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From regime-building to implementation: Harnessing the UN climate conferences to drive climate action

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Abstract

The gap between the internationally agreed climate objectives and tangible emissions reductions looms large. We explore how the supreme decision-making body of the United Nations Framework Convention on Climate Change (UNFCCC), the Conference of the Parties (COP), could develop to promote more effective climate policy. We argue that promoting implementation of climate action could benefit from focusing more on individual sectoral systems, particularly for mitigation. We consider five key governance functions of international institutions to discuss how the COP and the sessions it convenes could advance implementation of the Paris Agreement: guidance and signal, rules and standards, transparency and accountability, means of implementation, and knowledge and learning. In addition, we consider the role of the COP and its sessions as mega-events of global climate policy. We identify opportunities for promoting sectoral climate action across all five governance functions and for both the COP as a formal body and the COP sessions as conducive events. Harnessing these opportunities would require stronger involvement of

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national ministries in addition to the ministries of foreign affairs and environment that traditionally run the COP process, as well as stronger involvement of non-Party stakeholders within formal COP processes.

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climate regime, Conference of the Parties, COP, UNFCCC

1 | INTRODUCTION

Despite decades of international climate negotiations, the gap between the internationally agreed objectives and tangible emissions reductions still looms large. We explore how the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) could develop to better advance more ambitious climate policy and to guide more effective implementation. After the adoption of the Paris Agreement in 2015 and the final parts of its "rulebook' at COP26 in Glasgow, there have been calls, both in academic and in public policy circles, to reorient the COP toward promoting tangible action on the ground (Biniaz, 2020; Streck, 2020). Indeed, COP26 agreed to establish a "work programme to urgently scale up mitigation ambition and implementation in this critical decade" (UNFCCC, 2022, p. 27). The details of this mitigation work program (WP) are to be agreed at COP27. COP26 also agreed that future COPs will feature annual high-level ministerial roundtables on pre-2030 ambition (UNFCCC, 2022, p. 31).

We argue that urgent and effective climate action would benefit from a more sectoral approach to mitigation. The international climate regime has so far largely focused on the adoption and implementation of economy-wide emissions targets. However, it is the individual sectoral systems that constitute the communities of action that are most relevant for curbing emissions. At the national level, climate policy is essentially part of energy policy, transport policy, agricultural policy, and so on. Moreover, opportunities and barriers for climate action differ strongly across different sectoral systems. Taking these differences into account would help global governance to develop adequate instruments to support more ambitious mitigation action (Oberthür et al., 2021).

COP26 took some steps in this direction. In its "Glasgow Climate Pact" cover decision, the COP called on parties to "phase down" "unabated coal power" and "phase out" "inefficient fossil fuel subsidies" (UNFCCC, 2022, p. 36). In addition, the UK presidency capitalized on the conference as a platform for climate action by orchestrating a series of sectoral frontrunner initiatives. An initial assessment by the International Energy Agency found that full implementation of all pledges made up prior to and during Glasgow could lead to limiting global temperature increase by 2100 to 1.8°C (Birol, 2021), ostensibly bringing the Paris Agreement's temperature objective into reach.

Future COP sessions should build on these advances. Our recommendations for how to do so are based on existing literature and a series of workshops on how to improve an implementation-oriented functioning of the COP. To structure our discussion, we consider five key functions of global governance which international institutions (like the UNFCCC and its COP) can activate to help address particular problems (like climate change) (Kinley et al., 2021; Oberthür et al., 2021):

- Guidance and signaling on long-term visions and goals, such as the objectives of the Paris Agreement or specific sectoral goals, targets or initiatives pledged at COP sessions;
- Rules and standard setting on the behavior of the institutions' members, which may either be obligations of conduct, that is, to undertake specific actions, or obligations of result, that is, to achieve a certain outcome, such as an emissions target;
- Transparency and accountability to identify and address problems pertaining to compliance with agreed goals, rules and standards;
- Means of implementation such as financial, technological and capacity building support to enable the institutions' members and pertinent sectoral actors to deliver on their stated intentions;
- Knowledge and learning to promote the generation and diffusion of solutions to address the problem at hand throughout the sectors.

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This paper's focus on mitigation should not be interpreted as suggesting these five functions or indeed a sectoral approach are not relevant to adaptation. As with mitigation, there is growing debate on how to advance adaptation implementation and what the role of the UNFCCC and its COP could be in this process (Magnan & Ribera, 2016). However, the institutional context and actors involved in adaptation differ considerably from those in mitigation. Future work could consider the extent to which findings presented in this paper also apply to adaptation, and in which other ways the COP might help to catalyze adaptation ambition and action.

In the following, we first outline the nature of UN climate conferences and the roles of their different components to provide a basis for the discussion. We then use these functions to structure our analysis of how the COP may evolve into a better implementation driver.

2 | THE ROLE OF THE COP AND UN CLIMATE CONFERENCES IN GLOBAL CLIMATE GOVERNANCE

Historically and today, global climate governance as a process operates through different international bodies and transnational fora (Zelli, 2011). At the intergovernmental level, the COP is the central institution. It serves as the supreme decision-making body of the UNFCCC and is in charge of the regular review and promotion of its effective implementation (UNFCCC, Art. 7). The annual COP sessions have evolved beyond this diplomatic process and have come to constitute important moments in the larger global governance process. Similar to Zelli (2011) and Aykut et al. (2022), we therefore conceptualize UN climate conferences in terms of three concentric circles, roughly representing the spatial organization of activities, and reflecting different degrees of formalization, as shown in Figure 1.

