Navigating pathways to sustainability:

Assessing governance arrangements in the context of the 2030 Agenda and the SDGs

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List of abbreviations

100RC	100 Resilient Cities Network
CSSP	Cross-Subsector Partnership
ESG	Economic, Social and Governance
EU	European Union
GDP	Gross Domestic Product
GSDR	Global Sustainable Development Report
HLPF	High-Level Political Forum
IGO	Intergovernmental Organizations
IPCC	Intergovernmental Panel on Climate Change
ISSP	Intra-Subsector Partnership
MDGs	Millennium Development Goals
MSP	Multi-Stakeholder Partnership
NAZCA	Non-state Actor Zone for Climate Action
NDC	Nationally Determined Contributions
NGO	Non-Governmental Organizations
OECD	Organisation for Economic Co-operation and Development
SDGs	Sustainable Development Goals
TCI	Transnational Climate Initiative
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VNR	Voluntary National Review
WCED	World Commission on Environment and Development
WSSD	World Summit on Sustainable Development

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Abstract

In 2015, the United Nations General Assembly agreed upon the 2030 Agenda for Sustainable Development (2030 Agenda), with the ambitious aim of "*transforming our world*". At its core are 17 Sustainable Development Goals (SDGs), specified through 169 targets and 231 indicators, embodying a vision of fostering inclusive, peaceful and just societies, promoting shared economic growth and prosperity, and safeguarding the planet and its natural resources. Despite facing legitimate criticism, the SDGs have become the most authoritative anchoring for defining the goals of global sustainability. By unifying the way in which the concept of sustainable development is framed, debated and assessed across academic, political, and societal spheres, the SDGs represent a pivotal milestone in the evolution of sustainable development discourse. The 2030 Agenda and the SDGs highlight the complex interrelationship between social, economic and environmental sustainability objectives, and emphasize the need to for collaborative action by all countries and societal stakeholders for their successful realization.

However, midway to 2030, progress towards achieving the SDGs has been slow and uneven, prompting a critical examination of effective socio-political steering mechanisms, i.e., governance, necessary to facilitate and accelerate SDG implementation. This doctoral dissertation contributes to this endeavor by empirically analyzing governance arrangements at the sub-national, national, and global-transnational level. Specifically, it assesses the contribution of participatory and collaborative governance approaches to SDG achievement, including an analysis of the roles and governance functions assumed by diverse state and non-state actors involved therein. Furthermore, it examines which SDGs and interlinkages between them are predominantly addressed across the governance arrangements analyzed in order to identify potential patterns of (de-)prioritization across the social, economic and environmental dimensions of sustainable development. This analysis includes an assessment of governance arrangements in the area of climate change and resilience building to identify potential synergies between the SDGs, and between the SDGs and other global development agendas, that can serve as entry points to accelerate action towards their achievement. Through a synthesis of the findings, this dissertation identifies common challenges and opportunities in SDG implementation and derives key enabling factors to improve the effectiveness of governance arrangements across different levels.

The empirical findings of this dissertation show that participatory and collaborative governance arrangements can be conducive to SDG achievement, both in terms of effectiveness as well as regarding the consideration of diverse aspects of sustainable development and their interlinkages. The cumulative results further indicate a complementarity between state and non-state actors in SDG implementation efforts. While underscoring the crucial role of governmental actors to establish legal and regulatory frameworks, provide financial resources and create an enabling environment that facilitates participation and collaboration, this dissertation highlights the importance of softer mechanisms of socio-political steering by non-state actors, encompassing, for example, voluntary standard-setting, certification and reporting by corporate actors, advocacy, capacity-building and project implementation by non-governmental organizations (NGOs), and knowledge production and dissemination by the scientific community.

This dissertation supplements existing research on SDG interlinkages by emphasizing the potential of climate change and resilience actions to contribute to broader sustainable development. Specifically, it underscores that infrastructure enhancements (SDG 9) offer promising opportunities for fostering sustainable, climate-resilient pathways. Notably, the findings indicate a worrying tendency to prioritize the economic and social dimension of sustainable development across all governance arrangements analyzed. While context-dependent prioritization of certain SDGs is necessary and important, the comparatively low consideration of environmental goals overall can pose a severe threat to global SDG achievement. Collaborative governance arrangements involving stakeholders from diverse societal sectors, such as multi-stakeholder partnerships (MSPs), seem promising for driving more integrated SDG implementation efforts through nexus approaches, i.e., by addressing several issue domains simultaneously. Thereby, these efforts can contribute to mitigating trade-offs and enhancing synergies between the goals, which can accelerate overall SDG achievement. However, the empirical evidence highlights that MSPs largely refrain from tackling potentially conflicting pairs of SDGs, such as SDG 12 (consumption and production) and SDG 10 (reduced inequalities), indicating untapped potential for more integrated and transformative action.

While this dissertation adopts an actor-centric approach to the analysis of sustainability governance arrangements, it clearly acknowledges the importance of the structural, institutional and procedural aspects of governance for facilitating and accelerating SDG achievement. Therefore, this framework paper integrates findings on participation and collaboration, actors and their respective governance functions as well as patterns of issue prioritization and interlinkages to distill enabling factors related to these dimensions. Accordingly, the synthesis of the cumulative findings underscores the importance of *harnessing complementarities*, *improving coherence*, *strengthening monitoring, review and follow-up* as well as *increasing accountability and commitment*. Importantly, these aspects should be understood as analytical dimensions to be assessed and reflected upon within the respective context of diverse governance arrangements.

While recognizing the limitations of the 2030 Agenda and the SDGs, this dissertation emphasizes their crucial role in both research and practical application by offering a comprehensive guiding framework for integrated sustainable development. However, it highlights the need for governance reforms across all levels to overcome existing challenges and accelerate progress towards achieving the SDGs. This dissertation contributes to a better understanding of the complex relationship between governance arrangements and SDG achievement, offering insights for future research and informing policy and decision-making processes towards realizing the vision of the 2030 Agenda.

Framework paper

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1. Introduction

The adoption of the 2030 Agenda for Sustainable Development (2030 Agenda) by member states of the United Nations (UN) in September 2015 marked a watershed moment in global sustainability governance and research. The 17 Sustainable Development Goals (SDGs) and 169 targets that underpin the 2030 Agenda each represent a facet of the complex and interconnected challenges humanity faces, ranging from poverty eradication, health and education to economic growth, infrastructure and climate action (UN, 2015). Despite legitimate criticism as regards, for example, their drafting process, design and enforceability (e.g., Sénit & Biermann, 2021; Bexell & Jönsson, 2021; Vogt, 2022; *A1*; *S1*), the SDGs have emerged as a normative guiding framework providing a common reference point for assessing and discussing the concept of sustainable development (Biermann, Hickmann & Sénit, 2022; Biermann, Hickmann, Sénit, et al., 2022). Given that research and policy-making had been marked and often obstructed by competing definitions and operationalizations of the concept of sustainable development (Lange, 2017), the 2030 Agenda with the SDGs at its core can be considered a major advancement for theory and practice.

Halfway to 2030, however, the world is off track in achieving 50% of the SDG targets, and progress has stagnated or even been reversed on over 30% of the targets[1] (UN, 2023a). While these setbacks are heavily influenced by the COVID-19 pandemic, growing geopolitical tensions and the effects of climate change (Leal Filho et al., 2023), these numbers underline the lack of effective mechanisms of socio-political steering, i.e., governance, that can enable and accelerate SDG achievement. Key challenges identified in this regard relate to the enhancement of collective action to reconcile diverging interests and capitalize on different capabilities and resources, the integration of policy domains to foster co-benefits and reduce unintended, negative effects of policy interventions, as well as coherent and coordinated action at and across different political levels, i.e., from local to global and vice versa (Meuleman & Niestroy, 2015; Boas et al., 2016; Bowen et al., 2017; Allen et al., 2023; Weiland et al., 2021). While the empirical knowledge base on governance for the SDGs has improved considerably in the past years, further research and evidence is strongly needed to inform public policy and decision-making (Pradhan et al., 2022; Malekpour et al., 2023; Hickmann et al., 2024).

This cumulative dissertation contributes to three important areas of research highlighted in the scholarly discourse. First, while participatory and collaborative governance approaches have been championed particularly from a normative perspective within the 2030 Agenda itself and by academic scholarship (e.g., Meuleman & Niestroy, 2015; Boas et al., 2016; Bowen et al., 2017), our understanding of their specific contribution to complex sustainability

[1] Based on assessment of around 140 SDG targets with available data (UN, 2023a).

transformations as envisioned in the SDGs remains limited (Pickering et al., 2022; Pickering, 2023; Goetz et al., 2020; Florini & Pauli, 2018). Furthermore, as participatory and collaborative governance approaches enhance the political relevance of a wider array of actors, there is a critical need for scholarly inquiry to focus on the specific roles and governance functions assumed by these actors within the context of SDG implementation (Horn & Grugel, 2018; Spangenberg, 2017).

Second, increased knowledge on the interrelation of the SDGs and both positive and negative interactions between them is vital for the attainment of the 2030 Agenda (Hickmann et al., 2024; Bennich et al., 2023). While assessments of interlinkages between the SDG have proliferated (e.g., Pham-Truffert at al., 2020; Bennich et al., 2020, 2023; Weitz et al., 2018; Lusseau & Mancini, 2019; Warchold et al., 2021), improved knowledge on how to govern these interlinkages as well as the identification of potential entry points for aligning the SDGs with other global agendas to maximize coherence and synergies in implementation efforts is still required (Breuer et al., 2023; Soergel et al., 2021). Additionally, there is a need to complement existing research on patterns of goal prioritization across different governance arrangements and levels, considering a strong focus on national implementation processes (e.g., Forestier & Kim, 2020; Horn & Grugel, 2018). Given that the 2030 Agenda aims at achieving the three dimensions of sustainable development – social, economic and environmental – "in a balanced and integrated manner" (UN, 2015, p.3), assessing prioritization patterns in relation to these dimensions across different governance arrangements is crucial to identify and mitigate potential imbalances in current implementation efforts.

Lastly, the combination of knowledge on issue interlinkages with insights on polycentric governance structures – i.e., multiple centers of decision-making and authority, involving diverse stakeholders operating at various levels – is vital to inform and support the development of more effective and coherent policy responses and implementation efforts (Chan et al., 2021). Importantly, while the 2030 Agenda assigns public authorities the primary responsibility to implement the interconnected SDGs, it remains vague on the specific role of other actors (Bexell & Jönsson, 2017). Thus, it is crucial to examine how different actors have engaged with the SDGs across diverse levels of governance, whether the SDGs are being addressed in an integrated way, and whether and how the goals are taken up within related governance arrangements in the areas of climate change and resilience. While this dissertation predominantly adopts an actor-centric approach, it clearly acknowledges the significance of the broader governance context within which these actors operate. Therefore, it integrates findings on participation and collaboration, actors and their respective governance functions as well as patterns of issue prioritization and interlinkages with the aim to identify key enabling factors that also relate to the structural, institutional and procedural dimensions of governance to facilitate SDG attainment.

Given the urgency to act to achieve the 2030 Agenda, a better understanding of existing governance arrangements and their specific aspects contributing to integrated SDG achievement is vital (Allen et al., 2023; *A1*). To this end, this doctoral dissertation embarks on a multi-faceted exploration of governance arrangements for the SDGs at different levels, guided by three overarching aims:

Aim #1 – Participation and collaboration: Examine the contribution of participatory and collaborative governance arrangements to SDG achievement and identify patterns in the governance functions assumed by state and non-state actors across different levels.

Aim #2 – Issue prioritization and interlinkages: Explore and assess patterns of issue coverage in different governance arrangements, focusing on goal prioritization and interlinkages between the SDGs, as well as between climate and resilience actions and the SDGs.

Aim #3 –Key enabling factors: Based on the patterns observed with regard to participation and collaboration as well as issue prioritization and interlinkages, identify key enabling factors to increase the effectiveness of governance arrangements for the SDGs.

This cumulative dissertation builds on the following four peer-reviewed articles (*A1 – A4*) and one published book chapter that represents a supplementary contribution (*S1*):

[*A1*] Glass, L-M., & Newig, J. (2019). Governance for achieving the Sustainable Development Goals: how important are participation, policy coherence, reflexivity, adaptation and democratic institutions? *Earth System Governance*, *2*, 100031. https://doi.org/10.1016/j.esg.2019.100031

[*A2*] Coenen, J., Glass, L-M., & Sanderink, L. (2022). Two degrees and the SDGs: a network analysis of the interlinkages between transnational climate actions and the Sustainable Development Goals. *Sustainability Science, 17*, 1489–1510. https://doi.org/10.1007/s11625-021-01007-9

[*A3*] Glass, L-M., Newig, J., & Ruf, S. (2023). MSPs for the SDGs – Assessing the Collaborative Governance Architecture of Multi-stakeholder Partnerships for Implementing the Sustainable Development Goals. *Earth System Governance*, *17*, 100182. https://doi.org/10.1016/j.esg.2023.100182

[*A4*] Kochskämper, E., Glass, L-M., Haupt, W., Malekpour, S., & Grainger-Brown, J. (2024). Resilience and the Sustainable Development Goals: A scrutiny of adaptation strategies in the 100 Resilience Cities initiative. *Journal of Environmental Planning and Management*, 1–27. https://doi.org/10.1080/09640568.2023.2297648

[*S1*] Kotzé, L.J., Kim, R.E., Burdon, P., Du Toit, L., Glass, L-M., Kashwan, P., Liverman, D., Montesano, F. S., Rantala, S., Sénit, C.-A., Treyer, S., & Calzadilla, P. V. (2022). Planetary integrity. In F. Biermann, T. Hickmann & C.-A. Sénit (Eds.), *The Political Impact of the Sustainable Development Goals. Transforming Governance Through Global Goals?* (140–171). Cambridge University Press. https://doi.org/10.1017/9781009082945.007

The subsequent section of this framework paper elaborates on the conceptual background that underpins this dissertation. After a description of the research design and methodological approach chosen, this framework paper presents the results of the contributing publications in line

with the three overarching research aims specified above. Finally, the concluding section summarizes the key findings of this dissertation and highlights important areas for future research.

2. Conceptual background

This dissertation builds on the concepts of *sustainable development* and *governance*, which represent fundamental pillars underpinning the discourse and practice of addressing complex societal challenges. Both concepts are characterized by their normative and political nature, including questions and value judgements about the world we want to live in and ways of societal organization capable of balancing different needs and interests in light of ambivalence, uncertainty and complexity (e.g., Newig et al., 2007; Meadowcroft, 2007; Lange, 2017). Academic and political debates surrounding sustainable development, governance and sustainability governance (or governance for sustainable development[2]) have been marked by competing definitions and ongoing contestation (Jordan, 2008; Kemp et al., 2005). While conceptual vagueness may pose challenges in terms of, for example, comparability, interpretation and cumulation of research results, the broadness characterizing these concepts has proven instrumental in their capacity to serve as bridging concepts fostering interdisciplinary exchange and engaging heterogenous societal groups (e.g., Ansell & Torfing, 2022; Kates et al., 2005; Meadowcroft, 2000; Jordan, 2008). The remainder of this section elaborates on the emergence of the concepts of sustainable development and governance. Subsequently, it delves into the debate about sustainability governance in the context of the 2030 Agenda and the SDGs.

2.1. Sustainable development

The concept of sustainable development gained prominence in the late 1980s with the issuing of the report *Our Common Future* by the World Commission on Environment and Development (WCED), commonly known as the Brundtland Report. Accordingly, development was defined as being sustainable when it "meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, p.24). The Report has ever since shaped debates about sustainable development by emphasizing that societal development will not be sustainable without i) considering urgent and basic human needs, particularly those of the world's poorest population; and ii) acknowledging ecological limits to human (economic) activities (Meadowcroft, 2000; Lange, 2017).

The decades following the Brundtland Report have witnessed a lively debate on the concept of sustainable development within and across different academic disciplines. While some highlight (and criticize) its complex, ambiguous and normative nature (see e.g., Purvis et al., 2019; Meadowcroft 2007), others argue that the ongoing contestation and reassessment of the term constitutes an important and valuable process for advancing sustainable development in itself (Jordan, 2008). Although scholars acknowledged that the WCED addressed the growing criticism of neoliberal (development) politics, it was argued that it continued to portray economic growth as central element of sustainable development, crucial to combat poverty and thereby halt environmental degradation (Purvis et al., 2019). More recent conceptualizations have

[2] The terms "sustainable development" and "sustainability" are used interchangeably throughout this framework paper, while acknowledging that conceptual differences exist (e.g., Lélé, 1991; see also Pickering et al., 2022).

increasingly emphasized the importance of adopting an integrated and balanced approach to sustainable development, which entails paying equal attention to the social, economic and environmental dimensions, and preventing that progress in one domain comes disproportionally at the expense of another, particularly when conflicts exist between them. This perspective includes considerations of inter- and intra-generational justice, participatory approaches to political decision-making, as well as a long-term vision that acknowledges and protects Earth's life-supporting systems (e.g., Meadocroft, 2007; Jordan, 2008; Kates et al., 2005). Building on this, this dissertation understands sustainable development as "a societal role model aimed at *ensuring the well-being of present and future generations within the frame conditions of finite environmental and social resources as well as fragile social-environmental systems*" (Lange, 2017, p.32, emphasis in original).

Since 2015, the United Nations General Assembly Resolution *Transforming our world: the 2030 Agenda for Sustainable Development* (2030 Agenda) and the Sustainable Development Goals (SDGs) (UN, 2015) have emerged as a shared framework for discussing and assessing sustainable development in both academic and political discourse (Biermann, Hickmann & Sénit, 2022; Biermann, Hickmann, Sénit, et al., 2022). The 17 goals that are specified through 169 targets and 231 indicators relate to pressing challenges of our time, striving to realize a vision of just, peaceful and inclusive societies, shared prosperity and sustainable economic growth while safeguarding the planet and its natural resources (UN, 2015; 2017; see Table 1). Although the 2030 Agenda assigns a central role to national governments, it acknowledges that the involvement of all sectors of society will be crucial for its successful implementation (Allen et al., 2023).

Table 1: The Sustainable Development Goals (SDGs)

SDG 1	End poverty in all its forms everywhere
SDG 2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
SDG 3	Ensure healthy lives and promote well-being for all at all ages
SDG 4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
SDG 5	Achieve gender equality and empower all women and girls
SDG 6	Ensure availability and sustainable management of water and sanitation for all
SDG 7	Ensure access to affordable, reliable, sustainable and modern energy for all
SDG 8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
SDG 9	Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation
SDG 10	Reduce inequality within and among countries
SDG 11	Make cities and human settlements inclusive, safe, resilient and sustainable
SDG 12	Ensure sustainable consumption and production patterns
SDG 13	Take urgent action to combat climate change and its impacts*
SDG 14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
SDG 15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
SDG 16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
SDG 17	Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development

* Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.

Source: UN (2015, p.14).

The SDGs build on a series of international conferences and related outcome documents and processes that followed up on the Brundtland Report: Throughout major international conferences such as the 1992 Earth Summit, the 2002 World Summit on Sustainable Development (WSSD) and the 2012 United Nations Conference on Sustainable Development (Rio+20), heads of states and government continuously renewed their commitment to collectively achieve global sustainable development (UN, 2023b). Particularly important to highlight is the 2000 Millennium Summit and its Millennium Declaration, which entailed the drafting of eight Millennium Development Goals (MDGs) to be achieved by 2015 (UN, 2001). In line with the prevalent development discourse at that time, the primary focus of the goals remained on poverty reduction and related social challenges on the basis of increased economic growth (de Jong & Vijge, 2021). The MDGs were further discussed controversially in academia and practice regarding their exclusive focus placed on developing countries, their donor-centric perspective to development, insufficient review mechanisms and a lack of open societal consultations in the drafting process (Hickmann et al., 2023). The SDGs differ from their predecessors in their universal application to all countries; their broader scope, covering all three dimensions of sustainable development; a more inclusive drafting process; their political-institutional anchoring within the UN system, with the High-Level Political Forum (HLPF) annually reviewing implementation progress; and greater visibility in public discourses (Biermann, Hickmann & Sénit, 2022).

While the SDGs represent an unprecedented framework that offers an internationally agreed operationalization of the concept of sustainable development and have thereby significantly shaped academic and political discourse, they have not remained uncriticized. Scholars have pointed out process-related weaknesses, such as insufficient representation of the world's poorest in SDG negotiations (Sénit & Biermann, 2021), vagueness regarding the role of non-governmental actors in SDG implementation, and lacking accountability and enforcement mechanisms (Bexell & Jönsson, 2017). Other critiques have been levied regarding the substance of the goals, highlighting, for example, a limited recognition of traditional knowledge and cultural dimensions (Croese et al., 2020; Vogt, 2022), or the absence of an overarching goal on planetary integrity (see *S1*). Additional and related criticism refers to the structure and design of the SDGs. Although the 2030 Agenda emphasizes that the SDGs "are integrated and indivisible and balance the three dimensions of sustainable development" (UN, 2015, p.3), connections between different policy domains within the SDGs are often incomplete, weak and intransparent (Boas et al., 2016; Le Blanc, 2015). Such a design choice bears the risk of overlooking potential trade-offs and negative spillovers, where measures to achieve one goal negatively affect the achievement of others (Boas et al., 2016), be it through deliberate choices made between conflicting goals, or through unintended consequences arising from policy interventions. For instance, scholars have raised concerns about the compatibility between the pursuit of economic growth delineated in SDG 8 with targets on environmental protection under SDGs 6, 13, 14 and 15 (e.g., Hickel, 2019; Livermann, 2018; *S1*).

Prompted by such observations and in accordance with the overarching principles of the 2030 Agenda, scholarly inquiry has focused on investigating the interrelations between the SDGs. A prominent example is the "wedding cake" illustration proposed by Rockström and Sukhdev (2016), which categorizes the SDGs into economic (SDGs 8, 9, 10, and 12), social (SDGs 1, 2,

3, 4, 5, 7, 11, and 16) and environmental goals (SDGs 6, 13, 14, and 15). By depicting the economy as the top layer of the cake, supported by the social layer, which in turn rests upon the foundational layer of the environment, this nested perspective on the three dimensions of sustainable development underscores the embeddedness of the economy within society and its dependence on the Earth's life-supporting systems (see also Griggs et al., 2013; Folke et al., 2016). This categorization provides the basis for the analyses of SDG interlinkages and prioritization patterns in this dissertation, which will be discussed in more detail in section 2.3.

While facing legitimate criticism, it is important to note that the SDGs embody a normative and political framework resulting from inter-governmental negotiations and thus representing a compromise that accommodates diverse interests, concerns, and worldviews (Le Blanc, 2015). Despite all shortcomings, the SDGs can be considered a milestone in the evolution of the concept of sustainable development. The 2030 Agenda has opened an "unprecedented international policy window" (Bowen et al., 2017, p.90), drawing attention to the interconnectedness of sustainability goals and emphasizing the involvement of multiple stakeholders in their implementation. Given the highly political nature and inherent complexities associated with sustainable development, it is widely acknowledged that the successful implementation of the 2030 Agenda first and foremost presents a governance challenge, emphasizing the necessity of effective mechanisms of socio-political steering to catalyze transformative action to achieve the SDGs (e.g., ibid.; Meuleman & Niestroy, 2015; Allen et al., 2023; Bernstein, 2017).

2.2. Governance

At its core, governance refers to modes of societal coordination and steering (Treib et al., 2007; Kemp et al., 2005). The concept challenges the perspective that the act of governing – i.e., the "purposeful effort to guide, steer, control, or manage (sectors or facets of) societies" (Kooiman, 1993, p. 2) is confined to the state and formal government institutions, relying on hierarchical, top-down command-and-control approaches (Lange et al., 2013). Instead, the notion of governance emphasizes the involvement of a variety of public and private actors and encompasses also softer, non-hierarchical steering mechanisms to address the multifaceted challenges and dynamics of modern societies (Biermann & Pattberg, 2012).

Heavily influenced by the observation of increasing complexities and interdependencies in domestic politics (e.g., Rhodes, 1996) and international relations (e.g., Rosenau, 1995), governance scholars emphasized an alleged decreasing capacity of the state to steer societal development on its own (Peters & Pierre, 1998). There was a growing recognition that governing occurred also beyond formal government structures through interactions between a multitude of public and private actors (Ansell & Torfing, 2022). In early theoretical contributions, the involvement of non-governmental actors in public management (e.g. through privatization of public service delivery) and political decision-making was conceived as a "hollowing out of the state", shifting political authority from governments to self-organizing networks (Rhodes, 1994; 1996). Others noted a displacement of political power to international, regional and supranational organizations (upwards), to subnational governments (downwards) and to non-state actors (outwards) (Pierre & Peters, 2000). However, notions of a shift from government to governance or governing without government, which imply that state actors were becoming

superfluous, faced growing criticism. Over time, the concept evolved to emphasize a "reconfiguration" rather than a "relocation of authority", acknowledging the increasing significance of non-state actors alongside the remaining central role of national governments (Hickmann, 2017).

Accordingly, participation and collaboration among diverse actors constitutes a central element of governance (e.g., Biermann et al., 2010; Renn et al., 2011; Newig et al., 2018; 2023). Participatory and collaborative governance extends beyond mere representation or voting to encompass the broader engagement of non-governmental actors in political decision-making, implementation, and evaluation processes (Newig, 2011; Heinelt, 2002). Following Emerson et al. (2011, p.2), participatory and collaborative governance is defined as "*the processes and structures of public policy decision making and management that engage people constructively across the boundaries of public agencies, levels of government, and/or the public, private and civic spheres*" (emphasis in original). Such diverse public, private and hybrid arrangements are crucial to consider particularly in the realm of environmental and sustainability governance, which is characterized by diverse centers of decision-making spanning different institutions, actors, and policy domains (Biermann et al., 2009; Biermann & Kim, 2020). The roles and governance functions assumed by diverse public entities (i.e., national and sub-national governments, international and intergovernmental organizations) and private actors (i.e., business and civil society) in such governance arrangements will be elucidated in section 2.3.

In addition to examining the distribution of power among public and private actors and related interaction processes (*politics*), the concept of governance addresses institutional structures and systems (*polity*) as well as the specific policy content, objectives and applied steering instruments (*policy*) (Treib et al., 2007; Ansell & Torfing, 2022). Governance scholars are thus concerned with analyses of, *inter alia*, (de-)centralized steering structures and potential collaboration across different actors and loci of decision-making (e.g., Ostrom, 2010; Biermann et al., 2009; Biermann & Kim, 2020); coordination and integration across multiple levels, i.e., from global to local (e.g., Hooghe & Marks, 2003); and different modes of governance, such as hierarchies, markets, networks, as well as hybrids and combinations thereof (e.g., Meuleman, 2008). Accordingly, governance in this dissertation is understood as "*a multi-dimensional concept covering different actors, processes, structures and institutions involved in political decision-making and implementation*" (*A1*, p.2, emphasis added).

2.3. Sustainability governance in the context of the SDGs

Effective governance frameworks are indispensable for translating sustainable development principles into actionable policies and practices, while, conversely, sustainable development imperatives often serve as guiding principles for shaping governance structures and processes to ensure long-term well-being and resilience (Lange, 2017). Acknowledging the shared characteristics of both concepts, this dissertation understands sustainability governance as *socio-political steering that addresses the three dimensions of sustainable development in an integrated and balanced way to achieve long-term sustainable outcomes under careful consideration of goal-interdependencies as well as intra- and inter-generational justice.*

The interrelated nature of both concepts has influenced two different, yet complementary strands of research evolving in the specific context of the 2030 Agenda. On the one hand, the SDGs can be viewed as a governance approach themselves, i.e., "governance through goals" (Biermann et al., 2017), and research has been set out to assess their potential to steer and induce behavioral change among societal, economic, and political actors towards more sustainable development pathways (Biermann, Hickmann & Sénit, 2022; Biermann, Hickmann, Sénit, et al., 2022; *S1*). On the other hand, viewing the SDGs as an internationally agreed set of interrelated goals operationalizing the concept of sustainable development, a second strand of research aims to explore which aspects and modes of governance are conducive to their attainment (e.g., Allen et al., 2023; Meuleman, 2021). This dissertation follows the latter perspective and aims to contribute to identifying patterns of effective governance for sustainable development as envisioned in the SDGs.

Underscoring the inherent complexities of sustainability governance, scholars have emphasized the need for transformative and integrated action across actors (i.e., both state actors and non-state actors), sectors (i.e., specific issue and policy domains), and levels (global-transnational, regional, national, and local) for advancing effective SDG implementation (Boas et al., 2016; Meuleman & Niestroy, 2015; Bowen et al., 2017; Allen et al., 2023; Weiland et al., 2021). Although these analytical dimensions are not new to academic and political debates about sustainability governance (see e.g., Biermann et al., 2010; Jordan, 2008; Meadowcroft, 2011), the SDGs, as a set of interconnected goals and internationally agreed framework, have provided impetus to discuss and examine governance arrangements for sustainable development in a holistic and integrated manner, as elucidated below.

First, the 2030 Agenda promotes a whole-of-society approach by calling for collective implementation efforts by "all countries and all stakeholders, acting in collaborative partnership" (UN, 2015, p.1). This is complemented by SDG 17, which highlights partnership approaches as important means of implementation. It thereby recognizes that complex and interrelated global challenges require the engagement of both public and private actors. As signatories of both the 2030 Agenda and the Paris Agreement on climate change, national governments have set themselves ambitious goals to ensure a more sustainable, climate-resilient future. However, discrepancies between international commitments and government action persist. These are reflected, for example, in the significant gap between the 1.5/2°C target of the Paris Agreement and collective national climate pledges, and exacerbated by disparities between stated national

ambitions and actual implementation (Intergovernmental Panel on Climate Change [IPCC], 2023). Such discrepancies between public commitments and current actions permeate many areas of sustainable development, including poverty and hunger alleviation, gender equality, the expansion of renewable energy sources, and the protection of endangered species (UN, 2023a).

To address these gaps, non-state and collaborative efforts can play a crucial role by complementing state action (Andonova et al., 2017; Hickmann, 2017). These efforts encompass, for example, mobilization and education campaigns, (international) standard setting, labeling and certification schemes, roundtables and other multi-stakeholder fora, or – particularly in the business sector – the integration of sustainability criteria into commercial agreements and supply chain management (Vandenbergh, 2013). Besides responding to government failure to act (at all, adequately, or in a timely manner), private and collaborative action can thereby serve, for instance, to supplement public enforcement mechanisms (e.g., through legality verification) or incentivize higher performance levels (ibid.). While frequently advocated for based on rationales of empowerment, inclusiveness, and enhanced legitimacy, the effectiveness of participation and collaboration in environmental and sustainability governance has been contested, with scattered and sometimes contradictory findings (e.g., Newig et al., 2018; 2023; Pattberg & Widerberg, 2016). Consequently, given the unprecedented aspirations of the 2030 Agenda to "transform our world", empirical investigations into the impact of participatory and collaborative governance on SDG achievement emerge as critical areas of inquiry (Beisheim et al., 2022; Sondermann & Ulbert, 2021; Florini & Pauli, 2018; Pickering et al., 2022; Pickering, 2023; Goetz et al., 2020).

Furthermore, the involvement of multiple actors in governance arrangements, the non-legally binding nature of the SDGs for their signatories (i.e., governments) and weak international enforcement mechanisms raise questions about the responsibility and accountability of actors in implementing the 2030 Agenda (Bexell & Jönsson, 2017). These questions not only center around determining who is – or should be – in charge of implementation efforts (in terms of a legal and moral obligation) and the justification of respective (in-)action, but also draw attention to the "response-ability" of different actors (Fukuda-Parr & McNeill, 2015). The latter perspective underlines the need to reflect on the diverse resources, skills and capacities with which diverse actors are endowed, and the respective governance functions they (are able to) assume (Nasiritousi et al., 2016). Such governance functions include, for example, rulemaking and regulation, financial resource provision, knowledge generation and dissemination, agenda setting or monitoring and evaluation (Betsill & Milkoreit, 2020; Bäckstrand et al., 2017). Yet, the study of actors and their roles and governance functions in the specific context of the 2030 Agenda has thus far received only limited attention, despite being an important determinant for effective SDG implementation (Spangenberg, 2017; Horn & Grugel, 2018; Hickmann et al., 2024).

Second, by emphasizing the indivisible and interconnected nature of social, economic and environmental sustainability goals, the 2030 Agenda marked a paradigm shift in development approaches, sparking academic efforts to examine interlinkages between the 17 goals and 169 targets (Breuer et al., 2023). The corresponding body of literature focuses on identifying and assessing both positive interactions (synergies), where progress toward one goal simultaneously

advances the achievement of others, and negative interactions (trade-offs), where implementation efforts focused on one goal hinder or counteract the achievement of others (Pradhan et al., 2017). For example, while the expansion of bioenergy can contribute to emission reduction (SDG 13) and renewable energy supply (SDG 7), there is a risk that increased energy crop production may negatively affect food and water security (SDGs 2 and 6) or biodiversity (SDG 15) (*A2*; Vera et al., 2022). Successful SDG implementation thus depends on minimizing trade-offs and unintended spillover effects while fostering synergies between the goals, or even accomplish to convert trade-offs into synergies (Kroll et al., 2019; Bennich et al., 2023).

A steadily growing body of literature has engaged in empirical analyses of SDG interlinkages (e.g., Pham-Truffert at al., 2020; Bennich et al., 2020; 2023; Weitz et al., 2018; Lusseau & Mancini, 2019; Warchold et al., 2021). However, scholars have highlighted the persistent need to examine how to govern interlinkages once they are identified, given that different policy responses can be more or less conducive to the achievement of the SDGs as a whole (Breuer et al., 2023; Bennich et al., 2023). This does not only apply to interlinkages between the SDGs, but further requires assessments of the alignment between the SDGs and other development agendas such as the Paris Agreement (Bennich et al., 2023; Soergel et al., 2021). For example, while constructing a sea gate to protect human settlements from floods and storms may effectively enhance resilience to climate-related hazards (SDG 13), it could entail long-term economic and environmental costs in comparison to nature-based solutions like nourished beaches (Zhang & Li, 2018). Importantly, such synergies and trade-offs may vary across different contexts (Nilsson et al., 2018). Thus, there is a critical need for improved knowledge on these interlinkages across different governance arrangements, in particular to identify potential synergies in implementation in light of existing financial resource constraints (Hickmann et al., 2024; Malekpour et al., 2023).

Given these complex interdependencies, overcoming sectoral silos in public administration as well as integrated and coherent policy design and implementation efforts represent a key governance challenge (e.g., Bowen et al., 2017; Allen et al., 2023). Acknowledging the varied and often overlapping conceptualizations and applications of the terms 'integration' and 'coherence' within academic discourse (e.g., Tosun & Leiniger, 2017; Cejudo & Michel, 2017), this dissertation understands integration as a political strategy promoting the simultaneous consideration of social, economic and environmental targets and their interrelation in policy-making and implementation (Nilsson & Persson, 2017; Hickmann et al., 2024). Coherence, in turn, refers to the consistency across individual policies, ideally reinforcing each other and/or mitigating negative spillover effects across different policy domains (Organisation for Economic Co-operation and Development [OECD], 2017; Nilsson et al., 2012). While it is important to note that full coherence is unlikely to be achieved in the context of complexity, pluralist governance arrangements and diverging interests, striving for its maximization remains both desirable and essential for realizing sustainable development objectives in light of limited resources (Chan et al., 2021; *A2*).

Lastly, numerous SDG targets underscore the significance of actions "at all levels," with a specific goal, SDG 11, dedicated to advancing sustainable development within local communities and cities (UN, 2015). The 2030 Agenda thereby underscores that achieving the ambitious

global goals requires individual and collective efforts from all countries, with national development trajectories also depending on action taken at lower levels (e.g., cities, provinces and municipalities). In this regard, scholars have emphasized that SDG implementation demands "localization", i.e., adaptation of the goals to national and local contexts (Croese et al., 2021; Valencia et al., 2019). This process entails the challenge of setting political priorities according to the respective needs and capabilities on the ground (e.g., Zinkernagel et al., 2018; Horn & Grugel, 2018), and the SDG framework provides much leeway in this regard (Biermann et al., 2017). However, if not grounded in empirical evidence, there is a risk that prioritization occurs based on vested interests of powerful actors (Zinkernagel et al., 2018) and development plans that pre-existed the 2030 Agenda (Horn & Grugel, 2018). Excessive and unbalanced goal prioritization can, at the aggregate level, severely threaten integrated SDG achievement (Forestier & Kim, 2020). As the 2030 Agenda was agreed upon by heads of state and government, goal prioritization in SDG implementation has predominantly been evaluated at the national level (see e.g., ibid., Horn & Grugel, 2018). Yet, considering the importance of subnational and private actors in sustainability governance operating at different levels, the assessment of prioritization patterns across diverse governance arrangements presents an important, complementary area of research (Chan et al., 2021). While acknowledging the importance of exploring the interplay *between* the various levels in more detail (see e.g., Hickmann, 2021), this dissertation primarily focuses on providing insights into governance arrangements for the SDGs at different individual levels. Thereby, it contributes much-needed empirical evidence on SDG implementation at all scales (Pradhan et al., 2022). The findings can ultimately inform cross-level integration in both research and practice, i.e., the alignment of strategies, policies, and actions across local, regional, national, and international levels to ensure more coherent and effective implementation of the SDGs.

Although the framework paper of this dissertation concentrates on the analysis of participatory and collaborative governance arrangements, as well as patterns of issue interlinkages and prioritization, it clearly acknowledges that accelerated action required for SDG achievement is dependent on, enabled and/or constrained by additional factors such as economic and political systems and ideologies, production and consumption patterns, or institutional structures and their interplay. While the individual contributions to this dissertation address these issues to varying degrees, the synthesis of the findings presented in this framework paper will be related to broader structural, procedural and institutional aspects in section 4.3.

3. Research design and methodology

This cumulative dissertation employs a mixed-method design, combining qualitative and quantitative research methods (Plano Clark et al., 2008; Johnson and Onwuegbuzie, 2004). Mixed-method designs are well-suited for addressing complex, multi-dimensional problems (Irwin, 2008), rendering them particularly pertinent to the field of sustainability science (von Wehrden et al., 2017). By combining different yet complementary research methods, this approach allows for developing a more comprehensive and validated understanding of the phenomena under study (Plano Clark et al., 2008). Table 2 depicts the research design of the individual contributions to this dissertation, including dominantly or purely quantitative (*A1*, *A3*), dominantly

qualitative (*A4*) and mixed method studies (*A2*). The supplementary publication *S1* further represents a purely qualitative study.

Table 2: Research design and methodological approach of contributing publications. *Cells marked with "x" display the primary focus; "(x)" depicts the secondary/complementary focus.*

Publication	**A1**	**A2**	**A3**	**A4**	**S1**
Short title	Governance for achieving the SDGs	Transnational climate actions and the SDGs	Multi-Stakeholder partnerships for the SDGs	Resilience and the SDGs	Planetary integrity
Type					
Conceptual	(x)		(x)	(x)	x
Empirical	x	x	x	x	
Methodological Approach					
Qualitative	(x)	x		x	x
Quantitative	x	x	x	(x)	
Methods					
Literature review	(x)				x
Content Analysis		x		x	
Descriptive statistics	x	x	x	x	
Survey			x		
Network analysis		x			
Regression analysis	x				

Insufficient empirical evidence on the effectiveness of governance arrangements for integrated SDG achievement, including assessments of diverse actors and their collaboration as well as issue interlinkages across different levels, poses a persistent challenge to SDG implementation (Pradhan et al., 2022). Responding to this, the studies included in this dissertation were designed with a strong empirical focus, although complemented by conceptual contributions. As shown in Table 3, all publications provide complementary findings on participatory and collaborative governance arrangements, focusing on diverse actor types and their respective governance functions in the context of SDG implementation (Aim #1). While *A1* and *A4* place the primary focus on governance arrangements led by state actors (i.e., national and sub-national governments), *A2* and *A3* examine transnational cooperative initiatives and partnerships. Additionally, the supplementary publication *S1* assesses state action at the national, regional and international level, as well as non-state actors operating transnationally. The studies further contribute empirical evidence on issue interlinkages and prioritization patterns within in different governance arrangements (Aim #2) by assessing interlinkages between the SDGs (*A1-A4; S1*), as well as between the SDGs and climate and resilience actions (*A2* and *A4* respectively). By synthesizing the empirical findings and conceptual insights of the individual publications, this framework paper identifies key enabling factors to enhance the effectiveness of sustainability governance arrangements, particularly in the context of the 2030 Agenda and the SDGs (Aim #3).

Table 3: Analytical focus of contributing publications. *Cells marked with "x" display the primary focus; "(x)" depicts the secondary/complementary focus.*

Publication	**A1**	**A2**	**A3**	**A4**	**S1**
Short title	Governance for achieving the SDGs	Transnational climate actions and the SDGs	Multi-Stakeholder partnerships for the SDGs	Resilience and the SDGs	Planetary integrity
Actor type					
State	x	x	x	x	x
Non-state		x	x	(x)	x
Issue interlinkages					
SDGs	(x)	x	x	(x)	(x)
SDGs – Climate change		x		(x)	
SDGs – Resilience				x	
SDGs – Planetary integrity					x
Level					
Sub-national				x	
National	x				x
Regional					x
Global-transnational		x	x		x

The exploratory analysis conducted in *A1* was instrumental in determining the research focus of subsequent studies, thereby representing a sequential step in the research design. Drawing on literature from institutional, development and policy-network theory, the study identifies aspects of governance that are deemed vital for advancing sustainable development – i.e., participation, democratic institutions, policy coherence, reflexivity and adaptation – and assesses their correlation with national SDG achievement through multiple regression analyses. Taking into account the contextual nature of sustainability governance, a most-similar-system-design was applied in selecting the 41 cases under study (35 OECD countries and 6 additional non-OECD EU countries). Acknowledging the potential influence of other socio-economic conditions, the article further controls for the effects of population size, geographic location, gross domestic product (GDP) per capita, and education on individual as well as aggregate SDG achievement. This article was among the first to assess the often normative claims surrounding governance for the SDGs through an empirical and comparative cross-country analysis.

A2 focuses on collaborative action between non-state and subnational actors at the global-transnational level. The article examines 72 transnational climate initiatives (TCIs) registered on the Non-state Actor Zone for Climate Action (NAZCA) by means of content and network analysis[3]. Through an investigation of the extent to which the 17 SDGs and 169 targets are addressed by TCIs, it identifies synergies between the Paris Agreement and the 2030 Agenda and highlights potential entry points for aligning efforts directed at implementing both agendas. Thereby, it

[3] *A2* adhered to the terminology put forward by the NAZCA platform (now also referred to as Global Climate Action portal), which classifies cities and subnational actors as non-state actors. However, to ensure consistency within the context of this framework paper, TCIs are herein treated as cooperative initiatives.

complements existing research, which has predominantly focused on analyses at the international and national level. Furthermore, the study explores synergistic interrelations between the SDGs by visualizing the results in network graphs and determines the relative importance of individual goals in the network through an assessment of centrality measures. Finally, the article contrasts the results with findings from a comparable study on national climate actions to assess the complementarity of TCIs and state-led efforts.

Building on these findings, *A3* explores the collaboration between different actor types by analyzing the results of a survey among 192 multi-stakeholder partnerships (MSPs) for SDG implementation registered on the United Nations Partnership Platform[4]. The study assesses administrative and organizational aspects of MSPs, as well as the composition and roles of partners included, their governance functions, SDG coverage and (self-reported) effectiveness. Databases relying on self-reporting, such as the Partnership Platform, may introduce a "box-ticking" bias, potentially resulting in certain SDGs being disproportionately represented (*A3*; see also *A2*). Consequently, this study implemented a two-step selection process for survey respondents to identify only those SDGs that correspond to the *main* purpose of the partnerships' work (*A3*). This method aimed to mitigate potential overrepresentation of certain SDGs and ensuring a more accurate reflection of the partnerships' focus areas. Conceptually, the article presents a novel operationalization of MSPs that takes into account the different societal subsectors involved, moving beyond the traditional public/private actor dichotomy commonly applied in the study of partnerships. By differentiating between cross-subsector partnerships (CSSPs) and intra-subsector partnerships (ISSPs), the article empirically examines the assumption that cross-subsector collaboration is positively related to partnerships' effectiveness, and contributes to a more nuanced understanding of the roles and functions of individual partners within collaborative governance arrangements for the SDGs. Additionally, *A3* investigates which SDGs are addressed jointly by MSPs and compares the findings with previously identified interlinkages between the goals. It thereby assesses the potential of MSPs to advance nexus approaches, i.e., addressing several issue domains simultaneously, that are likely to accelerate progress towards SDG achievement (Boas et al., 2016).

