance reciprocity of mitigation contributions).

Second, if the steel industry as a whole is to go through deep decarbonization, it is urgent that standards and definitions be addressed. Indeed, it will be hard for the sector to become “green” without a common understanding of what that means. Early initiatives, such as XCarb by ArcelorMittal, aim at the development of standards by introducing green steel certificates, thereby enabling a qualitative differentiation between green and brown steel on the market. This way, consumers of the end product can make a conscious decision, while intermediate consumers are provided with the necessary information to report on their emissions. Such definitions urgently need to be addressed on a larger scale and on the policy level, as they can in turn have repercussions on companies’ targets and choices of production.

Third, and relatedly to the first point, data on volumes of brown and green (low carbon) steel products are hardly available as of 2021. Introducing disclosure regulations by governments could greatly improve this situation. As our research revealed, data on ICF flows in the industry sector are currently highly aggregated, making it impossible to track financial flows for industry decarbonization. Agreeing on and applying definitions and categories of industrial sub sectors would be a suitable way forward to address this in the context of, e.g., OECD DAC data banks.

Fourth, the development of ICF instruments such as international CCfDs can support clean projects both prior to and complementing national carbon pricing. By alleviating the risks which currently prevent private sector investments in innovative technologies, they can contribute to equalizing the playing field from a bottom-up perspective and thereby make the ratcheting up of climate ambitions more acceptable for both sides. Thus, ICF is essential in laying the foundations for increased cooperation.

Finally, it is crucial that ICF takes into account the social importance of the steel sector in receiving countries. Therefore, ICF instruments should be designed cautiously and tailored to the domestic situations of receiving countries so as to make a just transitioning of the steel industry possible.

Study limitations and future research

The present study was developed on the existing bodies of work on international industry decarbonization, international cooperative approaches and ICF in the industry sector. We have detected a particular gap in the literature when it comes to connections between ICF and global cooperation, which we attempted to address. While it was possible to present first hypotheses on how ICF can support GCCC (industry sector), further testing and development of these hypotheses are necessary. For that, more empirical case studies appear useful for future research, to analyze real life policy and industry situations in order to better understand how ICF can contribute to reciprocity of enhanced mitigation contributions. Preferably, such a research design would take the form of internationally connected case studies, involving donor and recipient countries.

The analysis of the steel sector case study has revealed that China would need to be considered as a cooperation partner for the emerging economies in the context of steel decarbonization, in particular when considering the larger international trade volumes, as compared to those of the EU. This does not contradict the propositions and arguments presented in this study as such (in particular considering the technological advancements in the EU), but future research may investigate the role of China with a view to global cooperation in the area of industry decarbonization. Additional research topics which emerged through this study are the analysis of options for market design and associated legal agreements for preferential market conditions for low carbon steel products. This may also include the question whether the creation of such lead markets can act as an additional factor to enhance GCCC according to the propositions of this study. Furthermore, we identify the role of trust, as oftentimes referred to by the literature as central for GCCC, as a subject for future research, for instance the role of partnerships such as the LeadIT group as a driver for more trust between parties involved on the international scene. Connected to the question of incentivizing lead markets, the CBAM, although not addressed in this study as such, may also play a role as factor for industry decarbonization in recipient countries and could be analyzed in terms of its effects in follow up studies.

The range of interviews covered most important actor groups but was limited in the areas of government and industry representatives. This presents certain limitations for the formulation of the hypotheses and findings of this study, as some of the information that was used about governments and industries were provided as secondary data in the literature and other by interviewees. Future research could address these shortcomings by leading specific individual interviews or by conducting focus group discussions to learn more about respective viewpoints on how ICF can contribute to enhanced GCCC.

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Annex

Overview on the conducted interviews.

Number interview (ID)	Institutional affiliation
1	Research
5	Research
8	Research
11	Research
13	Research
2	Donor agency
16	Donor agency
17	Donor agency
14	Private sector
7	Government
9	Advocacy organization
12	Advocacy organization
15	Advocacy organization
3	Finance institution
10	Finance institution
4	International organization
6	International organization