The innermost circle comprises the UNFCCC negotiation spaces: the COP and the respective decision-making bodies for the Paris Agreement (CMA) and the Kyoto Protocol (CMP), and the subsidiary bodies for scientific and technological advice (SBSTA) and implementation (SBI). All of these bodies operate by consensus on nearly all issues.[1] In addition, issue-specific bodies have been established that operate under the COP's guidance, often referred to as constituted bodies, for example, the Adaptation Committee.

FIGURE 1 Schematic illustration of the layered structure of the UN climate conferences as transnational mega-events. Authors' illustration

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In addition to the formal diplomatic process, annual COP sessions also host exhibits and side events within the so-called Blue Zone where admitted participants display their work or engage in consultancy and advocacy. These elements of the COP surrounding the formal negotiations have become major meeting places (Kuyper et al., 2018).

Finally, at its perimeter, COP sessions regularly host a space for civil society events, the so-called Green Zone, open to the general public. COPs as transnational mega-events, hence, attract a wide diversity of participants and provide global media attention to global climate governance.

We refer to these as different layers of UN climate summitry in our discussion below of the above-mentioned governance functions. While some of the bodies and processes under the UNFCCC also have sessions in between the annual COP sessions, our main focus lies on actions that could be taken only by the COP as the decision-making body, or by using the COP and its subsidiary bodies as a platform.[2]

2.1 | Guidance and signal

The objectives promulgated by international agreements may help to stimulate and synchronize activities across different levels of governance (Morseletto et al., 2017). They may also send signals to businesses, investors, and other actors (Aykut et al., 2021), and establish expectations regarding national policy, lending crucial support to domestic stakeholders (Dai, 2010; Kinley, 2017).

The Paris Agreement has already provided important signals to such actors to pursue "climate neutral" development (Falkner, 2016; Kinley et al., 2021). However, the COP has so far mostly focused on global emissions, pointing to the global "emissions gap" and exhorting a sense of urgency only in general terms. To provide more specific guidance, a breaking down of the global mitigation objective into individual emitting sectors and the setting of a timeline and roadmap for each sector to achieve (net) zero emissions would be helpful (Rayner et al., 2021). COP26 took a major step in this direction with its call for parties to "phase down" unabated coal power and "phase out" inefficient fossil fuel subsidies. Up to this point, fossil fuel-producing nations had always succeeded in blocking such discussions (van Asselt & Kulovesi, 2017).

The new mitigation WP would provide a fitting framework for developing more specific phase-down and phase-out schedules, and also for developing sectoral targets and roadmaps in general. The Global Stocktake (GST) provides another near-term opportunity to provide more specific guidance. It could be used to collate and institutionalize existing knowledge and roadmaps on what achieving the Paris objectives would mean for each sector and what the current status is. This would help guide the next round of NDC updates and also provide orientation and legitimacy for action by non-party stakeholders (Hermwille et al., 2019).

For example, regarding the phase-down of unabated coal, the latest IPCC assessment report finds that pathways likely limiting warming to 2 or 1.5°C involve a near elimination of coal use without CCS. Scenarios limiting warming to 1.5°C with no or limited overshoot involve a reduction of coal consumption without CCS by 67% to 82% already in 2030 (Pathak et al., 2022). These findings could be adopted into the UNFCCC process through the GST or through the mitigation WP and the COP could call on parties to develop national phase-down pathways on this basis.

Such discussions to develop sectoral targets and roadmaps could build on work that is already being conducted in the "outer circles" of the COP under the Marrakech Partnership for Global Climate Action (MPGCA). The MPGCA aims to support implementation of the Paris Agreement by facilitating collaboration between governments and cities, regions, businesses and investors. Part of the MPGCA's activities has been to develop "Climate Action Pathways" for sectors. The MPGCA also facilitates mobilization campaigns, such as the Race to Zero (R2Z), to raise ambition on mitigation, and its twin campaign Race to Resilience (R2R) for adaptation. Mobilization campaigns play a key role linking the intergovernmental process with sub-national and non-state actors to accelerate and amplify the implementation of the Paris Agreement (Chan et al., 2019; Chan, Eichhorn, et al., 2021). However, while the High-Level Climate Champions, who coordinate the MPGCA, are appointed by the COP presidents, their activities so far have no formal direct link to the intergovernmental negotiation space. Connecting their activities to an official process such as the new mitigation WP could enhance the impact on parties' policies because it would require them to engage with the issue (Hermwille, 2018). For example, the COP could decide that the WP needs to provide space for inputs from the Champions and from the communities of experts which the Champions have established around the Climate Action Pathways. The COP could also officially endorse the Climate Action Pathways and request parties to consider them in the development of their NDCs and long-term strategies.

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The impact could be especially strong if the process encouraged parties to engage more national ministries. Parties' COP delegations are mostly led by ministries of the environment or foreign affairs, but national implementation to a large extent depends on sectoral line ministries of energy, transport, agriculture, etc. In our observation, many governments have treated climate governance primarily as a task of environment ministries and not effectively mainstreamed climate policy into the work of other pertinent ministries. While the COP rarely requests participation of specific ministries, governments might still be nudged to bring their respective sectoral ministries to the table more often if official agenda items such as the new mitigation WP included a sectoral focus. There is a risk that stronger involvement of ministries that do not have climate policy as their main objective may protract rather than improve the process' efficiency and effectiveness.[3] However, the objectives and commitments under the Paris Agreement have already been agreed and apply government-wide. With a targeted focus on specific implementation issues, the effect of engaging and socializing the respective ministries to international climate governance should strengthen whole-of-government approaches at domestic levels and outweigh potential unintended impacts of broadened participation.