A4 turns the focus to the subnational level and explores the relationship between resilience, transformative adaptation, and sustainable development in cities. It analyzes resilience strategies of 30 cities from the Global South and North produced within the 100 Resilient Cities (100RC) network by means of qualitative content analysis. First, the article presents and applies an innovative index to assess the transformative potential of the governance approach chosen to enhance urban resilience, considering 39 indicators related to policy coherence, policy mode and policy content. Second, the study examines the extent to which urban resilience strategies contribute to sustainable development by identifying linkages between resilience actions and SDG targets, and assesses the distribution between the social, economic and environmental dimension addressed. Finally, *A4* analyses the relationship between both indices to explore whether more transformative governance approaches are linked to more comprehensive sustainable adaptation practices. Acknowledging the context sensitivity of resilience, governance and sustainable development, it further assesses the effects of population size, country income

[4] The platform changed its name to "SDG Actions Platform" in spring 2023.

level and year of admission to the 100RC network. This article enriches research on the urban resilience-sustainability link, which has been characterized primarily by conceptual studies and analyses of individual cases or single issue areas (Elmqvist et al., 2019). By including and comparing cases from the Global South and North, it further provides valuable insights for urban transformation and adaptation research that has been dominated by a focus on Global North cities (Sharifi, 2021).

Lastly, the supplementary publication *S1* presents findings of a literature survey, discussing the role of the SDGs in advancing planetary integrity, i.e., the stability of Earth's life-support systems, at the international, regional, national and corporate, transnational level. This synthesizing book chapter thereby contributes additional findings on whether implementation efforts at different levels pursue a balanced approach to SDG implementation and identifies respective patterns of (de-)prioritization of specific goals.

4. Results

This section summarizes the results of the contributing publications to this dissertation according to the three research aims specified. First, section 4.1 presents the findings on the contribution of participatory and collaborative governance arrangements to SDG achievement, including the analysis of actors and their governance functions across different levels. Section 4.2 then delves into patterns of issue prioritization and interlinkages observed within the governance arrangements analyzed. Finally, section 4.3 elucidates on identified key enabling factors that can increase the effectiveness of governance arrangements for the SDGs.

4.1. Participation and collaboration

Overall, the cumulative findings of this dissertation indicate that participatory and collaborative governance approaches can significantly contribute to SDG achievement. This is first demonstrated in the examination of non-state actor involvement in national (*A1*) and subnational (*A4*) policy formulation and implementation processes. The analysis of national governance arrangements conducted in *A1* reveals that participation and democratic institutions are those aspects of governance that most often show a significant positive correlation with SDG achievement (see *A1* for detailed results and discussion of multiple regression analyses). Drawing on the Sustainable Governance Indicators (Bertelsmann Stiftung, 2017), participation is measured through the capability of economic and non-economic interest associations to propose and assess policy measures and their implementation. Democratic institutions, on the other hand, encompass access to information, freedom of media, rule of law, civil rights and political liberties, as well as the electoral process (ibid.). Participation here thus denotes a deeper, institutionalized involvement of non-governmental actors in policy-making and implementation, whereas democratic institutions cover more indirect forms of public engagement. While acknowledging that the methodological approach chosen does not allow for identifying underlying causal mechanisms and that the effectiveness of participatory approaches is contingent upon various process- and actor-related factors (Newig et al., 2018), participatory policy-making and implementation processes seem to be conducive to SDG achievement by enabling inclusiveness, representation of diverse interests, trust-building and increased acceptance of outputs among stakeholders, as

well as knowledge and resource sharing (ibid., *A1*). On the other hand, functioning democratic institutions ensure that non-state actors can voice their opinion and influence political agenda-setting, have access to relevant information, and are able to hold public authorities accountable (*A1*). It is important to note, however, that the positive contribution of these variables to SDG achievement was in some cases displaced or weakened when regression models controlled for the effects of GDP per capita, education and geographic location, underlining the importance of structural and socio-economic factors in advancing sustainable development trajectories (*A1*).

The analysis of city-led governance approaches to resilience building provides additional and complementary evidence for the positive relationship between participatory and collaborative policy design and implementation and more comprehensive sustainable development pathways (*A4*). Specifically, results show that resilience strategies of cities in the Global South and North whose governance approach builds on participation and collaboration among stakeholders tend to address a greater variety of SDG targets within their proposed resilience actions (*A4*). Following Newig et al. (2018), participation in the planning and implementation of urban resilience actions is assessed through proxies on the breadth of stakeholder involvement, the type and iteration of participation formats, and participant influence. Collaborative approaches are captured through an assessment of several indicators relating to the inclusion of local as well as expert knowledge, knowledge co-creation with and capacity building of diverse non-governmental actors (both in communities of practice and place), as well as planning approaches based on partnership and network approaches. While the aggregate index compiled in *A4* to assess the transformative potential of the governance approach chosen includes also procedural, structural and institutional elements (e.g., policy coherence, envisioned changes in the physical environment, or economic incentives provided by the city administration), many individual indicators were constructed in a way that attributes higher scores to more participatory and collaborative urban governance approaches (see *A4*, appendix II for a detailed description). It thereby follows the assumption that local perspectives, knowledge, skills and resources provide an important lever for driving transformation towards more resilient and sustainable futures, particularly in the urban context (Novalia & Malekpour, 2020). The study finds a significant positive correlation of the index with the number of SDG targets addressed within resilience actions, which supports this claim.

The importance of collaboration between a diverse set of stakeholders for SDG achievement beyond (sub-)national decision- and policy-making processes is corroborated through the study of multi-stakeholder partnerships (MSPs) at the global-transnational level conducted in *A3*. The article builds on the observation that MSPs have often been conceptualized as public-private partnerships (e.g., Pattberg & Widerberg, 2016), falling short of capturing the diverse governance functions assumed by different stakeholders that form part of the same sector (*A3*; Nasiritousi et al., 2016). To increase our understanding of differences between individual actors and their role in collaborative governance arrangements, *A3* suggests a more nuanced conceptualization of MSPs that accounts for different stakeholder types by categorizing them as either cross-subsector partnerships (CSSPs) or intra-subsector partnerships (ISSPs). It thereby seeks to explore the benefits of collaboration among different societal subsectors, such as for example between non-governmental organizations (NGOs) and businesses, both traditionally

categorized under the "private sector" label. Results show that most CSSPs were rated "very successful" (51%) or "somewhat successful" (40%) in accomplishing their objectives by survey respondents, indicating a higher (self-reported) effectiveness of CSSPs compared to ISSPs (39% and 42%, respectively) (*A3*). Findings thus suggest that cross-subsector collaboration benefits from pooling material and immaterial resources of different partners, which CSSP also indicated as a more common motivator for establishing a partnership (49%) compared to ISSPs (21%) (*A3*). While the analysis did not ascertain a clear relationship between a partnership's annual project budget or staff size with (self-reported) effectiveness, it underscores the significance of regular monitoring and communication among partners (*A3*). This emphasizes the importance of institutionalizing stakeholder exchange, collaboration and robust monitoring within partnerships to facilitate learning, increase transparency and enhance accountability (*A3*; Pattberg & Widerberg, 2016).

Actors and their governance functions

The analysis of individual governance functions assumed by diverse actors underlines the strong and prevailing importance of national governments for SDG implementation. Governments are critical for determining the legal and regulatory framework, implementing and enforcing coherent policies directed at promoting sustainable development, as well as collecting and allocating financial resources (*A1; A3; S1*). The empirical evidence shows that financial resource endowment is particularly important for SDG achievement, as many targets require substantive investments and/or refer to the provision of public services (*A1*), which mirrors findings on MDG implementation (Hickmann et al., 2023). The analysis conducted in *A3* additionally reveals that governments act as key partners in providing funding within collaborative governance arrangements. Government-led MSPs were mostly reported to be highly effective in meeting their objectives (67%), only surpassed by partnerships led by intergovernmental organizations (IGOs), with an impressive 90% (*A3*). Thus, the results suggest that governments' funding capacity is decisive for determining partnership success, as is the credibility and legitimacy they can contribute to collaborative efforts (*A3*). Moreover, the findings presented above emphasize the crucial significance of governmental actors in establishing an enabling environment for fostering and institutionalizing participation and collaboration at all levels (*A1; A2; A4*).

Results of *A3* further show that IGOs – which are themselves often primarily relying on funds provided by their member states – often assume leadership roles in collaborative partnerships. Within MSPs, IGOs frequently focus on sharing information and expertise with implementing partners on the ground, and on representing their organization's interest (*A3*). Most partnerships led by IGOs were found to engage in capacity-building and knowledge production activities, which are likely to benefit from the organizations' financial, human and knowledge resources (A3; see also Dzebo, 2019). This indicates a pivotal role of IGOs in orchestrating collaborative governance efforts for SDG implementation (*A3*).

Sub-national actors such as cities and municipalities also assume the role of orchestrators in SDG implementation, yet at the local level, by convening and facilitating participation (*A3*; *A4*). Convening and facilitating participation is claimed to be crucial for stakeholder

coordination and enabling capacity-building of and knowledge exchange between the various actors involved (Betsill & Milkoreit, 2020). It emerges as one of the most frequently adopted governance functions by cities and other subnational entities within partnerships for the SDGs (*A3*). As highlighted above, the analysis conducted in *A4* further indicates that cities actively pursuing more collaborative and participatory governance approaches for the design and implementation of resilience actions tend to concurrently address a broader spectrum of sustainable development facets. Cities and other sub-national actors were also found to frequently engage in direct implementation efforts on the ground, providing empirical support for their importance in fostering SDG achievement through adapting global goals to the local context (*A3*; *A4*; see also Croese et al., 2021). Results indicate that the process of localizing global agendas often occurs through collaboration with partners from civil society and academia (*A4*).

The involvement of the scientific community in participatory and collaborative governance arrangements emerges to be crucial for generating and disseminating knowledge (*A3*; *A4*). The content analysis of urban resilience strategies revealed a strong emphasis on research and information sharing actions, often in partnership with academia (*A4*). The analysis of MSPs for the SDGs indicates a similar pattern at the global-transnational level (*A3*). Compared to earlier studies on partnerships for sustainable development that emerged in the context of the WSSD (see Pattberg et al., 2012), there is an observable increase in the involvement of actors from science and education, both as partners within MSPs and as lead partners of these partnerships (*A3*). Notably, around half of CSSPs analyzed include at least one partner from research and education, and almost one third of ISSPs are exclusively composed of actors from this subsector (*A3*). Alongside generating and sharing knowledge and information, scientific actors frequently engage in direct implementation of projects, mostly in collaboration with NGOs and business partners (*A3*). Taken together, these results suggest a strengthening of the science-policy-society interface across different levels, contributing to capacity-building and evidence-based approaches to SDG implementation (see also Bansard et al., 2019).

Furthermore, there is evidence on the growing importance of SDG implementation efforts by civil society actors and NGOs (*A2*; *A3*). Compared to WSSD partnerships (see Pattberg et al., 2012), the sample of MSPs for the SDGs analyzed show a strong increase in NGO involvement, emerging as the most prevalent stakeholder type within partnerships (*A3*). In the sample analyzed, 75% of CSSPs include at least one NGO, and ISSPs involving NGOs only account for 47% (*A3*). Moreover, results show a considerable increase in partnerships led by NGOs, focusing on direct implementation, capacity-building and campaigning (*A3*). Civil society actors thus appear to be central agents in transforming the SDG guiding framework into tangible initiatives (*A3*), both through collaboration with state and other non-state actors (see *A1 – A4*), as well as through independent implementation efforts (see *A2; A3*).

Lastly, results indicate a considerable potential of business actors in advancing SDG achievement (*A2*; *A3*; *S1*). There is an observable increase of corporate actors in partnership efforts over time, both as collaborators and as lead partners (*A3*). With regard to their governance functions, results show that business-led CSSPs rank first in engaging in certification and standard-setting (*A3*). Additionally, transnational climate initiatives (TCIs) – often involving corporate partners – most frequently address SDG target 12.6, which aims at promoting sustainable

business practices and corporate sustainability reporting (*A2)*. The literature review conducted in *S1* further identifies a growing engagement of companies with the SDGs, highlighting for example a strong increase in the publication of sustainability reports by corporate actors (UN, 2020), often including direct references to the SDGs (UN Global Sustainability Index Institute, 2019). These results point to an important role of corporate actors in establishing voluntary sustainability standards and certification schemes and indicate a positive turn in terms of increased transparency with regard to reporting and information disclosure. This observation is also shared by scholars from corporate sustainability governance (see e.g., van Zanten & van Tulder, 2018; 2021). However, there is also indication that these rather promising findings should be treated with caution. First, sustainability reporting is increasingly becoming mandatory in different jurisdictions around the world (e.g., Krueger et al., 2023), accompanied by growing pressure on companies from consumers and investors to increase (transparency regarding) their environmental, social and governance (ESG) performance (Yadav et al., 2017). This could suggest that the disclosure of sustainability-related data is a matter of compliance with laws and regulations, and/or demand-driven, rather than being indicative of transformative actions initiated by corporate actors. Studies further indicate that corporate action (*S1*) as well as TCIs (*A2*) tend to focus on social and economic rather than biosphere-related SDGs. Given the great potential levers for change that corporations possess, and the environmental destruction caused by unsustainable production patterns, these findings are cause for concern (*S1*). Moreover, a closer look at the roles of corporate actors within SDG partnerships reveals that their primary function often revolves around representing their own interest and providing financial resources to projects implemented by other actors (*A3*). Business-led partnerships further exhibit comparatively low (self-reported) effectiveness, with only 20% rated to be "very successful" (*A3*). Notwithstanding some discernible positive indication, results casts doubt on the overall effectiveness of corporate action in driving integrated SDG achievement so far, particularly in the absence of governmental regulation.

Taken together, these findings highlight that governance arrangements for the SDGs can benefit from participatory and collaborative implementation efforts. Increasing inclusion of diverse actors into policy design and implementation as well as independent non-state actor initiatives point to the realization of a whole-of-society approach as envisioned in the 2030 Agenda. A more detailed analysis of the governance functions adopted by different stakeholders has demonstrated the specific contribution of each actor group to fostering SDG achievement, suggesting a complementary division of labor at different levels. However, results underline the importance of governments in determining the regulatory framework and facilitating participation and cooperation. Political will and commitment, especially for financial resource provision, further result to be crucial for accelerating progress towards SDG achievement by 2030.

4.2. Issue prioritization and interlinkages

The scrutiny of SDG prioritization and interlinkages addressed across different levels reflects an additional important aspect to inform the establishment of effective sustainability governance arrangements. Since progress on one goal can have unintended consequences that might undermine the achievement of other goals (Pradhan et al., 2017), successful SDG implementation hinges on a balanced consideration of the different dimensions of sustainable development

while responding to context-specific needs and conditions (*A4;* Forestier & Kim, 2020). Furthermore, the identification of potential synergies between the SDGs, as well as between the SDGs and related global agendas, helps to highlight strategic entry points that can foster more integrated and coherent policy-making and implementation.

Urban resilience actions and transnational climate initiatives

Most notably, the empirical evidence shows that policies and initiatives in the areas of sustainable development, climate change and resilience building tend to address more frequently those SDGs that relate to the social and economic dimensions of sustainable development, rather than those associated with environmental protection and planetary integrity (*A2 – A4; S1*). At the national level, scholars identified patterns of path dependency, i.e., a prioritization of those SDGs that align with existing development plans and interests (ibid., Horn & Grugel, 2018). The comparative study of urban resilience actions in the Global South and North conducted in *A4* corroborates these results at the local level. While the tendency to prioritize social and economic goals is observable across the entire sample, cities in the Global South address a greater diversity of SDG targets, both overall and with respect to environment-related targets (*A4*). Strategic development plans can serve as opportunity to secure funding and/or might be influenced by international donors and organizations (Forestier & Kim, 2020) that advocate for more comprehensive actions reflecting the spirit of the 2030 Agenda (*A4*). This might be – at first sight – more pertinent for cities in the Global South (*A4*). However, most Global South cities included in the sample are located in middle-income countries (see *A4*, appendix I), and thus less dependent on international financial support. Furthermore, also cities in the Global North frequently lack financial resources and national-level political support to implement urban adaptation and mitigation plans (Anguelovski & Carmin, 2011), and the 100RC network provided the same financial support (i.e., around 1 million dollars) for each city alike (Fitzgibbons & Mitchell, 2019). Empirically, the statistical analysis conducted in *A4* did not find a strong effect of income-levels on the total number of SDG targets addressed in resilience actions. This suggests repercussions of acute shocks and chronic stresses across the social, economic and environmental spheres – rather than international donor relations or the aim to attract funding – might have incentivized Global South cities to embrace the concept of sustainability as a normative guidepost for resilience and adaptation planning (*A4*).

Nonetheless, it is noteworthy that most urban resilience strategies in both the Global South and North pay very little attention to biosphere-related targets other than those pertaining to SDG 13 on climate action, which are explicitly linked to resilience building and adaptation (*A4*). This is highly worrisome, considering increasing pressure on the Earth system caused by human social and economic activities (Richardson et al., 2023), and the risk of jeopardizing integrated SDG achievement if this tendency remains unbalanced at the aggregate level (Forestier & Kim, 2020). From the perspective of resilience thinking, however, the strong focus on societal targets in adaptation measures is rather surprising. Research has shown that the concept of resilience is often understood and applied narrowly in sustainability science and practice, with limited consideration of its social dimension (Nüchter et al., 2021). Thus, the findings of *A4* indicate that the encompassing definition of resilience promoted by the 100RC network contributed to the design of strategies and actions that address more diverse system facets, and thereby further

have the potential to simultaneously tackle broader sustainability issues (*A4*). This suggests that mainstreaming sustainability goals such as the SDGs into different policy domains represents an important lever to accelerate progress towards their achievement. The identification of entry points that connect different issue areas is a central step in this regard (*A2*; see also Allen et al., 2023). For example, *A4* showed that resilience actions – in addition to explicitly resilience-related SDG targets – frequently address issues of social, political and economic inclusion (targets 10.2 and 11.3), infrastructure improvement (target 9.1) and the development of effective and accountable institutions (target 16.6). These areas thus represent common entry points that have the potential to link urban resilience building and sustainable development in a more coherent and integrated way.

The prioritization of socio-economic SDGs is equally observable in the analysis of transnational climate initiatives (*A2*). Besides an expected focus on SDG 13, TCIs mainly contribute to the areas of responsible production and consumption (SDG 12), infrastructure (SDG 9) and energy (SDG 7), whereas biosphere-related SDGs clearly lag behind (*A2*). Specifically, the examination of SDG targets addressed by TCIs reveals that synergies between climate protection and sustainable development can be fostered by advancing more sustainable practices in the business sector (target 12.6), retrofitting industries (target 9.4), improving resilience and adaptive capacity to natural disasters (target 13.1) and facilitating access to clean energy technology and research (target 7.a) (*A2*). Similar to resilience building measures, climate actions are closely linked to infrastructure improvements. The visualization of the results through network graphs highlights the central role of SDG 9, showing thematic overlaps with many other SDGs, for example in terms of energy infrastructure (SDG 7), urban transportation systems (SDG 11) or waste management (SDG 12) (*A2*). Furthermore, its high betweenness centrality and position in the networks underline its potential to create synergies among other goals that would otherwise not be connected (*A2*). Infrastructure thus emerges as a crucial potential entry point for aligning climate action with other policy domains and enhancing synergies in the implementation of both the Paris Agreement and the 2030 Agenda (*A2*).

It is important to note that goal prioritization that caters to context-specific needs and challenges is not inherently wrong (*A4*). Studies have shown that interactions between the SDGs, both positive and negative, vary across different contexts (Lusseau & Mancini, 2019). For example, network analyses of SDG interlinkages based on income levels highlight that progress on SDG 1 (poverty eradication) in lower income countries has compound positive effects on overall SDG implementation, whereas the reduction of inequalities (SDG 10) represents a major lever in higher income countries (ibid.). Considering this, the observed prioritization of resilience actions promoting inclusion and equality (targets 10.2 and 10.3) in Global North cities, and the comparatively stronger focus on building resilience of the poor and vulnerable (target 1.5) in cities of the Global South (*A4*) could have a positive effect on overall goal achievement in the respective context. However, results suggest that the notably low consideration of environmental concerns across many governance arrangements and policy domains (see *A2*; *A4*; *S1*) requires counterbalancing interventions to halt and prevent irreversible damage to the Earth system, which will be discussed in more detail in section 4.3.

Multi-stakeholder partnerships

At first glance, partnerships for the SDGs – as compared to the studied cities and TCIs – show a more positive picture regarding a balanced approach to SDG implementation. SDG 13 on climate action is the most addressed goal by CSSPs, and other biosphere-related SDGs (i.e., SDGs 6, 14, 15) are comparatively well represented (see *A3*, Fig. 9). Further, the frequency with which pairs of SDGs are addressed jointly by CSSPs shows that combinations of social and biosphere-related SDGs dominate (see *A3*, Fig. 10). However, this result is heavily influenced by the frequent occurrence of SDG 13 in these combinations. A closer look at SDG 13 reveals that climate action is most often addressed in conjunction with social SDGs (i.e., SDGs 4, 5, 11 and 7). This indicates that partnerships working on climate change mitigation, adaptation and resilience building also tend to focus on the societal dimension (e.g., through awareness and education campaigns). Yet, partnerships engaging in climate action while simultaneously contributing to the protection and/or restoration of aquatic and terrestrial ecosystems (SDGs 14 and 15), for example by promoting nature-based solutions, are also well represented in the sample. While partnerships seem to promote nexus approaches with regard to the environmental SDGs, indicated by the frequent co-occurrence of these goals in their actions (see also Koloffon Rosas & Pattberg, 2023), the comparatively low alignment between environmental and economic SDGs is striking. Thus, much needed actions that drive the decoupling of consumption, production and economic growth from environmental degradation are clearly underrepresented.

The analysis further shows that SDG 12 (consumption and production) is among the least addressed goals by MSPs, both overall as well as in combination with other SDGs (*A3*). Pradhan and colleagues' (2017) assessment of SDG interlinkages identified SDG 12 as exhibiting the highest potential for trade-offs with other goals, particularly with SDG 10 (reduced inequalities), SDG 1 (poverty eradication), SDG 6 (water), and SDG 3 (health). Notably, these same combinations of goals are the least addressed by partnerships (*A3*). Collaborative action between partners from different societal subsectors could however be particularly suitable to tackle these issues jointly, contributing to the reduction of unintended consequences and trade-offs by breaking silos and combining diverse material and immaterial resources (*A3*). Conversely, MSPs prioritize combinations of SDGs that Pradhan et al. (2017) identified as predominantly synergistic, with education (SDG 4) and gender equality (SDG 5) emerging as the most frequently addressed pair of goals (*A3*). These initiatives play a crucial role in reducing educational gender disparities, thereby fostering the empowerment of women and ultimately the reduction of poverty, as underscored by the strong alignment between SDG 5 and SDG 1 in partnership efforts (*A3*). Similarly, many partnerships engage in urban and local climate action (SDGs 11 and 13), facilitating synergies by concurrently addressing inclusive, resilient social development and mitigating the adverse environmental impacts of human settlements (*A3*). This includes endeavors such as integrative, community-based waste-management and upcycling projects. In contrast, SDG 9 (infrastructure) is among the least addressed goals by MSPs (*A3*), indicating untapped potential in leveraging its co-benefits with other SDGs, particularly regarding climate action and resilience building as discussed above (see *A2*; *A4*).

Actor influence on SDG prioritization and interlinkages

Finally, the cumulative findings of this dissertation indicate that the interlinkages among the SDGs, as well as between the SDGs and other global agendas, are closely associated with the predominant types of actors engaged in governance arrangements. For example, while synergies between climate protection, resilience building and infrastructure improvements were observed both in *A2* and *A4*, the connection to additional goals and targets varies with the main implementing actors, their capacities and respective spheres of influence. Specifically, public authorities such as city governments might have a greater lever to drive actions related to the social, political and economic inclusion of all (targets 10.2 and 11.3) and the development of effective institutions (target 16.6) (see *A4*), as they possess the authority to design respective policies, steer urban planning and management processes and build or reform public institutions. In contrast, TCIs with high participation of (transnational) companies are more likely to possess direct influence over advancing sustainable business practices (target 12.6) or retrofitting industries through increased resource efficiency and the adoption of clean technologies and industrial processes (target 9.4) (see *A2*). The comparison between TCIs and state-led climate actions as part of countries' Nationally Determined Contributions (NDCs) conducted in *A2* further supports this argument. For example, while SDG 10 (reduced inequalities) shows low alignment with climate actions in general, state actions more frequently address target 10.4 (social protection policies) and, again, target 10.2 (social, economic and political inclusion). In contrast, TCIs focus on financial market monitoring (target 10.5) and enhancing foreign direct investment in most disadvantaged countries globally (target 10.b) (*A2*).

Partnership approaches combining diverse stakeholder types seem particularly promising for fostering more integrated SDG achievement (*A3*). Compared to partnerships that involve only one actor group, collaborative efforts including different societal subsectors are more likely to address two or more SDGs simultaneously, pointing to a greater consideration of interlinkages between the goals (*A3*). Here, the strong attention given to SDG 4 (education) and SDG 5 (gender equality) is particularly noteworthy (*A3*). These goals were found to be rather neglected both in TCIs and NDCs (*A2*), and gender equality was among the least addressed goals in urban resilience strategies (*A4*). MSPs seem to be more aware of the crucial role of education in achieving the SDGs, as observed also in *A1*, and the cross-cutting nature of gender equality (Leal Filho et al., 2022; *A3*). Further supported by higher levels of (self-reported) effectiveness, the combination of knowledge, capacities and resources appears essential for breaking silos, considering issue interlinkages and advancing synergies in SDG implementation (*A3*). Lastly, non-state and collaborative actions can be particular important for problems that transcend national boundaries, as their sphere of influence often cuts across various jurisdictions (*A2; A3;* see also Boas et al., 2016).

Taken together, the results of this dissertation highlight that state actors bear a central responsibility in driving SDG implementation, as certain targets can only (or predominantly) be achieved through interventions by public authorities (*A1*; *A2*; *A4*). However, results also underline that non-state actor involvement is crucial for integrated SDG implementation, as they possess an additional lever to foster synergies between the goals where state actors lack the capacity or political will to act (United Nations Framework Convention on Climate Change

[UNFCCC], 2017; *A2*). The synthesis of the results indicates complementarity of diverse governance arrangements in terms of SDG implementation and interlinkages addressed between the goals. Together, these efforts can boost integrated SDG achievement at the aggregate level, where governance gaps left by one actor group can be complemented through actions by others (*A2*; *A3*). However, there remains a risk that these efforts might be competing or even undermine each other if not pursued in a coherent way, as will be discussed in more detail in the following section.

4.3. Key enabling factors

The findings presented above highlighted patterns observed across different governance arrangements with regard to participation and collaboration as well as issue prioritization and interlinkages in the context of the SDGs. The following section distills the evidence on enabling factors for effective governance arrangements for the SDGs, which have been presented in the previous sections, and outlines how they can be harnessed further. Thereby, this dissertation responds to the need to translate scientific findings on SDG implementation into practical advice for decision-makers (Malekpour et al., 2023). The enabling factors identified cover procedural, structural and institutional aspects of governance for the SDGs. Rather than meant to be prescriptive, these aspects should be understood as analytical dimensions to be assessed and reflected upon within the respective context of diverse governance arrangements.

Harnessing complementarities

First, the analyses highlight that different actors assume complementary governance functions and address complementary issue areas. Furthermore, interlinkages between the SDGs, and with climate and resilience actions, that are fostered in different governance arrangements seem closely related to the authority, capacities and spheres of influence that different actors involved therein possess. Thus, establishing and reforming governance arrangements so that they build and capitalize on these this complementary potential is likely to increase the reach and effectiveness of interventions (*A2*; *A3*). Participation and the involvement of diverse stakeholders were found to be conducive to SDG achievement, pointing to the importance of inclusive and collaborative policy-making and implementation processes and their institutionalization (*A1-A4*).

As highlighted in *A3*, collaborative efforts between actors from different societal subsectors are likely to have a nexus-orientation, i.e., addressing several issue domains simultaneously. Such nexus approaches are crucial for integrated and accelerated SDG achievement (Boas et al., 2016). Consequently, decision-makers should assess governance arrangements in terms of their inclusiveness and breadth of involvement of diverse actors to capitalize on different sources of knowledge, skills, capacities and resources. This could be particularly important for enhancing progress towards often under-represented environmental goals, specifically with regard to SDG 14 and 15 (marine and terrestrial ecosystems). *A2* showed that both goals are, in relative terms, more frequently addressed by state actors than by collaborative TCIs. Similarly, SDG 14 is covered more often by partnerships involving only one societal subsector (*A3*). Considering that studies found these goals to be among the most negatively affected through trade-offs with

other SDGs (Pham-Truffert et al., 2020), nexus approaches promoted through collaborative, cross-sectoral governance efforts could help mitigating these negative spill-over effects.

It is important to reiterate that the wording of the 2030 Agenda with the SDGs at its core ascribes the primary responsibility for its attainment to national governments and public institutions, with comparatively few and only vague recognition of the role of non-state actors (*A2*; Bexell & Jönsson, 2017). For example, while target 10.5 concerns monitoring and regulation of financial institutions and markets, there is no specific reference to actions by financial investors (*A2*), despite the positive leverage effect that could result from reorienting investment strategies in line with the SDGs (*S1*). Considering the substantial contributions that actors other than national governments can make towards achieving the SDGs, their accountability and ownership could be increased by clearly spelling out responsibilities of diverse actor groups in specific targets (*A2*). Since these responsibilities may vary considerably across different governance arrangements and levels, this could be done in the process of adapting the SDGs to the respective context.

Improving coherence

Second, in light of the diverse and distributed capacities and governance functions of actors as well as the policy domains and interlinkages addressed within different governance arrangements, this dissertation underscores that enhancing coherence and coordination across policies, actors, and levels can serve as a pivotal mechanism for improving and accelerating SDG implementation. The analyses conducted in *A2* and *A4* demonstrated that governance efforts around climate change mitigation, adaptation and resilience building have the potential to generate valuable co-benefits with broader sustainability objectives. The rich and growing body of literature on SDG interlinkages, to which this dissertation contributes, provides indication on mutually beneficial relationships across different policy domains and contexts. These synergies could be further leveraged through context-sensitive assessments along the entire policy cycle that identify – based on science- and evidence-based approaches – thematic overlaps between policies and initiatives (see also Allen et al., 2018). The identified areas can then serve as entry points for overall SDG implementation and joint implementation of global (development) agendas (*A2*).

Although the contributing articles to this dissertation focused on synergistic relationships between the SDGs, and with related international agendas, a careful assessment of the potential negative effects and unintended consequences of implementation efforts is highly important. These considerations should be incorporated into impact assessments and decision-making on competing policy options. Such science and evidence-based impact assessments considering context-specific needs could further help counterbalancing excessive prioritization of social and particularly economic goals observed, which seem greatly driven by vested interests and the prevalent economic growth paradigm. Furthermore, policy design and implementation that takes into account positive and negative interactions could be facilitated by the adoption of an overarching strategic vision that embraces sustainability goals such as the SDGs as normative guiding principles (see *A4*). Some positive development is discernible in this regard. For example, the Global Climate Action portal / NAZCA platform now allows for filtering registered

cooperative initiatives according to thematic areas (e.g., energy, land use, adaptation/resilience) or SDGs addressed (see *A2* on this for the year 2021). Similarly, some of the urban resilience strategies analyzed included references to the SDGs (*A4*), and other researchers observed a trend toward increased SDG-referencing from 2017 onwards (see Croese et al., 2020). However, while highlighting common themes could lead to increased coherence and facilitate learning and knowledge exchange across actors and initiatives that share the same issue focus, approaches that rely on self-reporting can be prone to box-ticking and misrepresentation (*A2*-*A4*). Better monitoring and review mechanisms and a precise indication of the specific contributions of each action to the SDGs and their targets addressed simultaneously could help increase transparency, accountability, and ultimately effectiveness in this respect.

It is noteworthy, however, that coherence in policy-making and implementation can be difficult to achieve, particularly with regard to potentially conflicting policy domains involving diverse interests that may entail time- and resource intensive or even intractable coordination processes as well as lagged effects of feedback loops between mutually influencing policies (*A1*). This may explain why the comparative analysis of governance variables – which presents a snapshot of the year 2015 only – did not find a strong relationship between policy coherence and national SDG achievement (*A1*). Given the complexity of the SDGs and their targets, the use of aggregate indicators could further have obscured mixed individual effects at the target level (*A1*). Reassessing these results through longitudinal studies and target-level analyses (*A1*) or complementing them with a consideration of factors such as leadership, power dynamics and the presence of an overarching strategic vision, among others, therefore represents an important area for future research, which has recently received increasing scholarly attention (see for example Shawoo et al., 2022; Pickering, 2023).

Strengthening monitoring, review and follow-up mechanisms

Third, as has been touched upon above, improved coherence is closely tied to effective monitoring, review and follow-up mechanisms. For example, the analysis of partnerships registered on the UN Partnership Platform revealed often outdated, inconsistent or missing data entries, and feedback from survey respondents indicated insufficient support on behalf of the UN as well as lacking transparency in the compilation of database entries (*A3*). Enhanced monitoring on behalf of the UN could thus not only contribute to ensuring accurate and reliable data for research purposes, but also inform and enable the design of policy interventions that can counteract unbalanced attention given to specific SDGs or nexuses through deliberate steering (*A3*). As the analysis of MSPs indicates, SDG implementation could be accelerated if efforts registered on the UN Partnership Platform would be directed towards addressing underrepresented goals or pairs of SDGs that entail numerous or particularly challenging trade-offs (*A3*). For example, the UN could issue a call for multi-stakeholder efforts that effectively address sustainable consumption and production (SDG 12) with a particular focus on reducing inequalities within and among countries (SDG 10). Additionally, strengthened engagement with voluntary initiatives registered on IGO-hosted action platforms, such as the NAZCA database and the partnership registry, could contribute to improved accountability among actors and mitigate the risk of window dressing through sham commitments (*A2*; *A3*).

Relatedly, a study of Voluntary National Reviews (VNRs) on SDG implementation progress submitted to the High-Level Political Forum (HLPF) showed that countries barely assessed interlinkages between the goals, besides mainly text- and narrative-based analyses of specific SDGs that corresponded to each year's selected focus of the forum (Allen et al., 2018). This underlines, on the one hand, the need for better and more holistic monitoring and reporting mechanisms at all levels, which form the basis for integrated assessments and improved coherence as emphasized above. On the other hand, it suggests a strong steering potential of the HLPF to guide integrated SDG implementation in line with its given mandate (see also Boas et al., 2016). While the latest guidelines for VNR preparations encourage countries to assess SDG interlinkages in a comprehensive way and consider spillover effects of national actions on other countries (UN, 2023c), turning such recommendations into a mandatory reporting requirement could enhance more integrated national and local SDG implementation processes that consider synergies and trade-offs of policy interventions. Furthermore, the current approach of selecting specific focus SDGs to be reviewed at the HLPF could be adjusted to emphasize success stories and lessons learnt with regard to those SDGs that are severely lacking behind on an aggregate (i.e., regional or global) level, or focusing on potentially highly conflicting and particularly synergistic policy areas to accelerate progress. Similarly, others have proposed to link the HLPF's thematic focus to the Global Sustainable Development Report (GSDR), a report composed by the "Independent Group of Scientists" that synthesizes and assesses scientific/expert knowledge on SDG implementation (Beisheim, 2020). These approaches suggest structuring the HLPF around entry points and levers for transformation identified in the GSDR[5] to ensure a systematic approach to annual reviews of all 17 SDGs and their interactions (see Beisheim, 2020 for a detailed discussion). Such integrated reporting and review mechanism at the global level could help sensitize and guide national and local governments to design and reflect on policy responses in a more holistic way. Implementing such changes would partly require member states to adjust the forum's mandate. However, the first round of review of organizational aspects and the format of the HLPF in 2020/21 did not yield groundbreaking reforms, mainly due conflicting views of member states about the broader international order, as well as specific development and environmental matters (Beisheim, 2021). Adding to this the multiple exacerbated geo-political crises the world is currently facing, the next round of review in 2024 is unlikely to produce more substantive changes.

Increasing accountability and commitment

Adjusting the HLPF, enabling better engagement with voluntary initiatives and adapting institutional structures, processes and resource allocation at different levels so as to harness complementarities, improve coherence and prevent de-prioritization of ecological concerns is ultimately also contingent upon the will of decision-makers to implement such reforms (see *A3* and *S1*). Although the 2030 Agenda posits a normative internationally agreed framework, its non-legally binding nature has direct implications for compliance and accountability, as states

[5] The 2019 GSDR proposed six entry points based on SDG interlinkages (i.e., human well-being and capabilities; sustainable and just economies; food systems and nutrition patterns; energy decarbonization with universal access; urban and peri-urban development; and global environmental commons), as well as four cross-cutting levers (i.e., governance; economy and finance; individual and collective action; and science and technology). The 2023 GSDR added capacity building as a fifth lever (see UN, 2023d).

have much freedom to decide whether and how ambitiously they implement the goals (Biermann et al., 2017). Thus, tying the SDGs to other legally binding treaties and commitments could pose a meaningful lever to foster progress toward their achievement (see also Biermann et al., 2023). This has been done, for example, with SDG 13 on climate action, that is explicitly linked to the UNFCCC, whose members adopted the legally binding Paris Agreement in 2015. While collective climate pledges by states currently fall short of meeting global emission reduction targets, research highlights some critical positive changes since 2015 (including at sub-national levels) that, if scaled up, could help closing this gap (Höhne et al., 2020). Furthermore, national commitments under the Paris Agreement – and infringements thereof – are increasingly referenced in a steadily growing number of climate litigation cases, both by plaintiffs and rulings of relevant courts (see UN Environment Programme [UNEP], 2023). The possibility to hold governments accountable for incompliance with their commitments could incentivize political actions and raise levels of ambition. Other legally binding agreements, such as the treaty on plastic pollution related to SDG 12 or the treaty to protect marine biodiversity on the high seas related to SDG 14 (see Biermann et al., 2023 for additional examples) are promising to have similar effects. Additionally, the adoption of non-binding agreements such as the Kunming-Montreal Global Biodiversity Framework that supports and, in many areas, concretizes actions toward achieving SDG 15 (Lehmann, 2023) could further help accelerating implementation efforts in a more coherent way. Importantly, national and sub-national SDG implementation and development plans should be adjusted to incorporate these more recent developments. Clearly defining responsibilities of non-governmental actors as suggested in *A2* could mobilize non-state action regarding these related agreements. Further formalizing these responsibilities through binding obligations can contribute to increasing accountability of non-state actors, especially with regard to the business and financial sector. As emphasized in *S1*, aspirational goals such as the SDGs are more likely to be implemented effectively if reinforced by binding regulations, underlining again the central role of governmental actors highlighted in this dissertation.

It is essential to recognize that global international agreements involve extensive and protracted negotiation processes. Given the urgency to act, regulations on smaller scales, such as for example the EU Regulation on deforestation-free products explicitly relating to SDGs 15, 13, 12, 2 and 3 (EU, 2023), can significantly contribute to accelerating integrated action. While this regulation has faced criticism for inadequately considering possible negative side-effects on vulnerable groups in producer countries (e.g., Zhunusova et al., 2022), the approach of acknowledging SDG interlinkages within binding commitments at lower levels could serve as an example for other regions, provided they sufficiently address the unintended consequences of such regulations. Additionally, the use of alternative smaller (political) fora such as the Petersberg Climate Dialogue or the G7 Climate Club can provide valuable venues to discuss and agree on more ambitious targets and increased speed of implementation. This can also be done at lower levels, for example through cooperation in (transnational) city networks, where knowledge-sharing, learning as well as a common framework and vision can support integrated SDG achievement (see *A4*). Such arrangements can be particularly suitable to drive actions of cities and countries in the Global North, which collectively seem to fall short of taking an expected leading role in comprehensive measures that simultaneously promote sustainable development and resilience (*A4*).

Finally, it must be reiterated that implementing ambitious sustainability goals such as the SDGs is highly complex. The effectiveness of governance arrangements for the SDGs is closely linked to and dependent on other socioeconomic and structural factors, such as for example education levels, geographic location and financial resource endowment (*A1*). Additionally, different and sometimes competing ideologies and world views, values and traditions, vested interests and related struggles over power need to be considered within the respective context. These aspects have recently received increasing attention in debates on how to accelerate progress towards the SDGs (see e.g., Beisheim, 2023) and can be informed by the findings of this dissertation.

5. Conclusion

This dissertation has empirically analyzed governance arrangements and their contribution to SDG achievement at different levels. By synthesizing the findings on participatory and collaborative governance arrangements, as well as issue prioritization and interlinkages, this framework paper identified common opportunities and challenges to SDG implementation across all levels of governance analyzed. Based on the observed patterns, this framework paper derived enabling factors for effective governance arrangements that can foster integrated SDG achievement. Reiterating the context-sensitive nature of sustainable development, these enabling factors should be understood as overarching analytical dimensions necessitating thorough assessment and reflection within the diverse governance arrangements across different levels.

The findings of this dissertation have provided empirical support for normative claims about the virtue of participatory and collaborative governance arrangements for the SDGs. Evidence from the national, subnational and global-transnational level underscores that building on the diverse capacities, resources, skills and knowledge of different actor groups can increase the effectiveness of governance arrangements, stimulate a more comprehensive consideration of diverse aspects of sustainable development, and facilitate nexus approaches that break silos between policy domains and contribute to the mitigation of trade-offs and negative spillover effects through greater consideration of interlinkages between the goals. The assessment of the governance functions assumed by different actors has emphasized the persistent importance of governmental actors for establishing legal and regulatory frameworks, providing financial means and creating an enabling environment that facilitates participation and collaboration. In addition, it highlighted the contributions and complementary potential of non-state actions for SDG achievement. These encompass, for example, voluntary standard-setting and certification schemes by corporate actors, advocacy, capacity-building and project implementation by NGOs, and knowledge production and dissemination by academia essential for improving the science-policy interface.

Complementing the growing body of literature assessing SDG interlinkages, this dissertation highlights the significant potential of governance efforts in climate change and resilience building to contribute to broader sustainable development. Specifically, it revealed that infrastructure improvements (SDG 9) can serve as an important entry point for generating valuable co-benefits for achieving more sustainable, climate friendly and resilient development pathways. However, the cumulative results raise concern over the prevalent prioritization of social and

economic goals across the governance arrangements analyzed, and insufficient attention given to potentially conflicting pairs of SDGs, notably SDG 12 (consumption and production) and SDG 10 (reduced inequalities). Decoupling economic growth, production and consumption from environmental degradation while empowering and protecting the most vulnerable segments of society is thus a crucial task in the years to come. Cross-sectoral and multi-stakeholder approaches, despite currently largely neglecting to tackle these policy domains jointly, can provide an important venue for exploring and implementing such efforts.

By synthesizing the cumulative findings of this dissertation, this framework paper identified four interrelated enabling factors – i.e., *harnessing complementarities*, *improving coherence*, *strengthening monitoring, review and follow-up* as well as *increasing accountability and commitment* – that can facilitate and accelerate progress towards the SDGs at all levels. It highlighted common opportunities and challenges observed across different governance arrangements and thereby helps to draw attention to areas that require particular attention by decision-makers to drive integrated SDG achievement. These findings support and complement recent academic research in the field, which focuses, for example, on global governance reforms (e.g., Biermann et al., 2023) and the role of scientists (e.g., Malekpour et al., 2023) to facilitate SDG achievement. The collective body of research, including this dissertation, emphasizes the imperative of enhancing governance arrangements at all levels to galvanize action and political impetus toward realizing integrated sustainable development pathways envisioned in the 2030 Agenda.

This dissertation also informs future research avenues. For example, the findings suggest that a more detailed examination of actors and their roles and functions in sustainability governance can yield important insights by scrutinizing underlying interests, motivations and power relations, i.e., the politics of sustainable development (see also Beisheim, 2023). A better understanding of these factors could be highly useful to anticipate potential conflicts and explore ways to overcome barriers and resistance to necessary transformation pathways. While the traditional distinction between state and non-state actors has been useful for assessing and reflecting more generally on the increasing involvement of non-governmental actors in public policy-making, a closer look at individual actors and their governance functions suggests that both theory and practice can benefit from moving beyond the traditional state-non-state actor dichotomy by considering the particularities of individual actors in more detail. This, in turn, can further inform research on collective agency exercised by group actors (see e.g., Gehring & Marx, 2023), including, for example, multi-stakeholder partnerships and other collaborative initiatives. Such analyses could be complemented by studies adopting an actor-centric perspective on SDG interlinkages addressed, which has so far largely been disregarded. Furthermore, greater attention should be placed on capturing and understanding trade-offs between the goals, and assessing potential solution pathways to minimize these, particularly with regard to the environmental dimension of sustainable development. Context-sensitive comparative analyses of success and failure of specific policy responses, taking to account feedback loops between interacting policies, could provide valuable practical recommendations to decision-makers (see also Malekpour et al., 2023).

Despite all shortcomings, the SDGs have provided an unprecedented common framework to consider sustainable development in more integrated way within academic, societal and political discourse and practice. Drawing attention to the complex interrelation between sustainability goals, diverse actors and levels of governance, they can be considered a critical milestone in the evolution of the concept of sustainable development. However, the necessary governance responses to achieve them have not (yet) materialized, as emphasized in the official 2023 SDG report (UN, 2023a). It remains to be seen whether the United Nations' 2023 SDG Summit and the upcoming Summit of the Future in 2024 will result in accelerated action and necessary governance reforms by heads of state and government, taking into account the rich scientific evidence provided by the academic community, to which this dissertation contributes.

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Annex

Article 1:

Governance for achieving the Sustainable Development Goals: How important are participation, policy coherence, reflexivity, adaptation and democratic institutions?

Abstract

It is widely accepted that the achievement of the 17 Sustainable Development Goals (SDGs) depends on effective governance arrangements. However, it is less clear which modes and aspects of governance are important for which of the 17 goals. Until now, empirical research has mostly studied individual cases, with comparative studies largely missing. Here, we conduct a comparative analysis among 41 high and upper-middle income countries for the year 2015, drawing on the Sustainable Governance Indicators, the Global SDG Indicators Database and other official sources. Using multiple regression, we test the influence of different aspects of governance, namely participation, policy coherence, reflexivity, adaptation and democratic institutions on SDG achievement at the national level, controlling for the effects of additional socio-economic conditions. Of the tested factors, democratic institutions and participation as well as economic power, education and geographic location serve to explain SDG achievement.

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Governance for achieving the Sustainable Development Goals: How important are participation, policy coherence, reflexivity, adaptation and democratic institutions?

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ABSTRACT

It is widely accepted that the achievement of the 17 Sustainable Development Goals (SDGs) depends on effective governance arrangements. However, it is less clear which modes and aspects of governance are important for which of the 17 goals. Until now, empirical research has mostly studied individual cases, with comparative studies largely missing. Here, we conduct a comparative analysis among 41 high and upper-middle income countries for the year 2015, drawing on the Sustainable Governance Indicators, the Global SDG Indicators Database and other official sources. Using multiple regression, we test the influence of different aspects of governance, namely participation, policy coherence, reflexivity, adaptation and democratic institutions on SDG achievement at the national level, controlling for the effects of additional socio-economic conditions. Of the tested factors, democratic institutions and participation as well as economic power, education and geographic location serve to explain SDG achievement.

1. Introduction

In September 2015, member states of the United Nations (UN) agreed on the 2030 Agenda for Sustainable Development. With its 17 Sustainable Development Goals (SDGs) and 169 targets, the Agenda demonstrates the international commitment to achieve worldwide sustainable development in its social, economic and environmental dimension (United Nations, 2015). What makes the SDGs special is the broad acceptance and commitment of the international community, the comprehensive definition of sustainable development in its different dimensions made measurable through 232 indicators, and the understanding that these sustainability goals are universal, integrated and indivisible. The emergence of the goals can be understood in the context of and as a response to global problems emerging in the wake of globalization processes and increasing global interconnectedness.

The passing of the SDGs has sparked enormous academic attention. Many consider the interrelation, synergies and trade-offs between the goals (Nilsson et al., 2018; Weitz et al., 2018; Pradhan et al., 2017; Spaiser et al., 2017; Stafford-Smith et al., 2017; Le Blanc, 2015) or the SDG indicators and measurement of the SDGs more broadly (Reyers et al., 2017; Hák et al., 2016; Allen et al., 2017). The role of governance for the SDGs has mainly been addressed from a conceptional or normative point of view (Boas et al., 2016; Meuleman and Niestroy, 2015; Kanie et al., 2014; Bowen et al., 2017). To achieve the SDGs, all states are called upon to integrate the goals into their national sustainability and development plans (United Nations, 2015). Yet, the implementation of the 2030 Agenda poses challenges for different actors at different levels: Research suggests that the complexity and interrelation of the of the 17 SDGs requires integrated, holistic and coherent policy-making where decision-making, implementation and monitoring involves actors from the public and private sector as well as civil society (Boas et al., 2016; Meuleman and Niestroy, 2015; Kanie et al., 2014). Issues of ambivalence and uncertainty only add to this complexity (Newig et al., 2007). According to Bowen et al. (2017), governance for the SDGs needs to foster an enabling environment for collective action, ensure that the actors involved are held accountable and deal with emerging complex trade-offs between the goals. In this context, governance has been referred to as the "fourth pillar of sustainable development" (Kanie et al., 2014: p.6).

The central aim of this article is to contribute to the debate about

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the conceptualization and effectiveness of governance for sustainable development, particularly in the context of the 2030 Agenda and the SDGs. By means of a comparative analysis covering 41 high and upper-middle income countries, we test the explanatory power of different aspects of governance for sustainable development as defined by the SDGs. The findings provide a snapshot of the 2015 status quo and help derive insights about which features of governance are particularly important for achieving sustainable development in its different dimensions. Compared to their predecessors, the Millennium Development Goals (MDGs), the SDGs are much broader in scope. They underline the need for transformative policy change not only in developing countries, but recognize the role and responsibilities of industrialized countries in advancing global sustainable development (Biermann et al., 2017). Thus, by analyzing the governance characteristics of high and upper-middle income countries and their relation to SDG achievement, we aim at generating insights that can ultimately contribute to more effective SDG implementation. Recognizing that governance should also be analyzed in the light of a country's specific context, this article seeks to provide a basis for further in-depth analyses about the causalities at work in different national contexts.

The remainder of the article is organized as follows. First, we discuss the concepts of governance as regards sustainable development and present the theoretical foundations of governance for sustainable development based on a comprehensive literature review. Subsequently, we introduce our methodology for measuring and comparing SDG achievement across the 41 countries. Finally, we show and discuss the results of the multiple regression analyses examining the relationship between different aspects of governance and the achievement of each SDG at the national level, controlling for the effects of GDP per capita, population size, education and geographic location.

2. Governance, sustainable development and sustainability governance

Despite years of academic debate, governance remains a contested concept, with no universally agreed definition. A common feature across the various definitions of governance is a distinction between government and governance, rejecting a view of the state as monolithic entity and the government as primary and unitary actor responsible for policy-making and implementation (Bevir, 2011; Kooiman, 1999; Meadowcroft, 2011; Pierre and Peters, 1998). Government can rather be understood as a central component of governance (Meadowcroft, 2007). According to new governance approaches, governance involves a plurality of public and private stakeholders, hybrid practices (administrative systems and quasi-market strategies) and is considered to be multi-juristictional, i.e. spanning different institutions, sectors and levels of government (Bevir, 2011). Consequently, we understand governance as a multi-dimensional concept covering different actors, processes, structures and institutions involved in political decision-making and implementation (Treib et al., 2007; Driessen et al., 2012).

Similarly, the concept of sustainable development has been considered to be only vaguely defined and highly normative (Newig et al., 2007; Meadowcroft, 2000). The term sustainable development came to prominence in 1987, when the World Commission on Environment and Development (WCED) issued its report *Our Common Future*, also known as the Brundtland Report. Here, development was described as being sustainable when "it meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987: p.8). Since then, many definitions of sustainable development have evolved in a "constant process of redefinition and interpretation" (Jordan, 2008: p.20) – yet an undisputed, unambiguous concept did not emerge. Over time, triggered by the Brundtland Report, there was a growing understanding that sustainable development requires a simultaneous consideration of social, economic and environmental factors (Meadowcroft, 2000). However, sustainability had often been simply equated with environmental protection or long-term strategies (Newig et al., 2007). Ambiguities in the conceptualization, operationalization and measurability of sustainable development can be attributed to the high complexity of the topic: In the academic discourse, challenges in the area of sustainable development are referred to as so-called "wicked problems" (van Zeijl-Rozema et al., 2008), in which cause-effect relationships and potential solution approaches are subject of controversial debate. Ambivalence of sustainability goals, a large number of actors involved, and complex interactions between technology, society and nature only add to this (Newig et al., 2007). For the first time, with the 2030 Agenda and the SDGs, the international community has reached an agreement on the concept of sustainable development that was operationalized through its 17 goals, 169 targets and 232 indicators, triggering new research approaches which can be highly relevant to the political and societal implementation of the Agenda.

In the context of sustainable development, governance is regarded as an essential and indispensable steering tool (van Zeijl-Rozema et al., 2008). According to Meadowcroft (2007), we speak of governance for sustainability when policy-making and implementation involve complex state-society interactions that aim at achieving a more sustainable future. Scholars of environmental governance, essentially contributing to the broader sustainability governance discourse, equally underline its multidimensional nature (Driessen et al., 2012). However, it remains unclear which specific dimensions or modes of governance are most conducive to the achievement of sustainable development. Current research in sustainability governance often focuses only on one particular aspect of governance such as participation (Bäckstrand, 2006; Newig and Fritsch, 2009; Meadowcroft, 2004; Newig et al., 2018), reflexivity (Voß and Kemp, 2006) or policy implementation (O'Toole, 2004; Bressers, 2013). To our knowledge, there is no comprehensive analysis systemically examining the relationship of governance (understood as encompassing concept including actors, processes, structures and institutions) and sustainable development in its social, economic and environmental dimension as defined by the United Nations in the 2030 Agenda. In the broader context of governance and development, however, valuable contributions have been brought forward by Norris (2012) as well as Holmberg, Rothstein and Nasiritousi (2009).

3. Dimensions of effective sustainbility governance

In view of the uncertainty as to which dimensions of governance are particularly important for achieving sustainable development, we seek to synthesize empirical and theoretical findings from previous research and to test their respective relevance for SDG achievement in a structured manner. With this study, we intend to provide insights that help developing a more integrated and holistic concept of effective sustainability governance, thereby contributing to the ongoing theoretical debate.

As pointed out before, governance, in contrast to government, essentially relies on a diversity of participating actors. In the specific context of sustainability governance, the importance of participation in policy-making and implementation has been repeatedly stressed by scholars and practitioners. The inclusion of different actors, for example in the drafting of policy proposals, is deemed to yield more effective results on the basis of mutual

learning (Newig et al., 2018; Armitage, 2008), increased legitimacy and the bundling of resources (Newig et al., 2018; Verweij et al., 2013). In order to ensure effective sustainability governance and exploit potential synergies, it appears crucial to coordinate measures at different levels of government and between interacting policies. Particularly with regard to complex and interrelated sustainability goals, policy coherence can contribute to the reduction of trade-offs between different sectoral policies and thereby lead to more effective implementation (Monkelbaan, 2019). Coordinated measures should be regularly assessed in terms of effectiveness and, if necessary, be adjusted according to a changing environment. Such adaptive governance arrangements can be decisive when dealing with highly dynamic and long-term sustainability problems. This in turn requires reflexivity of institutions and procedures, a governance characteristic that often seems to contradict traditional rationalist problem-solving approaches (Voß and Kemp, 2006). Various studies point to the positive effects of democratic institutions on economic and social development (Halperin et al., 2009) as well as environmental quality (Barrett and Graddy, 2000). Nonetheless, and often with reference to developments in South and East Asia, there is a growing debate on potential trade-offs between democratic institutions and effective (sustainable) governance (Charron and Lapuente, 2010). Consequently, it is important to assess whether democratic institutions, i.e. universal franchise, regular elections, civil rights and political liberties as well as rule of law, positively relate to SDG achievement.

Below, we discuss these four central aspects of governance for sustainable development – participation, policy coherence, reflexivity and adaptation, and democratic institutions – in more detail with a view to building the conceptual foundations of our empirical study.

3.1. Participation

Governance research, with reference to diverse theoretical foundations (e.g. policy network theory, institutional theory or organization theory), suggests that – in the light of an alleged declining capacity of the government to effectively steer societal development – other social actors are needed to fill the emerging void (Peters, 2011; Rhodes, 2007). Scholars have argued that complex problems in particular, such as the challenges posed by interrelated SDGs, require representation and stakeholder involvement due to the various interest and potential trade-offs at stake (Meuleman and Niestroy, 2015; Meadowcroft, 2011; Jordan, 2008; Enroth, 2011; Emerson et al., 2012). In collaborative governance approaches, the institutionalization of state-non-state actor interactions is particularly important for building trust and a shared understanding, as well as for increasing the actors' commitment to collaboration (Ansell and Gash, 2008). It has been argued that greater stakeholder involvement will contribute to knowledge generation and consensus building, and that overall decision-making and policy acceptance will be facilitated by sharing specific knowledge, values and resources (Newig et al., 2018; Verweij et al., 2013). Taken together, participation is expected to generate "a higher degree of sustainable and innovative outcomes" (Heinelt, 2002: p.17). We thus expect higher levels of participation to be positively related to SDG achievement.

For conceptual clarification, we note that participation in this article does not refer to political representation or citizens' right to take part in elections (these aspects form part of the concept of democratic institutions discussed below). Rather, we adopt Heinelt's (2002: p.23) concept of participation who states that "participation in governing activities is not only a matter of being indirectly involved in governmental affairs (by voting, representation etc.) but also through extended engagement in forms of policy-making".

3.2. Policy coherence

Particularly from a normative policy perspective, many have stressed the importance of policy coherence and coordination for the achievement of sustainable development (Meuleman and Niestroy, 2015; Meadowcroft, 2011; Bernstein et al., 2014; Derkx and Glasbergen, 2014). In the 2030 Agenda itself, UN member states identified "policy and institutional coherence" (United Nations, 2015: p.27) as important means of implementation. In line with the good governance approach, the Commission of the European Communities (2001) published a white paper advocating a normative governance agenda composed of the principles of *openness, participation, accountability, effectiveness* and *coherence*. Equally recognizing the importance of policy coherence, the Organization for Economic Cooperation and Development (OECD) (OECD, 2016) published a "*Framework for policy coherence for sustainable development*", which shall help policy-makers to adapt institutional arrangements and processes in order to increase coherence in policy design and implementation.

Policy Coherence for Sustainable Development (PCSD) had emerged as a prominent concept in the debates surrounding development and aid effectiveness and, more recently, also sustainable development. Although lacking an agreed definition, policy coherence for (sustainable) development can be understood as involving "the systematic promotion of mutually reinforcing policy actions across government departments and agencies creating synergies towards achieving the defined objective" (OECD, 2001: p.90). Due to the interconnectedness of the various dimensions of sustainable development, scholars argue, an integrated and coherent approach is needed to effectively tackle the complex issues at hand (Stafford-Smith et al., 2017; Meuleman and Niestroy, 2015; Meadowcroft, 2011; Jordan, 2008). Policy network theory in particular underlines that coordination – an essential part of PCSD – is a central component of governance to achieve a common goal (Enroth, 2011). Major challenges in this regard include overcoming the silo mentality across policy sectors as well as generating high-level political commitment and strong leadership (Stafford-Smith et al., 2017).

Institutional structures and processes fostering policy coherence are claimed to contribute to the reduction of trade-offs and the enhancement of synergies between policies directed towards sustainable development. By aligning economic, social and environmental policies, PCSD can help to reduce unintended consequences and allows for more informed decision-making (Monkelbaan, 2019). We thus hypothesize a positive impact of policy coherence on SDG achievement. However, it must be noted that the value of PCSD as a dimension of sustainability governance has also been contested by some scholars (Zeigermann, 2018; Carbone, 2016). Critics base their doubts on the assumption that policy coherence is greater in less complex policy areas, i.e. those characterized by less diverging interests, greater targeting and stronger issue focus (May et al., 2006). If this holds true, the complexity and interrelation of the SDGs and targets would render effective policy coherence extremely difficult in many cases or result in highly time-consuming coordination efforts. Further, the effects of coherent and interacting policies might only be assessable with delay depending on the respective feedback loop. Investment in education, for example, can lead to increased productivity, which can result in higher government revenues. These resources collected through effective tax policies could then be used for new investments in education. As these feedback loops may take some time, potential delays might have to be taken into account when

evaluating the effects of policy coherence (Collste et al., 2017).

3.3. Reflexivity and adaptation

Scholars have further underlined that governance for sustainable development requires "critical self-awareness" and the capacity of governments and institutions to modify trajectories and existing behavior to face the complex challenges posed by cross-cutting sustainability issues (Meadowcroft, 2011: p.540). Rooted in institutional theory and taken up increasingly by scholars of sustainability and environmental governance (Feindt and Weiland, 2018), reflexive governance approaches suggest that monitoring performance and the institutionalization of reflexive governance mechanisms are vital in this regard (Voß and Kemp, 2006). This can be supported by creating new mechanisms, e.g. by establishing national sustainable development strategies, or by adapting existing institutions and the political system more generally in the appropriate country context, e.g. ranging from a reform of the electoral system to increasing civic education and public participation (Meadowcroft, 2011).

In this article, we adopt the definition suggested by Feindt and Weiland (2018: p.663) who describe reflexive governance as "governance arrangements where […] institutions allow for a reflexive adaptation of rules and procedures". According to Voß and Kemp (2006), reflexivity of institutions, processes and strategies is essential for governing sustainability problems that are characterized by their dynamic, long-term and systemic nature. They identified specific requirements that should be established to make reflexive governance for sustainable development work. These include integrated knowledge generation involving different actors from different disciplines, strategies and institutional arrangements that can be adapted according to changing and ambiguous sustainability challenges, as well as the consideration and scrutinizing of potential long-term repercussions of the strategies chosen. Additionally, policy goals and strategies should be developed in an iterative manner.

According to this rather normative and policy-oriented conceptualization, reflexivity as essential feature of sustainability governance "helps to overcome structurally embedded ignorance of specialized organizations and institutions with regard to the external effects of their own operations" (Feindt and Weiland, 2018: p.665). Thus, reflexive and adaptive governance arrangements can create a public space that fosters deliberation and transdisciplinary knowledge exchange between diverse actors, thereby facilitating innovative and integrated problem-solving considering different problem frames (Monkelbaan, 2019; Termeer et al., 2015). Second, when dealing with complex socio-ecological systems characterized by constant changes, the assessment and adaptation of strategies, goals and institutions can help building resilience and thus lead to more stable and sustainable development (Chaffin et al., 2014). Consequently, we hypothesize that reflexive and adaptive governance structures contribute to SDG achievement by establishing mechanisms that help dealing with the inherent dynamics, uncertainty and complexity related to sustainability problems. However, it might need to be considered that reflexive and adaptive governance structures and institutional change more broadly can result in processes that may require significant amounts of resources, data and time (Chaffin et al., 2014; Munaretto et al., 2014). Thus, the effects of reflexivity and adaptation of institutional arrangements on SDG implementation could not be clearly visible in the short term. While several studies have discussed the conceptualization of reflexive governance approaches and applied case-study analyses to examine the underlying processes (Kemp et al., 2007; van der Brugge and van Raak, 2007), quantitative analyses investigating their relation with sustainable development are still missing.

3.4. Democratic institutions

The concept of *good governance* has often been brought up in debates surrounding sustainable development. Good governance is widely considered to be strongly normative, and an in itself ambiguous and contested concept (Jordan, 2008; Holmberg et al., 2009; Knill, 2004). As championed by the World Bank, the concept includes "accountability, transparency, rule of law and government efficiency and effectiveness" (World Bank, 1992: p.165) and was seen as decisive for a country's development. Particularly prominent in the good governance debate is the discussion about *democratic institutions*. Influenced by the New Institutional Economics, institutions are understood as informal and formal "rules of the game" (North, 1990: p.3). Primary functions attributed to institutions are the facilitation of collective action and the reduction of transaction costs (Pomerantz, 2011). Further, Holmberg et al. (2009) suggest that it is not the mere establishment of institutions that matters for development, but the public perceptions about their credibilit.

Definitions of democratic institutions differ among scholars, but many agree that freedom of expression, free, fair and inclusive elections, rule of law, effective legislature, checks and balances, alternative information, respect for civil liberties and human rights and an independent judiciary belong to this category (Norris, 2012; Pomerantz, 2011). Democratic theory provides valuable insights regarding the relationship between democratic institutions and development. As Norris (2012: p.187) explains, on a normative account, "legitimate governance should be based on the will of the people, as expressed through the institutions of liberal democracy". According to median voter theory developed by Meltzer and Richard (1981), democratic institutions in the form of universal franchise and regular pluralist elections produce more equal economic and social outcomes based on pressure exerted by the electorate. Further, taking up Sen's development theory, leaders are assumed to act in line with the public interest if elected by informed citizens holding them accountable for their actions, if challenged in a competitive political process, and if controlled by a system of checks and balances (Norris, 2012; Siegle et al., 2004; Sen, 1999). This holds true for sustainable development more specifically, as some have argued, as it implies "choices about basic values, about defining the kind of lives citizens wish to live, and the sort of society they wish to build and leave for posterity" (Meadowcroft, 2011: p.537). Accordingly, we expect that democratic institutions foster progress towards the SDGs by ensuring accountability and transparency in the political process.

Many studies have focused on the role of democratic institutions for economic development in particular (Kraay, 2014; Rodrik et al., 2004), but institutions may equally be important to overcome collective action problems in the social and environmental dimensions of sustainable development. Although contested, empirical studies have shown that democracy and civil liberties lead to better economic and societal development outcomes (Halperin et al., 2009). Further research showed that civil liberties increase equality and people's income (Li et al., 2010) and that countries with greater civil liberties and political freedoms show higher levels of environmental quality (Barrett and Graddy, 2000; Dasgupta and De Cian, 2018). Democracy has further been claimed to better translate economic growth into higher quality calorie consumption than autocracies and hybrid regimes (Blaydes and

Table 1
Description and composition of governance variables.

Variable	Description	Indicators
1.Participation	The capability of economic and non-economic interest groups to propose and assess relevant policy measures and their implementation.	1.1 Association Competence (Business) 1.2 Association Competence (Others)
2. Policy coherence	The extent to which the institutional structure fosters coherent and coordinated policy-making and implementation.	2.1 Interministerial Coordination 2.2 Coherent Communication 2.3 Institutional coherence for implementation
3. Reflexivity & adaptation	The degree of reflexivity and adaptation of institutional arrangements including self-monitoring, capacity for reform, the influence of strategic planning units and regulatory impact assessments.	3.1 Organizational Reform 3.2 Adaptability 3.3 Strategic Planning 3.4 Evidence-based Instruments
4. Democratic institutions	The quality of democratic institutions including electoral process, media freedom and access to information, civil rights and political liberties as well as rule of law.	4.1 Electoral Processes 4.2 Access to Information 4.3 Civil Rights and Political Liberties 4.4 Rule of Law

Note: Individual indicators are taken from the Sustainable Government Indicators (SGI) published by the Bertelsmann Stiftung (2017) and were regrouped by the authors to reflect the concept of the respective governance variable.[1] For more information, see Appendix A.

Kayser, 2011) and to yield higher environmental commitment (Neumayer, 2002). A particular focus regarding democratic institutions has been placed on corruption, with empirical evidence supporting the claims that it negatively affects economic growth (Norris, 2012; Holmberg et al., 2009; Mo, 2001), health outcomes (Norris, 2012; Holmberg et al., 2009; Transparency International, 2006), government spending on social services (Holmberg et al., 2009; Mauro, 1998) and environmental performance (Morse, 2006; Welsch, 2004).

4. Methodology

To examine the relationship between the different aspects of governance described above and the achievement of each SDG, we analyze data for 41 countries (35 OECD countries and 6 additional EU, non-OECD countries), referring to the year 2015. The selection of countries is based on a Most-Similar-System-Design. While the MDGs put a strong focus on developing countries, the SDGs are much broader in scope, equally urging richer countries to introduce major policy change in order to meet the goals (Biermann et al., 2017; Kroll, 2015). The sample includes high and upper-middle income countries belonging to either or both the OECD and the EU. These countries are further characterized by similar contextual conditions, i.e. all being financially and politically stable, rule-based open market economies committed to democratic values (although differing in terms of the quality of democratic institutions). By analyzing the 2015 status quo of richer countries regarding SDG achievement and their respective governance characteristics, we can gain important insights that can contribute to more effective SDG implementation in the future.

To measure the different aspects of governance, we draw on the Sustainable Governance Indicators (SGI) published by the Bertelsmann Stiftung (2017). We regrouped the indicators so that they reflect the underlying concepts of the four governance variables (see Table 1). Data refers to the year 2015.

In order to identify relevant control variables to be included in the analysis, we first scrutinized pairs of countries that were similar in terms of their governance characteristics but showed considerable difference in SDG achievement. To do so, we rescaled data on governance variables to a scale from 0 to 100, constituting four groups describing the performance for each variable: low (0–24.9), lower-middle (25–49.9), upper-middle (50–74.9) and high (75–100). We speak of considerable differences when countries differ in SDG achievement by more than 25 points (based on normalized values). Subsequently, we hypothesized which potential factors could plausibly have influenced SDG achievement. Accordingly, we tested for the effects of a country's rents from fossil fuels as percentage of gross domestic product (GDP),[2] GDP per capita,[3] geographic location[4] as well as population and area size[5] as structural controls. Effects of high fossil fuel reliance on (sustainable) development are being discussed controversially. While some claim it increases growth and trade revenues and thereby serves to fund investment, others refer to the negative effects of the "resource course", where rent-seeking behavior of elites and the state increases inequality and corruption (Norris, 2012; Humphreys et al., 2007). GDP per capita serves as a proxy for wealth, thus securing financial resource endowment for the provision of public services, investment and increased income, factors that are equally claimed to be important for (sustainable) development (Norris, 2012). According to Diamond (1999), geographic location (i.e. latitude) affects a country's development insofar as it implies different challenges in terms of climate, disease prevalence, agriculture, transportation costs and access to markets.

Additionally, a commonly cited factor influencing a country's development is education or human capital. Higher levels of education, so the argument, increase labor productivity and foster the emergence of a strong middle class, thereby supporting (economic) development (Norris, 2012; Lipset, 1959). According to Barro

[1] The only exception relates to indicator 2.3, which consists of different indicators that can be found in the original data set under "implementation". See Appendix A for details.

[2] Rents from fossil fuels (coal, natural gas, oil) as % of GDP. Difference between value of production and production costs. Own calculation based on World Bank data (World Bank, 2018).

[3] GDP per capita, PPP (thousand, constant 2011 international $) (World Bank, 2018).

[4] The absolute value of the latitude of the capital city, divided by 90 (to take values between 0 and 1). Own calculation based on data from the Central Intelligence Agency's (CIA) World Factbook, borrowed from Teorell et al. (2016).

[5] Population size (in millions), area size in thousand sq. km, both based on World Bank data (World Bank, 2018).

(2001), increased human capital positively affects a country's development by facilitating the absorption and diffusion of new technologies. Further, as has been pointed out by the United Nations Educational, Scientific and Cultural Organization (UNESCO) (UNESCO, 2017: p.7), education in the context of the SDGs empowers people "to take informed decisions and responsible actions for environmental integrity, economic viability and a just society for present and future generations". Quality education is a factor that at the same time forms part of the SDGs (goal 4) and thus originally constitutes an outcome variable in this study. At this point, we note that the SDGs themselves can be considered to be means and ends simultaneously. The interrelation and potential synergies between the goals have recently attracted considerable attention by scholars (Nilsson et al., 2018; Pradhan et al., 2017; Le Blanc, 2015). While a detailed assessment of the importance of some of the SDGs as enabling factor for the achievement of others is beyond the scope of this article, we approached this aspect by screening Pearson's correlation among the goals to identify those SDGs showing relatively high significant correlation with other goals ($r > \pm$ 0.60 at $p < 0.001$). Here, goal 4 on quality education stood out, showing high significant correlations with six other goals. As this confirmed our qualitative assessment, we decided to include goal 4 as potential control variable.

Of the tested factors, GDP per capita, population size, geographic location and education showed significant results at $p < 0.05$ and increased the goodness-of-fit for some goals when compared to the initial model including the four governance dimensions (higher adj. R^2 and lower AIC). We therefore included these in our analysis.

To measure the achievement of each SDG, we borrowed from the methodology applied by Sachs, Schmidt-Traub, Kroll, Durand-Delacre and Teksoz (2017), authors of the SDG Index and Dashboard. We selected the indicators according to the following criteria:

1) Comparability, relevance and applicability: We did not consider those targets and indicators that predominantly describe ambitions for least developed and developing countries.[6] Indicators had to be clearly defined and measurable at the national level.[7] Additionally, as noted by Sachs et al. (2017), some of the proposed SDG indicators cannot be ranked or do not allow for setting a comparable threshold (e.g. manufacturing as percentage of GDP) without making highly normative assumptions. We excluded these from our analysis.
2) Quality and trustworthiness of sources: To ensure reliability and comparability, we drew on multiple official international databases such as the United Nations Global SDG Indicators Database (United Nations, 2018), UN data (United Nations Statistics Division, 2018) or the World Development Indicators (World Bank, 2018) (for more detail, see Appendix B).
3) Coverage: We included only those indicators where timely data was available for at least seventy percent of the countries in the sample.
4) Reference year 2015: Data refers to the year 2015 or closest year available.
5) Independence: We excluded those indicators that refer to aspects of governance.

[6] Example for type of excluded indicators: "10.6.1 Proportion of members and voting rights of developing countries in international organizations" (United Nations, 2018).

[7] Example for type of excluded indicators: "13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula" (United Nations, 2018).

In total, we collected 114 indicators reflecting sustainable development in its social, economic and environmental dimension. Applying the above mentioned criteria, we were able to include 70 of the 232 official SDG indicators proposed by the Inter-agency and Expert Group on SDG Indicators (IAEG-SDGs) (United Nations, 2018). For those indicators that did not meet selection criteria 1–3, we tried to identify alternative, closely aligned indicators that capture the idea outlined in the specific target. For this purpose, we screened official databases, reports and peer-reviewed publications for suitable data and included 44 additional indicators in the analysis (see Appendix B). To provide an example, indicator 5.1.1 measuring "whether or not legal frameworks are in place to promote, enforce and monitor equality and non-discrimination on the basis of sex" (United Nations, 2018) did not meet criteria 1 in terms of comparability and applicability. As the provided description is too vague and does not allow for clear measurement and comparison between countries in its original form, we identified suitable alternative indicators primarily from the OECD Gender, Institutions and Development Database (OECD, 2018) providing clear-cut measurements of concrete anti-discrimination laws in accordance with our selection criteria (e.g. existence of specific legislation addressing domestic violence or women's workplace rights).

To compare the achievement of each SDG across our sample, we had to define upper bound thresholds (borrowing from the methodology of Sachs et al. (2017)). Where possible, we used the threshold specified in the target. When the target referred to universal aspirations (such as *eradicate* poverty or provide *universal* health coverage) and no specific value was provided, we set the threshold at 0 or 100 accordingly. In case these proceedings were not possible, we used the scientific or technical optimum for the indicators. Finally, when none of the above was feasible or when most countries already met the threshold outlined in the target, we used the average of the 5 best-performing countries. We then normalized the values, converting them to a scale ranging from 0 to 100 (see Sachs et. al (2017: p. 43)): $x' = (x - min(x))/(max(x) - min(x))$; where x' represents the normalized value, x represents the actual value, $max(x)$ denotes the upper threshold and $min(x)$ denotes the lowest performance. When a country already exceeded the threshold, we set the score at 100. To compute the individual goal scores, we used the arithmetic mean of the normalized indicators for each goal. Using the arithmetic means mirrors the underlying idea that there is no ranking or priority of specific targets over others (Sachs et al., 2017). This equally applies to the computation of the "Total" score, reflecting the average performance of a country with regard to the achievement of all 17 SDGs.

5. Results & discussion

In terms of overall SDG achievement, we found a considerable difference between the countries analyzed. Scandinavian countries show the highest average achievement, followed by Finland, Austria and Switzerland, all scoring above 75 percent. With an average SDG achievement of less than 50 percent, Mexico and Turkey are located at the lower end of the spectrum, leaving behind Southeastern European countries, which score lowest in Europe. In general, we note that also in high and upper-middle income countries, there is still room for improvement in the path to achieve sustainable development. Fig. 1 depicts the overall SDG achievement for each country (see also Appendix C for descriptive statistics).

We conducted a series of multiple regression analyses to examine the relative contribution of different dimensions of governance to the achievement of each SDG as well as for the average SDG achievement at the national level. For each goal, we ran five different models: While model 1 included the four

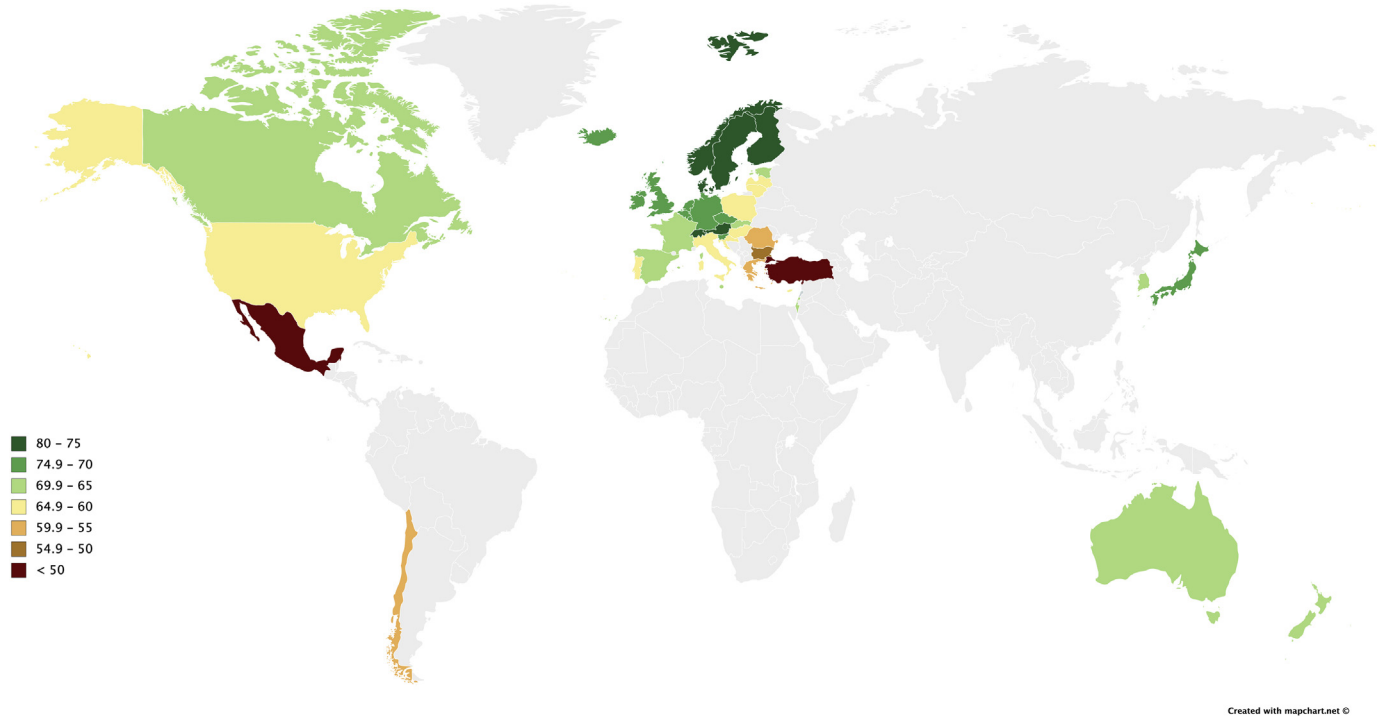

Fig. 1. Overall SDG achievement by country (%).

governance variables, model 2-5 additionally controlled for the effect of GDP per capita (PPP, constant 2011 international $), population size, education and geographic location. Table 2 shows the resulting regression models.

For goal 2 (*zero hunger*), 12 (*responsible consumption and production*) and 13 (*climate action*), neither of our models fit the data well. Results show non-significant *F*-statistics in all models for goal 2 and 12, and low goodness-of-fit for all models regarding goal 13 (adjusted $R^2 \leq 0.17$, as well as a non-significant *F*-statistics for model 3.13). We therefore decided to exclude these goals from our analysis. For goal 6 (*clean water and sanitation*) and 15 (*life on land*), we further excluded models 1.6, 3.6, 5.6, 3.15 and 4.15 due to non-significant *F*-statistics.

While the inclusion of control variables led to increased model fit for all goals, results show that governance variables play an important role for SDG achievement. From the dimensions tested in model 1, participation stands out as the aspect of governance that most often shows significant positive relation to goal achievement, relating to goal 1 (*no poverty*), 3 (*good health and well-being*), 10 (*reduced inequalities*), 17 (*partnerships for the goals*) and the total average SDG achievement. For goal 5 (*gender equality*), participation, next to reflexivity and democratic institutions, becomes a significant predictor when controlling for the effects of education (model 5.5, $ß_{Part} = .29^*$, $ß_{Ref} = -0.39^*$, $ß_{Demo} = 0.59^{***}$). This model shows the highest fit for this goal, with a slightly increased adj. R^2 of 0.59 (compared to .56 in model 1.5) and decreased AIC. Participation remains a significant predictor of the above-mentioned goals when controlling for the effects of population size and geographic location. However, the inclusion of GDP per capita (models 2.1, 2.3, 2.10, 2.17 and 2.T) and education (models 4.1, 4.10, 4.17 and 4.T) displaces participation. An exception is model 4.3, controlling for the effects of education on health and well-being, where participation and education jointly predict goal achievement, constituting the best model for this dependent variable (model 4.3, adj. $R^2 = 0.58$, $ß_{Part} = .31^*$ and $ß_{Edu} = 0.71^{***}$). In line with policy network theory, our findings tend to confirm that participation can lead to better decision-making and implementation processes for some goals on the basis of collaborative knowledge generation, a shared understanding of the problem at stake, greater policy acceptance and increased trust among actors (Newig et al., 2018; Verweij et al., 2013; Ansell and Gash, 2008). In the case of Norway for example, which ranks fourth on goal 1 and second on goal 3, economic and non-economic interest associations are deeply involved in the policy-making process. Their representatives are highly skilled and consultation processes are firmly institutionalized. For instance, participation of these associations in the policy-making process has been deemed crucial for improvements made in terms of pension plans or health insurance (Sverdrup et al., 2015). In contrast, Hungary, scoring lowest in participation, ranks 36th on both goal 1 and 3. Here, major economic associations often consent to the government's policy proposals without formulating own substantive alternatives. Funding has been withdrawn from independent non-economic interest associations, while those loyal to the government are still being supported financially (Ágh et al., 2015). This points to a lack of pluralistic deliberation and trust influenced by the absence of participatory governance processes, negatively affecting more sustainable policy outputs.

Contrary to expectations, we only find evidence of a significant relationship between policy coherence and the achievement of the SDGs with regard to goal 15 (*life on land, models 1.15, 2.15 and 5.*15) and 17 (*partnerships for the goals,* model 4.17). However, the proportion of variance explained by models 1.15 and 2.15 (adj. $R^2 = 0.18$ and 0.16 respectively) is considerably low. As scholars have argued before, "Policy Coherence for Sustainable Development appears as a political discourse while its added-value for governing sustainable development remains controversial" (Zeigermann, 2018: p.145). While many have championed the approach on a normative account, our findings do not yield strong empirical evidence to support this view. According to our interpretation, policy coherence can lead to mixed results with regard to the achievement of

Table 2

Results of multiple regression analyses. Shown are regression models for each SDG and the average overall SDG achievement (Total) as dependent variable. In model 1, independent variables are the four governance aspects (participation, policy coherence, reflexivity and adaptation and democratic institutions). Model 2–5 control for the effect of GDP per capita (PPP, constant 2011 international $), population size, education and geographic location respectively. Depicted are standardized beta values.