Finally, non-party stakeholders have an important role in putting and keeping issues on the agenda. They represent an indispensable transmission belt from wider society into intergovernmental negotiations (Bäckstrand et al., 2017; Kuyper et al., 2018). When the latter exclude important topics or framings, such as issues of global justice or questions of energy production technologies and fossil fuel subsidies, which were long times considered outside of the mandate of the UN climate regime, civil society organizations can lobby for their inclusion or keep them in the wider policy debate at COPs (Aykut & Castro, 2017). Conversely, engagement at the international level can be assumed to boost non-party stakeholders' ability to inform national agenda setting and even to push for implementation domestically (Dai, 2010).

Their role could be strengthened by integrating them more prominently in the formal process (Chan, Brandi, & Bauer, 2016). So far, non-party stakeholders usually have only very limited space for interventions, usually only at the end of a meeting after all parties have spoken. By contrast, the roundtables in the GST's first Technical Dialogue in June 2022 provided for an adequate back-and-forth among parties and non-party stakeholders. Moreover, in the Dialogue's world café formats such boundaries were virtually overcome. This encouraging example could be emulated for other UNFCCC processes.

2.2 | Setting rules and standards

In addition to signaling the desired way forward, international institutions may also require certain actions from their members to achieve the common objectives.

Parties' performance in reducing emissions has so far strongly varied among sectors. It would therefore be useful if international rules and standards compelled parties to demonstrate progress across all sectors. The COP could agree that nationally determined contributions (NDCs) and long-term greenhouse gas development strategies under the Paris Agreement should include sectoral breakdowns, with specific targets and measures for each sector (Obergassel et al., 2021).

In addition, the COP could seek to organize co-ordination on specific sectoral rules and standards, such as emission pricing or aligned phase-out dates for coal, conventional vehicles or fossil fuel subsidies, also as a means to respond to parties' concerns around economic competitiveness and international equity (Kinley et al., 2021).

As noted above, the Glasgow climate conference took some steps in this direction by calling on parties to "phase down" unabated coal power and "phase out" inefficient fossil fuel subsidies. Future COP sessions should follow up by developing specific rules and standards to operationalize these objectives, for example as part of the new mitigation WP. Building on adoption of a global coal phase-down target, parties should commit to develop national phase-down plans as part of their NDCs and long-term strategies. Regarding fossil fuel subsidies, parties could follow a two-step process as outlined by Verbruggen (2011). In a first step, parties would commit to providing full transparency on all governmental levies and subsidies related to high-emission and low-emission activities respectively. In a second step, parties would commit to gradually shift support from the former to the latter.

However, pertinent negotiations remain extremely contentious. It may therefore be politically difficult to achieve multilateral agreement on more detail. If advancing in the formal process is not possible, interested parties and other stakeholders could alternatively expand the use and give more visibility to the Blue and Green Zones as platforms for promoting sectoral climate initiatives. The Glasgow conference, for instance, advanced in this direction, producing a host of sectoral initiatives by subsets of parties and non-party stakeholders on issues such as phasing-out internal

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combustion engines, forest conservation, methane emissions reductions, etc. Future COPs could be used to further strengthen these initiatives in terms of their membership, specifying the commitments made and monitoring progress.

2.3 | Transparency and accountability

International institutions may enhance the transparency of their members' actions by collecting and analyzing relevant data, and identify and hold parties to account for any implementation deficits (Ciplet et al., 2018; Gupta & van Asselt, 2019; Park & Kramarz, 2019). Now that the "Paris rulebook" has been completed, the COP could promote implementation by devoting more attention to its transparency and accountability function. In theory, reporting, and expert and peer review can support countries in doing more by helping them to identify opportunities for further action, and they can allow other governments as well as non-party stakeholders to demand higher ambition and better implementation from governments (Chan, Falkner, et al., 2016; Stevenson, 2021; Weikmans et al., 2020).

However, some of the existing literature questions whether the mechanisms established under the Paris Agreement, the Enhanced Transparency Framework (ETF), the Paris Agreement Implementation and Compliance Committee (PAICC) and the GST are likely to have this effect (Pauw et al., 2018; Raiser et al., 2022; Weikmans et al., 2020). Most importantly, these mechanisms have no mandate to assess the adequacy of individual parties' NDCs, nor a mandate to assess the adequacy of parties' policies and measures to achieve their NDCs. In addition, the high diversity of NDCs makes assessment difficult in any case. Moreover, participation opportunities in transparency arrangements for non-party stakeholders are limited, which confines their ability to use these arrangements to create public pressure. Engaging them more closely in emergent transparency procedures could be expected to enhance their transmission belt function between domestic and international levels, but would also raise legitimacy concerns that may be hard to overcome in the short term. Finally, there are doubts whether parties and the UNFCCC Secretariat have sufficient resources to adequately operate the ETF.

From the perspective of sectoral transformation, another shortcoming is that reporting requirements currently do not mandate to specify challenges and barriers currently impeding sectoral transformations. Ideally, parties should include a systematic assessment of technological, economic, institutional or capacity-related transformation challenges specifically for each major sector. This would help to identify policy gaps and enable non-party stakeholders to hold their respective governments accountable. It would also provide valuable information for subsequent iterations of the GST (Hermwille et al., 2019).