	Goal 1 (*no poverty*)					Goal 2 (*zero hunger*)					Goal 3 (*good health & well-being*)					Goal 4 (*quality education*)				
Model no.	**1.1**	**2.1**	**3.1**	**4.1**	**5.1**	**1.2**	**2.2**	**3.2**	**4.2**	**5.2**	**1.3**	**2.3**	**3.3**	**4.3**	**5.3**	**1.4**	**2.4**	**3.4**	**4.4**	**5.4**
Participation	.36*	.12	.36*	.25	.36*	-.10	-.09	-.10	-.23	-.10	.51**	.25	.21**	.31*	.51**	.28.	.08	.28.	–	.28.
Coherence	.02	-.13	.05	-.03	.01	.12	.13	.13	.08	.13	.10	-.06	.08	.02	.11	.11	-.01	.12	–	.10
Reflexivity	.08	.26	.18	.11	.09	-.01	-.02	-.01	.03	-.03	-.29	-.10	-.33	-.23	-.31	-.09	.06	-.04	–	-.07
Demo. Inst.	.33.	.13	.22	.12	.28	.23	.24	.22	-.02	.30	.28	.06	.32	-.10	.41*	.53**	.37*	.48**	–	.42*
GDP p.c. (log)		.52**					-.03**					.57**					.42*			
Pop size (log)			-.23					-.01					.08					-.09		
Education				.40*					.46.					.71***					–	
Geo					.10					-.12					-.21					.18
R^2	.45	.57	.49	.53	.46	.06	.06	.06	.15	.07	.41	.55	.41	.64	.44	.54	.62	.55	–	.56
Adj. R^2	.39	.51	.42	.46	.38	-.05	-.08	-.08	.03	-.07	.34	.48	.33	.58	.36	.49	.56	.48	–	.50
F-value	7.42***	9.35***	6.72***	7.79***	5.92***	.53	.42	.41	1.26	.49	6.17***	8.44***	4.88**	12.24***	5.45***	10.57***	11.29***	8.45***	–	9.01***
AIC	320.53	312.40	319.61	316.51	322.07	340.45	342.44	342.45	338.00	342.00	317.28	308.23	318.97	299.23	317.07	319.67	314.16	321.08	–	319.61
Intercept	7.38	−34.16*	12.69	8.89	5.62	50.88**	52.99*	51.15**	52.55***	53.08**	30.15**	−11.33	28.46*	32.60***	33.80**	−4.10	−40.00*	−1.65	–	−7.67
Observations	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	–	41

	Goal 5 (*gender equality)*					Goal 6 (*clean water and sanitation*)					Goal 7 (affordable and clean energy)					Goal 8 (*decent work and economic growth)*				
Model no.	**1.5**	**2.5**	**3.5**	**4.5**	**5.5**	**1.6**	**2.6**	**3.6**	**4.6**	**5.6**	**1.7**	**2.7**	**3.7**	**4.7**	**5.7**	**1.8**	**2.8**	**3.8**	**4.8**	**5.8**
Participation	.30.	.28	.32*	.25	.29*	.03	-.32	.02	-.16	.03	-.04	-.07	-.04	-.17	-.04	.34.	.04	.34.	.24	.34.
Coherence	.06	.05	.07	.05	.05	.12	-.08	.11	.05	.13	.16	-.14	.21	.11	.13	.13	-.06	.14	.09	.12
Reflexivity	-.41*	-.40*	-.34.	-.40*	-.39*	-.16	.10	-.21	-.10	-.16	-.13	-.11	.03	-.09	-.09	-.07	.16	-.03	-.04	-.06
Demo. Inst.	.72***	.70***	.62***	.63***	.59***	.44*	.15	.50*	.08	.44.	.67***	.64**	.50*	.42*	.41*	.24	-.02	.20	.03	.18
GDP p.c. (log)		.05					.75***					.07					.67***			
Pop size (log)			-.14					.12					-.34*					-.08		
Education				.16					.66**					.47*					.39.	
Geo					.22.					-.01					.43**					.10
R^2	.60	.61	.62	.62	.64	.18	.43	.19	.38	.18	.41	.41	.50	.51	.54	.31	.51	.32	.38	.32
Adj. R^2	.56	.55	.56	.56	.59	.09	.35	.08	.30	.07	.34	.33	.42	.44	.47	.23	.44	.22	.29	.22
F-value	13.35***	10.42***	10.99***	10.96***	12***	2.00	5.25**	1.69	4.37**	1.56	6.30***	4.90**	6.91***	7.29***	8.17***	4.05**	7.17***	3.23*	4.28**	3.25*
AIC	247.27	249.17	247.85	247.94	245.65	318.54	305.85	319.95	308.88	320.53	332.03	333.90	327.50	326.40	323.94	314.82	303.14	316.52	312.48	316.43
Intercept	48.88***	46.98***	45.78***	49.14***	46.60***	48.13***	.59	45.78***	50.12***	48.35***	0.93	−4.88	9.87	2.87	−7.97	18.75.	−25.35.	20.39.	19.96.	17.25
Observations	40	40	40	40	40	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41

	Goal 9 (*industry, innovation and infrastructure*)					Goal 10 (*reduced inequalities*)					Goal 11 (*sustainable cities and communities*)					Goal 12 (*responsible production and consumption*)				
Model no.	**1.9**	**2.9**	**3.9**	**4.9**	**5.9**	**1.10**	**2.10**	**3.10**	**4.10**	**5.10**	**1.11**	**2.11**	**3.11**	**4.11**	**5.11**	**1.12**	**2.12**	**3.12**	**4.12**	**5.12**
Participation	.34.	.06	.34.	.18	.34.	.43*	.29	.43*	.25	.42*	.30	.22	.30.	.15	.30	.05	.28	.05	.15	.05
Coherence	.18	.01	.15	.12	.17	.12	.02	.11	.02	.08	-.17	-.22	-.09	.18	-.18	.14	.28	.14	.18	.15
Reflexivity	-.03	.17	-.13	.02	-.01	-.58*	-.45.	-.55*	-.47*	-.53*	.07	.13	.32	-.17	.09	-.14	-.31	-.13	-.17	-.16
Demo. Inst.	.21	-.02	.32	-.10	.10	.28	.14	.25	-.04	.08	.30	.24	.03	.43	.19	.23	.43.	.22	.42	.37
GDP p.c. (log)		.60**					.30					.17					-.50*			
Pop size (log)			.21					-.04					-.52***					-.02		
Education				.59**					.54*					-.36					-.36	
Geo					.20					.32.					.19					-.23
R^2	.35	.51	.38	.51	.37	.35	.39	.35	.48	.42	.26	.27	.46	.27	.28	.07	.18	.07	.13	.11
Adj. R^2	.28	.44	.29	.44	.28	.26	.28	.23	.39	.32	.17	.16	.38	.17	.18	-.03	.07	-.06	.01	-.02
F-value	4.79**	7.19***	4.32**	7.27***	4.19**	3.96*	3.64*	3.07*	5.29**	4.18**	3.09*	2.56*	5.91***	2.64*	2.73*	0.72	1.58	.56	1.08	.86
AIC	351.08	341.62	350.89	341.38	351.36	282.20	281.99	284.14	276.33	280.03	317.52	318.85	306.53	318.50	318.13	333.81	330.61	335.79	333.08	334.22
Intercept	−7.60	−71.22**	−14.30	−4.64	−12.46	40.37*	19.24	42.76*	46.79*	37.83*	45.88***	35.00.	56.05***	46.49***	42.97***	39.37**	75.39	39.78**	38.15**	43.16**
Observations	41	41	41	41	41	35	35	35	35	35	41	41	41	41	41	41	41	41	41	41

	Goal 13 (*climate action*)					Goal 14 (*life below water*)					Goal 15 (*life on land*)					Goal 16 (*peace, justice and strong institutions*)				
Model no.	**1.13**	**2.13**	**3.13**	**4.13**	**5.13**	**1.14**	**2.14**	**3.14**	**4.14**	**5.14**	**1.15**	**2.15**	**3.15**	**4.15**	**5.15**	**1.16**	**2.16**	**3.16**	**4.16**	**5.16**
Participation	-.34.	-.20	-.34.	-.26	-.34.	.02	-.22	.04	-.06	.04	-.11	-.18	-.11	-.15	-.12	.35.	.27	.35.	.22	.35.
Coherence	-.29	-.21	-.27	-.26	-.29	.43	.39	.36	.43	.39	-.47*	-.51*	-.48*	-.49*	-.50*	-.21	-.26	-.20	-.26	-.23
Reflexivity	-.01	-.11	.06	-.04	-.00	-.15	-.08	-.18	-.14	-.14	-.06	-.02	-.09	-.05	-.02	-.36.	-.30	-.35	-.32.	-.33.
Demo. Inst.	.16	.28	.09	.33	.13	.39*	.26	.47*	.26	.48*	.33	.28	.36	.26	.10	.44*	.37.	.42.	.18	.22
GDP p.c. (log)		-.30					.43*					.14					.18			
Pop size (log)			-.14					.15					.06					-.04		
Education				-.31					.28					.13					.49*	
Geo					.05					-.15					.39*					.37*
R^2	.23	.27	.25	.27	.23	.39	.47	.41	.42	.40	.26	.27	.26	.26	.37	.33	.34	.33	.44	.42
Adj. R^2	.15	.17	.14	.17	.12	.31	.38	.31	.31	.30	.18	.16	.16	.16	.27	.25	.25	.23	.36	.34
F-value	2.72*	2.63*	2.30	2.69*	2.14*	4.82**	5.11**	2.48**	4.13**	3.93**	3.14*	2.55*	2.48	2.54	4.03**	3.37**	3.62**	3.42*	5.49***	5.10**
AIC	321.41	321.17	322.63	320.93	323.33	261.02	258.28	262.09	261.60	262.28	342.23	343.73	344.06	343.78	337.86	337.70	338.84	339.64	332.21	333.51
Intercept	110.29	−34.16*	113.10***	109.29***	109.55***	4.83	−25.60	1.99	6.35	5.97	90.16***	77.45**	88.48***	90.71***	81.98***	54.16***	38.33	55.13***	56.23***	5.97
Observations	41	41	41	41	41	35	35	35	35	35	41	41	41	41	41	41	41	41	41	41

	Goal 17 (*partnerships for the goals*)					Total *(average SDG achievement)*				
Model no.	**1.17**	**2.17**	**3.17**	**4.17**	**5.17**	**1.T**	**2.T**	**3.T**	**4.T**	**5.T**
Participation	.48*	.17	.48**	.36.	.48*	.35*	.10	.35*	.16	.34*
Coherence	-.12	-.30.	-.06	-.16*	-.14	.04	-.11	.06	-.03	.02
Reflexivity	.10	.33.	.29	.14	.13	-.24	-.05	-.16	-.18	-.21
Demo. Inst.	.12	-.14	-.08	-.11	-.05	.59***	.39*	.51**	.24.	.45*
GDP p.c. (log)		.67***					.53***			
Pop size (log)			-.39*					-.16		
Education				.43*					.67***	
Geo					.28.					.25.
R^2	.31	.50	.42	.39	.36	.56	.68	.57	.76	.60
Adj. R^2	.23	.43	.34	.30	.27	.51	.63	.51	.73	.54
F-value	3.97**	7.08***	5.04**	4.49**	3.96**	11.27***	14.75***	9.44***	22.8***	.10.46***
AIC	361.48	349.79	356.21	358.15	360.07	264.52	253.32	264.82	240.42	262.34
Intercept	−0.86	−78.81**	12.59	1.49	−8.57	34.37***	10.85	36.44***	35.79***	31.77***
Observations	41	41	41	41	41	41	41	41	41	41

Note: Statistical significance is depicted as (.) $p < 0.1$, (*) $p < 0.05$, (**) $p < 0.01$, (***) $p < 0.001$.

sustainability objectives. Interministerial coordination for example, which is a central indicator for this variable, might in some cases facilitate the achievement of a target, particularly in cases that do not involve controversial trade-offs. In cases where complex weighing of interests is involved, however, coordination efforts might result in extremely time-consuming or intractable processes. This in turn could then hamper goal achievement significantly. Alternatively, as has been argued before, feedback loops between interacting policies might result in delayed effects of policy coherence (Collste et al., 2017) and might thus not yet be reflected in our analysis.

Also contrary to expectations, when analyzing the effects of reflexivity and adaptation, we detect, if any, only a negative relationship. For goal 10 (*reduced inequalities*) and goal 5 (*gender equality*), reflexivity remains a significant negative predictor throughout all models (although only at $p < 0.1$ in models 2.5 and 2.10). With regard to goal 16 (*peace, justice and strong institutions*), the effects of reflexivity (at $p < 0.1$) vanish when controlling for GDP per capita and population size, while remaining visible in the strongest model controlling for education (model 4.16, adj. $R^2 = 0.36$). On the one hand, this could possibly be attributed to a time component. As our analysis is only a snapshot of the 2015 status quo, we hypothesize that this result is associated with a lagged effect of adaptive and reflexive governance structures. This seems to corroborate considerations about delayed effects of adaptive governance arrangements and broader institutional change (Chaffin et al., 2014; Munaretto et al., 2014). Indicators for this variable include the capacity to change and adaptation of institutional arrangements, the influence of strategic planning units and the application of regulatory impact assessments. All these processes are time-consuming and could imply administrative burdens, which might hamper the achievement of the defined objective in the short term. On the other hand, self-monitoring and consequent adaptation of institutional structures and strategies could result in constant reformulation of goals, which could equally influence the speed of implementation when it comes to sustainability policies.

For goal 4 (*quality education*), 5 (*gender equality*) and 7 (*affordable and clean energy*), democratic institutions show a constant positive relationship with goal achievement in all models tested. With regard to goal 4, only GDP per capita (model 2.4, $ß_{GDP} = .42^*$, adj. $R^2 = 0.56$) appears as significant predictor next to democratic institutions. Its inclusion in the model reduces the significance of democratic institutions, yet their effects still remain visible ($ß_{Demo} = 0.37^*$ compared to $ß_{Demo} = 0.53^{**}$ in model 1.4). Other controls appeared insignificant. We can thus suppose a joint effect of governance and wealth on the achievement of quality education. Notably, regarding goal 5, none of the tested control variables appeared to have a significant relation with goal achievement. While model 5.5 including education showed the highest goodness-of-fit (adj. $R^2 = 0.59$ and decreased AIC), results of this model only show a significant relation with governance variables, i.e. participation ($ß_{Part} = .29^*$), reflexivity ($ß_{Ref} = -0.39^*$) and democratic institutions ($ß_{Demo} = 0.59^{***}$). Governance consequently appears to be a decisive factor when it comes to gender equality. For goal 7 (model 1.7, $ß_{Demo} = 0.67^{***}$, adj. $R^2 = 0.34$), the positive relationship between democratic institutions and goal achievement equally remained significant in all models, yet slightly weakened after inclusion of GDP per capita (model 2.7, $ß_{Demo} = 0.64^{**}$, adj. $R^2 = 0.33$), population size (model 3.7, $ß_{Demo} = 0.50^*$, adj. $R^2 = 0.42$), education (model 4.7, $ß_{Demo} = 0.42^*$, adj. $R^2 = 0.44$) and geographic location (model 5.7, $ß_{Demo} = 0.41^*$, adj. $R^2 = 0.47$). In the latter model, which fitted data best, democratic institutions and geographic location ($ß_{Geo} = 0.43^{**}$) jointly predict goal achievement. Interestingly, we note that economic power or wealth does not significantly relate to higher performance in terms of progress towards affordable and clean energy.

One possible explanation is that goal 4 on quality education, goal 5 on gender equality and goal 7 on clean energy cover rather popular topics that are commonly discussed by media and civil society, such as equal pay for women and men or energy transitions. In countries with functioning democratic institutions, political liberties ensure that media and civil society are granted the rights to voice their opinion. Thus, they are able to raise awareness on these topics, exert pressure on policy makers and contribute to the political agenda setting in a country. Additionally, regarding goal 5, one could argue that in a country where democratic institutions are stronger, civil society and policy makers show greater respect for democratic values such as equality. Taken together, results point to a confirmation of the hypothesis that democratic institutions foster sustainable development based on increased transparency in policy-making and implementation, greater accountability of political leaders and pressure by competitive elections and the electorate, thus ensuring political responsiveness (Norris, 2012).

Further, democratic institutions show a positive relation with goal 16 on peace, justice and strong institutions. It is the only significant predictor in model 1.16 ($ß_{Demo} = 0.44^*$, adj. $R^2 = 0.25$). When controlling for GDP per capita and population size in model 2.16 and 3.16 (explaining a similar amount of variance as model 1.16), democratic institutions still appear as significant predictor at $p < 0.1$ ($ß_{Demo} = 0.37.$, adj. $R^2 = 0.25$ and $ß_{Demo} = 0.42.$, adj. $R^2 = 0.23$ respectively). Its significance vanishes however when adding controls on education (model 4.16, adj. $R^2 = 0.36$) and geographic location (model 5.16, adj. $R^2 = 0.34$). Goal 16 includes indicators such as the percentage of people feeling safe in their neighborhood or the share of unsentenced prisoners in custody. Stronger rule of law, a key measurement as part of democratic institutions, could lead to an increased perception of security among citizens and protect them against political arbitrariness.

Altogether, results point to the importance of governance, particularly participation and democratic institutions, for the achievement of the SDGs. Nonetheless, the provision of financial resources and strong human capital appear to serve as crucial enabling factors in the path to sustainable development. Of the tested models, model 2 controlling for the relative contribution of GDP per capita as a proxy of wealth and funding capacity performed best in predicting the achievement of many of the goals. Specifically, it was the single explanatory variable in model 2 for goals 1 (*no poverty*), 6 (*clean water and sanitation*), 8 (*decent work and economic growth*), 14 (*life below water*) and 17 (*partnerships for the goals*). It also performed best for goal 4 (*quality education*), where it significantly influences goal achievement in conjunction with democratic institutions. These goals include several indicators measuring the fulfillment of central government tasks that require the provision of public funds, such as for example the existence of social protection systems, government spending on education and health, safely managed drinking water and sanitation services, full employment and economic growth. Consequently, the achievement of these targets appears to be strongly influenced by a state's social and economic policy and its respective funding capacity.

Further, model 4 controlling for the effects of education on SDG achievement performed best among the five models in the context of industry, innovation and infrastructure (goal 9), reduced inequalities (goal 10), peace, justice and strong institutions (goal 16) as well as for the total average. The model also showed the highest fit for goal 3 on health and well-being, adding to the significant contribution of participation to goal achievement (model 4.3, $ß_{Part} = .31^*$, $ß_{Edu} = 0.71^{***}$, adj. $R^2 = 0.58$). These findings suggest that education as across-cutting issue for sustainable development

deserves particular attention. Its positive relation with attainment of goal 9 (model 4.9, $\beta_{Edu} = 0.59^{***}$, adj. $R^2 = 0.44$) corroborates the argument that skilled labor is needed for faster adoption and diffusion of new technologies, thereby fostering development (Barro, 2001). Findings regarding goal 10 seem to be in line with Lipset's (Lipset, 1959) argument that education promotes the emergence of a stronger middle class, thus creating a supportive environment for more equal growth and development. Further, findings on the positive effect on health outcomes point to the importance of increasing peoples' knowledge about topics such as communicable and non-communicable diseases, sexual and reproductive health or risks of drug addiction in order to foster progress on goal 3 (UNESCO, 2017).

Finally, model 5 including geographic location (measured in terms of absolute distance from the equator) as a proxy for a country's structural conditions performed best for goal 5 (*gender equality*), 7 (*affordable and clean energy*) and 15 (*life on land*). Regarding goal 5 (model 5.5), however, governance variables, i.e. democratic institutions ($\beta_{Demo} = 0.59^{***}$), reflexivity ($\beta_{Ref} = -0.39^{*}$) and participation ($\beta_{Part} = .29^{*}$), rather than geographic location, were shown as significant predictors for successful implementation. Nonetheless, having added this control resulted in slightly improved model fit (adj. $R^2 = 0.59$ compared to .56 in model 1.5). For goal 7, geographic location ($\beta_{Geo} = 0.44^{**}$) and democratic institutions ($\beta_{Demo} = 0.41^{*}$) jointly predict the level of attainment. We understand these findings as a confirmation of Diamond's (1999) hypothesis, arguing that geographic location affects development based on its effects on a country's vulnerability in terms of climate and diseases, access to world markets and societal modernization more generally. This further underlines that progress on the SDGs globally needs to pay particular attention to universal and inclusive development as has been pointed out in the 2030 Agenda.

Acknowledging the multi-dimensional nature of sustainability governance, this study seeks to contribute to the current debate about effective governance for sustainable development and the SDGs more specifically. By testing the effects of different aspects of governance on aggregated SDG indicators, we aimed at providing first insights that might guide future more in-depth analyses. Taken together, our results indicate that participation and functioning democratic institutions can have a positive effect on sustainable development in its social, economic and environmental dimension. Although our analysis does not allow for identifying a clear causal relationship, the observed trends at the aggregate level seem to confirm that inclusive deliberation, trust and knowledge-sharing as well as accountability and transparency in the policy process form important aspects of governance for achieving the SDGs.

As far as reflexivity, adaptation and policy coherence are concerned, our findings should not be taken as evidence of their insignificance. Rather, our interpretation of the results is that their effects might be more sensitive to the degree of complexity and the trade-offs involved in single targets. Consequently, we recommend reassessing our findings at the target level, as working with aggregated indices for each SDG can have disguised individual varying effects. Further, as reflexivity, adaptation and policy coherence relate to institutional change, sophisticated coordination mechanisms and feedback loops between interacting policies, it might be worth scrutinizing potential lagged effects of these governance dimensions by means of in-depth or longitudinal analyses.

Finally, we note that the tested dimensions of governance do not suffice to explain successful SDG implementation alone. In our sample of high and upper-middle income countries, structural and socio-economic factors such as GDP per capita, education or geographic location show significant effects on the achievement of sustainable development. While these could to an extent also be influenced by governance arrangements, their impact on SDG achievement should not be underestimated, particularly with regard to less or least developed countries.

6. Conclusion

Particularly since the drafting of the 2030 Agenda and the SDGs, the importance of governance for sustainable development has gained considerable attention in research and public debate. While both concepts had been characterized by predominantly vague and ambiguous definitions, the emergence of the 17 SDGs provided an internationally agreed framework for measuring sustainable development in its social, economic and environmental dimension. This article aimed at contributing to develop a clearer understanding of sustainability governance by empirically assessing the relationship of different aspects of governance with the achievement of the SDGs at the national level.

Our analysis of the 2015 status quo of 41 high and upper-middle income countries showed that most of the OECD and European countries included in this study still have considerable room left for improvement when it comes to the implementation of the SDGs. While primarily Northern European countries, first and foremost Denmark, Sweden and Norway, show a rather positive status quo in terms of average SDG achievement (above 75 percent), Turkey and Mexico score less than 50 percent.

The results of multiple regression analyses suggest that the enhancement of democratic institutions and participation could lead to greater progress in SDG implementation. Both participatory and democratic governance structures seem to facilitate the decision-making process, implementation and acceptance of policies directed towards the achievement of sustainable development. Findings further seem to support the hypothesis that democratic institutions create a conducive environment for SDG achievement by ensuring accountability and transparency in policy-making as well as political responsiveness. While we did not find strong evidence supporting the hypothesis that political coherence is important for the achievement of the SDGs, our results show, if any, a negative correlation with regard to reflexivity and adaptation. We assume that these aspects of governance relating to the design of the institutional structure as well as to processes of coordination, iterative policy-making and strategy adaptation produce mixed results depending on the complexity of the trade-off at stake. Further, considering that our findings are based on an assessment of the 2015 status quo, we assume a lagged effect of allegedly time-consuming reflexive governance structures and policy coherence for dealing with highly dynamic and complex questions of sustainable development. This assumption requires further investigation by researchers.

We must note, however, that economic power (GDP per capita) appeared to be a significant predictor for the achievement of many of the goals. Several SDG indicators measure the fulfillment of central government tasks such as the existence of social protection systems or the provision of health care services. Our findings could thus point to the importance of adequate government funding for the provision of public services in order to *leave no one behind*, as the underlying principle of the 2030 Agenda reads. Moreover, our findings seem to underline the importance of education for sustainable development. While an educated workforce may contribute to the establishment of a solid middle class, thereby promoting reduction of inequalities, skilled labor can further contribute to faster adoption and diffusion of new technologies beneficial to modernization and development. Increased knowledge and related behavioral change with regard to health risks could further contribute to achieve sustainable development in its different dimensions.

While it needs to be adapted to national circumstances, the SDG framework can provide supportive guidance for fostering global sustainable development in its social, economic and environmental dimension. At this point, we remark however that some of the proposed SDG indicators may not be fully suitable to adequately capture the achievement of specific targets. One can at least question whether the number of fixed broadband subscriptions, for example, appropriately measures the ambitions of target 17.6 to "Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation (…)" (United Nations, 2018). Further, we reiterate that our findings apply to the sample of high and upper-middle income countries, member states of either or both the EU and the OECD. While recognizing that the implementation of the SDGs should always be assessed in the light of the specific country context, we aimed at providing a proxy for future research on governance for the goals. Additionally, we acknowledge that this study relies on indicators that need to be treated with caution. To ensure comparability in terms of SDG achievement, we drew on official international databases. However, in some cases, these rely on self-reported data from national governments, which needs to be considered with regard to the reliability of the indicators used. The data provided by international sources might not always reflect most recent statistics or might have been modified for the purpose of consistency (Sachs et al., 2017). In terms of the selected governance indicators, we note that the SGI drawn on in this article rely on qualitative expert assessments. According to the authors of the SGI, while being based on subjective evaluation by country experts, validity and reliability of the data is ensured by a multi-stage peer review process (Bertelsmann Stiftung, 2017).

This article intends to stimulate the academic discourse about governance for SDG implementation by presenting empirical findings of a comparative analysis covering 41 high and upper-middle income countries. With the rather broad approach of analyzing governance arrangements for the SDGs at the national level, we present first insights that can serve as a proxy and provide guidance for further in-depth studies or verification of our results by means of a longitudinal analysis. We encourage future research to look more closely at different aspects of governance and their relation to SDG achievement, specifically focusing on the causalities at work. Studies assessing potential lagged effects of reflexive and adaptive governance structures or policy coherence could contribute to this endeavor. While being beyond the scope of the present article, an assessment of the interaction between the different dimensions of governance e.g. by means of a qualitative comparative analysis would contribute to further develop the concept of sustainability governance and its relevance for SDG implementation more specifically. Finally, revisiting our findings in the context of low income countries could yield additional valuable insights regarding the importance of specific aspects of governance for SDG achievement in different country contexts.

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Declaration of competing interest

None.

Appendix A-C. Supplementary data

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Appendix A: Composition of governance variables. Individual indicators and guiding questions are taken from the *Sustainable Governance Indicators (SGI)* for the year 2015, published by the Bertelsmann Stiftung (2017). They were regrouped by the authors to reflect each governance variable. The SGI selected are based on a multi-stage peer-reviewed assessment by respective country experts.

Variable	Indicators	Sub-indicators (if applicable)	Guiding question for expert assessment
1. Participation	1.1 Association Competence (Business)		To what extent are economic interest associations capable of formulating relevant policies?
	1.2 Association Competence (Others)		To what extent are non-economic interest associations capable of formulating relevant policies?
2. Policy coherence	2.1 Interministerial Coordination		Is government decision-making coordinated across institutional lines?
		2.1.1 Government Office Expertise	Does the government office / prime minister's office (GO / PMO) have the expertise to evaluate ministerial draft bills substantively?
		2.1.2 Government Office Gatekeeping	Can the government office / prime minister's office return items envisaged for the cabinet meeting on the basis of policy considerations?
		2.1.3 Line Ministries	To what extent do line ministries involve the government office/prime minister's office in the preparation of policy proposals?
		2.1.4 Cabinet Committees	How effectively do ministerial or cabinet committees coordinate cabinet proposals?
		2.1.5 Ministerial Bureaucracy	How effectively do ministry officials/civil servants coordinate policy proposals?
		2.1.6 Informal Coordination	How effectively do informal coordination mechanisms complement formal mechanisms of interministerial coordination?
	2.2 Coherent Communication		To what extent does the government achieve coherent communication?
	2.3 Institutional coherence for implementation*		To what extent do institutional structures contribute to coherent implementation processes?*
		2.3.1 Ministerial Compliance	To what extent does the organization of government provide incentives to ensure that ministers implement the government's program?
		2.3.2 Monitoring Ministries	How effectively does the government office/prime minister's office monitor line ministry activities with regard to implementation?
		2.3.3 Monitoring Agencies, Bureaucracies	How effectively do federal and subnational ministries monitor the activities of bureaucracies and executive agencies with regard to implementation?
		2.3.4 Task Funding	To what extent does the central government ensure that tasks delegated to subnational self-governments are adequately funded?
3. Reflexivity & adaptation	3.1 Organizational Reform		Does the government monitor its own institutional arrangements, reforming them if necessary?
		3.1.1 Self-monitoring	To what extent do actors within the government monitor whether institutional arrangements of governing are appropriate?
		3.1.2 Institutional Reform	To what extent does the government improve its strategic capacity by changing the institutional arrangements of governing?
	3.2 Adaptability		Does the government cooperate with other states, while adapting to new developments at home?
		3.2.1 Domestic Adaptability	To what extent does the government respond to international and supranational developments by adapting domestic government structures?
		3.2.2 International Coordination	To what extent is the government able to collaborate effectively in international efforts to foster global public goods?
	3.3 Strategic Planning		How much influence do strategic planning units and bodies have on government decision-making?
	3.4 Evidence-based Instruments		Does the government apply RIAs (regulatory impact assessments)? Is the quality and sustainability of the RIA process ensured?
		3.4.1 RIA Application	To what extent does the government assess the potential impacts of existing and prepared legal acts (regulatory impact assessments, RIA)?
		3.4.2 Quality of RIA Process	Does the RIA process ensure participation, transparency and quality evaluation?
		3.4.3 Sustainability Check	Does the government conduct effective sustainability checks within the framework of RIA?

4. Democratic institutions	4.1 Electoral Processes		Are candidacy procedures and access to the media fair? Are voting and registration rights guaranteed?
		4.1.1 Candidacy Procedures	How fair are procedures for registering candidates and parties?
		4.1.2 Media Access	To what extent do candidates and parties have fair access to the media and other means of communication?
		4.1.3 Voting and Registration Rights	To what extent do all citizens have the opportunity to exercise their right of participation in national elections?
		4.1.4 Party Financing	To what extent is private and public party financing and electoral campaign financing transparent, effectively monitored and in case of infringement of rules subject to proportionate and dissuasive sanction?
		4.1.5 Popular Decision-Making	Do citizens have the opportunity to take binding political decisions when they want to do so?
	4.2 Access to Information		Are the media independent and do they express a diversity of opinions? Is government information accessible?
		4.2.1 Media Freedom	To what extent are the media independent from government?
		4.2.2 Media Pluralism	To what extent are the media characterized by an ownership structure that ensures a pluralism of opinions?
		4.2.3 Access to Government Information	To what extent can citizens obtain official information?
	4.3 Civil Rights and Political Liberties		Are civil rights and political liberties respected?
		4.3.1 Civil Rights	To what extent does the state respect and protect civil rights and how effectively are citizens protected by courts against infringements of their rights?
		4.3.2 Political Liberties	To what extent does the state concede and protect political liberties?
	4.4 Rule of Law		Do institutions act in accordance with the law? Do they check and balance each other? Is corruption prevented?
		4.4.1 Legal Certainty	To what extent do government and administration act on the basis of and in accordance with legal provisions to provide legal certainty?
		4.4.2 Judicial Review	To what extent do independent courts control whether government and administration act in conformity with the law?
		4.4.3 Appointment of Justices	To what extent does the process of appointing (supreme or constitutional court) justices guarantee the independence of the judiciary?
		4.4.4 Corruption Prevention	To what extent are public officeholders prevented from abusing their position for private interests?

* The name and related guiding question for this indicator was edited by the authors. In the original SGI dataset, sub-indicators 2.3.1-2.3.4 can be found under “implementation”.

Appendix B: Indicators used for measuring SDG achievement. Goals, targets and proposed SDG Indicators according to the Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development (United Nations, 2018).

Target	Proposed SDG Indicator	Actual indicator used in this study	Official or aligned indicator?	Year(s) l.a. = or latest year available before	Source
Goal 1. End poverty in all its forms everywhere					
1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day	1.1.1 Proportion of population below the international poverty line, by sex, age, employment status and geographical location (urban/rural)	Poverty headcount ratio at $1.90/day (% population)	Official	Jan 2016	World Data Lab. World Poverty Clock. http://worldpoverty.io/
1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	1.2.1 Proportion of population living below the national poverty line, by sex and age	Poverty rate after taxes and transfers, Poverty line 50% (% population) = Relative income poverty rate (OECD IDD, 2012-15)	Aligned	2015 (l.a.)	OECD https://data.oecd.org/
1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable	1.3.1 Proportion of population covered by social protection floors/systems, by sex, distinguishing children, unemployed persons, older persons, persons with disabilities, pregnant women, newborns, work-injury victims and the poor and the vulnerable	Minimum income benefits = Net income of a one earner couple with two children, out of work, receiving minimum income benefits only, as % of median income	Aligned	2015 (l.a.)	OECD Tax-Benefits http://www.oecd.org/els/benefits-and-wages.htm
		Proportion of employed population covered in the event of work injury	Official	2013/16	UNdata http://data.un.org/
		Proportion of population above retirement age receiving a pension	Official	2010-16	UNdata http://data.un.org/
		Proportion of unemployed receiving unemployment benefits	Official	2011-16	UNdata http://data.un.org/
1.a.2 Proportion of total government spending on essential services (education, health and social protection)	1.a.2 Proportion of total government spending on essential services (education, health and social protection)	Government expenditure on education, total (% of government expenditure)	Official	2000-14	World Bank Open Data https://data.worldbank.org/
		Health expenditure, public (% of government expenditure)	Official	2014	World Bank Open Data https://data.worldbank.org/
		Total indicators Goal 1	8		
Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture					
2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round	2.1.1 Prevalence of undernourishment		Official	2015	World Bank Open Data https://data.worldbank.org/
	2.1.2 Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES)	Estimated number of population in moderate or severe food insecurity	Official	2015	UNdata http://data.un.org/

2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	2.4.1 Proportion of agricultural area under productive and sustainable agriculture	Area under organic farming % of utilised agricultural area, EU28, bis 2016 (Eurostat, Code: sdg_02_40)	Aligned	2015	Eurostat https://ec.europa.eu/eurostat/en/data/database
2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed	2.5.2 Proportion of local breeds classified as being at risk, not-at-risk or at unknown level of risk of extinction	Proportion of local breeds classified as being at risk of extinction	Official	2017	UNdata http://data.un.org/
		Total indicators Goal 2	4		
Goal 3. Ensure healthy lives and promote well-being for all at all ages					
3.1 By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live birth	3.1.1 Maternal mortality ratio		Official	2015	UNdata http://data.un.org/
3.2 By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births	3.2.1 Under-five mortality rate (per 1000 live births)		Official	2015	UNdata http://data.un.org/
	3.2.2 Neonatal mortality rate (per 1000 live births)		Official	2015	UNdata http://data.un.org/
3.3 By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases	3.3.1 Number of new HIV infections per 1,000 uninfected population, by sex, age and key populations	Age-standardised rate of new HIV infections (per 1,000 population), unscaled value	Aligned	2015	GBD, 2016. Measuring the health-related Sustainable Development Goals in 188 countries: a baseline analysis from the Global Burden of Disease Study 2015. The Lancet, 388, pp. 1813–1850. DOI: https://doi.org/10.1016/S0140-6736(16)31467-2

	3.3.2 Tuberculosis incidence per 100,000 population		Official	2015	UNdata http://data.un.org/
	3.3.4 Hepatitis B incidence per 100,000 population		Official	2015 (l.a.)	OECD Data https://data.oecd.org/
3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being	3.4.1 Mortality rate attributed to cardiovascular disease, cancer, diabetes or chronic respiratory disease		Official	2015	UNdata http://data.un.org/
	3.4.2 Suicide mortality rate		Official	2015	UNdata http://data.un.org/
3.5 Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol	3.5.2 Harmful use of alcohol, defined according to the national context as alcohol per capita consumption (aged 15 years and older) within a calendar year in litres of pure alcohol	Alcohol per capita consumption (aged 15 years and older) within a calendar year in litres of pure alcohol	Official	2016	UNdata http://data.un.org/
3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents	3.6.1 Death rate due to road traffic injuries		Official	2013	UNdata http://data.un.org/
3.8 Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all	3.8.1 Coverage of essential health services (defined as the average coverage of essential services based on tracer interventions that include reproductive, maternal, newborn and child health, infectious diseases, non-communicable diseases and service capacity and access, among the general and the most disadvantaged population)	Coverage of 7 UHC tracer interventions for prevention and treatment services	Aligned	2015	GBD, 2016. Measuring the health-related Sustainable Development Goals in 188 countries: a baseline analysis from the Global Burden of Disease Study 2015. The Lancet, 388, pp. 1813–1850. DOI: https://doi.org/10.1016/S0140-6736(16)31467-2
3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	3.9.1 Mortality rate attributed to household and ambient air pollution		Official	2012	WHO Global Health Observatory data repository http://apps.who.int/gho/data/node.main.ENVHEALTHJOINTAAPHAP?lang=en
	3.9.2 Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All (WASH) services)	Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene	Official	2012	UNdata http://data.un.org/
	3.9.3 Mortality rate attributed to unintentional poisoning		Official	2015	UNdata http://data.un.org/
3.a Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate	3.a.1 Age-standardized prevalence of current tobacco use among persons aged 15 years and older (%)		Official	2015	UNdata http://data.un.org/

3.c Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States	3.c.1 Health worker density and distribution	Total health and social employment	Aligned	2015 (l.a.)	OECD Data https://data.oecd.org/
3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks	3.d.1 International Health Regulations (IHR) capacity and health emergency preparedness	International Health Regulations (IHR) core capacity index	Official	2010-2016	UN Global SDG Database https://unstats.un.org/sdgs/indicators/database/
		Total indicators Goal 3	17		
Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all					
4.1 By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes	4.1.1 Proportion of children and young people: (a) in grades 2/3; (b) at the end of primary; and (c) at the end of lower secondary achieving at least a minimum proficiency level in (i) reading and (ii) mathematics, by sex	Proportion of students at the end of lower secondary education achieving at least a minimum proficiency level in reading, both sexes (%)	Official	2015	UNESCO http://data.uis.unesco.org/
		Proportion of students at the end of lower secondary education achieving at least a minimum proficiency level in mathematics, both sexes (%)	Official	2015	UNESCO http://data.uis.unesco.org/
4.2 By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education	4.2.2 Participation rate in organized learning (one year before the official primary entry age), by sex	Adjusted net enrolment rate, one year before the official primary entry age, both sexes (%)	Official	2015	UNESCO http://data.uis.unesco.org/
4.3 By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university	4.3.1 Participation rate of youth and adults in formal and non-formal education and training in the previous 12 months, by sex	Gross enrolment ratio for tertiary education, both sexes (%)	Aligned	2015	UNESCO http://data.uis.unesco.org/
4.4 By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship	4.4.1 Proportion of youth and adults with information and communications technology (ICT) skills, by type of skill	Proportion of youth and adults with information and communications technology (ICT) skill, creating electronic presentations with presentation software	Official	2015	UNESCO http://data.uis.unesco.org/
		Proportion of youth and adults with information and communications technology (ICT) skill, writing a computer program using a specialized programming language	Official	2015	UNdata http://data.un.org/
		Proportion of youth and adults with information and communications technology (ICT) skill transferring files between a computer and other devices	Official	2015	UNdata http://data.un.org/

4.6 By 2030, ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy	4.6.1 Proportion of population in a given age group achieving at least a fixed level of proficiency in functional (a) literacy and (b) numeracy skills, by sex	Proportion of population (16-65) achieving at least a fixed level of proficiency in functional literacy skills	Official	2015 (l.a.)	UNdata http://data.un.org/
		Proportion of population (16-65) achieving at least a fixed level of proficiency in functional numeracy skills	Official	2015 (l.a.)	UNdata http://data.un.org/
4.a Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all	4.a.1 Proportion of schools with access to: (a) electricity; (b) the Internet for pedagogical purposes; (c) computers for pedagogical purposes; (d) adapted infrastructure and materials for students with disabilities; (e) basic drinking water; (f) single-sex basic sanitation facilities; and (g) basic handwashing facilities (as per the WASH indicator definitions)	Students using computers at school	Aligned	2012	OECD http://www.oecd-ilibrary.org/education/students-computers-and-learning/snapshot-of-ict-equipment-and-use-at-school_9789264239555-table2-en
		Total indicators Goal 4	10		
Goal 5. Achieve gender equality and empower all women and girls					
5.1 End all forms of discrimination against all women and girls everywhere	5.1.1 Whether or not legal frameworks are in place to promote, enforce and monitor equality and non-discrimination on the basis of sex	Legal age of marriage	Aligned	2014	OECD Gender, Institutions and Development Database 2014 (GID-DB) https://www.genderindex.org/data/
		Parental authority after divorce	Aligned	2014	OECD Gender, Institutions and Development Database 2014 (GID-DB) https://www.genderindex.org/data/
		Laws on domestic violence	Aligned	2014	OECD Gender, Institutions and Development Database 2014 (GID-DB) https://www.genderindex.org/data/
		Laws on rape	Aligned	2014	OECD Gender, Institutions and Development Database 2014 (GID-DB) https://www.genderindex.org/data/
		Laws on sexual harassment	Aligned	2014	OECD Gender, Institutions and Development Database 2014 (GID-DB) https://www.genderindex.org/data/
		Secure access to land	Aligned	2014	OECD Gender, Institutions and Development Database 2014 (GID-DB) https://www.genderindex.org/data/
		Secure access to non-land assets	Aligned	2014	OECD Gender, Institutions and Development Database 2014 (GID-DB) https://www.genderindex.org/data/
		Access to financial services	Aligned	2014	OECD Gender, Institutions and Development Database 2014 (GID-DB) https://www.genderindex.org/data/
		Access to public space	Aligned	2014	OECD Gender, Institutions and Development Database 2014 (GID-DB) https://www.genderindex.org/data/

		Workplace rights	Aligned	2014	OECD Gender, Institutions and Development Database 2014 (GID-DB) https://www.genderindex.org/data/
		Gender wage gap	Aligned	2015 (l.a.)	OECD https://data.oecd.org/earnwage/gender-wage-gap.htm
5.2 Eliminate all forms of violence against all women and girls in the public and private spheres, including trafficking and sexual and other types of exploitation	5.2.1 Proportion of ever-partnered women and girls aged 15 years and older subjected to physical, sexual or psychological violence by a current or former intimate partner in the previous 12 months, by form of violence and by age	Prevalence of violence in the lifetime	Aligned	2014	OECD Gender, Institutions and Development Database 2014 (GID-DB) https://www.genderindex.org/data/
5.4 Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate	5.4.1 Proportion of time spent on unpaid domestic and care work, by sex, age and location	Unpaid care work (male to female ratio)	Aligned	2014	OECD Gender, Institutions and Development Database 2014 (GID-DB) https://www.genderindex.org/data/
5.5 Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life	5.5.1 Proportion of seats held by women in (a) national parliaments and (b) local governments	5.5.1 Proportion of seats held by women in (a) national parliaments	Official	2017	UNdata http://data.un.org/
		5.5.2 Proportion of women in managerial positions	Official	2015 (l.a.)	UNdata http://data.un.org/
		Total indicators Goal 5	15		
Goal 6. Ensure availability and sustainable management of water and sanitation for all					
6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all	6.1.1 Proportion of population using safely managed drinking water services		Official	2015	UN Global SDG Database https://unstats.un.org/sdgs/indicators/database/
6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations	6.2.1 Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water	Proportion of population using safely managed sanitation services	Official	2015	UNdata http://data.un.org/
6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources		Official	2014	UNdata http://data.un.org/
6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	6.5.1 Degree of integrated water resources management implementation (0-100)		Official	2017	UN Global SDG Database https://unstats.un.org/sdgs/indicators/database/
		Total indicators Goal 6	4		

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all					
7.1 By 2030, ensure universal access to affordable, reliable and modern energy services	7.1.2 Proportion of population with primary reliance on clean fuels and technology		Official	2014	UNdata http://data.un.org/
7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	7.2.1 Renewable energy share in the total final energy consumption		Official	2014	UNdata http://data.un.org/
7.3 By 2030, double the global rate of improvement in energy efficiency	7.3.1 Energy intensity measured in terms of primary energy and GDP (Megajoules per USD constant 2011 PPP GDP. energy intensity (the ratio of energy used per unit of GDP))	Energy intensity, improvement rate from 2010-14	Aligned	2014	UNdata http://data.un.org/
		Total indicators Goal 7	3		
Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all					
8.1 Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries	8.1.1 Annual growth rate of real GDP per capita	The growth rate of GDP adjusted to income levels	Aligned	2015	Sachs, J., Schmidt-Traub, G., Kroll, C., Durand-Delacre, D. and Teksoz, K. (2017): SDG Index and Dashboards Report 2017. New York: Bertelsmann Stiftung and Sustainable Development Solutions Network (SDSN)
8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors	8.2.1 Annual growth rate of real GDP per employed person		Official	2015	UNdata http://data.un.org/
8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value	8.5.1 Average hourly earnings of female and male employees, by occupation, age and persons with disabilities	Employment-to-Population ratio (%	Aligned	2015	OECD Data https://data.oecd.org/
	8.5.2 Unemployment rate, by sex, age and persons with disabilities	Unemployment rate, total, 15-64	Official	2015	OECD Data https://data.oecd.org/
8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training	8.6.1 Proportion of youth (aged 15-24 years) not in education, employment or training	Share of youth not in education, employment or training, total (% of youth population)	Official	2015 (l.a.)	World Bank Open Data https://data.worldbank.org
8.8 Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment	8.8.2 Level of national compliance of labour rights (freedom of association and collective bargaining) based on International Labour Organization (ILO) textual sources and national legislation	Job strain	Aligned	2015	OECD Data https://data.oecd.org/

8.10 Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all	8.10.1 (a) Number of commercial bank branches per 100,000 adults and (b) number of automated teller machines (ATMs) per 100,000 adults	(a) Number of commercial bank branches per 100,000 adults	Official	2015 (l.a.)	UNdata http://data.un.org/
		(b) number of automated teller machines (ATMs) per 100,000 adults	Official	2015	UNdata http://data.un.org/
	8.10.2 Proportion of adults (15 years and older) with an account at a bank or other financial institution or with a mobile-money-service provider		Official	2014	UNdata http://data.un.org/
		Total indicators Goal 8	9		
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation					
9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all	9.1.1 Proportion of the rural population who live within 2 km of an all-season road	Quality of overall infrastructure (1-7)	Aligned	2015	World Economic Forum. The Global Competitiveness Report 2015-2016 http://www3.weforum.org/docs/gcr/2015-2016/Global_Competitiveness_Report_2015-2016.pdf
9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	9.4.1 CO2 emission per unit of value added	Emissions of carbon dioxide per unit of GDP (PPP)	Official	2014	UNdata http://data.un.org/
9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending	9.5.1 Research and development expenditure as a proportion of GDP		Official	2012-14	UNESCO http://data.uis.unesco.org/
	9.5.2 Researchers (in full-time equivalent) per million inhabitants		Official	2010-14	UNdata http://data.un.org/
9.b Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities	9.b.1 Proportion of medium and high-tech industry value added in total value added		Official	2014	UNdata http://data.un.org/

9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020	9.c.1 Proportion of population covered by a mobile network, by technology	Proportion of population covered by at least a 4G mobile network	Official	2015-16	UNdata http://data.un.org/
		Total indicators Goal 9	6		
Goal 10. Reduce inequality within and among countries					
10.1 By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average	10.1.1 Growth rates of household expenditure or income per capita among the bottom 40 per cent of the population and the total population	Income share of the bottom 40 % of the population	Aligned	2015	Eurostat http://ec.europa.eu/eurostat/web/products-datasets/product?code=sdg_10_50
		Palma ratio	Aligned	2015 (l.a.)	OECD https://data.oecd.org/inequality/income-inequality.htm
		Gini index	Aligned	2008-14	World Bank Open Data https://data.worldbank.org
10.2 By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status	10.2.1 Proportion of people living below 50 per cent of median income, by sex, age and persons with disabilities	Gender gap in poverty rates among people older than 65	Aligned	2014	OECD http://www.oecd.org/social/income-distribution-database.htm
10.7 Facilitate orderly, safe, regular and responsible migration and mobility of people, including through the implementation of planned and well-managed migration policies	10.7.2 Number of countries that have implemented well-managed migration policies	Difference in unemployment rates between foreign born and native born	Aligned	2015	OECD https://data.oecd.org/migration/native-born-unemployment.htm#indicator-chart
		Total indicators Goal 10	5		
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable					
11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums	11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums	Housing overcrowding among low-income, %	Aligned	2014	OECD http://www.oecd.org/social/affordable-housing-database.htm
		Households' housing cost burden (mortgage and rent cost) as a share of disposable income	Aligned	2011-14	OECD http://www.oecd.org/social/affordable-housing-database.htm
11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations	11.5.2 Direct economic loss in relation to global GDP, damage to critical infrastructure and number of disruptions to basic services, attributed to disasters	Direct disaster economic loss, average annual loss, USD	Official	2016	UNdata http://data.un.org/
		Direct disaster economic loss, average annual loss in relation to global GDP (per 1,000 UDS)	Official	2016	UNdata http://data.un.org/

11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	11.6.2 Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)	Urban	Official	2016	UNdata http://data.un.org/
		Total indicators Goal 11	5		
Goal 12. Ensure sustainable consumption and production patterns					
12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment	12.4.2 Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment	E-waste generated in 2016 (kg/inh)	Aligned	2016	UNU / ITU http://ewastemonitor.info/
		Wastewater treated (%)	Aligned	2014	Yale University. Environmental Performance Index. http://epi2016.yale.edu/downloads
12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse	12.5.1 National recycling rate, tons of material recycled	Recycling rate of municipal waste (%)	Aligned	2015	OECD Environment Statistics https://data.oecd.org/environment.htm
		Total indicators Goal 12	3		
Goal 13. Take urgent action to combat climate change and its impacts					
13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	13.1.2 Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030	Climate change vulnerability index	Aligned	2014	The Hague Centre for Strategic Studies, The Hague. Climate change vulnerability monitor. http://projects.hcss.nl/monitor/70/
13.2 Integrate climate change measures into national policies, strategies and planning	13.2.1 Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)	CO2 emissions (metric tons per capita)	Aligned	2014	World Bank Open Data https://data.worldbank.org
		Methane emissions (kt of CO2 equivalent)	Aligned	2012	World Bank Open Data https://data.worldbank.org
		Nitrous oxide emissions (thousand metric tons of CO2 equivalent)	Aligned	2012	World Bank Open Data https://data.worldbank.org

		Total greenhouse gas emissions (kt of CO2 equivalent)	Aligned	2012	World Bank Open Data https://data.worldbank.org
		Total indicators Goal 13	5		
Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development					
14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution	14.1.1 Index of coastal eutrophication and floating plastic debris density	Ocean Health Index - Clean waters (0-100)	Aligned	2015	The Ocean Helath Index. http://data.oceanhealthindex.org/home
14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics	14.4.1 Proportion of fish stocks within biologically sustainable levels	Ocean Health Index - Biodiversity (0-100)	Aligned	2015	The Ocean Helath Index. http://data.oceanhealthindex.org/home
		Ocean Health Index - Food Provision (0-100)	Aligned	2015	The Ocean Helath Index. http://data.oceanhealthindex.org/home
14.5 By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information	14.5.1 Coverage of protected areas in relation to marine areas		Official	2016	UNdata http://data.un.org/
14.b Provide access for small-scale artisanal fishers to marine resources and markets	14.b.1 Progress by countries in the degree of application of a legal/regulatory/policy/institutional framework which recognizes and protects access rights for small-scale fisheries	Ocean Health Index - Artisanal Fishing Opportunities (0-100)	Aligned	2015	The Ocean Helath Index. http://data.oceanhealthindex.org/home
		Total indicators Goal 14	5		
Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss					
15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	15.1.1 Forest area as a proportion of total land area	Change in Forest Cover	Aligned	2014	Yale University. Environmental Performance Index. http://epi2016.yale.edu/downloads
	15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type	Proportion of important sites for freshwater biodiversity that are covered by protected areas	Official	2016	UNdata http://data.un.org/
		Proportion of important sites for terrestrial biodiversity that are covered by protected areas	Official	2016	UNdata http://data.un.org/

15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	15.2.1 Progress towards sustainable forest management	Proportion of forest area with a long-term management plan	Official	2010	UNdata http://data.un.org/
15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development	15.4.1 Coverage by protected areas of important sites for mountain biodiversity		Official	2016	UNdata http://data.un.org/
	15.4.2 Mountain Green Cover Index		Official	2017	UNdata http://data.un.org/
15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	15.5.1 Red List Index		Official	2016	UNdata http://data.un.org/
		Total indicators Goal 15	7		
Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels					
16.1 Significantly reduce all forms of violence and related death rates everywhere	16.1.1 Number of victims of intentional homicide per 100,000 population, by sex and age		Official	2015 (l.a.)	UNdata http://data.un.org/
	16.1.4 Proportion of population that feel safe walking alone around the area they live		Official	2016	Gallup World Poll 2016, in Sachs, J., Schmidt-Traub, G., Kroll, C., Durand-Delacre, D. and Teksoz, K. (2017): SDG Index and Dashboards Report 2017. New York: Bertelsmann Stiftung and Sustainable Development Solutions Network (SDSN)
16.3 Promote the rule of law at the national and international levels and ensure equal access to justice for all	16.3.2 Unsentenced detainees as a proportion of overall prison population		Official	2015	UNdata http://data.un.org/
16.9 By 2030, provide legal identity for all, including birth registration	16.9.1 Proportion of children under 5 years of age whose births have been registered with a civil authority, by age		Official	2015 (l.a.)	UNdata http://data.un.org/
		Total indicators Goal 16	4		

Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development					
17.6 Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge-sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism	17.6.2 Fixed Internet broadband subscriptions per 100 inhabitants		Official	2015	UNdata http://data.un.org/
17.8 Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology	17.8.1 Proportion of individuals using the Internet		Official	2015	UNdata http://data.un.org/
17.2 Developed countries to implement fully their official development assistance commitments, including the commitment by many developed countries to achieve the target of 0.7 per cent of gross national income for official development assistance (ODA/GNI) to developing countries and 0.15 to 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries	Net official development assistance (ODA) as a percentage of OECD-DAC donors' GNI, by donor countries (%)	ONLY DAC countries	Official	2015	UN Global SDG Database https://unstats.un.org/sdgs/indicators/database/
17.1 Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection	17.1.1 Total government revenue as a proportion of GDP, by source	Only non-DAC countries	Official	2015 (l.a.)	World Bank Open Data https://data.worldbank.org
		Total indicators Goal 17	4		

Appendix C: **Descriptive statistics of SDG achievement.** The table depicts the mean, the minimum and maximum value as well as the standard deviation for each SDG and the overall average.