Substantial strengthening of the PA's transparency provisions is therefore needed to enable them to actually have an impact. However, the first review and potential update of modalities, procedures and guidelines for the ETF is due only in 2028 (UNFCCC, 2019, p. 2). As the negotiations on these provisions were contested vehemently it may therefore not be possible to re-open them in the near future. In this case, the new mitigation WP and the annual high-level ministerial on pre-2030 ambition and implementation should be used as a complementary avenue to enhance accountability. The WP and the agenda for the high-level ministerial should make clear that parties will be expected to demonstrate each year how they are scaling up ambition and implementation of their climate policies. In addition to the NDCs, this should include a focus on sectoral commitments such as the ones made at COP26. Again, the impact could be especially strong if the process encouraged parties to engage more national ministries. If line ministries were invited to internationally account for how they have implemented pertinent requirements of the PA in their respective portfolios, this could help to promote climate mainstreaming domestically and further the basis for peer-learning at the international level.

Beyond the formal transparency mechanisms of the COP, the wider UN climate conference space also hosts important transparency-related activities. It provides an occasion for activists and social movements to observe the implementation of existing commitments, critically scrutinize new sectoral initiatives and examine new climate neutrality pledges from parties and non-party stakeholders. Some of these activities feed into the so-called Independent Global Stocktake (iGST), which brings together NGOs and experts to support and strengthen the GST through official inputs, but also by presenting analyses in side-events in the Blue Zone. Such initiatives should be supported and given more visibility, so that they can constitute a platform for work that goes beyond the current constraints of the formal process. Controversial debates on accountability and implementation in the wider conference space could then act as "informal assessments" (Rip, 1986) of sectoral initiatives.

To ensure credibility and accountability, the mobilization campaigns under the MPGCA have put in place criteria to prevent greenwashing and double-counting. For instance, a metrics framework has been developed for the Race to

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Resilience to verify the impacts of adaptation and resilience actions by non-party stakeholders (Race to Resilience, 2021). These criteria often apply to specific areas of application, such as farming and agriculture, or the mining industry. While these thematic and sector-specific criteria are gaining more attention, they are still very broad. Hence, further development is needed to clearly identify actions that are truly additional and ensure full transparency and accountability. This also applies to the Race to Zero has recently toughened its minimum membership criteria after months of consultative process.

These efforts are important because respective commitments should be credible and deliver on their promises. The development of methodologies and metrics to track and assess progress is necessary for transparency and accountability and was duly called for by the UNFCCC Secretariat in 2017. The resulting collaborative engagement of the global data community in the CAMDA network (https://camda.global) is pivotal for transparency and accountability, and is integral to efforts to strengthen and link actions by non-party stakeholders to actions by national governments.

To further strengthen such efforts, a voluntary scheme for independent third-party assessment of pledges by non-party stakeholders could be established. This would entail an agreed catalogue of assessment criteria for both target ambition and implementation, as well as a governance scheme designating and overseeing independent auditors. Verified non-party stakeholder pledges could then be highlighted to encourage replication. The recently established High-level Expert Group (HLEG) on the Net-Zero Emissions Commitments of Non-state Entities, appointed by UN Secretary-General Guterres (IISD, 2022), could work into that direction and develop recommendations for the COP and its subsidiary bodies.

2.4 | Means of implementation

The so-called means of implementation, that is mobilization of financial resources, capacity building and technology transfer, have been central to the UNFCCC from the very beginning (Kinley et al., 2021; Oberthür et al., 2021). UNFCCC Art. 4.7 and similarly Paris Agreement Art. 4.5 tie the extent to which developing countries will implement their commitments to the provision of support by developed countries. In this context, the "outer layers" of COP sessions are often used as platforms to announce new funding initiatives and these often have a sectoral focus. For example at COP21, twenty countries launched the "Mission Innovation" initiative to double research and development investments to around US$10 billion in clean energy and innovation research (US Department of Energy, 2015).

The question is to what extent the support that is being made available is sufficient to achieve the Paris objectives. The high-level process has so far focused to a large extent on resource mobilization in aggregate, for example follow-up on the pledge made by developed countries at COP15 in Copenhagen to mobilize USD 100 billion annually by 2020. Discussions have focused on whether the target is being met or not, what actually counts as climate finance, delays and conditionalities (Kinley et al., 2021). There is much less consideration of financing needs, both in the UNFCCC and in the academic literature (Patt et al., 2022). The UNFCCC Standing Committee on Finance (SCF) in 2021 for the first time produced a report on financing needs of developing countries in addition to its biennial assessment of climate finance flows. Both reports include consideration of needs and flows at sector level, but they note that there are strong data gaps (UNFCCC, 2021a, 2021b). Donor countries should therefore invest resources to fill these data gaps in order to gain a more accurate picture. In addition, the question of sectoral needs and actual sectoral flows should also be tackled at a higher political level than the SCF. The GST, which started at COP26, would be a fitting high-level framework to address this question since it already has means of implementation as one of its topics. Once financing needs and gaps have been identified more clearly, both the formal negotiations and individual funding initiatives could target identified gaps more clearly.

2.5 | Knowledge and learning

International institutions create knowledge and can facilitate knowledge brokering, for instance as platforms for individual and social learning and by promoting the diffusion of scientific, economic, technical and policy-related knowledge to address the problem at hand (Haas & Haas, 1995). This also applies to the UNFCCC process (Kinley et al., 2021). With the PA and the explicit ambition to pursue efforts to limit global warming to 1.5°C in place, the COP should now strive to facilitate the implementation of commensurate policies by promoting peer learning and

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international support to that end. Organizing and orchestrating focused exchanges on sectoral specifics promises to be conducive in that respect.