Goal	Mean	Min	Max	Std. dev.
1	61.7	21.1	85.3	14.3
2	70.4	39.5	99.6	13.8
3	69.7	39.5	85.5	13.2
4	62.8	25.5	88.1	15.4
5	78.1	57.0	87.3	7.4
6	76.9	47.2	95.1	11.4
7	61.2	21.1	100.0	15.8
8	56.1	21.6	79.0	11.8
9	56.7	19.3	87.2	19.0
10	68.8	38.4	92.9	14.4
11	74.9	41.2	94.4	11.8
12	60.5	24.6	92.6	12.9
13	86.1	31.5	97.5	12.2
14	46.3	27.4	65.0	11.0
15	71.6	38.0	97.1	16.0
16	78.0	0.4	98.9	15.8
17	52.9	18.3	95.0	20.9
Total	66.8	42.3	78.5	8.0

Article 2:

Two degrees and the SDGs: a network analysis of the interlinkages between transnational climate actions and the Sustainable Development Goals

Abstract

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SPECIAL FEATURE: ORIGINAL ARTICLE

Synergies and Trade-offs between Sustainable Development Goals and Targets

Two degrees and the SDGs: a network analysis of the interlinkages between transnational climate actions and the Sustainable Development Goals

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Abstract

Given the interconnectedness of climate change and sustainable development, policymakers and scholars have started to investigate how climate actions can contribute to achieving the Sustainable Development Goals (SDGs), and vice versa. To date, research has mainly focused on the national and international levels, while little is known about the interlinkages between climate actions and the SDGs at the transnational level. Not only nation states, but also non-state actors undertake ambitious actions designed to reduce greenhouse gas emissions and to promote sustainable development. Using content analysis and network analysis techniques, we examine the interlinkages between the climate actions of 72 transnational initiatives and the 169 targets of the 17 SDGs. We find that actions of 71 initiatives contribute to achieving 16 SDGs, thus generating valuable co-benefits. Besides SDG 13 on climate action and SDG 17 on partnerships for the goals, transnational climate actions frequently address SDGs 9 on industry, innovation and infrastructure, SDG 7 on affordable and clean energy, and SDG 12 on responsible consumption and production. While SDG 3 on good health and well-being and SDG 4 on quality education are barely addressed, SDG 5 on gender equality is not at all covered by transnational climate actions. Additionally, the network reveals that SDG 9 is highly synergistic with many other frequently addressed SDGs and functions as an important connector between them. Finally, our results indicate that transnational initiatives fill a governance gap left by states with regards to SDG 12. Climate initiatives of non-state actors can thus complement state-led actions to implement the Paris Agreement and the SDGs jointly.

Keywords Agenda 2030 · SDGs · Paris agreement · Global environmental governance · Network analysis · Synergies

Introduction

The year 2015 can be considered a landmark year for sustainable development. It saw the adoption of the United Nations' Sustainable Development Goals (SDGs) within the framework of the Agenda 2030 for Sustainable Development, and the Paris Agreement, an international climate agreement under the United Nations Framework Convention on Climate Change (UNFCCC) with the goal of keeping global temperature rise well below two degrees Celsius (United Nations, 2015; UNFCCC 2015). Both climate change and sustainable development involve social, economic, and environmental issues that do not conform to established sectoral and political boundaries. Given strong interlinkages between climate change and sustainable development (Allen et al. 2019; Nerini et al. 2019), leveraging

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synergies in the implementation of these two global agendas can save time and money and enhance efficiency, effectiveness, and coherence (UNFCCC 2017).

Interactions between the SDGs and their targets have gained increased scholarly attention (Bennich et al. 2020; Nerini et al. 2019; Breuer et al. 2019; Le Blanc, 2015; Stafford-Smith et al. 2017; Waage et al. 2015; Weitz et al. 2018). The interrelated nature of the goals poses challenges regarding numerous trade-offs involved, but equally opens a window of opportunity to achieve co-benefits in the implementation when capitalizing on synergies (Scharlemann et al. 2020). The SDGs are seen as a system of interacting components rather than just a collection of goals, targets, and indicators (Pradhan 2019). However, there is little research that has broadened the study of interactions to analyze the synergies arising from a joint implementation of the Paris Agreement and Agenda 2030 based on functional interactions between them. By functional interactions, we are referring to "inherent structural connections between policy domains that are largely independent of the rules and procedures of political institutions in the domain" (van Asselt et al. 2005, p. 257). To date, scholars have mainly examined these interactions at the national level, focusing on the connections between state-led climate actions set out in Nationally Determined Contributions (NDCs) under the UNFCCC and the SDGs (Brandi et al. 2017b; Janetschek et al. 2020; Northrop et al. 2016).

However, not only states, but also non-state actors and collaborative arrangements have gained importance for addressing interrelated global climate change and sustainability problems (Abbott 2012; Biermann and Pattberg 2012; Pattberg and Widerberg 2016). At the national level, research shows that participation of non-state actors in policy-making and implementation is positively correlated with the achievement of many of the SDGs (Glass and Newig 2019). At the global and transnational level, collaborative arrangements in the form of multi-stakeholder partnerships have been described as "the glue for implementation" of the Agenda 2030 (United Nations Development Group 2014, p. 5). These partnerships form an integral part of transnational regime complexes in the area of climate change and sustainable development (Abbott 2012). Such transnational governance arrangements emerged in reaction to the perception that there were increasing regulatory and implementation deficits in multilateral regimes (Bäckstrand 2006) and involve a diverse set of public and private actors (Abbott 2012). Recent empirical evidence suggests that transnational initiatives complement state-led efforts to combat climate change (Andonova et al. 2017; Tosun and Schoenefeld, 2017; Roelfsema et al. 2018). Both inter- and transnational regime complexes have become increasingly fragmented and decentralized (Abbott 2012; Dasandi et al. 2015; Keohane and Victor 2011), giving rise to a situation in which most environmental and sustainability issues are co-governed by multiple institutions involving a diverse set of state and non-state actors. As a result, potential overlaps between these institutions become more likely (Hickmann et al. 2020; Oberthür and Gehring, 2006; Young 2002). An example from our sample of TCIs illustrates this point. The *SE4All: Building Efficiency Accelerator* aims to "contribute toward the targets for SDG 7 (*affordable and clean energy*) and achievement of national climate commitments (NDCs)" (Climate Initiatives Platform 2019b), and thus clearly recognizes that the ambitions of transnational climate actions overlap with goals set under the state-led climate agenda and Agenda 2030. In the light of limited human and financial resources, it is particularly important to promote synergies and ensure complementarity between climate actions and sustainable development, thus avoiding inconsistencies, contradictions or duplication of implementation efforts (UNFCCC 2017).

This study follows the underlying assumption that a partial integration of the two post-2015 agendas is feasible and desirable while recognizing, however, that full integration would be neither possible nor preferable. A full integration may undermine the autonomy and focus of the two agendas that have been formulated through distinct processes, involving different actors and legal frameworks (UNFCCC 2017). SDG 13 explicitly states that the "UNFCCC is the primary international, intergovernmental forum for negotiating the global response to climate change" (United Nations 2018, p.14). Since there is little empirical research on the interlinkages between climate change and broader sustainable development at the transnational level, this article explores the extent to which transnational climate initiatives (TCIs) registered at the Non-state Actor Zone for Climate Action (NAZCA) platform[1] can reinforce and promote sustainable development in accordance with the SDGs. The aim of our research is threefold. First, we examine how the commitments of TCIs contribute towards achieving the SDGs, revealing which SDGs are particularly synergetic with climate actions. Second, we visualize the interlinkages between SDGs and climate actions by applying network analysis techniques. Third, we analyze whether transnational climate actions complement state-led efforts as described in the NDCs. A better knowledge of the thematic overlaps between the Agenda 2030 and climate actions can help both state and non-state actors leverage synergies and co-benefits when designing and implementing transnational climate initiatives.

The remainder of this article proceeds as follows. After introducing the analytical framework, we explain our

[1] Now referred to as "Global Climate Action portal", but the term NAZCA platform is widely used in academic publications (see e.g. Chan et al. 2019; Hsu et al. 2016; Widerberg, 2017).

methodological approach that combines content and network analysis techniques to identify and visualize interlinkages between climate actions and broader sustainable development. Subsequently, we present our results on the linkages between the commitments of 72 cooperative NAZCA initiatives and the SDGs. We proceed by discussing challenges and opportunities associated with a joint implementation of the post-2015 agendas, focusing on the role of transnational actors. By drawing on findings of previous research, we then compare our results to state-led climate actions laid out in the NDCs. Lastly, we briefly reflect on the strengths and weaknesses of our methodological approach.

Functional interactions and transnational governance

To analyze the interlinkages between climate change and sustainable development at the transnational level, we focus on two central aspects: First, we build on literature on functional interactions between climate change and sustainable development. Second, we discuss the role of non-state actors in global environmental and sustainability governance in the context of a proliferation of governance arrangements, actors and institutions in recent years.

Functional interactions

A growing body of literature is concerned with thematic or issue-specific interconnections, also referred to as functional interactions, between the SDGs (Bennich et al. 2020; Le Blanc, 2015; Nilsson et al. 2018; Pradhan et al. 2017; Stafford-Smith et al. 2017; Weitz et al. 2018). Waage et al. (2015) made one of the first contributions to this research area. They group the SDGs into three categories—wellbeing, infrastructure and the natural environment—which emphasize the prospects for synergistic or disruptive interactions. Additionally, Nilsson et al. (2016) developed a framework to map interactions between SDGs, scoring them on a 7-point scale from indivisible to canceling (see also Nilsson et al. 2018). Moreover, researchers have used various approaches to visualize such interactions. For instance, Rockström and Sukhdev (2016) use a "wedding cake" metaphor to map interactions between social, environmental and economic SDGs, while several other studies apply a network perspective to the Agenda 2030 (Le Blanc, 2015; Lusseau and Mancini, 2019; Pham-Truffert et al. 2020; Weitz et al. 2018; Zhou and Moinuddin 2017). In short, these efforts commonly pursue a systematic understanding of functional interactions to support an integrated approach towards the SDGs.

Functional interactions are not only visible among the SDGs alone, but also in relation to the climate targets under the Paris Agreement. Most obviously, SDG 13 on climate action is highly relevant to the Paris Agreement. From a broader perspective, climate change is interlinked in both cause and effect with most areas of human and sustainable development. For instance, progress towards SDGs related to energy, cities and infrastructure is likely to address some of the fundamental causes of climate change; and activities on SDGs related to hunger, water or health will presumably increase resilience to climate change (UNFCCC 2017). Conversely, implementation of climate policy can strongly affect SDG achievement (von Stechow et al. 2016). For example, a rising demand for bioenergy could have a negative effect on food and water security, which relate to SDG 2 and 6, respectively. A growing body of literature is concerned with such functional interactions between climate actions and development policies (Eriksen et al. 2011; Smit and Pilifosova 2001; van Asselt et al. 2005). Scholars have explored how to connect the fields of climate change and sustainable development by reducing trade-offs and supporting synergies that may result from these interactions (Beg et al. 2002; Mayrhofer and Gupta 2016; von Stechow et al. 2015, 2016; Weitz et al. 2018). In 2016, the World Resource Institute published an interactive tool that identifies potential alignments between the SDGs and the targets, actions and policy measures set out in the NDCs (Northrop et al. 2016). One year later, the German Development Institute and the Stockholm Environmental Institute analyzed and compared how climate actions formulated in the NDCs correspond to each of the 17 SDGs (Brandi et al. 2017b). Similarly, Janetschek et al. (2020) explored connections between the Paris Agreement and the Agenda 2030 across all NDCs and more detailed interactions at SDG target level for a subset of six developing countries. At the national and regional level, researchers have analyzed the alignment between the NDCs and SDGs for West Africa (Antwi-Agyei et al. 2018), South Africa (England et al. 2018) and Mexico (GIZ 2018).

Transnational governance

The proliferation of actors, governance arrangements and institutions in global governance has been discussed primarily within three major strands of research. By referring to the concepts of fragmentation (Biermann et al. 2009), polycentricity (Jordan et al. 2018), and complexity (Orsini et al. 2019), scholars have described the emerging ever more diverse global governance architecture and the potentially complementary or conflictive interactions between actors and institutions from separate but partially overlapping perspectives. While causes, consequences and policy implications differ depending on the analytical concept applied, it is important to note that they are not mutually exclusive

and their structural features are often found simultaneously (Kim 2020).

The areas of climate change and sustainable development have certainly seen a proliferation of governance arrangements in recent years. For instance, there are over 3,000 multilateral and bilateral environmental agreements to date (Mitchell et al. 2020). Yet, climate commitments by nation states under the Paris Agreement to limit global warming to 1.5/2 °C remain insufficient (Rogelj et al. 2016), and deficits with regard to other areas of sustainable development also persist (Chan et al. 2019). While this by no means implies that state actors have become superfluous in global environmental and sustainability governance, these gaps underline the importance of non-state and transnational action in complementing state-led efforts (Andonova et al. 2017; Chan and Amling, 2019; Hickmann, 2017). With non-state actors we refer to economic actors, subnational actors (such as cities and municipalities), as well as social movements and civil society (Bäckstrand et al. 2017). These fulfill a variety of governance functions, including defining problems, stimulating dialog, sharing knowledge and information, building capacity, shaping rules and norms, transferring technology, providing finance, pooling resources and mobilizing public engagement (Bäckstrand et al. 2017; Chan et al. 2019). We speak of transnational governance "when non-state and/or sub-state actors in at least two different states adhere to rules and practices that seek to steer behavior toward shared, public goals" (Andonova et al. 2017, p. 254). Although various scholars criticize the added value, effectiveness and legitimacy of transnational and non-state initiatives (Bäckstrand et al. 2017; Bulkeley et al. 2012; Hickmann 2017; Kuyper et al. 2018), a growing body of literature stresses how transnational and non-state action bridge governance gaps, for example related to implementation and participation (Börzel and Risse 2010; Chan et al. 2019; Roelfsema et al. 2018; Tosun and Schoenefel 2017).

In short, scholars have made detailed efforts to study interactions among the SDGs, and between the SDGs and the global climate targets, particularly in the international realm. However, given a proliferation of actors and institutions in global environmental and sustainability governance, it is important to further expand the body of empirical research on these interactions with a specific focus on the transnational level. Since intergovernmental and transnational spheres of global climate and sustainability governance can mutually reinforce each other (Andonova et al. 2017; Bäckstrand, 2006; Chan et al. 2016), it is important to determine the extent to which interlinkages between the two agendas at the intergovernmental level compare to those at the transnational level.

Methods and materials

Our analysis of the interlinkages between TCIs and the SDGs is based on a detailed content and network analysis of 72 multi-actor climate initiatives. We coded interlinkages when TCIs make reference to the content of a specific SDG target, indicating that the proposed climate action will contribute to progress towards the SDGs (i.e., synergies between climate action and SDGs). We undertook this analysis in three steps. First, we retrieved complementary information about, for example, each initiative's goals, activities and participants from the NAZCA platform[2] and the Climate Initiatives Platform[3] (CIP). We drew on both databases because they provide more data for the subsequent content analysis than a single source alone. At the time of data collection (May 2018), 77 cooperative initiatives were registered on the NAZCA platform, but comprehensive information was available for only 72 of these initiatives on the CIP platform. Thus, we restricted our sample size to 72, thereby ensuring a high level of data consistency and comparability. We created a text document for every initiative, synthesizing the available information from both data platforms. Cooperative initiatives registered at the NAZCA platform are typically multi-actor and in many cases multi-sectoral partnerships aimed at addressing climate change. They involve several participants from different countries, and at least one non-state actor (i.e., company, city, organization or investor). For instance, the *CEM: Global Lighting Challenge* involves 2 regions, 11 companies and 16 countries (Climate Initiatives Platform 2019a).

Second, we conducted a qualitative content analysis to systematically examine the textual information of the 72 TCIs for references to the 17 SDGs and their 169 targets. We coded text segments that reflect the content of the SDGs (see Appendix A2 for examples; methodological approach inspired by Brandi et al. (2017a, b)). When an initiative addressed at least one specific target, we linked it to the respective SDG. Since coding is an interpretive process, two authors first conducted the content analysis independently. To reach intercoder agreement, both coders discussed and resolved inconsistencies between their individual coding results. In particularly difficult cases, all three authors discussed inconsistencies so as to ensure a high reliability of the results. Some discussions revolved around the vague wording of the SDGs, which include broad phrases like "modern energy services" (target 7.1), "inclusive and

[2] Non-state Actor Zone for Climate Action (NAZCA) / Global Climate Action portal. https://climateaction.unfccc.int/. Last accessed on June 22, 2020.

[3] Climate Initiatives Platform. http://climateinitiativesplatform.org. Last accessed on June 22, 2020.

sustainable urbanization" (target 11.3) and "awareness raising" (target 13.3), which leave much room for interpretation. We excluded targets 17.16 and 17.17 (*strengthening and promoting multi-stakeholder partnerships*) from the analysis, as they apply to the entire dataset. We note that there are several targets that non-state actors cannot address as they fall primarily under the purview of governmental actors (e.g., target 1.3[4] and target 5.c[5]). While we acknowledge that non-state actors might be able to influence domestic policy-making, we decided to adhere to the specific wording of the targets. Thus, according to our methodological approach, there cannot be a 100% alignment between transnational climate initiatives and some SDGs on a target level.

The third step of the analysis involved data visualization through the use of bar charts and networks. First, we visualized the quantitative links between TCIs and the SDGs in descriptive graphs. While it is possible to discern some patterns (e.g., the relative frequency of particular SDGs addressed by climate initiatives) directly from the charts, a systematic study of the interlinkages between TCIs and the SDGs called for a more sophisticated methodology. To this end, we analyzed the data further using network techniques. Up until now, network analysis in social science research has been used mainly for studying relationships among societal entities, such as people, groups, or organizations (e.g., Widerberg 2017), or to analyze citation networks (e.g., Kim 2013). In recent years, a small but growing body of research has applied a network perspective to examine SDG interlinkages (GIZ 2018; Le Blanc 2015; Putra et al. 2020; Weitz et al. 2014, 2018; Zhou and Moinuddin 2017). A network is a structure consisting of a set of nodes (objects) and set of edges (ties). Our network analysis employs two sets of nodes (climate initiatives and SDGs on both a goal and target level) which are linked through edges where the coding analysis revealed a thematic overlap between a climate initiative and the SDG or target. We present our data in a two-mode network (including both sets of nodes) and one-mode networks (including only one set of nodes).[6] To identify SDGs that are particularly important in the network, we analyze degree centrality, betweenness centrality and eigenvector centrality. According to Zhou and Moinuddin (2017), who interpret these network measures in the context of SDG networks, SDGs with high degree centrality connect with many other SDGs. SDGs with high betweenness centrality act as important intermediates bridging unconnected SDGs. Lastly, SDGs with high eigenvector centrality interact with many other SDGs and place at strategic positions in connecting with other influential SDGs.

Network analysis techniques are a useful tool to represent the web of connections between various units. The networks illustrate the underlying structure of the interlinkages and elucidate the relative importance of individual nodes based on their position in the network (Hanneman and Riddle 2005). These techniques provide significant added value to our data set by revealing the position of individual SDGs within the whole system and by visualizing which SDGs are closely interlinked through transnational climate actions. Networks provide a comprehensive overview of a large quantity of connections and make information easily accessible and understandable. They demonstrate which goals and targets can be grouped together due to their thematic interactions and interdependencies and reveal that many targets are inherently cross-sectoral.

Results

Our analysis proceeds in two steps. We first examine to what extent climate initiatives propose actions that link to the SDGs (i.e., SDG coverage) before subsequently investigating the interlinkages between TCIs and the SDGs using network analysis techniques.

Analysis of SDG coverage

We found that nearly all transnational climate initiatives involve climate actions that contribute to achieving the SDGs. Out of 72 initiatives, 71 demonstrate connections to the SDGs in their proposed actions. Only the *Montreal Carbon Pledge* initiative, which aims to "measure and publicly disclose the carbon footprint of their [investors'] investment portfolios on an annual basis" (NAZCA, n.d.-a) does not include any linkages to the SDGs. Although target 10.5 addresses the broader financial system ("Improve the regulation and monitoring of global financial markets and institutions"), there is no specific target focusing on financial investors or sustainable investment portfolios specifically.

As expected, most TCIs (35 out of 72; 49%) demonstrate a link to SDG 13 on climate action (Fig. 1). Additionally, we found that the non-state actor climate initiatives analyzed contribute to 15 other SDGs. Thirty-four initiatives (47%) reference the content of SDG 12 (*responsible consumption and production*), followed by 33 initiatives (46%) that link to SDG 9 on industry, innovation and infrastructure. Thirty-one initiatives (43%) promote access to energy, energy efficiency or the use of renewable energy as set out in SDG 7. SDG 17 on partnerships for the goals is addressed by 27 initiatives (38%), while 20 initiatives (28%) contribute to SDG 11 on

[4] SDG target 1.3: "Implement nationally appropriate social protection systems […]"(United Nations 2018, p. 1).

[5] SDG target 5.c: "Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality […]" (United Nations 2018, p. 7).

[6] We used the qualitative coding softwares *ATLAS.ti* and *MAXQDA* for the content analysis, and *Gephi* for the network analysis.

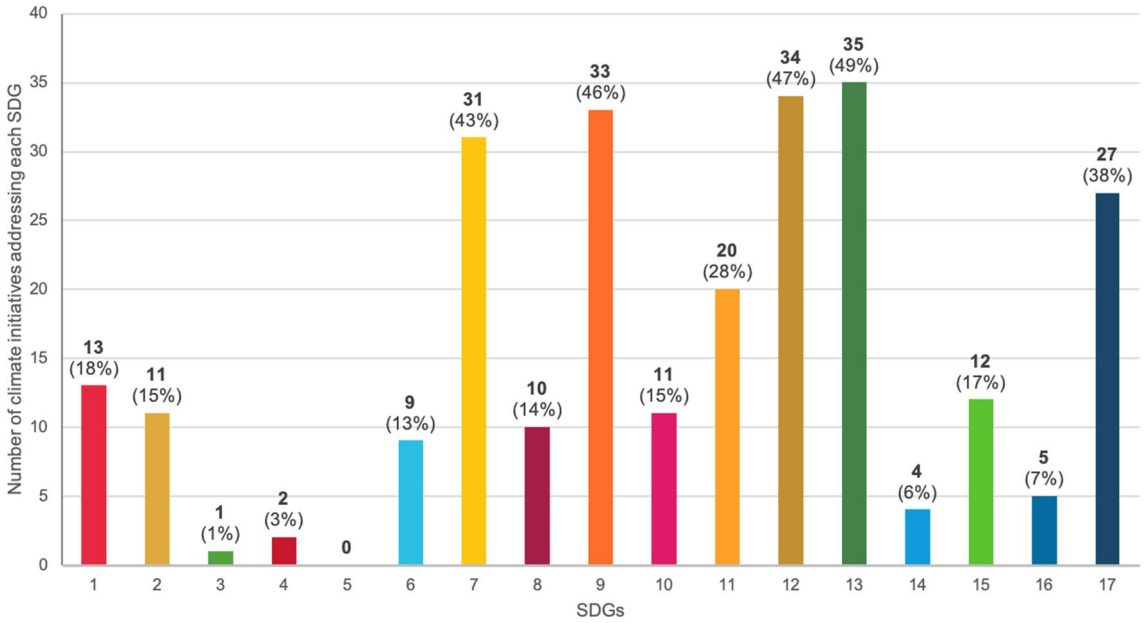


Fig. 1 Interlinkages between 72 transnational climate initiatives and the SDGs at the goal-level. Each initiative may relate to several SDGs

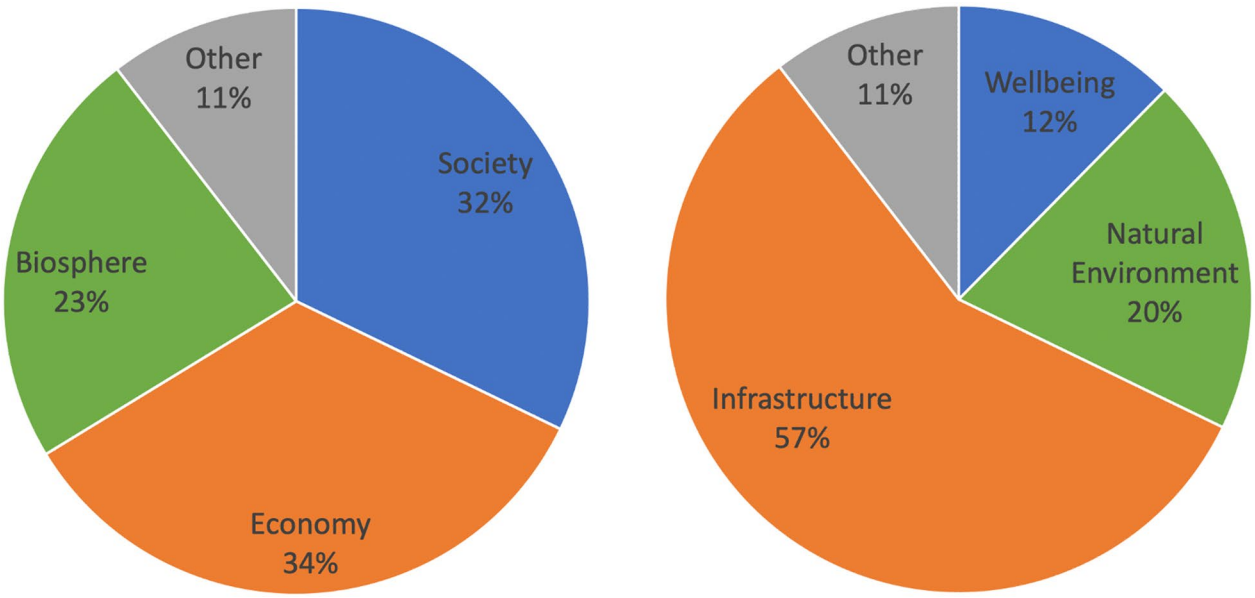


Fig. 2 Coverage of SDGs by transnational climate actions, grouped according to the categorizations proposed by Rockström and Sukhdev (2016) on the left and Waage et al. (2015) on the right

sustainable cities. The initiatives cover SDG 14 (*life below water*, 6%) and SDG 16 (*peace, justice and strong institutions*, 7%) only marginally. While SDG 3 (*good health and well-being*) and SDG 4 (*quality education*) are addressed by only one and two initiatives, respectively, no initiative explicitly refers to SDG 5 on gender equality. We note that some TCIs refer to the importance of the inclusion of women in general. For reasons of consistency, however, we did not code these text sections because the initiatives made no reference to a specific target under SDG 5.[7]

[7] For example, the "Save Food Initiative" aims to ensure "food security and nutrition for the world's poorest and most vulnerable communities, particularly women […] (Climate Initiatives Platform 2018a, b), yet this does not relate to any specific target under SDG 5.

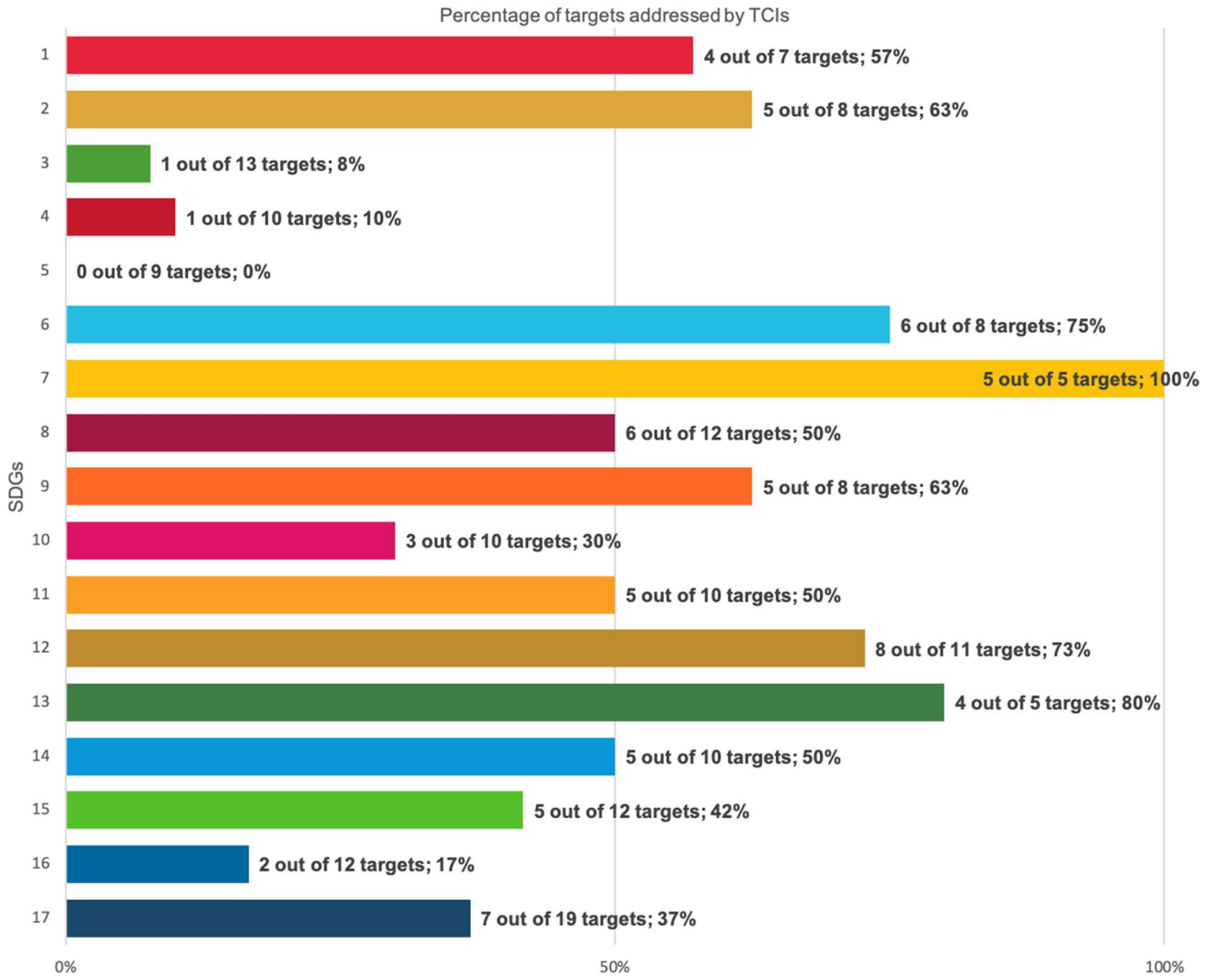


Fig. 3 Interlinkages between 72 transnational climate initiatives and the SDGs at the target level

Furthermore, we analyzed the SDG coverage according to the categorizations proposed in previous research (Fig. 2). Following Rockström and Sukhdev's approach (2016), we found that the initiatives address economic SDGs the most (34%). The coverage for social SDGs is almost equally high, with 32% of initiatives addressing that dimension. Only 23% of all covered SDGs relate to the natural environment. However, a very different picture emerges when applying the categories developed by Waage et al. (2015). While initiatives cover SDGs related to infrastructure (SDGs 2, 6, 7, 8, 9, 11 and 12) most often (57%), only 20% of initiatives address SDGs on the natural environment (SDGs 13, 14 and 15). Notably, initiatives cover SDGs on wellbeing (SDGs 1, 3, 4, 5, 10 and 16) the least (12%). Grouping the SDGs into different categories underlines that socio-economic SDGs feature more prominently than environmental SDGs in transnational climate actions. Infrastructure appears to be a crosscutting theme, connecting many transnational climate actions.

As Fig. 3 shows, the TCIs analyzed in this study can be linked to 71 out of 169 total targets under the SDGs. SDG 7 (*affordable and clean energy*) is the only goal for which TCIs address all of its targets. Further, we found interlinkages with the majority of targets for SDGs 1 (*no poverty*), 2 (*zero hunger*), 6 (*clean water and sanitation*), 9 (*industry, innovation and infrastructure*), 12 (*responsible consumption and production*) and 13 (*climate action*). For SDGs 8 (*decent work and economic growth*), 11 (*sustainable cities and communities*) and 14 (*life below water*), the results show linkages with 50% of the targets. Notably, the data show a particularly low degree of interlinkages between TCIs and the targets of SDGs 3 (*good health and well-being*), 4 (*quality education*) and 16 (*peace, justice and strong institutions*). In absolute terms, we found that TCIs address target 12.6

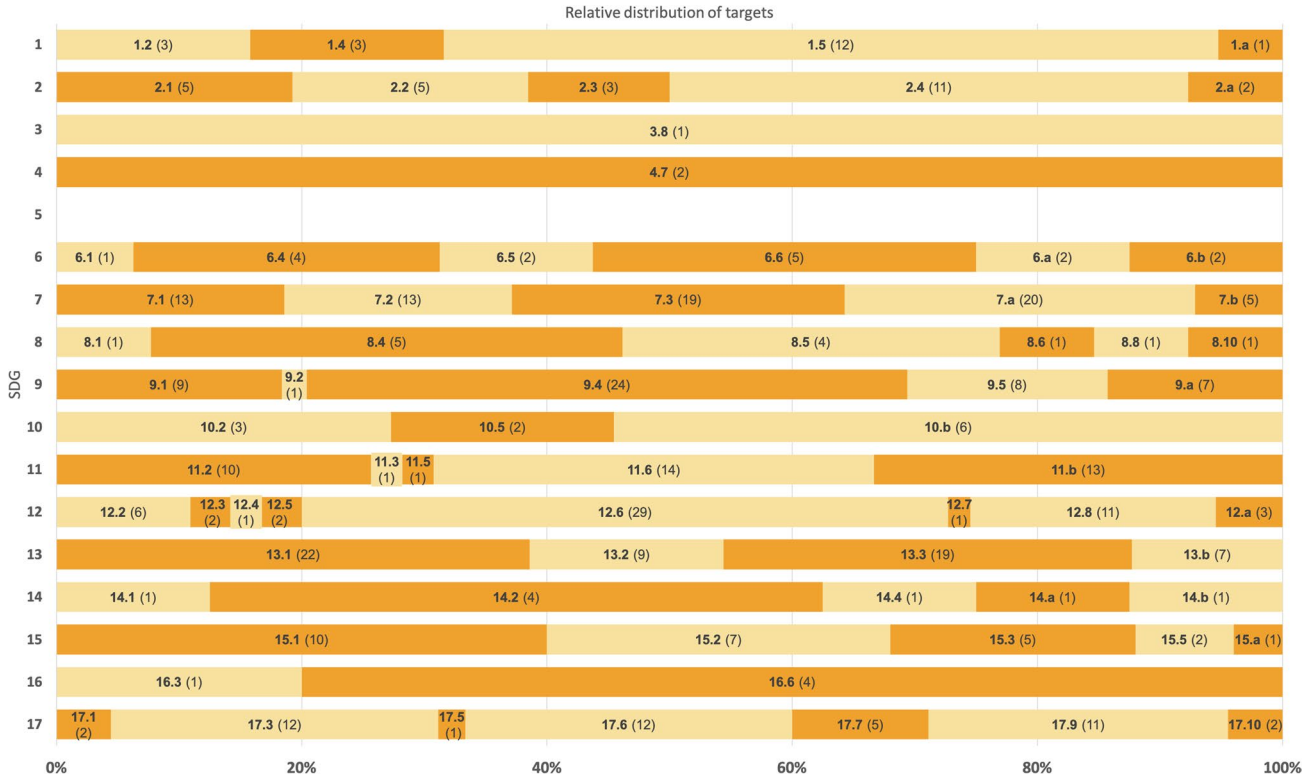


Fig. 4 Relative distribution of targets across the SDGs. This figure shows the extent to which TCIs address individual targets under each goal. The bold numbers in the bars indicate the SDG targets and the numbers in brackets denote the absolute number of linkages between TCIs and targets

(*sustainable business practices*) most often (i.e., by 29 initiatives; 40%), followed by target 9.4 on sustainable infrastructure and retrofitted industries (24 initiatives, 33%), target 13.1 on resilience and adaptation (22 initiatives, 31%) and target 7.a on access to clean energy research and technology (20 initiatives, 28%).

By looking at the relative distribution of the targets that TCIs addressed (Fig. 4), we can identify the extent to which the 72 TCIs analyzed align with the SDG targets. Furthermore, we can also determine which targets are being addressed primarily by non-state actors. Regarding the best-aligned SDG at the goal-level, SDG 13 on climate action (35 TCIs; Fig. 1), it is clear that TCIs show the most interlinkages with target 13.1 on resilience and adaptation in relative terms. The 35 TCIs connected to SDG 13 have 57 linkages with targets 13.1, 13.2, 13.3 and 13.b, of which 39% (22 initiatives) link to SDG 13.1. This commitment to resilience-building measures is also recognizable when looking at target 1.5 (*resilience of the poor to climate-related extreme events*), which makes up 63% of all TCIs showing interlinkages with SDG 1. Target 13.3, which deals with improved education, awareness raising and capacity building for climate mitigation and adaptation accounts for one third of SDG 13 interlinkages.

It is striking that SDG target 12.6 (*sustainable business practices*) covers slightly over half of the interlinkages pertaining to SDG 12. Given that SDG 12 is the second-most frequently addressed SDG, this finding indicates that TCIs are strongly focused on fostering sustainable practices in the private sector. Regarding SDG 9 (*industry, innovation and infrastructure*), target 9.4 (*sustainable infrastructure and retrofitted industries*) is prominent, accounting for 49% of targets addressed under this goal. With regards to SDG 7 (*affordable and clean energy*), which also shows great potential to create synergies between the climate and the Agenda 2030 (i.e., 43% coverage on a goal level), the targets that TCIs addressed were generally spread evenly. Our results demonstrate that TCIs covered target 7.a (*access to clean energy research and technology*) the most in relative terms with 29%, followed by target 7.3 (*energy efficiency*) with 28%. Targets 7.1 (*access to energy services*) and 7.2 (*renewable energy*) both make up 19%. This indicates that TCIs often focus on research and technology transfer in the field of energy. Under SDG 16 on peace, justice and strong institutions, only targets 16.6 (*effective institutions*; addressed by four initiatives) and 16.3 (*rule of law*; addressed by one initiative) show interlinkages with TCIs. For both SDG 3 (*good health and well-being*) and SDG 4 (*quality education*),

we found that the analyzed initiatives link to only one target each, being target 3.8 (*universal health coverage*; addressed by one initiative) and target 4.7 (*provide learners with knowledge and skills to promote sustainable development*; addressed by two initiatives), respectively.

Network analysis

To advance our analysis and visualize the results, we used network analysis techniques to examine the data. An interactive version of this network can be accessed online.[8] Figure 5 outlines the overall structure of the network, comprising two sets of nodes (SDGs at the goal and target level and TCIs).[9] The edges represent thematic interlinkages between TCIs and the SDGs. The network includes 158 nodes (16 goals, 71 targets and 71 initiatives) out of 258 possible nodes (17 goals, 169 targets and 72 initiatives). Isolates, which are nodes that are not connected to other nodes, have been filtered out. On average, every node is connected to 8.9 other nodes (see supplementary material A1a). However, there is a high variance in the number of connections that the nodes have, which is represented by the size of the nodes in Fig. 5. In the network, linked nodes are attracted to each other and non-linked nodes are pushed apart, thereby emphasizing complementarities.