Indeed, the UNFCCC's Technical Examination Processes (TEPs) and the MPGCA point in that direction. Yet, as noted above, MPGCA activities have so far had no direct link to the formal negotiation space, while the TEPs have so far met with little attention (Hermwille, 2018; Obergassel et al., 2019). The GST as well as the new mitigation WP offer a new opportunity for advancing such designated practices of knowledge and learning, for instance by calling thematic sessions on concrete implementation challenges at sectoral level. Such sessions may be expected to galvanize more constructive and outcome-oriented discussions than inconsequential exchanges on abstract concepts such as raising ambition (Streck, 2020). Again, the impact could be especially large if these thematic sessions prompted engagement by pertinent national line ministries and associated relevant non-party stakeholders, which could broaden the basis for knowledge and learning, enhance ownership by stakeholders that operate beyond the margins of climate governance proper, and facilitate the circulation of policy frames and insights from respective implementation successes and failures at domestic and international levels.

For instance, the Koronivia Joint work on Agriculture has so far made good progress in sharing information and knowledge on the impact from climate change on the agricultural sector and lowering the sector's contribution to global warming. Stronger engagement of agricultural ministries would reorient this work from its current "talking shop" format into a more action-oriented platform that enables the COP to facilitate uptake and ownership by sectoral stakeholders.

Likewise, such thematic sessions could also seek to guide and to promote the integration of climate action with related multilateral processes and agendas, in particular the other Rio Conventions and the Sustainable Development Goals (SDGs). On the one hand there are potential synergies, but on the other hand non-climate impacts of climate actions may also have strong negative repercussions on other agendas. For example, the upscaling of nature-based bioenergy use and negative emission technologies entail serious risks for biodiversity, human rights and the sustainable use of land and water resources (Burns & Nicholson, 2017; Fuss et al., 2014).

Hence, sector-specific exchange between UNFCCC and CBD, for instance, on the mutual interest to avoid deforestation or to restore wetlands could be more useful than recurrent general references to the potential of "nature-based solutions." The COP (ideally in concert with COPs or subsidiary bodies of pertinent MEAs) should therefore assess both potential synergies and negative impacts of climate actions at sectoral level in a structured and more consistent approach.

Finally, in support of the learning function, the COP should encourage diffusion, replication and adaptation of effective and innovative climate policies or governance solutions in key sectors that have proven effective in one country or jurisdiction to other countries or jurisdictions. The specific potential of international institutions to advance policy diffusion has long been recognized in environmental policy research (Busch & Jörgens, 2005) and international relations scholarship (Dobbin et al., 2007). It also applies to the UNFCCC (Bergero et al., 2021; Tosun & Schoenefeld, 2017). To further facilitate and speed up policy diffusion that is conducive to the implementation of the PA, a possible near-term solution would be for the COP to set up a global climate policy "hub" or Clearinghouse at the international level under its guidance. This could also be instrumental to demonstrate good practice examples, such as from Global Climate Action Award winners, for emulation and replication by sectoral peers as well as to mobilize targeted means for scaling up (Chan, Boran, et al., 2021).

3 | CONCLUSION

The discussion of five key governance functions of international institutions has enabled us to identify ways in which the COP could evolve to better support the implementation of the PA by focusing more on individual sectoral systems. Figure 2 below summarizes our proposed lines of action.

In summary, we argue in favor of focusing the agenda of future COP sessions on the development and implementation of targets at the sector level, while broadening participation to actors that are especially relevant for implementation, such as sectoral ministries and non-party stakeholders.

In our view, COP26 showed signs of shifting toward a more sectoral perspective, which could be expanded. In particular the new work program on scaling up mitigation ambition and implementation offers a promising avenue that could and should be used to promote action across a broad range of sectors and with regard to all five governance functions.

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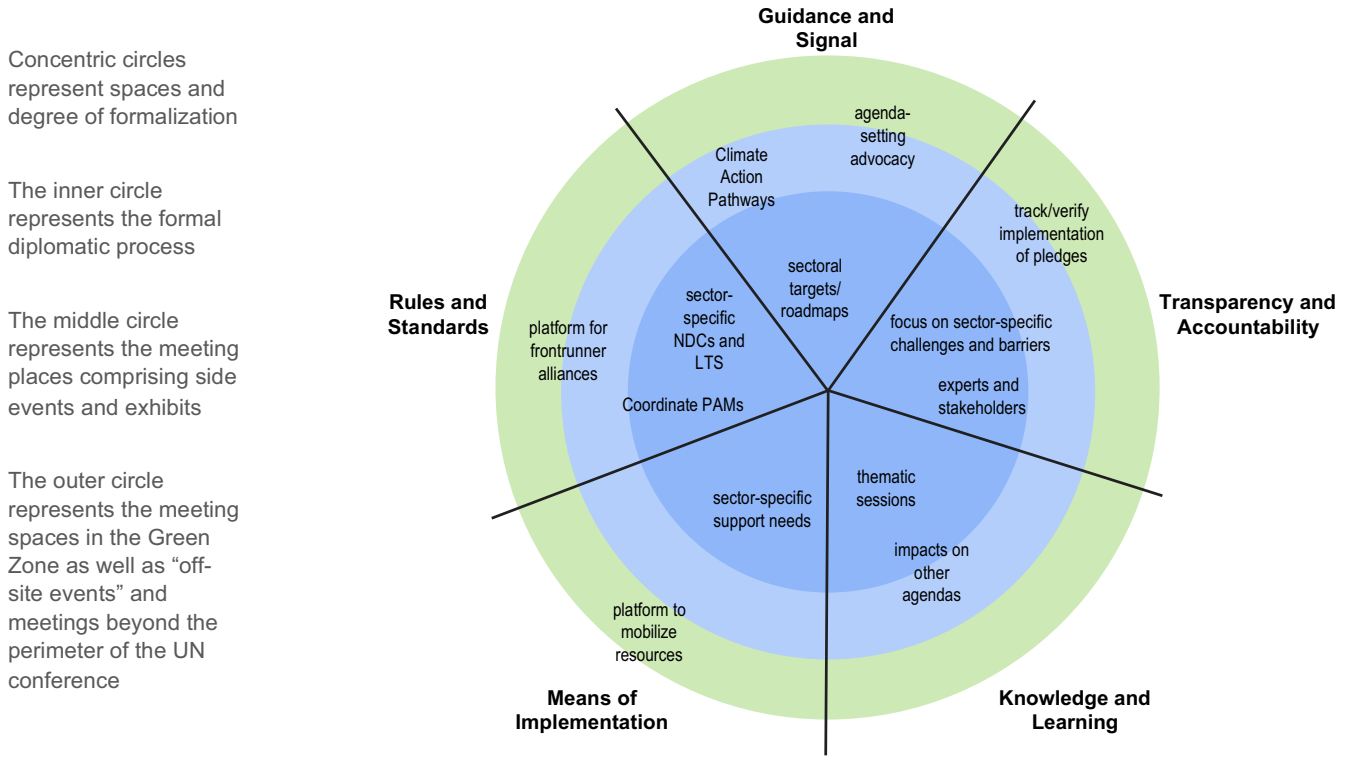

FIGURE 2 Visual summary of options to promote implementation across the climate conferences' layers. Authors' illustration

AUTHOR CONTRIBUTIONS

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CONFLICT OF INTEREST

Heike Schroeder is a Domain Editor of the journal and was excluded from the peer-review process and all editorial decisions related to the publication of this article.

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Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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ENDNOTES

[1] There is a limited number of issues that allow voting, for example, on some procedural matters. There are draft rules of procedure that would provide for voting more generally, but parties have so far not agreed to adopt them.

[2] In addition to the annual COP meetings, SBI and SBSTA regularly convene for intersessional technical meetings in Bonn in May/June each year. The outcomes of the respective SBs are typically adopted by the subsequent COP.

[3] We thank one of the anonymous reviewers for this observation.

REFERENCES

Aykut, S. C., & Castro, M. (2017). The end of fossil fuels? Understanding the partial climatisation of global energy debates. In S. C. Aykut, J. Foyer, & E. Morena (Eds.), *Globalising the climate: COP21 and the climatisation of global debates*. Routledge Earthscan.

Aykut, S. C., Morena, E., & Foyer, J. (2021). 'Incantatory' governance: Global climate politics' performative turn and its wider significance for global politics. *International Politics*, *58*(4), 519–540. https://doi.org/10.1057/s41311-020-00250-8

Aykut, S. C., Schenuit, F., d'Amico, E., & Klenke, J. (2022). *It's a performance, not an orchestra! Rethinking soft coordination in global climate governance. Global Environmental Politics.* (forthcoming).

Bäckstrand, K., Kuyper, J. W., Linnér, B.-O., & Lövbrand, E. (2017). Non-state actors in global climate governance: From Copenhagen to Paris and beyond. *Environmental Politics*, *26*(4), 561–579. https://doi.org/10.1080/09644016.2017.1327485

Bauer, S., Chan, S., Hermwille, L., & Obergassel, W. (2020, October 20). *It's the end of the COP as we know it! Reflections by the co-chairs*. German Development Institute/Deutsches Institut für Entwicklungspolitik. https://www.die-gdi.de/fileadmin/user_upload/pdfs/veranstaltungen/2020/20201021-End-of-COP-Chairs-Reflection.pdf

Bergero, C., Rich, M. J., & Saikawa, E. (2021). All roads lead to Paris: The eight pathways to renewable energy target adoption. *Energy Research & Social Science*, *80*, 102215. https://doi.org/10.1016/j.erss.2021.102215

Biniaz, S. (2020). *After Madrid, W(h)ither the COP?* Sabin Center for Climate Change Law, Columbia Law School https://climate.law.columbia.edu/sites/default/files/content/docs/Biniaz%202020-%20After%20Madrid%2C%20W%5Bh%5Dither%20the%20COP_FINAL.pdf

Birol, F. (2021). *COP26 climate pledges could help limit global warming to 1.8°C, but implementing them will be the key—Analysis*. IEA https://www.iea.org/commentaries/cop26-climate-pledges-could-help-limit-global-warming-to-1-8-c-but-implementing-them-will-be-the-key

Burns, W., & Nicholson, S. (2017). Bioenergy and carbon capture with storage (BECCS): The prospects and challenges of an emerging climate policy response. *Journal of Environmental Studies and Sciences*, *7*(4), 527–534. https://doi.org/10.1007/s13412-017-0445-6

Busch, P., & Jörgens, H. (2005). The international sources of policy convergence: Explaining the spread of environmental policy innovations. *Journal of European Public Policy*, *12*(5), 860–884. https://doi.org/10.1080/13501760500161514

Chan, S., Boran, I., Asselt, H., Ellinger, P., Garcia, M., Hale, T., Hermwille, L., Liti Mbeva, K., Mert, A., Roger, C. B., Weinfurter, A., Widerberg, O., Bynoe, P., Chengo, V., Cherkaoui, A., Edwards, T., Gütschow, M., Hsu, A., Hultman, N., ... Shrivastava, M. K. (2021). Climate ambition and sustainable development for a new decade: A catalytic framework. *Global Policy*, *12*(3), 245–259. https://doi.org/10.1111/1758-5899.12932