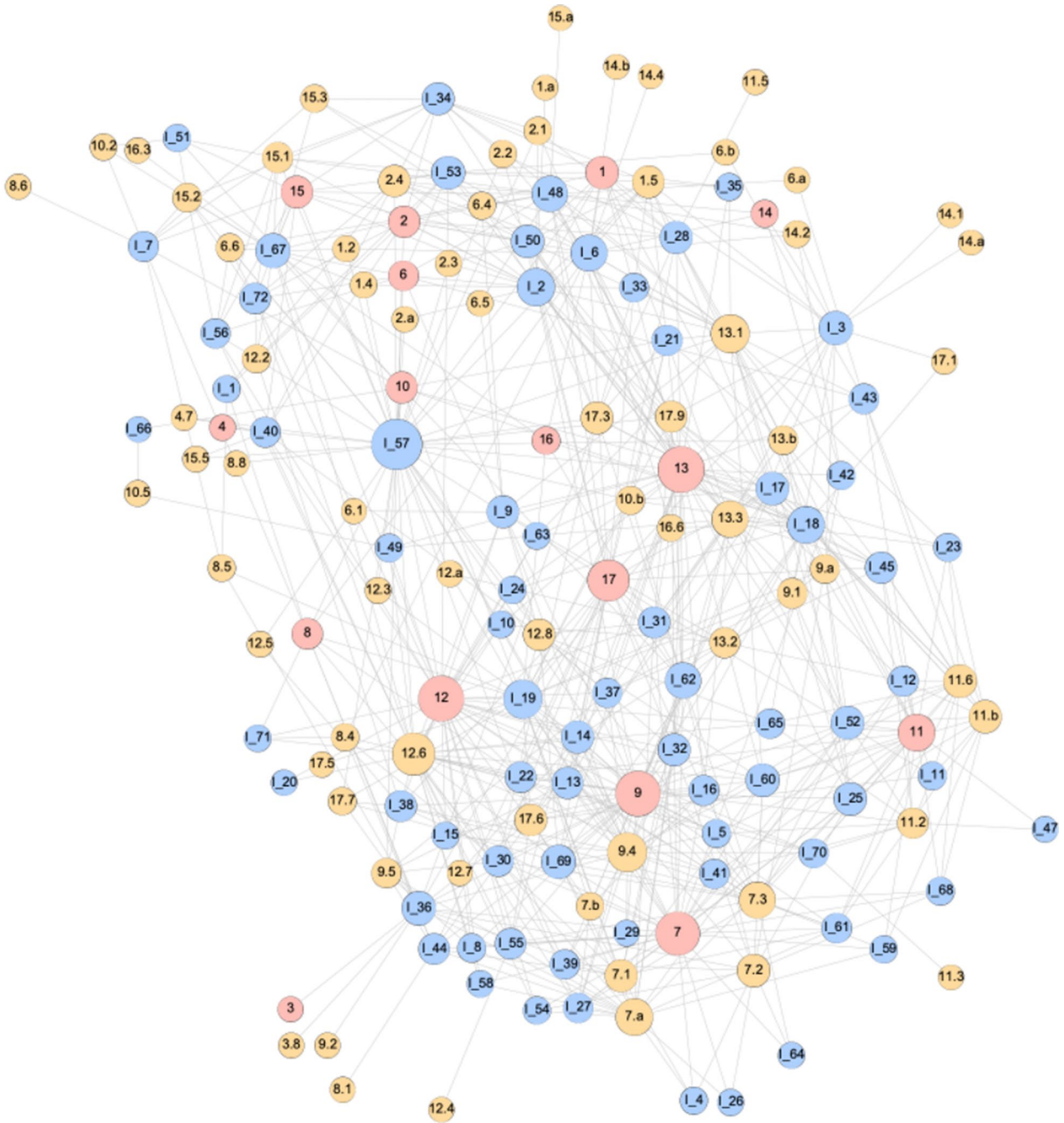
SDG 17 (*partnerships for the goals*) is located at the center of the network. This indicates that this goal is highly synergistic; TCIs address SDG 17 in combination with a wide range of other SDGs. The network analysis thus corroborates the claim by several scholars that SDG 17 is a cross-cutting goal that supports the implementation of all other goals (Le Blanc 2015; Waage et al. 2015). As expected, SDG 13 on climate action is located near SDG 17 in the central area of the network. It shows the highest degree centrality within the network (35), connecting to 35 initiatives. The results also show high degree centrality for SDGs 12 (*responsible consumption and production*; 34), 9 (*industry, innovation and infrastructure*; 33) and 7 (*affordable and clean energy*; 31), highlighting priority areas of the TCIs.

Looking at the position of the initiatives in the network helps to identify functional interactions between the SDGs through the climate actions of TCIs. For example, initiatives that are grouped between SDGs 12 (*responsible consumption and production*), 9 (*industry, innovation and infrastructure*) and 7 (*affordable and clean energy*) mainly concern climate actions in the private sector; they typically have a particular focus on retrofitting industries and promoting cleaner, more efficient energy use. For example, the initiative *United for Efficiency* (I_69) aims to support "emerging economies to switch their markets to energy-efficient products" (Climate Initiatives Platform 2019c) by engaging with manufacturers of appliances and equipment, such as refrigerators, lighting and air conditioners. Additionally, initiatives located between SDG 7 (*affordable and clean energy*), 9 (*industry, innovation and infrastructure*) and 11 (*sustainable cities and communities*) often relate to climate actions in urban areas, particularly energy efficiency in urban transportation. At the upper part of the network, many initiatives are centered between SDG 2 (zero *hunger*), 6 (*clean water and sanitation*), 1 (no *poverty*) and 14 (*life below water*). Most of these initiatives are concerned with resilience-building and sustainable practices in the aqua- and agricultural sectors, focusing on smallholders and the most vulnerable parts of the population. Interestingly, however, while the network reveals strong functional interlinkages between the SDGs that address water- and food-related topics, it does not support the often-cited water-energy-food nexus, with SDG 7 (*affordable and clean energy*) placed at the other end of the network. This tends to corroborate the argument of some scholars that governance arrangements across these three potentially highly synergetic sectors still remain fragmented (Weitz et al. 2017).

Scholars rarely analyze multi-mode networks (Fig. 5) without transforming them into one-mode networks, which include only one type of nodes. This process, called projection, is important for a more in-depth analysis because most network measures are solely defined for one-mode networks (Opsahl, 2013). Figures 6 and 7 depict projected networks. In both of these projected networks, SDGs or targets that are addressed by the same initiative(s) are shown as being linked. SDGs which are connected through a strong edge are arguably synergistic because they are often addressed jointly. In Fig. 6, the strongest connection exists between SDG 9 (*industry, innovation and infrastructure*) and SDG 7 (*affordable and clean energy*), with 21 climate initiatives proposing actions related to both themes. A sub-group of SDGs that appears in the shape of a pentagon (i.e., SDG 7, 9, 11, 12, 13 and 17) is particularly well connected. SDG 9 (*industry, innovation and infrastructure*) is at the center of the pentagon, indicating that many frequently addressed SDGs are synergistic with this goal. These projected networks suggest that infrastructure is a cross-cutting theme that ties the SDGs closer together; SDG 9 relates to many other goals, such as SDGs 7 (e.g., energy infrastructure), 11 (e.g., urban infrastructure) and 12 (e.g., waste infrastructure). This corroborates findings of previous research suggesting that infrastructure-related goals and targets show great synergistic potential to achieve the SDGs (Adshead et al. 2019; Waage et al. 2015). Additionally, SDGs 7, 8, 9 and 17 have

[8] See https://kumu.io/-/202345#map-UsyuvvlU

[9] We apply different colors to the SDGs and targets to increase the readability of the figure even though they belong to the same set of nodes in this two-mode network.



SDG Abbreviation

1. No poverty
2. Zero hunger
3. Good health and well-being
4. Quality education
5. Gender equality
6. Clean water and sanitation
7. Affordable and clean energy
8. Decent work and economic growth
9. Industry, innovation and infrastructure
10. Reduced inequalities
11. Sustainable cities and communities
12. Responsible consumption and production
13. Climate action
14. Life below water
15. Life on land
16. Peace, justice and strong institutions
17. Partnerships for the goals

the highest betweenness centrality and eigenvector centrality in the network (supplementary material S1b). This underlines that these SDGs function as connectors between pairs of otherwise unconnected SDGs, while also being connected to many other important SDGs in the network. Furthermore, these findings demonstrate the analytical value of the

◂**Fig. 5** Overall structure of the network: SDGs (red), targets (orange) and initiatives (blue). We applied a force-based layout, which means that linked nodes are attracted to each other and non-linked nodes are pushed apart, thereby emphasizing complementarities. This network consists of two sets of entities (SDGs on both a goal and target level, and initiatives). Edges only exist between nodes belonging to different sets. The size of the node indicates degree centrality: the more connections a node has with other nodes, the bigger it appears. Isolates have been filtered out (degree range ≥ 1). See Appendix A1 for the full names of the initiatives. Interested readers can explore our network interactively at: https://kumu.io/-/202345#map-UsyuvvlU

network analysis. Arranging the SDGs in a network structure reveals synergies between the goals and the importance of individual SDGs that function as connectors.

By examining the network data at a target level (Fig. 7), an even more nuanced picture emerges. Target 12.6 (*sustainable business practices*) bridges different subgroups of the network. Furthermore, target 9.4 (*sustainable infrastructures and retrofitted industries*) is synergistic with many other targets, particularly targets 12.6 (*sustainable business practices*),[10] 7.3 (*energy efficiency*)[11] and 7.a (*access to clean energy research and technology*).[12] For example, the proximity between targets 7.3 and 9.4 illustrates the strong thematic overlap between both targets. Initiatives that aim to upgrade infrastructure and retrofit industries are likely to address energy efficiency issues. Target 13.1 (*climate change adaptation*) has the highest degree centrality, meaning that it links to the highest number of other targets. The network also underlines the synergistic potential of certain pairs of SDGs, which have strong connecting ties. For instance, climate initiatives often address target 13.1 (*climate change adaptation*) in conjunction with target 1.5 (*resilience of the poor*); both targets relate to resilience-building. Lastly, Fig. 7 underlines the importance of target 17.3 (*mobilize additional financial resources*), which is located at the center of the network and has the second highest high eigenvector centrality in this network after target 17.9 (*capacity building in developing countries*). Previous research has shown that the provision of financial resources is a cross-cutting theme, which serves as a crucial enabling factor for SDG achievement at the national level (Glass and Newig, 2019). Our results tend to corroborate this finding in the realm of transnational climate actions.

[10] Fourteen initiatives address both targets in their actions.

[11] Twelve initiatives address both targets in their actions.

[12] Nine initiatives address both targets in their actions.

Discussion

Our results demonstrate that activities set out in TCIs have a high potential to contribute to the achievement of the SDGs. Functional interactions between climate actions and the SDGs are particularly prominent in the areas of energy (SDG 7), infrastructure (SDG 9) and consumption and production (SDG 12). Since the TCIs we analyzed usually relate to several SDGs in their proposed actions, it is clear that TCIs can generate several co-benefits simultaneously. Our discussion of the results proceeds in three steps. First, we discuss the role of transnational actors in the joint implementation of the two post-2015 agendas and detail associated challenges and opportunities. Second, we relate our findings to previous research by illustrating how climate initiatives by non-state actors address both agendas jointly in comparison to state-led actions (i.e., NDC-SDG linkages). Third, we briefly reflect on the strengths and weaknesses of our methodological approach.

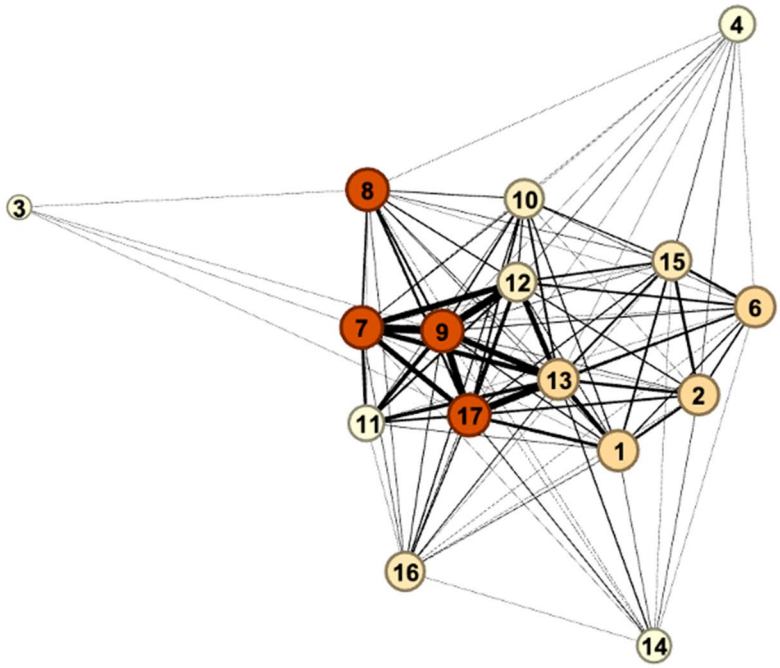
First, our results illustrate that non-state actors can perform climate actions that contribute to meeting the objectives of both post-2015 agendas. While the primary focus of state actors arguably lies at the implementation of the agendas at the national level, transnational multi-stakeholder initiatives can facilitate the exchange of information and experiences across national borders. Since transnational initiatives can target specific stakeholder groups (e.g., Adaptation for Smallholder Agriculture Programme[13]), specific sectors (e.g., Life Beef Carbon Initiative[14]), specific problem areas (e.g., remove commodity-driven deforestation[15]) and specific regions (e.g., Clean Energy Corridors in Africa[16]), they can transfer financial, human, knowledge and material resources to participants and beneficiaries who are located in geographically distant places. Thus, TCIs can bring together actors from various organizations and locations who work on similar issues. In doing so, TCIs facilitate mutually beneficial relationships by pooling different actors' capacities and expertise regarding the achievement of a low-carbon and climate-resilient development. Transnational governance arrangements are constantly increasing, which is well illustrated by the fact that the number of cooperative initiatives registered at the NAZCA platform almost doubled since we retrieved our data in 2018. This demonstrates that responses

[13] See https://climateaction.unfccc.int/views/cooperative-initiative-details.html?id=4

[14] See https://climateaction.unfccc.int/views/cooperative-initiative-details.html?id=41

[15] See https://climateaction.unfccc.int/views/cooperative-initiative-details.html?id=71

[16] See https://climateaction.unfccc.int/views/cooperative-initiative-details.html?id=19



SDG Abbreviation

1. No poverty
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7. Affordable and clean energy
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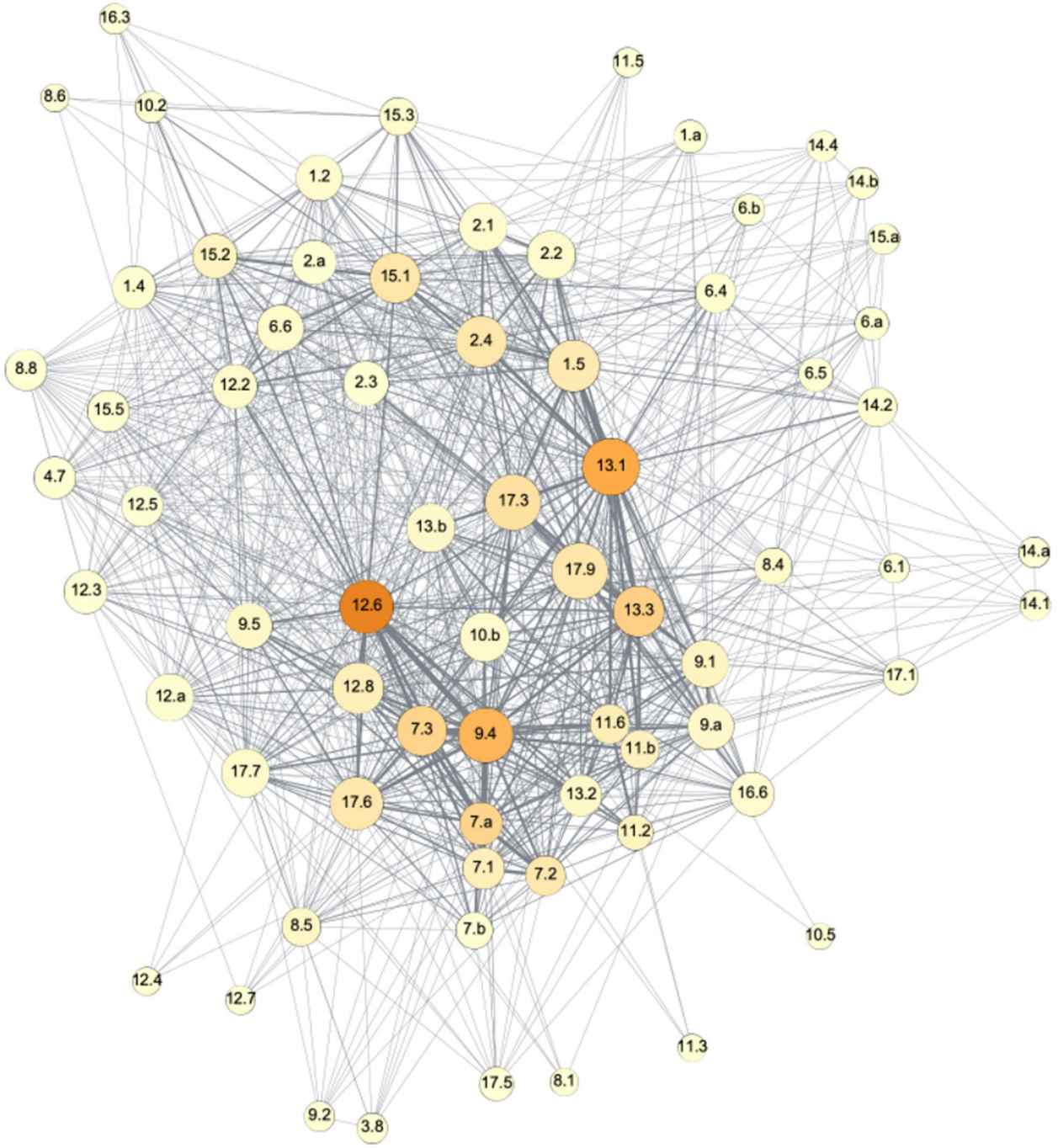
9. Industry, innovation and infrastructure
10. Reduced inequalities
11. Sustainable cities and communities
12. Responsible consumption and production
13. Climate action
14. Life below water
15. Life on land
16. Peace, justice and strong institutions
17. Partnerships for the goals

Fig. 6 Links between the SDGs through TCIs. We applied a force-based layout. The color of the nodes indicates betweenness centrality: the darker the node, the more often this node lies on the shortest path between two other nodes. Nodes with a high betweenness centrality connect pairs of other nodes that would otherwise not be able to reach one another. The thicker the edge between two nodes, the more often initiatives address this pair of SDGs jointly. The network metrics can be found in supplementary material (S1)

to pressing societal challenges like climate change are not limited to public policy and state-led actions, but increasingly include activities by a multitude of public, private and civil society actors.

However, the phrasing of several SDGs and targets suggests that actions concerning certain development goals only concern the state and do not apply to non-state or subnational actors. The only explicit reference to businesses, for example, can be found in target 12.6, which encourages companies to adopt sustainable practices. Hajer et al. (2015, p. 1652) criticize the SDGs for following a logic of "cockpitism", which refers to the perception that top-down steering by governments and intergovernmental organizations can solve global problems. While references to domestic policy-making and implementation in the SDGs do not exclude the possibility of involving other stakeholders, at present, the responsibilities, capabilities and interests of subnational and non-state actors find only limited recognition in the Agenda 2030. Mainstreaming the contribution of non-state actors into specific targets could lead to an increased sense of responsibility and accountability among various stakeholders. For example, targets dealing with the means of implementation (e.g., target 1.a, 1.b) could differentiate between stakeholder groups so as to convey a strong sense of ownership, responsibility and accountability. At the national level, governments could encourage inclusivity, accountability and transparency in SDG implementation efforts by establishing a recurrent review process involving all stakeholders.

Our results indicate that some SDGs show greater potential for alignment with climate actions than others based on their stronger functional linkages with climate change. While some SDGs have inherent connections with the climate agenda, such as target 7.2 (*renewable energy*), other SDGs require deliberate decisions and actions if they are to be mainstreamed in climate initiatives, such as target 4.7 (*ensure that all learners acquire the knowledge and skills needed to promote sustainable development*). However, we do not argue that TCIs should address all SDGs equally, or that some SDGs should be prioritized. It might be worth exploring why TCIs address some SDGs only marginally,



SDG Abbreviation

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13. Climate action
14. Life below water
15. Life on land
16. Peace, justice and strong institutions
17. Partnerships for the goals

Fig. 7 Links between the SDG targets through initiatives. We applied a force-based layout. The color of the nodes indicates betweenness centrality: the darker the node, the more often this node lies on the shortest path between two other nodes. Nodes with a high betweenness centrality connect pairs of other nodes that would otherwise not be able to reach one another. In our calculation of this metric, all edge weights are considered equal. The size of the node denotes degree centrality: the more connections a node has with other nodes, the bigger it appears. The network metrics can be found in supplementary material (S1)

like SDGs 3 (*good health and well-being*), 4 (*quality education*) and 5 (*gender equality*).

Furthermore, it is challenging to avoid the duplication of efforts or conflicting activities between both post-2015 agendas. Considering the multitude of institutions involved in the climate change and sustainable development regime complexes, as well as the high number of climate initiatives registered on the NAZCA platform, it is important to find mechanisms through which actors can coordinate their actions to capitalize on each other's work. This is particularly important in view of the limited human and financial resources, and a diverse pool of knowledge and capabilities that often remains untapped due to a lack of cooperation and integration (UNFCCC 2017). The growing awareness for the need to connect both agendas has led to concrete efforts to promote interlinkages between them. For example, the United Nations Department of Economic and Social Affairs (UN DESA) and the UNFCCC Secretariat convened a multi-stakeholder conference entitled "Strengthening Synergies between the Paris Agreement and the 2030 Agenda for Sustainable Development" in 2019, inviting participants to discuss joint implementation efforts (United Nations 2019). Additionally, one can filter the climate actions registered at the NAZCA platform according to different topics, such as transport or water. Likewise, at the CIP database, actors can now indicate whether their efforts relate to the SDGs.[17] These examples illustrate that global governance institutions like the UNFCCC increasingly try to map the TCI landscape, cluster them according to various themes or SDGs, and organize targeted events to create awareness about the interlinkages between climate actions and sustainable development.

Second, we gained additional insights when comparing our results to existing findings about the interlinkages between national state-led climate actions and the SDGs. This is particularly interesting, as non-state actions are increasingly acknowledged as to fill gaps in the existing climate governance regime (Andonova et al. 2017; Hsu et al. 2016; Tosun and Schoenefeld, 2017) not solely in scientific debates, but also by the UN and UNFCCC, as demonstrated by the fact that they provide platforms and register initiatives under the "Partnerships for SDGs" and "NAZCA" databases (Chan et al. 2019). By implementing projects across sectors and borders, non-state actors can initiate climate actions in areas that are beyond the reach of national governments. As the UNFCCC Secretariat highlights, "in many cases, the private sector, NGOs and civil society have a part to play in pursuing the [two] agendas, particularly in areas where the government actors may lack the will or capacity" (UNFCCC 2017, pp. 17–18). Given the rather "soft" governance functions assumed by non-state actors described earlier, the question arises whether TCIs simply reproduce the pattern of alignment between both agendas at the state level, or whether they actually complement these actions. To answer this question, we compared our findings to the results of a study that analyzed NDC-SDG connections (Brandi et al. 2017b). That study used a very similar methodology, as Brandi et al. (2017a) also employed content analysis to identify the thematic linkages between state-led climate actions and the SDGs. The main difference between that study and our research here is the number of climate actions that were analyzed. Brandi et al. (2017b) identified 7,080 climate actions from 161 NDCs (for details on methodology, see Brandi et al. 2017a), while we counted 258 thematic linkages between 72 climate actions and the SDGs. However, the results of both studies can arguably be compared, particularly when one focuses on the relative distribution of SDGs addressed across all climate actions. Figure 8 shows that transnational climate actions have the most interlinkages with SDG 13 (*climate action*). In contrast, Brandi et al. (2017b) found that most climate activities set out in the NDCs connect with SDG 7 (*affordable and clean energy*). Both studies show that SDG 5 (*gender equality*) and SDG 16 (*peace, justice and strong institutions*) are very weakly aligned with climate actions, and SDGs 4, 8, 11 and 14 demonstrate a relatively similar degree of alignment compared to other SDGs.

A striking difference between both studies concerns the interlinkages between climate actions and SDG 12 regarding responsible consumption and production. While national climate actions are only weakly connected to SDG 12, this goal is most often addressed by transnational climate actions. Thus, TCIs appear to fill a governance gap in mobilizing consumers and producers to take action. At the target level, state actors mainly address target 12.4 (*environmentally sound management of chemicals and all wastes*) and 12.5 (*reducing waste generation*) (Brandi et al. 2017b), while TCIs take a complementary role by focusing on target 12.6 (*sustainable business practices*). We further found that, relatively speaking, a greater number of TCIs address SDG 9 (*industry, innovation and infrastructure*) compared to actions at the national level. While both transnational and national climate actions most often relate to target 9.4 (*upgrade infrastructure and retrofit industries*) and target 9.1 (*resilient infrastructure*), TCIs complement actions at the national level with regard to target 9.5 (*research and innovation*). SDG 10 (*reduced inequalities*) constitutes a third issue area for which we find greater interlinkages with climate actions at the transnational level. While NDC actions prioritize the social, economic and political inclusion of all

[17] However, this data was not available when we retrieved our data from the CIP platform. Additionally, this self-reported data is arguably less reliable than our dataset because it may be based on a simple "box-ticking" approach that carries the risk of overrepresenting some SDGs.

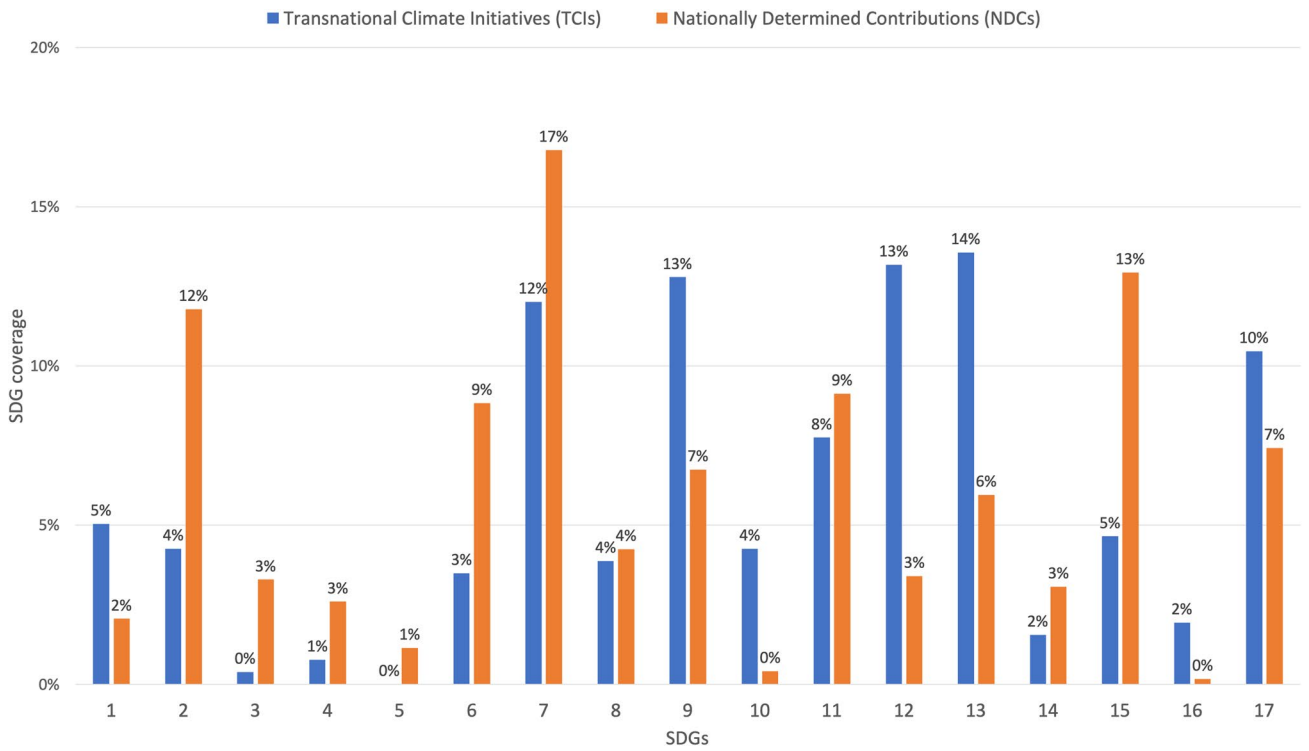


Fig. 8 Interlinkages between transnational climate actions and the SDGs (own data) compared to interlinkages between national climate actions and the SDGs (based on data from Brandi et al. 2017b). The absolute numbers can be found in supplementary material S2

(target 10.2) and social protection policies (target 10.4), TCIs add to these efforts by encouraging financial flows and foreign direct investment to the world's poorest regions (target 10.b) and by contributing to improved regulation and monitoring of financial markets (target 10.5).

Furthermore, TCIs show a greater focus on resilience and adaptation measures than state-led climate actions. While the climate actions formulated under the NDCs show a relatively weak connection to SDG target 13.1 (*climate change adaptation and resilience*) and target 1.5 (*resilience of the poor*) (Brandi et al. 2017b), TCIs align well with these two targets. In contrast, national climate actions connect better with SDG 15, particularly target 15.2 (*sustainable forest management and halting deforestation*). This is surprising because transnational initiatives have proliferated in the forestry sector in recent decades (Overdevest and Zeitlin, 2014). Potential reasons for this bolstered role of state actors in addressing SDG 15 could be the principle of national sovereignty over forest exploitation (Overdevest and Zeitlin, 2014) and the fact that private governance initiatives like certification schemes for forestry products have not been registered at the NAZCA platform. The last major difference is that NDCs address SDG 2 (*zero hunger*) more often than transnational initiatives. Nonetheless, at the target level, target 2.4 (*sustainable agricultural production systems*) is the most frequently addressed target in both international and transnational climate actions. In sum, our findings indicate that transnational actors complement state-led interventions in climate and sustainability governance. Our study supports the argument by Andonova et al. (2017, p. 253), who explain that "we should understand national policies and transnational governance as complements, rather than competitors"; and generally, further strengthens the yet growing optimism about the role of transnational and non-state actions in global climate and sustainability governance (Chan et al. 2019).

The third and last point of our discussion is a reflection on the strengths and weaknesses of our methodological approach, particularly the use of network analysis techniques. The network perspective provides easily accessible information about (1) which SDGs function as connectors of other pairs of SDGs, (2) which SDGs and initiatives cluster in sub-groups and (3) which SDGs show the greatest potential for joint implementation due to thematic overlaps. In addition, viewing the SDGs as a network can help to avoid retreating into silo particularism, which involves failing to account for the crosscutting nature of many SDGs. Aligning TCIs and the SDGs requires identifying the actual or potential co-benefits between climate actions and particular SDGs, while at the same time acknowledging the network structure of the SDGs. Not only does the network approach

help to recognize synergistic SDGs, but it can also help identify which climate initiatives could benefit from collaboration and exchange. Therefore, network analysis is a valuable analytical tool for researchers and practitioners alike. For example, an egocentric network on specific targets can reveal which initiatives will likely benefit from cooperation with one another, e.g., through learning about best practices and pitfalls of their peers (see Appendix A3 for example). Finally, making use of interactive online platforms to present network data provides a valuable opportunity to communicate scientific research results with practitioners, and to encourage scholars and policy-makers to explore the complex system of interlinkages between climate actions and the broader Agenda 2030.[18]

Our analysis has several limitations. First, we only analyzed cooperative climate initiatives, which represent just a small fraction of all climate actions registered on the NAZCA platform. In total, several thousand climate actions by different countries, cities, regions, companies, investors and organizations are listed on the NAZCA platform. Since this study focuses on transnational governance arrangements, we limited our analysis to cooperative initiatives involving a diverse set of non-state actors. Further, we assumed that the initiatives would show greater heterogeneity with respect to SDG linkages than initiatives of single actor groups, such as cities, which might be centered around particular SDGs like SDG 11 (*sustainable cities and communities*). Future studies could explore and compare the SDG networks that underlie climate actions by different groups of actors or conduct a social network analysis of the different types of actors involved in such collaborative arrangements. Second, since the NAZCA platform and the Climate Initiatives Platform rely on self-reported information, the level of detail and accuracy of data may vary between different initiatives. The information on some initiatives may be updated more regularly, accurately and extensively than others. Third, our methodological approach cannot capture trade-offs between the SDGs. It focuses on how initiatives thematically overlap and identifies potential synergies, but it does not determine where overlaps are missing or where they result in disruptive trade-offs. Previous research has shown that, while there are far more synergies between climate action and the SDGs, there are also trade-offs that nevertheless have the potential to block climate action or delivery on the SDGs (Nerini et al. 2019). For example, if climate policies are not properly designed, they can exacerbate inequality and poverty (SDG 1.1 and 1.2), and hamper a just transition to sustainable agriculture (SDG 2.3 and 2.4) and industrialization (SDG 9.2) (Nerini et al. 2019). While it goes beyond the scope of our analysis to assess such trade-offs, it is important to take into account that these are likely to occur between climate action TCIs and the SDG. Network analysis techniques can be used to study constraining or counteractive interactions between SDGs, but doing so requires expert judgments about the scoring of interactions (Weitz et al. 2018). Lastly, our network approach does not allow one to make any inferences about the type of a positive interaction between SDGs, which have been conceptualized by Nilsson et al. (2016) as enabling, reinforcing or indivisible relations.

[18] Interested readers can explore our network at: https://kumu.io/-/202345#map-UsyuvvlU

Conclusion

Transnational climate actions can promote wider social, economic and environmental development goals. Out of the 72 multi-stakeholder climate initiatives that we analyzed in this study, 71 initiatives showed thematic interlinkages with the SDGs in their proposed actions. The strongest links exist between TCIs and SDG 13 (*climate action*), followed by SDGs 12 (*responsible consumption and production*), 9 (*industry, innovation and infrastructure*), 7 (*affordable and clean energy*), and 17 (*partnerships for the goals*). While TCIs barely address SDGs 3 (*good health and well-being*) and 4 (*quality education*), TCIs do not cover SDG 5 (*gender equality*) at all. Thus, climate actions around sustainable production and consumption, energy, and industry and infrastructure appear to be key for combating climate change while simultaneously fostering sustainable development.

Applying network analysis techniques enabled us to go beyond simply quantitatively describing which SDGs are covered by transnational climate actions and to investigate the interactions between individual SDGs. Up until now, social science research has usually employed network analysis for studying social or citation networks. We demonstrate that network analysis techniques can yield fruitful insights when applied to new contexts, such as interlinkages between the SDGs created through transnational climate actions. Our network visualizations highlight the synergistic relations between several SDGs, particularly SDG 9 (*industry, innovation and infrastructure*), which is often addressed in combination with SDGs 7 (*affordable and clean energy*), 11 (*cities*), 12 (*responsible consumption and production*), 17 (*partnerships for the goals*) and 13 (*climate action*). The network reveals that SDG 9 is highly synergistic with many other frequently addressed SDGs. This is not evident when only considering the descriptive statistical analysis regarding SDG coverage. The network perspective helps to break down complex interconnections and makes information easily accessible, comprehensible and useful for both scholars and policy-makers. It demonstrates which initiatives could benefit from sharing information and best practices with one

another due to their close location in the network, which implies some thematic overlaps of their actions.

The challenges for aligning climate actions and the SDGs stem from the need to connect actors, institutions, themes and sectors. Considering the different capacities and responsibilities of state and non-state actors, coordinated actions must take place across geographic and knowledge borders. Even though the wording of some SDG targets suggests that actions in certain issue areas fall into the sole responsibility of state actors, one must acknowledge that non-state actors can play an important complementary role in achieving the state-led global Paris Agreement and Agenda 2030. TCIs generally assume rather soft governance functions within the climate and sustainability regime complex, such as, inter alia, knowledge sharing or mobilization of public engagement. Political decision-makers should thus be encouraged to design open and inclusive policy-making, implementation and monitoring processes to harness the complementary potential between state and non-state actor contributions. Mutual learning, as well as sharing of resources and best practices between different stakeholder groups could then contribute to a more effective and efficient implementation of the Paris Agreement and the SDGs. Our findings present a first step in raising awareness about how TCIs can contribute to the achievement of the SDGs. In particular, the presence of common themes in both agendas provides a major opportunity to align actions that address climate change and further sustainable development. By pursuing actions that address common themes, such as resilience, energy or infrastructure, policy-makers and practitioners, can contribute to a joint implementation of both agendas.

There are several questions that remain unaddressed. A detailed analysis of the actors involved in TCIs could be further expanded to scrutinize power relations, interest politics and geographic (im)balances in the context of global environmental and sustainability governance. Another question worth investigating is whether transnational initiatives effectively meet their commitments and are held accountable for achieving their objectives. The NAZCA platform mobilizes a broad set of actors, covering issues from food waste to urban transportation, thus making it difficult to evaluate their performance against a common yardstick. Future research could examine whether TCIs actually provide the co-benefits they set out to achieve. Equally relevant is the counter question: when implementing transnational climate actions, what trade-offs with regards to other sustainability goals are made? While this article focuses on synergies, future research should also study the disruptive connections between climate actions and the SDGs. Extending the analysis by clustering TCIs according to specific themes, such as energy or resilience, might further yield interesting findings. A particularly relevant task for future research is to demonstrate how the interlinkages between weakly or not covered SDGs, such as SDG 5 (*gender equality*), can be strengthened. Lastly, many TCIs are not formally integrated into NAZCA. Follow-up research could involve a broader sample size and include additional initiatives that are not covered by the NAZCA registry.

This article represents an effort to consider climate actions within and across sectors of sustainable development and as a complex series of interlinkages. It encourages discussions, critical reflections and engagement with the two post-2015 agendas at the transnational level. Our findings contribute towards identifying entry points to jointly govern, implement and achieve both agendas to ensure a carbon-neutral, climate-resilient and sustainable global development path.

Appendix A1: Cooperative NAZCA initiatives

Code used in network	Full name
I_1	4/1000 Initiative—Soils for Food Security and Climate
I_2	Adaptation for Smallholder Agriculture Programme (ASAP)
I_3	Adaptation of West African Coastal Areas
I_4	Africa Renewable Energy Initiative
I_5	Airport Carbon Accreditation (ACI)
I_6	Blue Growth Initiative
I_7	Bonn Challenge–Landscape Restoration
I_8	Breakthrough Energy Coalition
I_9	Business Alliance for Water and Climate
I_10	Business Leadership Criteria on Carbon Pricing
I_11	C40 Clean Bus Declaration
I_12	Carbon Neutral Cities Alliance
I_13	Caring for Climate
I_14	CCAC: Phasing Down Climate Potent HFCs / HFCs Initiative
I_15	CCAC: Oil and Gas Methane Partnership
I_16	CEM: Global Lighting Challenge
I_17	Cities and regions 5-year vision
I_18	Cities Climate Finance Leadership Alliance (CCFLA)
I_19	Clean Energy Corridors in Africa
I_20	Climate Change Reporting and Fiduciary Duty

Code used in network	Full name
I_21	Climate Risk and Early Warning Systems Initiative
I_22	Collaborative Climate Action Across the Air Transport World
I_23	Compact of Mayors
I_24	Corporate Engagement in Climate Policy
I_25	Covenant of Mayors for Climate & Energy
I_26	Divest-Invest Global Movement
I_27	En.lighten Initiative
I_28	Food Security Climate Resilience Facility
I_29	Global Alliance for Buildings and Construction
I_30	Global Alliance for Clean Cookstoves
I_31	Global Fuel Economy Initiative (GFEI)
I_32	Global Geothermal Alliance
I_33	Global Resilience Partnership
I_34	Great Green Wall for Sahara and the Sahel Initiative (GGWSSI)
I_35	InsuResilience Climate Risk Insurance Initiative
I_36	International Solar Alliance
I_37	International Zero-Emission Vehicle Alliance (ZEV Alliance)
I_38	LCTPi Cement Sustainability Initiative
I_39	LCTPi Renewables
I_40	Life Beef Carbon Initiative
I_41	Low-Carbon Sustainable Rail Transport Challenge
I_42	Maritime Regions in Action against Climate Change
I_43	Megacities Alliance for Water and Climate
I_44	Mission Innovation
I_45	MobiliseYourCity Partnership
I_46	Montreal Carbon Pledge
I_47	Paris Declaration on Electromobility on Climate Change
I_48	Paris Pact on Water and Adaptation
I_49	Portfolio Decarbonization Coalition
I_50	Promotion of Smart Agriculture Towards Climate Change
I_51	Protection of 400 million Hectares of Forests
I_52	Public Transport Declaration on Climate Leadership (UITP)
I_53	R4 Rural Resilience Initiative
I_54	RE100
I_55	Refrigerants, Naturally!
I_56	Remove commodity-driven deforestation
I_57	Save Food initiative
I_58	Science Based Targets initiative
I_59	SE4All: Building Efficiency Accelerator
I_60	SE4All: Global Energy Efficiency Accelerator Platform (Main)
I_61	SE4All: District Energy Accelerator
I_62	SIDS Lighthouses Initiative
I_63	Smart Risk Investing (SRI)
I_64	States and Regions Annual Disclosure
I_65	Taxi4SmartCities
I_66	The 1-in-100 Initiative
I_67	The New York Declaration on Forests
I_68	Under 2 MOU
I_69	United for Efficiency
I_70	Urban Electric Mobility Initiative
I_71	WWF Climate Savers
I_72	Zero Deforestation Commitments from Commodity Producers and Traders
Excluded	Global Green Freight Action Plan[b]
Excluded	Industry Energy Efficiency Accelerator[a]
Excluded	Lima Challenge[a]
Excluded	Municipal Solid Waste Initiative[a]
Excluded	Statement by Financial Institutions on Energy Efficiency Finance[a]

Source: NAZCA (2018a; b). Data retrieved in April 2018

[a]Data is unavailable on Climate Initiatives Platform (2018a, 2019a; b, b, c)

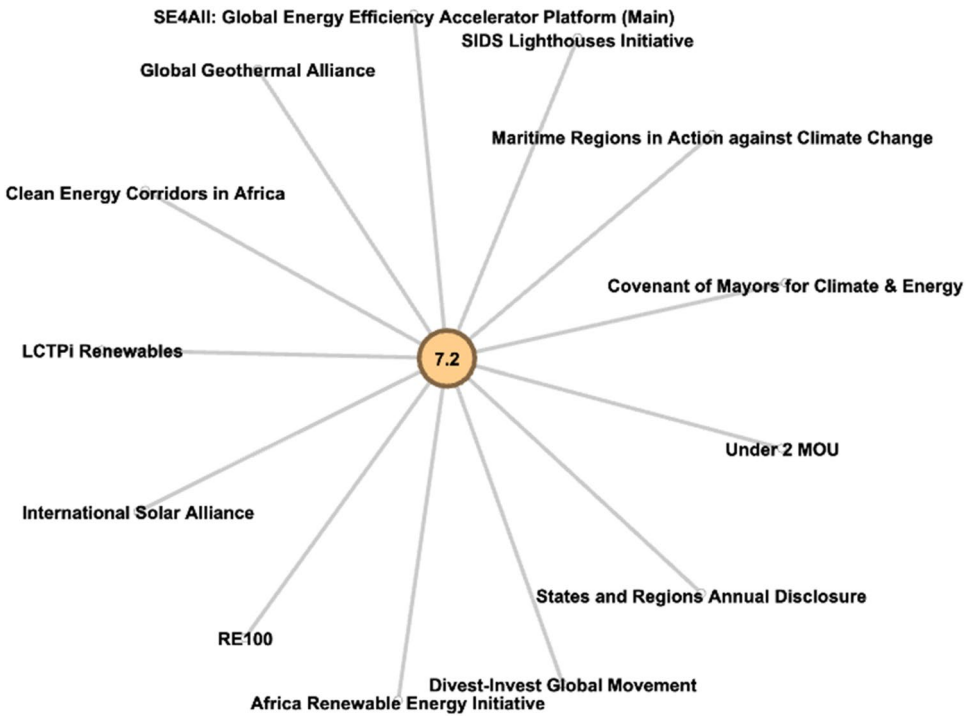
[b]Data is incomplete on Climate Initiatives Platform (2018a, 2019a; b, b, c)

Appendix A2: Illustrative examples of text passages that are coded for their interlinkages with the SDGs

Example	Target
"Scale up the Africa's renewable energy potential to achieve at least 10 GW of new and additional renewable energy generation capacity by 2020 and at least 300 GW by 2030 […] The overall goal of AREI is to produce 300 GW of electricity for Africa by 2030 from clean, affordable and appropriate forms of energy"	Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all Target 7.1: By 2030, ensure universal access to affordable, reliable and modern energy services Target 7.2: By 2030, increase substantially the share of renewable energy in the global energy mix
"Restore 150 million hectares of the world's deforested and degraded lands by 2020"	Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss Target 15.1: By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements Target 15.2: By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally Target 15.3: By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world
"A company joining the CCAC Oil & Gas Methane Partnership voluntarily commits itself to survey for nine core sources that account for the bulk of methane emissions in typical upstream operation […]"	Goal 12. Ensure sustainable consumption and production patterns Target 12.6: Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle

Appendix A3: Egocentric network of SDG target 7.2 regarding increasing the share of renewable energy in the global energy mix

The TCIs involved in the network will likely benefit from learning about best practices and pitfalls of their peers because they all work on a similar topic.