17577799, 2022, 6, Downloaded from https://wires.onlinelibrary.wiley.com/doi/10.1002/wcc.797 by Utrecht University Library, Wiley Online Library on [15/12/2022]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Chan, S., Boran, I., van Asselt, H., Iacobuta, G., Niles, N., Rietig, K., Scobie, M., Bansard, J. S., Delgado Pugley, D., Delina, L. L., Eichhorn, F., Ellinger, P., Enechi, O., Hale, T., Hermwille, L., Hickmann, T., Honegger, M., Hurtado Epstein, A., La Hoz Theuer, S., ... Wambugu, G. (2019). Promises and risks of nonstate action in climate and sustainability governance. *WIREs Climate Change*, *10*(3), e572. https://doi.org/10.1002/wcc.572

Chan, S., Brandi, C., & Bauer, S. (2016). Aligning transnational climate action with international climate governance: The road from Paris. *Review of European, Comparative & International Environmental Law*, *25*(2), 238–247. https://doi.org/10.1111/reel.12168

Chan, S., Eichhorn, F., Biermann, F., & Teunissen, A. (2021). A momentum for change? Systemic effects and catalytic impacts of transnational climate action. *Earth System Governance*, *9*, 100119. https://doi.org/10.1016/j.esg.2021.100119

Chan, S., Falkner, R., Goldberg, M., & van Asselt, H. (2016). Effective and geographically balanced? An output-based assessment of non-state climate actions. *Climate Policy*, *18*, 24–35. https://doi.org/10.1080/14693062.2016.1248343

Ciplet, D., Adams, K. M., Weikmans, R., & Roberts, J. T. (2018). The transformative capability of transparency in global environmental governance. *Global Environmental Politics*, *18*(3), 130–150. https://doi.org/10.1162/glep_a_00472

Dai, X. (2010). Global regime and national change. *Climate Policy*, *10*(6), 622–637. https://doi.org/10.3763/cpol.2010.0146

Dobbin, F., Simmons, B., & Garrett, G. (2007). The global diffusion of public policies: Social construction, coercion, competition, or learning? *Annual Review of Sociology*, *33*(1), 449–472. https://doi.org/10.1146/annurev.soc.33.090106.142507

Falkner, R. (2016). The Paris Agreement and the new logic of international climate politics. *International Affairs*, *92*(5), 1107–1125.

Fuss, S., Canadell, J. G., Peters, G. P., Tavoni, M., Andrew, R. M., Ciais, P., Jackson, R. B., Jones, C. D., Kraxner, F., Nakicenovic, N., Le Quéré, C., Raupach, M. R., Sharifi, A., Smith, P., & Yamagata, Y. (2014). Betting on negative emissions. *Nature Climate Change*, *4*(10), 850–853. https://doi.org/10.1038/nclimate2392

Gupta, A., & van Asselt, H. (2019). Transparency in multilateral climate politics: Furthering (or distracting from) accountability?: Transparency in climate politics. *Regulation & Governance*, *13*(1), 18–34. https://doi.org/10.1111/rego.12159

Haas, P. M., & Haas, E. B. (1995). Learning to learn: Improving international governance. *Global Governance*, *1*(3), 255–284.

Hermwille, L. (2018). Making initiatives resonate: How can non-state initiatives advance national contributions under the UNFCCC? *International Environmental Agreements: Politics, Law and Economics*, *18*(3), 447–466. https://doi.org/10.1007/s10784-018-9398-9

Hermwille, L., Siemons, A., Förster, H., & Jeffery, L. (2019). Catalyzing mitigation ambition under the Paris Agreement: Elements for an effective Global Stocktake. *Climate Policy*, *19*(8), 988–1001. https://doi.org/10.1080/14693062.2019.1624494

IISD. (2022). *Expert Group to Build Accountability for Net Zero Pledges | News | SDG Knowledge Hub | IISD*. http://sdg.iisd.org/news/expert-group-to-build-accountability-for-net-zero-pledges/

Kinley, R. (2017). Climate change after Paris: From turning point to transformation. *Climate Policy*, *17*(1), 9–15. https://doi.org/10.1080/14693062.2016.1191009

Kinley, R., Cutajar, M. Z., de Boer, Y., & Figueres, C. (2021). Beyond good intentions, to urgent action: Former UNFCCC leaders take stock of thirty years of international climate change negotiations. *Climate Policy*, *21*(5), 593–603. https://doi.org/10.1080/14693062.2020.1860567

Kuyper, J. W., Linnér, B., & Schroeder, H. (2018). Non-state actors in hybrid global climate governance: Justice, legitimacy, and effectiveness in a post-Paris era. *WIREs Climate Change*, *9*(1), 1–18. https://doi.org/10.1002/wcc.497

Magnan, A. K., & Ribera, T. (2016). Global adaptation after Paris. *Science*, *352*(6291), 1280–1282. https://doi.org/10.1126/science.aaf5002

Morseletto, P., Biermann, F., & Pattberg, P. (2017). Governing by targets: Reductio ad unum and evolution of the two-degree climate target. *International Environmental Agreements: Politics, Law and Economics*, *17*(5), 655–676. https://doi.org/10.1007/s10784-016-9336-7

Obergassel, W., Arens, C., Hermwille, L., Kreibich, N., Ott, H. E., & Wang-Helmreich, H. (2019). Paris agreement: Ship moves out of the drydock. *Carbon & Climate Law Review*, *13*(1), 3–18. https://doi.org/10.21552/cclr/2019/1/4

Obergassel, W., Lah, O., & Rudolph, F. (2021). Driving towards transformation? To what extent does global climate governance promote decarbonisation of land transport? *Earth System Governance*, *8*, 100098. https://doi.org/10.1016/j.esg.2021.100098

Oberthür, S., Hermwille, L., & Rayner, T. (2021). A sectoral perspective on global climate governance: Analytical foundation. *Earth System Governance*, *8*, 100104. https://doi.org/10.1016/j.esg.2021.100104

Park, S., & Kramarz, T. (Eds.). (2019). *Global environmental governance and the accountability trap*. The MIT Press.

Pathak, M., Slade, R., Pichs-Madruga, R., Ürge-Vorsatz, D., Shukla, P. R., Skea, J., Abdulla, A., Al Khourdajie, A., Babiker, M., Bai, Q., Bashmakov, I., Bataille, C., Berndes, G., Blanco, G., Cabeza, L. F., Carraro, C., Clarke, L., de Coninck, H., Creutzig, F., ... Winkler, H. (2022). *Working Group III contribution to the IPCC sixth assessment report (AR6)* (Technical summary). https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_FinalDraft_TechnicalSummary.pdf

Patt, A., Rajamani, L., Bhandari, P., Ivanova Boncheva, A., Caparrós, A., Djemouai, K., Kubota, I., Peel, J., Sari, A., Sprinz, D. F., Wettestad, J., Babiker, M., Bala, G., Bataille, C., Bertoldi, P., Creutzig, F., de Coninck, H., Dubash, N. K., Garett, R., ... van Asselt, H. (2022). Chapter 14: International cooperation. In *Climate change 2022: Mitigation of climate change. Contribution of working group III to the sixth assessment report of the Intergovernmental Panel on Climate Change*. https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_FinalDraft_Chapter14.pdf

Pauw, W. P., Klein, R. J. T., Mbeva, K., Dzebo, A., Cassanmagnago, D., & Rudloff, A. (2018). Beyond headline mitigation numbers: We need more transparent and comparable NDCs to achieve the Paris agreement on climate change. *Climatic Change*, *147*(1–2), 23–29. https://doi.org/10.1007/s10584-017-2122-x

Race to Resilience. (2021). *Race to resilience metrics framework*. https://racetozero.unfccc.int/wp-content/uploads/2021/11/202111_R2R_Metrics_framework.pdf

17577799, 2022, 6, Downloaded from https://wires.onlinelibrary.wiley.com/doi/10.1002/wcc.797 by Utrecht University Library, Wiley Online Library on [15/12/2022]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Raiser, K., Çalı, B., & Flachsland, C. (2022). Understanding pledge and review: Learning from analogies to the Paris Agreement review mechanisms. *Climate Policy*, *22*, 711–727. https://doi.org/10.1080/14693062.2022.2059436

Rayner, T., Oberthür, S., & Hermwille, L. (2021). A sectoral perspective on international climate governance: Key findings and research priorities. *Earth System Governance*, *8*, 100105. https://doi.org/10.1016/j.esg.2021.100105

Rip, A. (1986). Controversies as informal technology assessment. *Knowledge: Creation, Diffusion, Utilization*, *8*(2), 349–371.

Stevenson, H. (2021). Reforming global climate governance in an age of bullshit. *Globalizations*, *18*(1), 86–102. https://doi.org/10.1080/14747731.2020.1774315

Streck, C. (2020). The mirage of Madrid: Elusive ambition on the horizon. *Climate Policy*, *20*(2), 143–148. https://doi.org/10.1080/14693062.2020.1726564

Tosun, J., & Schoenefeld, J. J. (2017). Collective climate action and networked climate governance. *WIREs Climate Change*, *8*, e440. https://doi.org/10.1002/wcc.440

UNFCCC. (2019, March 19). Decision 18/CMA.1, Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement, FCCC/PA/CMA/2018/3/Add.2.

UNFCCC. (2021a). *UNFCCC standing committee on finance: First report on the determination of the needs of developing country parties related to implementing the convention and the Paris Agreement*. United Nations Framework Convention on Climate Change https://unfccc.int/sites/default/files/resource/54307_2%20-%20UNFCCC%20First%20NDR%20technical%20report%20-%20web%20%28004%29.pdf

UNFCCC. (2021b). *UNFCCC Standing Committee on Finance Fourth (2020): Biennial assessment and overview of climate finance flows*. United Nations framework convention on Climate Change https://unfccc.int/sites/default/files/resource/54307_1%20-%20UNFCCC%20BA%202020%20-%20Report%20-%20V4.pdf

UNFCCC. (2022, March 8). Decision 1/CMA.3, Glasgow Climate Pact, Advance version, FCCC/PA/CMA/2021/10/Add.1.

US Department of Energy. (2015). *Announcing 'Mission Innovation'*. Energy.Gov. https://www.energy.gov/articles/announcing-mission-innovation

van Asselt, H., & Kulovesi, K. (2017). Seizing the opportunity: Tackling fossil fuel subsidies under the UNFCCC. *International Environmental Agreements: Politics, Law and Economics*, *17*(3), 357–370. https://doi.org/10.1007/s10784-017-9357-x

Verbruggen, A. (2011). A turbo drive for the global reduction of energy-related CO_2 emissions. *Sustainability*, *3*(12), 632–648. https://doi.org/10.3390/su3040632

Weikmans, R., van Asselt, H., & Roberts, J. T. (2020). Transparency requirements under the Paris Agreement and their (un)likely impact on strengthening the ambition of nationally determined contributions (NDCs). *Climate Policy*, *20*(4), 511–526. https://doi.org/10.1080/14693062.2019.1695571

Zelli, F. (2011). The fragmentation of the global climate governance architecture. *WIREs Climate Change*, *2*(2), 255–270. https://doi.org/10.1002/wcc.104

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