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Data availability We invite interested readers to explore our network at: https://kumu.io/-/202345#map-UsyuvvlU

Declarations

Conflict of interest The authors declare that they have no competing interests.

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Supplementary Materials

S1. Network metrics.

S1a. Network metrics of figure 5 (nodes).

Node	Category	Degree
1	SDG goal	13
1.2	SDG target	3
1.4	SDG target	3
1.5	SDG target	12
1.a	SDG target	1
2	SDG goal	11
2.1	SDG target	5
2.2	SDG target	5
2.3	SDG target	3
2.4	SDG target	11
2.a	SDG target	2
3	SDG goal	1
3.8	SDG target	1
4	SDG goal	2
4.7	SDG target	2
6	SDG goal	9
6.1	SDG target	1
6.4	SDG target	4
6.5	SDG target	2
6.6	SDG target	5
6.a	SDG target	2
6.b	SDG target	2
7	SDG goal	31
7.1	SDG target	13
7.2	SDG target	13
7.3	SDG target	19
7.a	SDG target	20
7.b	SDG target	5
8	SDG goal	10
8.1	SDG target	1
8.4	SDG target	5
8.5	SDG target	4
8.6	SDG target	1
8.8	SDG target	1
9	SDG goal	33
9.1	SDG target	9
9.2	SDG target	1
9.4	SDG target	24
9.5	SDG target	8
9.a	SDG target	7
10	SDG goal	11
10.2	SDG target	3
10.5	SDG target	2
10.b	SDG target	6
11	SDG goal	20
11.2	SDG target	10
11.3	SDG target	1
11.5	SDG target	1
11.6	SDG target	14
11.b	SDG target	13
12	SDG goal	34
12.2	SDG target	6
12.3	SDG target	2
12.4	SDG target	1
12.5	SDG target	2
12.6	SDG target	29
12.7	SDG target	1
12.8	SDG target	11
12.a	SDG target	3
13	SDG goal	35
13.1	SDG target	22
13.2	SDG target	9
13.3	SDG target	19
13.b	SDG target	7
14	SDG goal	4
14.1	SDG target	1
14.2	SDG target	4
14.4	SDG target	1
14.a	SDG target	1
14.b	SDG target	1
15	SDG goal	12
15.1	SDG target	10
15.2	SDG target	7
15.3	SDG target	5
15.5	SDG target	2
15.a	SDG target	1
16	SDG goal	5
16.3	SDG target	1
16.6	SDG target	4
17	SDG goal	27
17.1	SDG target	2
17.3	SDG target	12
17.5	SDG target	1
17.6	SDG target	12
17.7	SDG target	5
17.9	SDG target	11
I_1	Initiative	4
I_2	Initiative	21
I_3	Initiative	15
I_4	Initiative	4
I_5	Initiative	6
I_6	Initiative	19
I_7	Initiative	9
I_8	Initiative	6
I_9	Initiative	12
I_10	Initiative	4
I_11	Initiative	6
I_12	Initiative	9
I_13	Initiative	11
I_14	Initiative	13
I_15	Initiative	4
I_16	Initiative	9
I_17	Initiative	14
I_18	Initiative	20
I_19	Initiative	23
I_20	Initiative	2
I_21	Initiative	10
I_22	Initiative	10
I_23	Initiative	6
I_24	Initiative	5
I_25	Initiative	13
I_26	Initiative	3
I_27	Initiative	9

I_28	Initiative	13
I_29	Initiative	2
I_30	Initiative	10
I_31	Initiative	11
I_32	Initiative	12
I_33	Initiative	7
I_34	Initiative	12
I_35	Initiative	4
I_36	Initiative	15
I_37	Initiative	8
I_38	Initiative	11
I_39	Initiative	8
I_40	Initiative	9
I_41	Initiative	8
I_42	Initiative	6

I_43	Initiative	9
I_44	Initiative	10
I_45	Initiative	11
I_47	Initiative	2
I_48	Initiative	18
I_49	Initiative	6
I_50	Initiative	13
I_51	Initiative	5
I_52	Initiative	14
I_53	Initiative	14
I_54	Initiative	5
I_55	Initiative	10
I_56	Initiative	8
I_57	Initiative	42
I_58	Initiative	4

I_59	Initiative	5
I_60	Initiative	14
I_61	Initiative	9
I_62	Initiative	18
I_63	Initiative	4
I_64	Initiative	3
I_65	Initiative	8
I_66	Initiative	2
I_67	Initiative	16
I_68	Initiative	6
I_69	Initiative	15
I_70	Initiative	8
I_71	Initiative	4
I_72	Initiative	10

S1.b. Network metrics of Figure 6 (nodes).

Node	Category	Degree	Betweenness Centrality	Eigenvector Centrality
1	SDG goal	14	0.70404	0.978488
2	SDG goal	14	0.70404	0.978488
3	SDG goal	4	0	0.301786
4	SDG goal	11	0	0.805707
6	SDG goal	14	0.70404	0.978488
7	SDG goal	15	3.45404	1
8	SDG goal	15	3.45404	1
9	SDG goal	15	3.45404	1
10	SDG goal	13	0.281818	0.926852
11	SDG goal	11	0	0.805707
12	SDG goal	13	0.281818	0.926852
13	SDG goal	14	0.70404	0.978488
14	SDG goal	10	0	0.735544
15	SDG goal	13	0.40202	0.92198
16	SDG goal	13	0.40202	0.92198
17	SDG goal	15	3.45404	1

S1.c. Network metrics of Figure 6 (edges between nodes)

The weight of the edges indicates the number of climate initiatives which address both SDG A and B in their proposed actions.

SDG A	SDG B	Weight
1	17	9
1	16	2
1	15	6
1	14	2
1	13	12
1	12	3
1	11	2
1	10	4
1	9	4
1	8	2
1	7	1
1	6	4
1	4	1
1	2	7
2	17	6
2	16	1
2	15	8
2	14	2
2	13	8
2	12	4
2	11	1
2	10	1
2	9	2
2	8	3
2	7	1
2	6	5
2	4	2
3	17	1
3	9	1
3	8	1
3	7	1
4	17	1
4	15	2
4	13	1
4	12	2
4	10	1
4	9	1
4	8	1
4	7	1
4	6	1
6	17	3
6	16	1
6	15	7
6	14	1
6	13	6
6	12	6
6	11	1
6	10	2
6	9	3
6	8	1
6	7	1
7	17	14
7	16	2
7	15	1
7	14	1
7	13	13
7	12	16
7	11	8
7	10	3
7	9	21
7	8	5
8	17	7
8	16	2
8	15	2
8	14	1
8	13	2
8	12	4
8	11	1
8	10	3
8	9	6
9	17	18
9	16	3
9	15	2
9	14	1
9	13	16
9	12	20
9	11	11
9	10	5
10	17	6
10	16	4
10	15	4
10	13	6
10	12	4
10	11	2
11	17	6
11	16	1
11	13	10
11	12	6
12	17	10
12	16	2
12	15	6
12	13	14
13	17	19
13	16	3
13	15	6
13	14	4
14	17	3
14	16	1
14	15	1
15	17	4
15	16	1
16	17	4

S1.d. Network metrics of figure 7 (nodes)

Node	Category	Degree	Betweenness Centrality	Eigenvector Centrality
1.2	SDG target	37	27.513727	0.759375
1.4	SDG target	32	8.428773	0.704882
1.5	SDG target	47	61.362455	0.892165
1.a	SDG target	13	0	0.300667
2.1	SDG target	41	25.933236	0.839598
2.2	SDG target	41	25.933236	0.839598
2.3	SDG target	35	5.788782	0.780032
2.4	SDG target	46	51.026076	0.880431
2.a	SDG target	34	4.565916	0.768097
3.8	SDG target	9	0	0.169907
4.7	SDG target	29	0	0.68265
6.1	SDG target	7	0	0.147603
6.4	SDG target	27	14.650584	0.519181
6.5	SDG target	16	3.522044	0.319426
6.6	SDG target	38	25.35226	0.776239
6.a	SDG target	14	2.274263	0.255484
6.b	SDG target	11	1.295092	0.208108
7.1	SDG target	29	19.857632	0.552165
7.2	SDG target	26	10.273112	0.512374
7.3	SDG target	44	34.543493	0.893612
7.a	SDG target	31	30.217192	0.566158
7.b	SDG target	20	0.966308	0.427571
8.1	SDG target	5	0	0.092696
8.4	SDG target	21	15.100674	0.420523
8.5	SDG target	24	31.366753	0.436834
8.6	SDG target	5	0	0.074687
8.8	SDG target	29	0	0.68265
9.1	SDG target	39	30.851468	0.753594
9.2	SDG target	9	0	0.169907
9.4	SDG target	52	98.377178	0.960666
9.5	SDG target	37	30.38248	0.790431
9.a	SDG target	37	27.96009	0.706768
10.2	SDG target	11	2.935911	0.186208
10.5	SDG target	2	0	0.04861
10.b	SDG target	43	20.262403	0.893666
11.2	SDG target	18	5.669247	0.379221
11.3	SDG target	4	0	0.07798
11.5	SDG target	7	0	0.178655
11.6	SDG target	25	16.561581	0.486804

11.b	SDG target	24	7.040872	0.484416
12.2	SDG target	34	14.474128	0.725302
12.3	SDG target	32	6.208991	0.725182
12.4	SDG target	5	0	0.115868
12.5	SDG target	29	0	0.68265
12.6	SDG target	50	145.700459	0.910124
12.7	SDG target	7	0	0.163899
12.8	SDG target	46	33.958308	0.922536
12.a	SDG target	40	13.212011	0.857109
13.1	SDG target	56	116.049179	0.990806
13.2	SDG target	29	15.004638	0.56488
13.3	SDG target	45	93.934129	0.797374
13.b	SDG target	42	22.744212	0.87643
14.1	SDG target	9	0	0.173604
14.2	SDG target	25	17.858822	0.430646
14.4	SDG target	11	0	0.22514
14.a	SDG target	9	0	0.173604
14.b	SDG target	11	0	0.22514
15.1	SDG target	44	67.411741	0.845608
15.2	SDG target	34	24.941652	0.719447
15.3	SDG target	22	16.214586	0.427529
15.5	SDG target	29	0	0.68265
15.a	SDG target	11	0	0.222438
16.3	SDG target	9	0	0.171643
16.6	SDG target	33	19.883304	0.642975
17.1	SDG target	17	3.148989	0.33669
17.3	SDG target	54	91.543158	0.991693
17.5	SDG target	15	0	0.312665
17.6	SDG target	49	81.529703	0.927245
17.7	SDG target	41	26.716055	0.844794
17.9	SDG target	55	93.453099	1

S1.e. Network metrics of figure 7 (edges between nodes).

The weight of the edges indicates the number of climate initiatives which address both SDG target A and B in their proposed actions.

SDG target A	SDG target B	Weight
1.2	17.9	2
1.2	17.7	1
1.2	17.6	1
1.2	17.3	1
1.2	16.6	1
1.2	16.3	1
1.2	15.5	1
1.2	15.3	1
1.2	15.2	2
1.2	15.1	2
1.2	14.b	1
1.2	14.4	1
1.2	14.2	1
1.2	13.b	1
1.2	13.1	2
1.2	12.a	1
1.2	12.8	1
1.2	12.6	2
1.2	12.5	1
1.2	12.3	1
1.2	12.2	2
1.2	10.b	1
1.2	10.2	1
1.2	9.5	1
1.2	9.4	1
1.2	8.8	1
1.2	8.4	1
1.2	7.3	1
1.2	6.6	2
1.2	4.7	1
1.2	2.a	1
1.2	2.4	2
1.2	2.3	1
1.2	2.2	2
1.2	2.1	2
1.2	1.5	2
1.2	1.4	2
1.4	17.9	1
1.4	17.7	1
1.4	17.6	1
1.4	17.3	2
1.4	16.3	1
1.4	15.5	1
1.4	15.3	1
1.4	15.2	2
1.4	15.1	2
1.4	13.b	1
1.4	13.1	2
1.4	12.a	1
1.4	12.8	1
1.4	12.6	2
1.4	12.5	1
1.4	12.3	1
1.4	12.2	2
1.4	10.b	1
1.4	10.2	1
1.4	9.5	1
1.4	9.4	1
1.4	8.8	1
1.4	7.3	1
1.4	6.6	2
1.4	4.7	1
1.4	2.a	1
1.4	2.4	1
1.4	2.3	1
1.4	2.2	1
1.4	2.1	1
1.4	1.5	2
1.5	17.9	4
1.5	17.7	1
1.5	17.6	2
1.5	17.3	6
1.5	17.1	1
1.5	16.6	1
1.5	15.5	1
1.5	15.3	3
1.5	15.2	2
1.5	15.1	4
1.5	14.b	1
1.5	14.a	1
1.5	14.4	1
1.5	14.2	2
1.5	14.1	1
1.5	13.b	3
1.5	13.3	5
1.5	13.1	12
1.5	12.a	1
1.5	12.8	1
1.5	12.6	1
1.5	12.5	1
1.5	12.3	1
1.5	12.2	2
1.5	11.b	1
1.5	11.6	1
1.5	11.5	1
1.5	10.b	3
1.5	9.a	2
1.5	9.5	1
1.5	9.4	1
1.5	9.1	3
1.5	8.8	1
1.5	8.4	1
1.5	7.3	1
1.5	6.b	1
1.5	6.6	1
1.5	6.4	2
1.5	4.7	1
1.5	2.a	2
1.5	2.4	7
1.5	2.3	3
1.5	2.2	5
1.5	2.1	5
1.5	1.a	1
1.a	17.3	1
1.a	15.1	1
1.a	13.3	1
1.a	13.1	1
1.a	9.a	1

1.a	9.1	1
1.a	6.4	1
1.a	2.a	1
1.a	2.4	1
1.a	2.3	1
1.a	2.2	1
1.a	2.1	1
2.1	17.9	2
2.1	17.7	1
2.1	17.6	1
2.1	17.3	3
2.1	16.6	1
2.1	15.5	1
2.1	15.3	1
2.1	15.2	2
2.1	15.1	3
2.1	14.b	1
2.1	14.4	1
2.1	14.2	1
2.1	13.b	2
2.1	13.3	1
2.1	13.1	5
2.1	12.a	1
2.1	12.8	1
2.1	12.6	1
2.1	12.5	1
2.1	12.3	1
2.1	12.2	1
2.1	11.5	1
2.1	10.b	1
2.1	9.a	1
2.1	9.5	1
2.1	9.4	1
2.1	9.1	1
2.1	8.8	1
2.1	8.4	1
2.1	7.3	1
2.1	6.6	1
2.1	6.4	1
2.1	4.7	1
2.1	2.a	2
2.1	2.4	5
2.1	2.3	2

2.1	2.2	5
2.2	17.9	2
2.2	17.7	1
2.2	17.6	1
2.2	17.3	3
2.2	16.6	1
2.2	15.5	1
2.2	15.3	1
2.2	15.2	2
2.2	15.1	3
2.2	14.b	1
2.2	14.4	1
2.2	14.2	1
2.2	13.b	2
2.2	13.3	1
2.2	13.1	5
2.2	12.a	1
2.2	12.8	1
2.2	12.6	1
2.2	12.5	1
2.2	12.3	1
2.2	12.2	1
2.2	11.5	1
2.2	10.b	1
2.2	9.a	1
2.2	9.5	1
2.2	9.4	1
2.2	9.1	1
2.2	8.8	1
2.2	8.4	1
2.2	7.3	1
2.2	6.6	1
2.2	6.4	1
2.2	4.7	1
2.2	2.a	2
2.2	2.4	5
2.2	2.3	2
2.3	17.9	2
2.3	17.7	1
2.3	17.6	1
2.3	17.3	3
2.3	15.5	1
2.3	15.3	1

2.3	15.2	1
2.3	15.1	2
2.3	13.b	1
2.3	13.3	2
2.3	13.1	3
2.3	12.a	1
2.3	12.8	1
2.3	12.6	1
2.3	12.5	1
2.3	12.3	1
2.3	12.2	1
2.3	10.b	1
2.3	9.a	1
2.3	9.5	1
2.3	9.4	1
2.3	9.1	1
2.3	8.8	1
2.3	7.3	1
2.3	6.6	1
2.3	6.4	1
2.3	4.7	1
2.3	2.a	2
2.3	2.4	3
2.4	17.9	4
2.4	17.7	1
2.4	17.6	1
2.4	17.3	5
2.4	16.6	1
2.4	15.a	1
2.4	15.5	2
2.4	15.3	3
2.4	15.2	3
2.4	15.1	6
2.4	14.b	1
2.4	14.4	1
2.4	14.2	2
2.4	13.b	2
2.4	13.3	3
2.4	13.1	8
2.4	12.a	1
2.4	12.8	2
2.4	12.6	3
2.4	12.5	1

2.4	12.3	1
2.4	12.2	3
2.4	11.5	1
2.4	10.b	1
2.4	9.a	1
2.4	9.5	1
2.4	9.4	1
2.4	9.1	1
2.4	8.8	1
2.4	8.5	1
2.4	8.4	1
2.4	7.3	1
2.4	6.b	1
2.4	6.a	1
2.4	6.6	3
2.4	6.5	1
2.4	6.4	3
2.4	4.7	2
2.4	2.a	2
2.a	17.9	1
2.a	17.7	1
2.a	17.6	1
2.a	17.3	2
2.a	15.5	1
2.a	15.2	1
2.a	15.1	2
2.a	13.b	1
2.a	13.3	1
2.a	13.1	2
2.a	12.a	1
2.a	12.8	1
2.a	12.6	1
2.a	12.5	1
2.a	12.3	1
2.a	12.2	1
2.a	10.b	1
2.a	9.a	1
2.a	9.5	1
2.a	9.4	1
2.a	9.1	1
2.a	8.8	1
2.a	7.3	1
2.a	6.6	1

2.a	6.4	1
2.a	4.7	1
3.8	17.7	1
3.8	17.6	1
3.8	17.3	1
3.8	9.4	1
3.8	9.2	1
3.8	8.5	1
3.8	7.a	1
3.8	7.2	1
3.8	7.1	1
4.7	17.9	1
4.7	17.7	1
4.7	17.6	1
4.7	17.3	1
4.7	15.5	2
4.7	15.2	1
4.7	15.1	1
4.7	13.b	1
4.7	13.1	1
4.7	12.a	1
4.7	12.8	2
4.7	12.6	2
4.7	12.5	1
4.7	12.3	1
4.7	12.2	1
4.7	10.b	1
4.7	9.5	1
4.7	9.4	1
4.7	8.8	1
4.7	7.3	1
4.7	6.6	1
6.1	13.2	1
6.1	13.1	1
6.1	12.8	1
6.1	12.6	1
6.1	9.4	1
6.1	6.5	1
6.1	6.4	1
6.4	17.9	1
6.4	17.3	2
6.4	15.a	1
6.4	15.3	1

6.4	15.1	3
6.4	14.2	1
6.4	13.3	2
6.4	13.2	1
6.4	13.1	4
6.4	12.8	1
6.4	12.6	1
6.4	12.2	1
6.4	9.a	1
6.4	9.4	1
6.4	9.1	1
6.4	6.b	1
6.4	6.a	1
6.4	6.6	1
6.4	6.5	2
6.5	17.9	1
6.5	17.3	1
6.5	15.a	1
6.5	15.1	1
6.5	14.2	1
6.5	13.3	1
6.5	13.2	1
6.5	13.1	2
6.5	12.8	1
6.5	12.6	1
6.5	9.4	1
6.5	6.a	1
6.5	6.6	1
6.6	17.9	2
6.6	17.7	1
6.6	17.6	1
6.6	17.3	2
6.6	16.3	1
6.6	15.a	1
6.6	15.5	1
6.6	15.3	1
6.6	15.2	4
6.6	15.1	5
6.6	14.2	1
6.6	13.b	1
6.6	13.3	1
6.6	13.1	2
6.6	12.a	1

6.6	12.8	1
6.6	12.6	4
6.6	12.5	1
6.6	12.3	1
6.6	12.2	4
6.6	10.b	1
6.6	10.2	1
6.6	9.5	1
6.6	9.4	1
6.6	8.8	1
6.6	7.3	1
6.6	6.a	1
6.a	17.9	1
6.a	17.3	1
6.a	15.a	1
6.a	15.1	1
6.a	14.2	1
6.a	13.3	2
6.a	13.1	2
6.a	11.b	1
6.a	11.6	1
6.a	6.b	1
6.b	15.3	1
6.b	15.1	1
6.b	13.3	1
6.b	13.1	2
6.b	12.2	1
6.b	11.b	1
6.b	11.6	1
7.1	17.9	3
7.1	17.7	3
7.1	17.6	4
7.1	17.5	1
7.1	17.3	3
7.1	16.6	2
7.1	13.b	1
7.1	13.3	2
7.1	13.2	1
7.1	13.1	1
7.1	12.a	1
7.1	12.8	4
7.1	12.6	4
7.1	11.b	3

7.1	11.6	3
7.1	10.b	2
7.1	9.a	3
7.1	9.5	2
7.1	9.4	9
7.1	9.2	1
7.1	9.1	2
7.1	8.5	2
7.1	8.4	2
7.1	8.1	1
7.1	7.b	4
7.1	7.a	12
7.1	7.3	7
7.1	7.2	8
7.2	17.9	3
7.2	17.7	2
7.2	17.6	2
7.2	17.5	1
7.2	17.3	2
7.2	16.6	2
7.2	14.2	1
7.2	13.b	1
7.2	13.3	2
7.2	13.1	2
7.2	12.a	1
7.2	12.8	3
7.2	12.6	3
7.2	11.b	3
7.2	11.6	3
7.2	10.b	2
7.2	9.a	3
7.2	9.4	6
7.2	9.2	1
7.2	9.1	2
7.2	8.5	2
7.2	7.b	2
7.2	7.a	9
7.2	7.3	5
7.3	17.9	2
7.3	17.7	3
7.3	17.6	6
7.3	17.3	3
7.3	16.6	1

7.3	15.5	1
7.3	15.2	1
7.3	15.1	1
7.3	13.b	2
7.3	13.3	5
7.3	13.2	3
7.3	13.1	4
7.3	12.a	1
7.3	12.8	3
7.3	12.7	1
7.3	12.6	9
7.3	12.5	2
7.3	12.4	1
7.3	12.3	2
7.3	12.2	2
7.3	11.b	7
7.3	11.6	6
7.3	11.2	3
7.3	10.b	2
7.3	9.a	3
7.3	9.5	5
7.3	9.4	12
7.3	9.1	2
7.3	8.8	1
7.3	8.4	1
7.3	7.b	4
7.3	7.a	9
7.a	17.9	4
7.a	17.7	3
7.a	17.6	5
7.a	17.5	1
7.a	17.3	3
7.a	16.6	2
7.a	13.b	2
7.a	13.3	4
7.a	13.2	2
7.a	13.1	1
7.a	12.a	2
7.a	12.8	4
7.a	12.6	7
7.a	12.4	1
7.a	11.b	4
7.a	11.6	3

7.a	11.2	1
7.a	10.b	2
7.a	9.a	4
7.a	9.5	4
7.a	9.4	9
7.a	9.2	1
7.a	9.1	3
7.a	8.5	2
7.a	8.4	2
7.a	8.1	1
7.a	7.b	4
7.b	17.9	2
7.b	17.7	2
7.b	17.6	3
7.b	17.5	1
7.b	17.3	1
7.b	16.6	2
7.b	13.3	2
7.b	13.2	1
7.b	12.a	1
7.b	12.8	2
7.b	12.6	2
7.b	10.b	2
7.b	9.a	2
7.b	9.4	5
7.b	9.1	1
7.b	8.5	1
8.1	17.6	1
8.1	9.5	1
8.1	8.4	1
8.4	17.9	1
8.4	17.6	2
8.4	17.3	1
8.4	16.6	1
8.4	14.b	1
8.4	14.4	1
8.4	14.2	1
8.4	13.1	1
8.4	12.6	2
8.4	11.2	1
8.4	9.5	2
8.4	9.4	1
8.5	17.9	1
8.5	17.7	2
8.5	17.6	2
8.5	17.5	1
8.5	17.3	1
8.5	16.6	1
8.5	15.3	1
8.5	15.2	1
8.5	15.1	1
8.5	12.a	1
8.5	12.8	1
8.5	10.b	1
8.5	10.2	1
8.5	9.a	1
8.5	9.4	2
8.5	9.2	1
8.5	9.1	1
8.5	8.6	1
8.6	15.3	1
8.6	15.2	1
8.6	15.1	1
8.6	10.2	1
8.8	17.9	1
8.8	17.7	1
8.8	17.6	1
8.8	17.3	1
8.8	15.5	1
8.8	15.2	1
8.8	15.1	1
8.8	13.b	1
8.8	13.1	1
8.8	12.a	1
8.8	12.8	1
8.8	12.6	1
8.8	12.5	1
8.8	12.3	1
8.8	12.2	1
8.8	10.b	1
8.8	9.5	1
8.8	9.4	1
9.1	17.9	3
9.1	17.7	1
9.1	17.6	2
9.1	17.5	1
9.1	17.3	2
9.1	17.1	2
9.1	16.6	2
9.1	15.1	1
9.1	14.a	1
9.1	14.2	1
9.1	14.1	1
9.1	13.b	2
9.1	13.3	5
9.1	13.2	2
9.1	13.1	5
9.1	12.a	1
9.1	12.8	3
9.1	12.6	1
9.1	11.b	4
9.1	11.6	5
9.1	11.2	2
9.1	10.b	3
9.1	9.a	6
9.1	9.5	1
9.1	9.4	4
9.2	17.7	1
9.2	17.6	1
9.2	17.3	1
9.2	9.4	1
9.4	17.9	5
9.4	17.7	5
9.4	17.6	8
9.4	17.5	1
9.4	17.3	4
9.4	17.1	1
9.4	16.6	3
9.4	15.5	1
9.4	15.2	1
9.4	15.1	1
9.4	13.b	2
9.4	13.3	7
9.4	13.2	5
9.4	13.1	5
9.4	12.a	2
9.4	12.8	7
9.4	12.7	1
9.4	12.6	14

9.4	12.5	2
9.4	12.3	2
9.4	12.2	2
9.4	11.b	4
9.4	11.6	5
9.4	11.3	1
9.4	11.2	5
9.4	10.b	4
9.4	9.a	4
9.4	9.5	4
9.5	17.9	1
9.5	17.7	2
9.5	17.6	4
9.5	17.3	2
9.5	15.5	1
9.5	15.2	1
9.5	15.1	1
9.5	13.b	1
9.5	13.3	1
9.5	13.2	1
9.5	13.1	1
9.5	12.a	1
9.5	12.8	2
9.5	12.6	5
9.5	12.5	2
9.5	12.4	1
9.5	12.3	1
9.5	12.2	2
9.5	10.b	1
9.a	17.9	4
9.a	17.7	1
9.a	17.6	1
9.a	17.5	1
9.a	17.3	3
9.a	17.1	2
9.a	16.6	3
9.a	15.1	1
9.a	14.a	1
9.a	14.2	1
9.a	14.1	1
9.a	13.b	2
9.a	13.3	5
9.a	13.2	1

9.a	13.1	4
9.a	12.a	1
9.a	12.8	1
9.a	11.b	3
9.a	11.6	3
9.a	11.2	1
9.a	10.b	3
10.2	16.3	1
10.2	15.3	2
10.2	15.2	3
10.2	15.1	3
10.2	12.6	1
10.2	12.2	1
10.5	13.3	1
10.5	12.6	1
10.b	17.9	4
10.b	17.7	2
10.b	17.6	3
10.b	17.5	1
10.b	17.3	4
10.b	17.1	1
10.b	16.6	3
10.b	15.5	1
10.b	15.2	1
10.b	15.1	1
10.b	13.b	3
10.b	13.3	4
10.b	13.2	1
10.b	13.1	4
10.b	12.a	2
10.b	12.8	2
10.b	12.6	1
10.b	12.5	1
10.b	12.3	1
10.b	12.2	1
10.b	11.b	2
10.b	11.6	2
11.2	17.9	1
11.2	17.6	2
11.2	17.3	1
11.2	13.b	1
11.2	13.3	2
11.2	13.2	2

11.2	13.1	2
11.2	12.8	1
11.2	12.6	5
11.2	11.b	4
11.2	11.6	6
11.2	11.3	1
11.3	12.6	1
11.3	11.6	1
11.5	17.3	1
11.5	13.b	1
11.5	13.1	1
11.6	17.9	2
11.6	17.6	2
11.6	17.3	2
11.6	17.1	1
11.6	16.6	1
11.6	13.b	3
11.6	13.3	6
11.6	13.2	3
11.6	13.1	7
11.6	12.8	2
11.6	12.6	3
11.6	11.b	12
11.b	17.9	2
11.b	17.6	2
11.b	17.3	2
11.b	17.1	1
11.b	16.6	1
11.b	13.b	3
11.b	13.3	6
11.b	13.2	3
11.b	13.1	7
11.b	12.8	1
11.b	12.6	1
12.2	17.9	1
12.2	17.7	2
12.2	17.6	1
12.2	17.3	1
12.2	16.3	1
12.2	15.5	1
12.2	15.3	2
12.2	15.2	4
12.2	15.1	5

12.2	13.b	1
12.2	13.1	2
12.2	12.a	1
12.2	12.8	1
12.2	12.6	5
12.2	12.5	2
12.2	12.3	1
12.3	17.9	1
12.3	17.7	1
12.3	17.6	2
12.3	17.3	1
12.3	15.5	1
12.3	15.2	1
12.3	15.1	1
12.3	13.b	1
12.3	13.3	1
12.3	13.2	1
12.3	13.1	1
12.3	12.a	1
12.3	12.8	1
12.3	12.7	1
12.3	12.6	2
12.3	12.5	1
12.4	17.6	1
12.4	12.6	1
12.5	17.9	1
12.5	17.7	2
12.5	17.6	1
12.5	17.3	1
12.5	15.5	1
12.5	15.2	1
12.5	15.1	1
12.5	13.b	1
12.5	13.1	1
12.5	12.a	1
12.5	12.8	1
12.5	12.6	2
12.6	17.9	1
12.6	17.7	3
12.6	17.6	6
12.6	17.3	1
12.6	16.3	1
12.6	15.5	2

12.6	15.3	1
12.6	15.2	4
12.6	15.1	4
12.6	13.b	1
12.6	13.3	4
12.6	13.2	4
12.6	13.1	4
12.6	12.a	1
12.6	12.8	7
12.6	12.7	1
12.7	17.6	1
12.7	13.3	1
12.7	13.2	1
12.8	17.9	4
12.8	17.7	3
12.8	17.6	3
12.8	17.5	1
12.8	17.3	1
12.8	16.6	1
12.8	15.5	2
12.8	15.2	1
12.8	15.1	1
12.8	13.b	2
12.8	13.3	3
12.8	13.2	4
12.8	13.1	3
12.8	12.a	3
12.a	17.9	3
12.a	17.7	2
12.a	17.6	2
12.a	17.5	1
12.a	17.3	1
12.a	16.6	1
12.a	15.5	1
12.a	15.2	1
12.a	15.1	1
12.a	13.b	2
12.a	13.3	1
12.a	13.2	1
12.a	13.1	1
13.1	17.9	6
13.1	17.7	1
13.1	17.6	2

13.1	17.3	8
13.1	17.1	2
13.1	16.6	2
13.1	15.a	1
13.1	15.5	1
13.1	15.3	3
13.1	15.2	2
13.1	15.1	5
13.1	14.b	1
13.1	14.a	1
13.1	14.4	1
13.1	14.2	4
13.1	14.1	1
13.1	13.b	4
13.1	13.3	10
13.1	13.2	3
13.2	17.9	3
13.2	17.7	1
13.2	17.6	2
13.2	17.3	2
13.2	17.1	1
13.2	16.6	1
13.2	13.b	3
13.2	13.3	4
13.3	17.9	8
13.3	17.6	4
13.3	17.3	7
13.3	17.1	2
13.3	16.6	2
13.3	15.a	1
13.3	15.3	1
13.3	15.1	2
13.3	14.a	1
13.3	14.2	2
13.3	14.1	1
13.3	13.b	4
13.b	17.9	4
13.b	17.7	1
13.b	17.6	1
13.b	17.3	5
13.b	17.1	1
13.b	16.6	1
13.b	15.5	1

13.b	15.2	1
13.b	15.1	1
14.1	17.9	1
14.1	17.1	1
14.1	14.a	1
14.1	14.2	1
14.2	17.9	3
14.2	17.3	1
14.2	17.1	1
14.2	16.6	1
14.2	15.a	1
14.2	15.1	1
14.2	14.b	1
14.2	14.a	1
14.2	14.4	1
14.4	17.9	1
14.4	16.6	1
14.4	14.b	1
14.a	17.9	1
14.a	17.1	1
14.b	17.9	1
14.b	16.6	1

15.1	17.9	2
15.1	17.7	1
15.1	17.6	1
15.1	17.3	3
15.1	16.3	1
15.1	15.a	1
15.1	15.5	1
15.1	15.3	4
15.1	15.2	7
15.2	17.9	1
15.2	17.7	1
15.2	17.6	1
15.2	17.3	1
15.2	16.3	1
15.2	15.5	1
15.2	15.3	3
15.3	17.9	1
15.3	17.3	1
15.3	16.3	1
15.5	17.9	1
15.5	17.7	1
15.5	17.6	1

15.5	17.3	1
15.a	17.9	1
15.a	17.3	1
16.6	17.9	4
16.6	17.7	1
16.6	17.6	1
16.6	17.5	1
16.6	17.3	2
16.6	17.1	1
17.1	17.9	2
17.1	17.3	1
17.3	17.9	6
17.3	17.7	2
17.3	17.6	2
17.5	17.9	1
17.5	17.7	1
17.5	17.6	1
17.6	17.9	2
17.6	17.7	4
17.7	17.9	2

S2. Interlinkages between Nationally Determined Contributions (NDCs) and the SDGs compared to interlinkages between climate actions by transnational climate initiatives (TCIs) and the SDGs.

Data about NDC-SDG connections retrieved from Brandi et al. (2017b). Data TCI-SDG connections based on own analysis.

NDCs	No of climate activities	Percentage	TCIs	No of climate activities	Percentage
SDG 1	149	2%	SDG 1	13	5%
SDG 2	852	12%	SDG 2	11	4%
SDG 3	238	3%	SDG 3	1	0%
SDG 4	188	3%	SDG 4	2	1%
SDG 5	83	1%	SDG 5	0	0%
SDG 6	639	9%	SDG 6	9	3%
SDG 7	1213	17%	SDG 7	31	12%
SDG 8	307	4%	SDG 8	10	4%
SDG 9	488	7%	SDG 9	33	13%
SDG 10	30	0%	SDG 10	11	4%
SDG 11	660	9%	SDG 11	20	8%
SDG 12	246	3%	SDG 12	34	13%
SDG 13	430	6%	SDG 13	35	14%
SDG 14	222	3%	SDG 14	4	2%
SDG 15	935	13%	SDG 15	12	5%
SDG 16	12	0%	SDG 16	5	2%
SDG 17	537	7%	SDG 17	27	10%
Sum	**7229**	**100%**	**Sum**	**258**	**100%**

Article 3:

MSPs for the SDGs – Assessing the collaborative governance architecture of multi-stakeholder partnerships for implementing the Sustainable Development Goals

Abstract

Multi-stakeholder partnerships (MSPs) involving a diverse set of actors are assumed to reduce implementation gaps of the 2030 Agenda and the Sustainable Development Goals (SDGs). While existing research suggests that MSPs can complement state-led efforts in environmental and sustainability governance, a deeper understanding of the composition, thematic focus, and specific governance functions of MSPs for the SDGs is still wanting. In this article, we present the results of a survey of 192 MSPs registered on the United Nations Partnership Platform, analyzing their set-up and organization, partner composition, agency of partners, governance functions, SDG coverage, and effectiveness. We further complement existing research by investigating whether MSPs address SDG nexuses and relate our findings to previously identified interlinkages between the goals. Comparing our results to earlier studies, we find that MSPs have become more inclusive, involving more non-state actors overall, and as lead partners. Our results further indicate a complementary role of MSPs in SDG implementation by focusing on often underrepresented and cross-cutting goals such as climate action (SDG 13), quality education (SDG 4) and gender equality (SDG 5). However, there appears to be untapped potential for MSPs to capitalize on shared resources and capabilities to address combinations of SDGs that are likely to produce negative spillovers among each other. Moreover, we find partnerships between actors from multiple societal sectors to be potentially more effective than those involving only one societal sector.

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MSPs for the SDGs – Assessing the collaborative governance architecture of multi-stakeholder partnerships for implementing the Sustainable Development Goals

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ABSTRACT

Multi-stakeholder partnerships (MSPs) involving a diverse set of actors are assumed to reduce implementation gaps of the 2030 Agenda and the Sustainable Development Goals (SDGs). While existing research suggests that MSPs can complement state-led efforts in environmental and sustainability governance, a deeper understanding of the composition, thematic focus, and specific governance functions of MSPs for the SDGs is still wanting. In this article, we present the results of a survey of 192 MSPs registered on the United Nations Partnership Platform, analyzing their set-up and organization, partner composition, agency of partners, governance functions, SDG coverage, and effectiveness. We further complement existing research by investigating whether MSPs address SDG nexuses and relate our findings to previously identified interlinkages between the goals. Comparing our results to earlier studies, we find that MSPs have become more inclusive, involving more non-state actors overall, and as lead partners. Our results further indicate a complementary role of MSPs in SDG implementation by focusing on often underrepresented and cross-cutting goals such as climate action (SDG 13), quality education (SDG 4) and gender equality (SDG 5). However, there appears to be untapped potential for MSPs to capitalize on shared resources and capabilities to address combinations of SDGs that are likely to produce negative spillovers among each other. Moreover, we find partnerships between actors from multiple societal sectors to be potentially more effective than those involving only one societal sector.

1. Introduction

People, planet, prosperity and peace – these are four of the "5 P's" (Gusmão Caiado et al., 2018; Jayasooria, 2016), the pillars that structure the United Nations (UN) 2030 Agenda for Sustainable Development. Its 17 Sustainable Development Goals (SDGs) and 169 targets are considered the major internationally agreed normative guiding framework for the attainment of worldwide sustainable social, economic and environmental development (Biermann et al., 2022a). However, in the face of a global pandemic, the worsening effects of climate change, and appalling military conflicts, recent years have shown that major challenges to achieving sustainable development by 2030 remain pressing. Much hope is placed on the fifth "P" – *partnerships* – which are explicitly recognized as important means of implementation within SDG 17 (*partnerships for the goals*) under targets 17.16[2] and 17.17[3] (UN, 2015).

Especially since the 2002 Johannesburg World Summit on Sustainable Development (WSSD), multi-stakeholder partnerships (MSPs) have emerged alongside multilateral agreements and national policies as an important governance component for addressing complex sustainability problems (Pattberg and Widerberg, 2016; Bäckstrand, 2006). Although the term often suffers from conceptual vagueness (Pattberg et al., 2012),

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[2] "Enhance the Global Partnership for Sustainable Development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the Sustainable Development Goals in all countries, in particular developing countries." (UN, 2015).

[3] "Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships." (UN, 2015).

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MSPs are commonly regarded as voluntary collaborative agreements between actors from different societal sectors working transnationally to implement public policy objectives (ibid.; Pattberg and Widerberg, 2016; Bäckstrand, 2006). Academic literature has repeatedly underlined their potential to complement purely governmental efforts in sustainability governance (Andonova, 2014; Pattberg et al., 2012; Stafford-Smith et al., 2017; Biermann et al., 2012) by performing a variety of governance functions, such as generating and disseminating knowledge, setting standards, and facilitating participation in decision-making and implementation (Andonova and Levy, 2003).

International institutions and national governance initiatives are struggling to address the ambitious 2030 Agenda and the SDGs in an integrated way (Biermann et al., 2022a; UN, 2023). In this context, scholars have emphasized the need to harness the diverse capacities of public and private actors (Haywood et al., 2019; Coenen et al., 2022), taking into account both positive interactions (synergies) and negative spillovers (trade-offs) between the goals (Liu et al., 2018; Bennich et al., 2020; Weitz et al., 2018; Pradhan et al., 2017; Nilsson et al., 2018). Resonating with the call for integrated implementation efforts, they suggest nexus approaches that engage different stakeholders to identify and enhance synergies and reduce trade-offs between the SDGs by integrating different policy domains (Liu et al., 2018; van Zanten and van Tulder, 2021a, b; Bowen et al., 2017; Boas et al., 2016). Involving a diverse set of actors from different societal sectors, MSPs can thus serve as one important vehicle for putting nexus approaches into practice, provided that their work considers and reflects SDG interlinkages (Staffort-Smith et al., 2017). They could thereby help to bridge silos between the goals and drive integrated and collaborative implementation.

By now, research has been devoted to the analysis of (multi-stakeholder) partnerships in environmental and sustainability governance in terms of accountability (Bäckstrand, 2008), effectiveness (Beisheim and Liese, 2014; Pattberg et al., 2012), legitimacy (Bäckstrand, 2006), and internal and external conditions for their success (Pattberg and Widerberg, 2016; Horan, 2019). However, empirical studies to assess their potential to overcome silo approaches to SDG implementation by enhancing synergies between the goals through cross-sectoral collaboration are still missing. With the present study, we aim to address this question by presenting the results of a survey of 192 partnerships listed on the UN Partnership Platform[4] (UN, 2022).

We structure our analysis as follows. First, we describe the conceptual foundation and previous research findings on MSPs as a collaborative governance tool. Given the prevailing ambiguity in defining and operationalizing the term MSP in existing scholarship, we distinguish between cross-subsector partnerships (CSSPs) and intra-subsector partnerships (ISSPs) as different types of MSPs. This distinction allows us to capture nuanced differences between all participating subsectors. After elaborating on our research method, we then turn to the presentation and discussion of our survey results. We examine MSPs for the SDGs along six dimensions, i.e., set-up and organization, partner composition, agency of partners, governance functions, SDG coverage, and effectiveness. By analyzing which SDGs are addressed jointly by MSPs, we follow the call to enrich in-depth qualitative research on nexus approaches for the SDG with quantitative research methods (Liu et al., 2018). Finally, comparing our findings to earlier studies on partnerships for sustainable development allows us to provide valuable insights into the dynamics of the collaborative global sustainability governance architecture over time.

[4] Hereafter also referred to as "the partnership platform" or "the platform". In June 2022, the "Partnerships for SDGs online platform" (https://sustainabledevelopment.un.org/partnerships) was migrated to a new website and changed its name to "The Partnership Platform" (https://sdgs.un.org/partnerships). In spring 2023, its name was changed again to "SDG Actions Platform".

Table 1
Differentiation between societal sectors and subsectors in the context of MSPs.

Sector	Public/State	Private/Non-state	
	Governmental	Civil society (non-profit)	Business (for-profit)
Sub-sector/ Stakeholder types	• IGOs • National government (agencies) • Cities • Other subnational actors (e.g., counties, districts, provinces)	• NGOs • Research and education • Others (e.g., youth groups, faith-based organizations, think tanks)	• Companies/ corporations • Business associations

2. MSPs as collaborative governance instrument for SDG implementation

Collaborative governance approaches involving public and private actors (particularly in the form of MSPs) can be seen as a "manifestation of the ongoing restructuring of environmental governance in the context of globalization" (Andonova, 2014, p.506). In light of an insufficient response of (inter-)national actors and traditional multilateral agreements to address the urgency and complexity of sustainable development (Bäckstrand, 2006; Chan et al., 2019), MSPs have found their way into nearly all major international climate and development agendas over the past thirty years. From the 1992 Earth Summit and the Agenda 21, to the 2002 WSSD, the 2012 United Nations Conference on Sustainable Development (Rio +20) and more recently, the 2015 Paris Agreement and the 2030 Agenda (see Pattberg and Widerberg, 2016) – the international realm has been promoting the establishment of MSPs with increasing impetus.

The proliferation of partnership approaches has sparked considerable academic interest. However, the research landscape remains scattered across disciplines and at times inconsistent, from the use of competing definitions to differing assessments of partnerships (Pattberg and Widerberg, 2016). Ambiguities in the definition and operationalization of the term partnership has led some to discredit it as a buzzword (Stott and Murphy, 2020), or as "conceptually empty and merely politically expedient" (Brinkerhoff and Brinkerhoff, 2011, p.31). This is particularly true for the term MSP. While initially often equated with (transnational) public-private partnerships (Pattberg et al., 2012; Stott and Murphy, 2020), more recent definitions of MSPs in the context of the SDGs define them as "collaborative relationship between or among organizations from different stakeholder types aligning their interests around a common vision (…) to maximize value creation towards the Sustainable Development Goals" (Stibbe and Prescott, 2020, p.23). We believe that the evolution of the term MSP to capture interactions between different stakeholder types is important. First, since in practice, many MSPs (including in the context of the WSSD and the SDGs) are formed between stakeholders from the same sector. Examples hereof include partnerships between governmental agencies and intergovernmental organizations (IGOs) (public sector only); or between non-governmental organizations (NGOs) and academia (private sector only). These types of MSPs have been deemed equally relevant to the implementation of the SDGs alongside (transnational) public-private partnerships (Beisheim and Simon, 2016). Second, scholars have increasingly cautioned against a mere distinction between public and private (or state and non-state) actors, arguing that actors from the same sector often fulfill different governance functions depending on their capacities, resources, and power (Nasiritousi et al., 2016). Since the term "sector" has equally been used interchangeably to differentiate between public and private actors, state and non-state actors or

stakeholder from different societal subsectors, Table 1 below depicts our understanding of the different terms at play. With this, we aim to be transparent about the terminology applied in this article. Accordingly, we refer to sectors to denote the duality between public or state and private or non-state actors. The private sector is commonly also further divided into civil society and business actors to capture differences between non-profit and for-profit organizations.

To account for different constellations of stakeholder types (according to subsectors) involved in many MSPs and to test the added value of this more nuanced conceptualization, in the empirical analysis of this article we further distinguish between *cross subsector partnerships* (CSSPs) involving two or more actors from different subsectors, and *intra subsector partnerships* (ISSPs), denoting collaborations between two or more actors from the same subsector. While ISSPs also bring together different actors (e.g., two or more NGOs, or two or more IGOs, etc.), CSSPs combine knowledge, resources and experiences from different subsectors, which is argued to be particularly important for advancing nexus approaches (Boas et al., 2016).

While by no means uncontested, MSPs are seen as a promising collaborative governance tool for promoting sustainable development, increasing effectiveness, efficiency and inclusiveness in global policy (Pattberg and Widerberg, 2016). These high expectations placed on MSPs build inter alia on the observed complementarity of state and non-state action in environmental and sustainability governance (Andonova et al., 2017; Coenen et al., 2022), and the diverse capabilities and resources of the actors involved (Moreno-Serna et al., 2020). Mostly distinguishing between public and private actors only, research has highlighted that non-state actors such as cities and other subnational actors, NGOs, private business as well as think tanks and other research organizations assume a variety of functions in global governance. These include e.g., knowledge production and dissemination, capacity building, technology provision, monitoring and evaluation, agenda or goal setting, and mobilization of public engagement (Bäckstrand et al., 2017; Chan et al., 2019). While the distinction is not always clear-cut, these can be considered rather *soft* governance functions as opposed to *hard* governance functions such as regulation, rulemaking and funding, which are predominantly assumed by states, government agencies and IGOs (Betsill and Milkoreit, 2020). Ideally, effective sustainability governance should build on these complementary soft and hard modalities to achieve the change required. Leveraging and pooling these resources remains a major argument in favor of collaborative governance arrangements and MSPs in particular (Beisheim and Simon, 2018).

The literature provides as many assessments of MSPs as different definitions. Comprehensive analyses of MSPs in the field of climate and sustainability governance question their overall performance, while simultaneously acknowledging that – under favorable conditions – they can be highly effective (Pattberg and Widerberg, 2016; Beisheim and Simon, 2018; Pattberg et al., 2012). Some ascribe legitimacy to MSPs based on the involvement of diverse actors and underrepresented groups (Chan et al., 2019), while others consider them a neoliberal tool to advance business interests (Utting and Zammit, 2009). Similarly, we find mixed results regarding their ability to close governance gaps (Coenen et al., 2022; Pattberg et al., 2012; Chan et al., 2019; Bäckstrand, 2006). This list is by far not exclusive and could be extended to a variety of controversially discussed aspects related to collaborative governance approaches (see e.g., Widerberg et al., 2022). And indeed, we should be cautious not to blindly overestimate their potential, also considering that international institutions, and especially the UN, fall short of effective monitoring and follow-up of MSPs (Beisheim and Simon, 2018). However, still today, many national governments fail to deliver on their climate and sustainability commitments, and despite their mixed track record, MSPs keep being promoted, are steadily increasing in number and became normatively situated within the 2030 Agenda as important means of implementation of the complex and interrelated SDGs.

It has been argued that the cross-sectoral collaboration characterizing MSPs makes them particularly suitable for advancing SDG achievement (Boas et al., 2016; Horan, 2019; Stott and Murphy, 2020; Moreno-Serna et al., 2020). First, their setup of actors with diverse capabilities can help effectively leverage resources, as described above. Empirical findings further point to a positive correlation of collaborative and participatory governance arrangements with the achievement of the SDG at the national level (Glass and Newig, 2019), and underline their potential to create co-benefits with climate targets under the Paris Agreement at the transnational level (Coenen et al., 2022). Second, MSPs involving a diverse set of stakeholders from different (sub-)sectors appear suitable to foster integrated SDG implementation by means of nexus approaches, bridging silo, and enhancing synergies and mitigating trade-offs between the goals (Liu et al., 2018; van Zanten and van Tulder, 2021a, b; Boas et al., 2016; Bowen et al., 2017; Horan, 2019). Although the 2030 Agenda itself emphasizes that the SDGs are "integrated and indivisible" (UN, 2015, p.3), their setup and operationalization reflects a siloed approach with weak explicit and rather intransparent connections between the goals that – if implemented without a holistic understanding – could hinder overall SDG achievement by neglecting negative spillovers (Boas et al., 2016; van Zanten and van Tulder, 2021b). To prevent this, and acknowledging the complex relationship between the social, economic and environmental dimension of sustainable development, much research has been devoted to revealing the interlinkages between the SDGs (Bennich et al., 2020; Weitz et al., 2018; Pradhan et al., 2017; Nilsson et al., 2018). These empirical findings form the basis for nexus approaches to help identify synergistic effects, minimize trade-offs, uncover unintended consequences, prevent unbalanced prioritization of some goals over others, and thus support integration and policy coherence for the SDGs (Liu et al., 2018; Boas et al., 2016). Third and lastly, transnational MSPs could be particularly suitable to tackle interrelated sustainability problems that often transcend political and jurisdictional boundaries (Boas et al., 2016). A typical case in point is the water-energy-food nexus. The increasing pressure on water resources related to growing demands for food and energy is exacerbated by globalized supply chains which disconnect production and consumption across borders (Newig et al., 2020). Another example are transboundary river basins, where questions of competing economic interests, allocation and resource security could be steered towards more resilient and sustainable development pathways through the application of a nexus lens (Liu et al., 2018).

In sum, MSPs can serve as an effective governance tool for integrated SDGs implementation when attention is given to integration across multiple SDGs (Stafford-Smith et al., 2017). As noted, MSPs have the potential to address SDG nexuses by fostering cross-sector collaboration, leveraging resources and overcoming silo approaches. Whether these expectations are met in practice has to our knowledge not been systematically studied. With this article, we aim at examining the current collaborative governance architecture of MSPs for the SDGs and exploring the extent to which they address previously identified interlinkages between the SDGs in practice.

3. Methodology

Starting our study in 2019, we contacted the UN Division for Sustainable Development Goals requesting access to the underlying raw data of their official partnership platform to conduct our analysis. Our request was denied, indicating that the UN "will not be able to provide the data in xls or csv format".[5] Thus, to receive the data required for our study, we first developed a computer program to systemically crawl the entries listed on the platform. By means of this program, we retrieved and parsed the data at three different points of time between January

[5] UN Division for Sustainable Development Goals, personal communication, February 6, 2019.

2021 and August 2022. The platform lists different types of initiatives, both (single actor) voluntary commitments and MSPs, yet it is not possible to filter entries accordingly. In general, data quality of the platform is low, as the data is often unstructured and inconsistent, incomplete or outdated. In addition, it is not readily possible to identify the types of partners involved in the partnerships. Therefore, we decided to contact all listed initiatives that provided an email address, explicitly inviting those that registered a partnership to participate in an online survey. After filtering out duplicates, we contacted a total of 4226 initiatives between July 2021 and August 2022. We received responses from 192 initiatives that correspond to the definition of MSPs applied in the present article. The survey consisted of 20 questions, including on the set-up and organization, the partners and their respective roles and activities within the partnership, the geographic focus, the SDGs addressed, the governance functions assumed by partnerships, as well as about the respondents' judgement of the partnership's success in pursuing its objectives (the complete survey is available in the appendix). To compile the list of governance functions, we drew on previous research on WSSD partnerships (Pattberg et al., 2012), transnational cooperative initiatives (Dzebo, 2019) and agency in earth system governance (Betsill and Milkoreit, 2020).

While the decision to contact the partnerships directly entailed a smaller sample size when compared to the totality of cases listed on the platform, the survey method offered important advantages: First, this approach ensured that only partnerships that have been or are currently "active" were included in our study. For there is reason to assume that a large part of the 4226 listed initiatives is no longer – or has never even been – active. For example, 15% of all survey invitations could not be delivered, mostly since the provided contact email was inexistent. This corroborates the claim that the UN failed to provide a clear mandate, political will and sufficient funding for effective monitoring, review and follow-up of partnerships (Beisheim and Simon, 2018). Further, the UN appears to use the platform to showcase action towards the SDGs. However, quite some of the initiatives that we contacted for our survey were not aware of their listing on the platform. To some degree, this can be attributed to the UN merging commitments from earlier conferences and action networks in one platform – including some that were held prior to the launch of the SDGs (see UN, 2022). In conjunction with unstructured, missing or outdated information about partnerships registered on the platform, the transparency and accountability of the UN database can at least be questioned. Second, we were able to scrutinize the SDGs addressed by MSPs though a two-stage selection process. In the first step, we asked respondents to indicate the SDGs that correspond to both the primary and secondary objectives of the partnership. In the second step, we only displayed the SDGs selected before and asked respondents to choose exclusively those that reflect the partnership's *main* purpose. This enabled us to reduce a bias by "box-ticking" all SDGs, which has been observed in comparable data bases (Coenen et al., 2022). It further helped us to create a refined data set for the analysis of SDG nexuses addressed. We consider a partnership to address an SDG nexus if it selected at least two goals as the primary objectives of their work. Third, by giving respondents the opportunity to comment freely on their input provided, we were able to retrieve additional insights about the partnerships that we would not have received by relying only on the information published at the platform.

4. Results and discussion

This section presents and discusses the results of the 192 MSPs that answered our survey. Of these, 114 qualify as CSSPs, involving at least two partners from different subsectors. 34 MSPs can be considered ISSPs, referring to partnerships between stakeholders from the same subsector. For 44 partnerships, we received no specification on the stakeholder types involved.

We structure our analysis according to six dimensions: *Set-up and organization, partner composition, agency of partners, governance functions, SDG coverage,* and *effectiveness*. Mostly, we contrast our results on CSSPs and ISSPs to explore differences between the two types of MSPs. Selectively, we focus on CSSPs only to examine particularities between the different societal subsectors involved. While we acknowledge that we cannot assume full representativeness of our sample, our findings can nonetheless provide valuable insights on the collaborative governance architecture of MSPs for SDG implementation.

4.1. Set-up and organization

Table 2 depicts the findings on set-up and organization related variables, i.e., activity status, annual project budget, communication frequency and monitoring. We find that most partnerships in our sample are still active (89%), while 11% have ceased their activities. For the subset of CSSPs, we see a higher percentage of active partnerships (93%), especially when compared to ISSPs with 76%. We note, however, that the survey methodology used in our study may bias these results, as active partnerships are more likely to have available resources to respond to our questionnaire. Regarding financial resource endowment, we find huge differences across partnerships. While 17% have no budget at all, 13% indicate an annual project budget of more than $1,000,000.

Most MSPs (53%) are rather small partnerships, with 1–20 people actively involved. This number is slightly higher for ISSPs (64% vs. 54% of CSSPs). However, 25% of CSSPs report working with up to five people only, compared to 12% for ISSPs. In terms of regular communication between partners, we find that the majority (68%) communicates at least monthly or bi-monthly, or even more frequently. This aggregate result is the same for both types of MSPs. Yet, we find that more ISSPs (21%) communicate daily, compared to 12% of CSSPs. Notably, we find a higher number of ISSPs reporting no or no regular communication (14%) compared to CSSPs (9%). Similarly, a higher share of CSSPs (91%) reports regularly monitoring of its activities compared to ISSPs (79%). Taken together, the analysis indicates that partnerships for the SDGs in our sample have a relatively high degree of institutionalization. Previous research has argued that "institutionalization is the basic factor leading to partnerships' effectiveness" (Szulecki et al., 2012, p.98). In how far these institutional variables relate to (self-reported) effectiveness of MSPs will be assessed in section 4.6.

Fig. 1 shows the location of partnerships' administrative bases, spanning 61 different countries. We find a relatively even regional distribution between Africa (27%), Asia (23%) and Europe (27%), while fewer partnerships report their administrative base location in Latin America and the Caribbean (14%), Northern America (8%) and especially Oceania (1%). Earlier studies have criticized the predominance of Global North-based actors in collaborative climate and sustainability governance arrangements, cautioning against a consolidation of power asymmetries in global governance (Bäckstrand, 2012; Chan et al., 2019). While we find that, taken together, 35% of partnerships in our sample have their administrative base in either Europe or Northern America, roughly two thirds of the MSPs' headquarters or secretariats are located in other regions. However, while Northern America has a lower regional representation in relative terms, the United States were the second most frequently reported administrative base location after India.

Fig. 2 depicts the countries of implementation. The partnerships reported current or past activity in 147 countries. 20 partnerships (15%) indicated a global scope[7]. On average, a partnership is or was active in four different countries. The pie chart in Fig. 2 shows how many partnerships report implementation in at least one country of the respective

[6] A global scope refers to partnerships whose output and impact is not focused on a specific territory only, and which aims to address global challenges to advance sustainable development globally.

[7] Regional groupings are based on the UN SDG Indicator site (https://unstats.un.org/sdgs/indicators/regional-groups/) except for Taiwan, which was counted as Asian country.

Table 2
Set-up and organization of partnerships. The table depicts variables concerning the set-up and organization of MSPs for the SDGs for the total sample and its subsets CSSPs and ISSPs. Data for "NA" refers to survey responses that did not provide further information on the stakeholder types involved.

	n Total (CSSPs/ISSPs/NA)	Total	CSSPs	ISSPs	NA
Activity status					
Active	192 (114/34/44)	170 (89%)	106 (93%)	26 (76%)	38 (86%)
Inactive		22 (11%)	8 (7%)	8 (24%)	6 (14%)
Budget					
No budget	191 (114/34/43)	32 (17%)	16 (14%)	6 (18%)	10 (23%)
Less than USD 25,000		34 (18%)	22 (19%)	7 (21%)	5 (12%)
USD 25,001–100,000		31 (16%)	22 (19%)	5 (15%)	4 (9%)
USD 100,001–250,000		24 (13%)	15 (13%)	3 (9%)	6 (14%)
USD 250,001–1,000,000		30 (16%)	17 (15%)	5 (15%)	8 (19%)
More than USD 1,000,000		25 (13%)	14 (12%)	4 (12%)	7 (16%)
Unknown/No answer		15 (8%)	8 (7%)	4 (12%)	3 (7%)
Staff (people actively involved)					
1–5	191 (114/34/43)	41 (21%)	29 (25%)	4 (12%)	8 (19%)
6–20		62 (32%)	33 (29%)	18 (52%)	11 (26%)
21–50		35 (18%)	26 (23%)	3 (9%)	6 (14%)
51–200		19 (10%)	11 (10%)	3 (9%)	5 (12%)
More than 200		24 (13%)	11 (10%)	3 (9%)	10 (23%)
Unknown		10 (5%)	4 (4%)	3 (9%)	3 (7%)
Communication frequency					
Daily	119 (91/28/-)	17 (14%)	11 (12%)	6 (21%)	–
Weekly/Bi-weekly		30 (25%)	25 (27%)	5 (18%)	–
Monthly/Bi-monthly		34 (29%)	26 (29%)	8 (29%)	–
3–5 times per year		19 (16%)	16 (18%)	3 (11%)	–
Once or twice per year		7 (6%)	5 (5%)	2 (7%)	–
None/not regularly		12 (10%)	8 (9%)	4 (14%)	–
Monitoring					
Yes	192 (114/34/44)	171 (89%)	104 (91%)	27 (79%)	40 (91%)
No		21 (11%)	10 (9%)	7 (21%)	4 (9%)

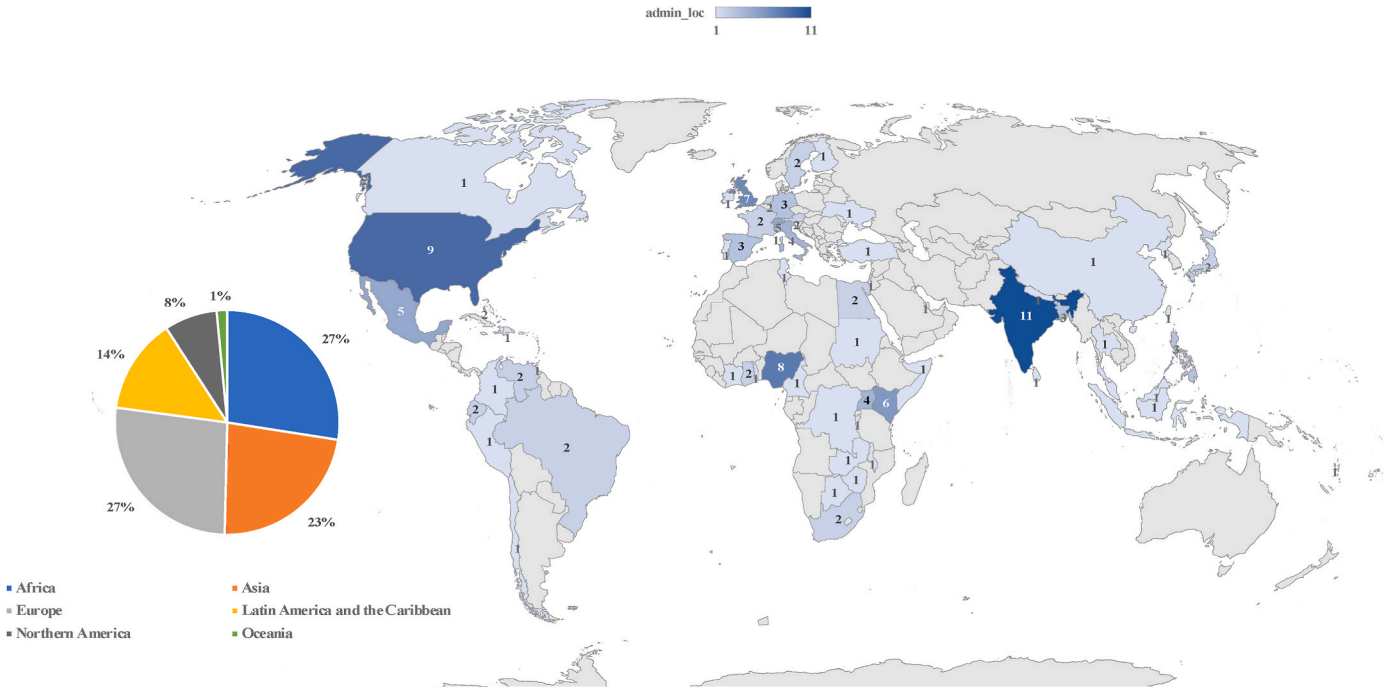


Fig. 1. Partnerships' administrative base location. The map shows in which countries the partnerships' administrative base are located. The pie chart indicates the regional distribution[6] (n = 131).

region. Here, Europe and Northern America sum up to 38%, while a similar share of partnerships implements their projects in at least one country in Africa (37%) and Asia (34%). Latin America and the Caribbean (17%) and again, especially Oceania (5%), are comparatively underrepresented.

We can think of two possible interpretations for this. On the one hand, a relatively equal regional distribution could indicate a positive development, as the SDGs aim for universal applicability in all countries. On the other hand, Chan et al. (2019) questioned whether predominantly Northern-led initiatives can provide real benefits to countries where the need is greatest, or whether they primarily benefit the Global North. They argue that North-based actors could promote their own (economic) interests at the expense of actual long-term, local needs. Without further analysis, we cannot draw either one or the other conclusion and encourage future research to take up this question.

Borrowing from Esparcia et al. (2000), we further inquired about the

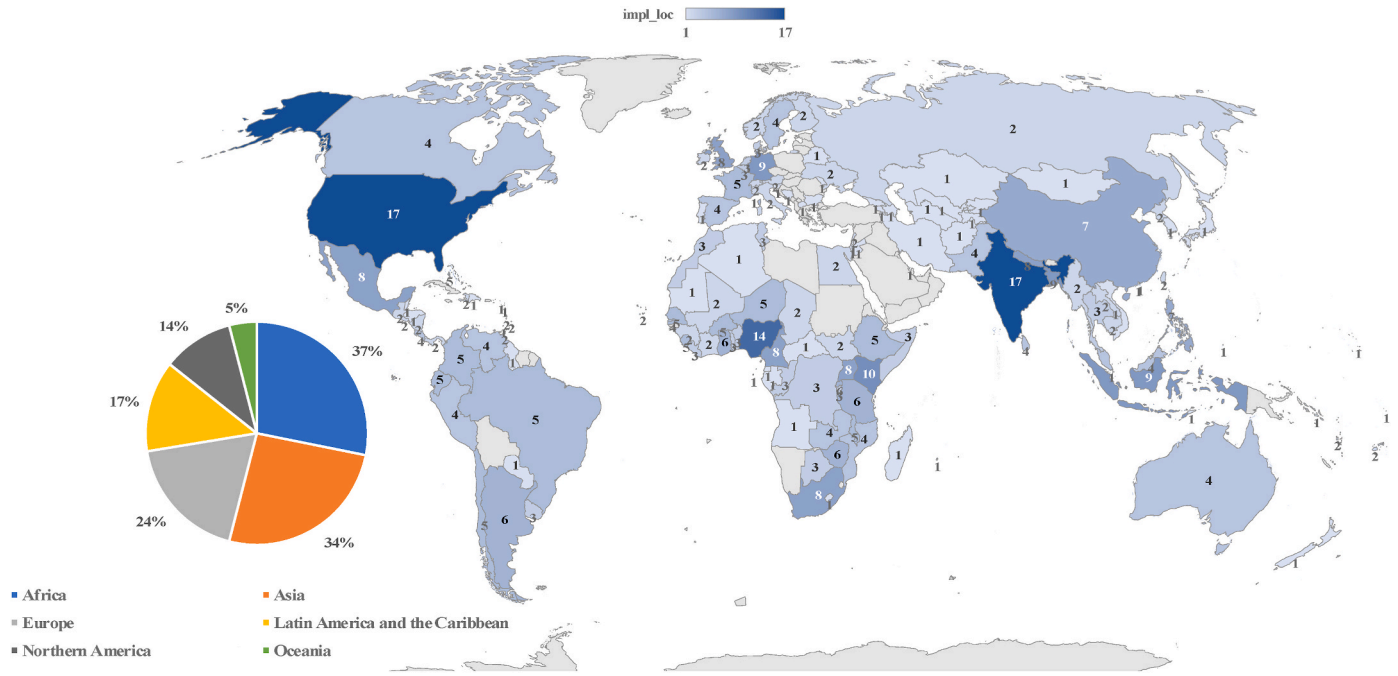


Fig. 2. Countries of implementation. The map shows the countries for which the partnerships reported past or current activity. The pie chart indicates the regional distribution[6], i.e., the percentage of partnerships that was/is active in at least one country of the respective region (n = 133).

reasons for establishing partnerships (see Fig. 3). For the majority of both CSSPs and ISSPs, joint implementation, the involvement of local or national organizations, as well as strengthening an existing partner network were important motivators. For ISSPs, the latter was reported by most respondents (59%). Remarkably, we find that pooling of resources and securing access to funding are much more important drivers for CSSPs. This points to a higher awareness of the benefits emerging from leveraging different capacities and resources through cross-subsector collaboration by actors participating in CSSPs, which has been deemed decisive for effective and integrated SDG implementation, particularly to enhance synergies between the goals (Moreno-Serna et al., 2020). However, it is important to assess which specific capabilities and resources and thus, which actors are needed for a partnership to fulfill its objectives (Pattberg and Widerberg, 2016).

4.2. Partner composition

Concerning the number of partners, we find that most ISSPs in our sample (56%) involve two partners, still 21% involve three partners and 15% involve four partners. Only three include more than four partners. Numbers for CSSPs are more distributed, yet with the majority involving three partners (20%), followed by two (18%), four (16%) and five partners (12%). The largest CSSP in our sample consists of 117 partners.

As Table 3 shows, we find that in absolute terms, NGOs or Civil Society Organizations (CSOs)[8] are the subsector most represented in CSSPs, followed by research and education, business and industry, IGOs[9] and national government (agencies). Other subnational actors (e.g., counties, districts and provinces) are less represented, yet still more frequently than cities. "Other" includes e.g., faith-based organizations, think tanks, youth organizations or philanthropes. In ISSPs, most actors belong to business and industry, followed by NGOs and research and education. IGOs and national governments are much less represented in absolute terms. We find no ISSPs between subnational actors.

If we compare our findings to earlier studies on WSSD partnerships for sustainable development registered with the UN Commission on Sustainable Development (UNCSD) in 2006 (see Pattberg et al., 2012, p.82), we find considerable differences in the participation of different societal subsectors (see Fig. 4). Acknowledging that we cannot claim representativeness of our sample, comparison with earlier studies can nonetheless provide valuable insights into changes in the collaborative governance architecture over time. Further, UN data may also be non-representative of the universe of partnerships, as many might not even register their activities.

Assuming a broadly similar definition and partnership coverage of the two UN databases, Fig. 4 shows a relative decline of state actor participation in partnerships for sustainable development, i.e., a drop of IGO involvement by 6%, and by 21% for national governments compared to 2006. In contrast, we find an increase of NGO participation by 15%, and by 8% for business and industry as well as research and education. Thus, our results indicate an increased participation of non-state actors in global sustainability governance. We see several possible explanations for this development. On a positive note, there could be greater awareness among non-state actors of the urgency and need for action due to an overall societal shift toward greater sustainability, or due to more noticeable pressures from the increasing deterioration of socio-environmental conditions, such as growing inequality, food insecurity, or the effects of climate change. The relatively inclusive drafting process of the SDGs involving diverse non-state actors (Biermann et al., 2022b) might have influenced this development as well. To what extent such changes in global governance arrangements have been induced by the SDGs is however difficult to single out (Biermann et al., 2022a). On the other hand, the UN partnership platform could suggest more action than is actually out there. First, and especially regarding business actors, these kinds of platforms give room for window-dressing, or what in the present context has been coined "SDG-washing" (Dahlmann et al., 2020) or "blue-washing" (Beisheim and Simon, 2018). While both approaches aim at increasing social legitimacy, the first

[8] Hereafter, the terms NGO and CSO are used interchangeably.

[9] Including e.g., specialized UN agencies such as the World Health Organization (WHO), the UN Environment Programme (UNEP) and the UN Educational, Scientific and Cultural Organization (UNESCO); financial organizations such as the World Bank and the Asian Development Bank; regional organizations such as the Secretariat of the Pacific Regional Environment Programme (SPREP), and others.

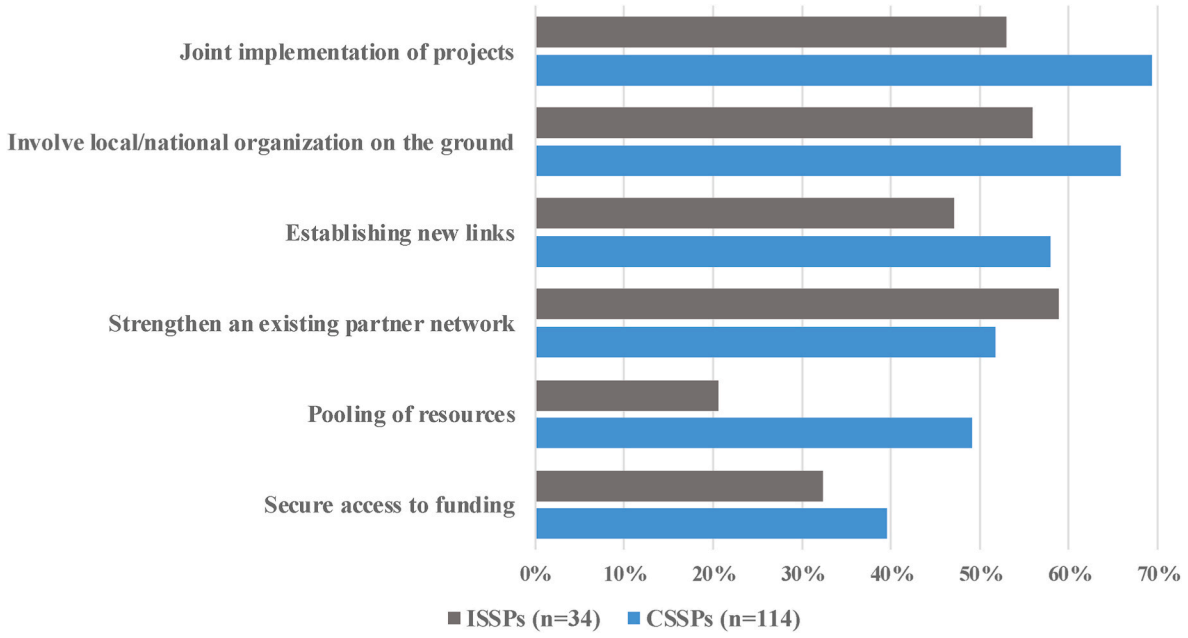


Fig. 3. Motivation for establishing a partnership. The figure shows the reasons for initiating a partnership (multiple answers possible) as percentage of ISSPs (n = 34) and CSSPs (n = 114).

Table 3
Number of partners by subsector (absolute count). The figure shows the involvement of actors from different subsectors for MSPs (n = 148), and for CSSPs (n = 114) and ISSPs (n = 34) specifically.

	NGO/ CSO	IGO	Research and Education	Business And Industry	National Government (Agencies)	City	Other Subnational Actors	Other	Not indicated
CSSPs	319	119	156	146	81	10	56	16	9
ISSPs	46	7	28	58	10	0	0	0	0
Total	365	126	184	204	91	10	56	16	9

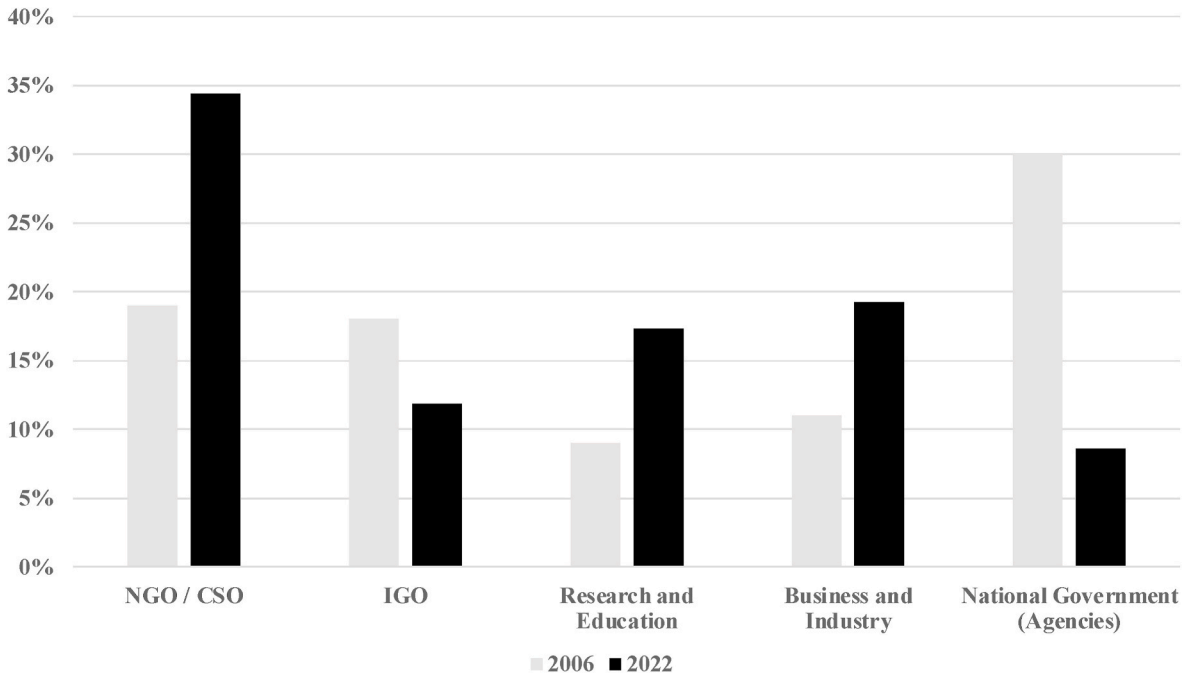


Fig. 4. Participation of partners in MSPs by subsector (2006 vs. 2022; in %). The figure displays the relative distribution of partners from selected subsectors (n_{2006} = 6711; n_{2022} = 1061). Data for 2006 from Pattberg et al. (2012, p. 82).

seeks to do so through superficial or sham commitments to the SDGs, while the latter intends to create benefits from association with the UN. This could be reduced by sound review and tracking of the registered entries. Yet, as we have elaborated in section 3, evidence from our survey suggests that the monitoring, review and follow-up to the registered partnerships is at best moderate.

It is further insightful to examine the representation of stakeholder types *within* partnerships instead of focusing only on the absolute count displayed in Table 3. For instance, the sample includes a single ISSP involving 53 business actors alone. Fig. 5 shows the percentage of partnerships involving at least one partner from the respective subsector.

Here, we see that most ISSPs in our sample (47%) are collaborations among NGOs, followed by research and education partnerships (26%). Much less arrangements consist solely of national governments (12%), business and industry (9%) or IGOs (6%). Percentages for CSSPs exceed 100% as every CSSP combines at least two or more subsectors. Here, we also find a predominance of NGOs, with 75% of all CSSPs including at least one partner from this subsector. Almost half of all CSSPs involve at least one partner from business and industry (48%) or research and education (46%). National governments participate in 42% of the CSSPs, while IGOs are involved in slightly more than a third (36%).

We find that the vast majority (80%) of CSSPs involves two (53%) or three (27%) different sectors. Fig. 6 shows the most frequent combinations of partners in CSSPs by subsector, displayed as a network graph. While the size of the nodes corresponds to the absolute number of actors from the respective subsector (see Table 3), the thickness of the edges relates to the number of CSSPs involving at least one actor from both connected subsectors (see Table 4).

The most prevalent combinations of actors in CSSPs are those of NGO and business/industry (46), followed by NGO and research/education (38), and NGO and national government (32). When analyzing the combination of state and non-state actors in CSSPs (excluding "Others" and "NA"; n = 110), we find that most partnerships (65%) involve both state actors (national governments, IGOs, cities or other subnational actors) and non-state actors (NGOs, research/education, or business/industry). 28% of CSSPs are constellations between different non-state actors, while only 7% are partnerships solely between state actors. This underlines again the relevance of non-state actors in global sustainability governance, both in combination with state actors, yet also in collaborative initiatives established without public sector involvement.

We further analyzed which actors most often lead MSPs. Fig. 7 display the results in comparison to earlier studies by Pattberg et al. (2012) and Andonova and Levy (2003), who analyzed leadership in WSSD partnerships for the years 2007 and 2003 respectively. Contrasting these results with our findings on MSPs for the SDGs in 2022 provides a valuable overview of changes in leadership patterns within partnerships for sustainable development over time.

Our findings show NGOs to be the most frequent lead partners in MSPs (43%). This contrasts previous findings, where state actors, i.e., national and local governments as well as IGOs, led around 60% of all partnerships. Interestingly, we find not only an increasing participation of non-state actors overall (see Fig. 4), but also as lead partners. In our sample, state actors run only 23% of all partnerships. Our results further show an increase of business and industry partners leading MSPs, from around three percent in 2003 and 2007 to 10% in 2022. Lead partners from research and education keep steadily increasing over time, reaching about 12% in 2022. This could indicate greater collaboration among scientist or the strengthening of research networks in the context of the SDGs. Indeed, the SDGs have attracted considerable scientific interest, and evidence-based approaches have become central to assessing progress towards the SDGs. One example is the Global Sustainable Development Report (GSDR), an UN-mandated scientific assessment report to strengthen the science-policy interface and inform the High-Level Political Forum (HLPF), which is responsible for the follow-up and review of SDG implementation. While we find that relatively fewer MSPs today are led by IGOs, they remain the second most frequent lead partner (15%). Endowed with human and financial resources, IGOs are well-equipped to manage and support partnerships (Dzebo, 2019). They often lead as powerful orchestrators, which has been claimed to be key for effective governance (ibid.). Below (section 4.6), we further examine the relationship between lead partners and MSPs' effectiveness. Finally, we find few MSPs led by subnational actors. In our sample, no city actor, but rather other subnational actors lead MSPs. This is quite surprising given the many city networks, such as C40 or 100 Resilient Cities, concerned with building resilient and sustainable urban areas. It is likely that these networks are simply not registered on the partnership platform.

In sum, while Pattberg et al. (2012, p.83) concluded that partnerships (at the time) "reproduce or even intensify existing relationships in

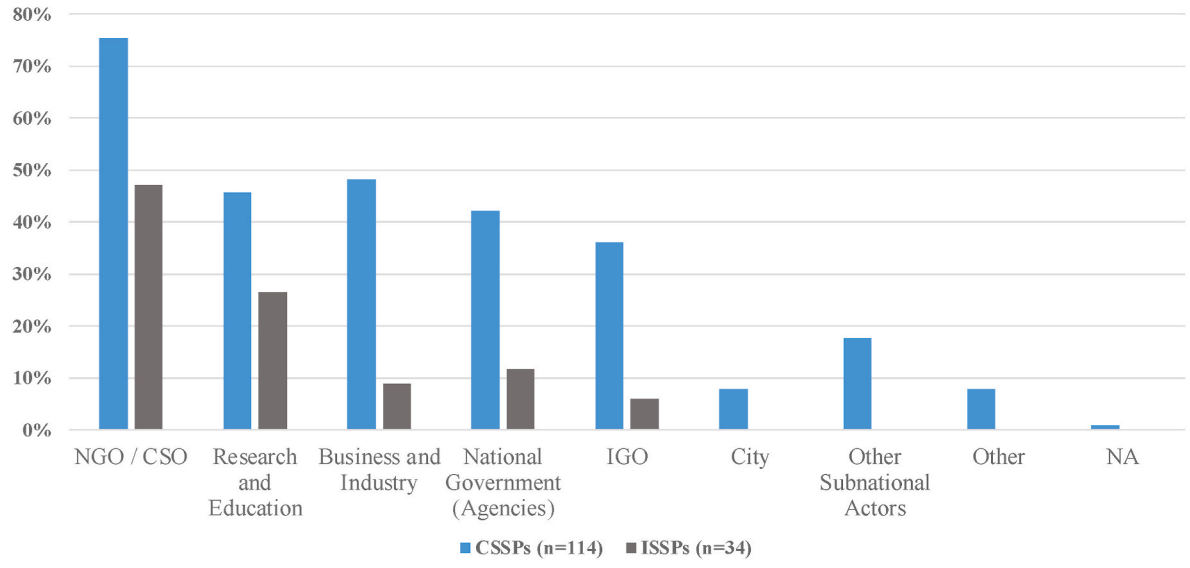


Fig. 5. Representation of subsectors in partnerships (in %). The figure displays the percentage of partnerships involving at least one partner from the respective subsector, for both CSSPs (n = 114) and ISSPs (n = 34).

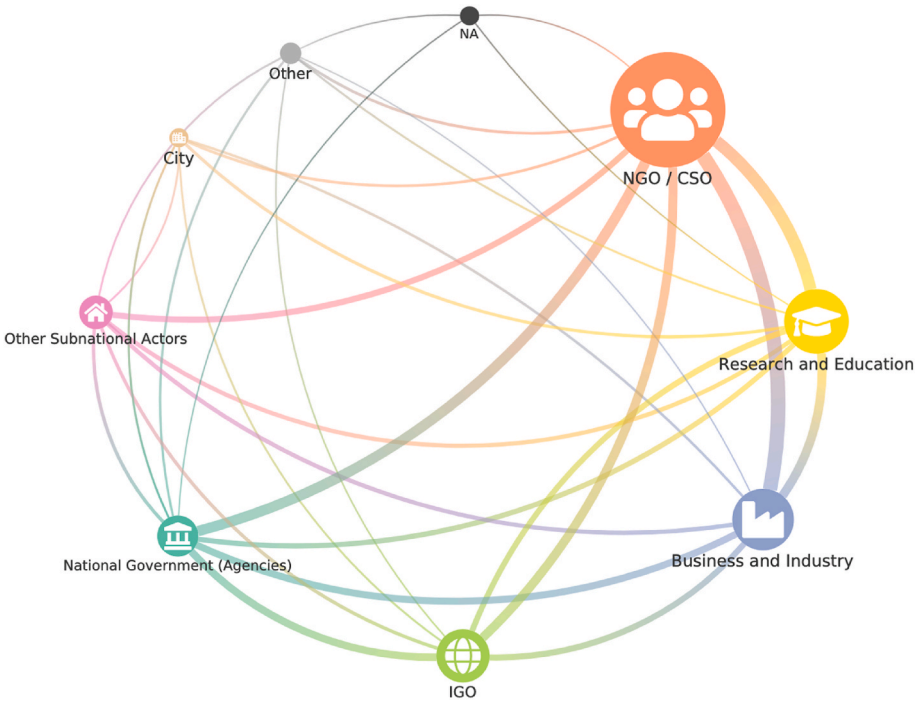


Fig. 6. Partner network of CSSPs. The network shows the connections between different subsectors involved in CSSPs for the SDGs (n = 114). The size of the nodes depicts the total amount of each stakeholder type involved (see also Table 3). The thickness of the edges indicates the number of CSSPs involving at least one partner from both connecting subsectors (see also Table 4). The network can be explored online at: https://kumu.io/LMAG/msps-for-sdgs.

Table 4
Combination of partners in CSSPs, by subsector. The table depicts the number of CSSPs involving at least one partner from respective subsectors (n = 114).

	NGO/ CSO	IGO	Research and Education	Business and Industry	National Government (Agencies)	City	Other Subnational Actors	Other	Not indicated
NGO/CSO	–	–	–	–	–	–	–	–	–
IGO	27	–	–	–	–	–	–	–	–
Research and Education	38	16	–	–	–	–	–	–	–
Business and Industry	46	17	27	–	–	–	–	–	–
National Government (Agencies)	32	22	14	20	–	–	–	–	–
City	6	3	7	5	3	–	–	–	–
Other Subnational Actors	17	8	11	11	8	3	–	–	–
Other	6	2	3	1	4	0	3	–	–
Not indicated	1	0	1	0	1	0	0	1	–

the international system", our data contrasts their findings, pointing to increasing non-state actor involvement over time and in the context of the SDGs. While earlier studies considered the increased participation of non-state actors in global governance as a shift of political authority from public to private actors (Pattberg and Stripple, 2008), more recently the debate has turned to the idea of a "reconfiguration of authority" (Hickmann, 2017, p.432). In this view, non-state action complements the efforts of governments, but public actors continue to play a central role in global governance. Our results corroborate this assumption, as the next section will elaborate in more detail.

4.3. Agency of partners

We further analyzed agency within partnerships, i.e., the activities assumed by individual actors. Here, we focus on CSSPs only to highlight nuanced differences between actors from different societal subsectors. Fig. 8 displays the results, focusing on the three most frequently indicated activities by stakeholder type.

We find that NGOs are most often involved in implementation (35%), indicating their central role in putting internationally agreed guidelines into practice through direct action on the ground. IGOs mostly engage in providing information and expertise (30%), as well as representation within the partnerships (29%).[10] This again points to their role as orchestrators. Additionally, these types of activities suggest that IGOs are involved in partnerships to increase their legitimacy. We further note that the main role of national governments is to fund partnerships. Given that governments are involved in 42% of all CSSPs, this finding underlines the remaining importance of nation states in global governance besides the growing involvement of non-state actors. Results further show that partners from research and education are primarily concerned with providing information and expertise (28%) as well as communication (24%) and implementation (22%). Together with their participation in 46% of all MSPs, this is another indication of the importance of science-based approaches to SDG implementation, which is a central component of the nexus approach. Key roles of partners from business and industry include representation (23%) and financing (21%). While critics may interpret representation as pointing towards window-

[10] With "representation" we refer to the participation of stakeholders in a partnership to represent the respective interests and opinions of their organization regarding the projects at stake.

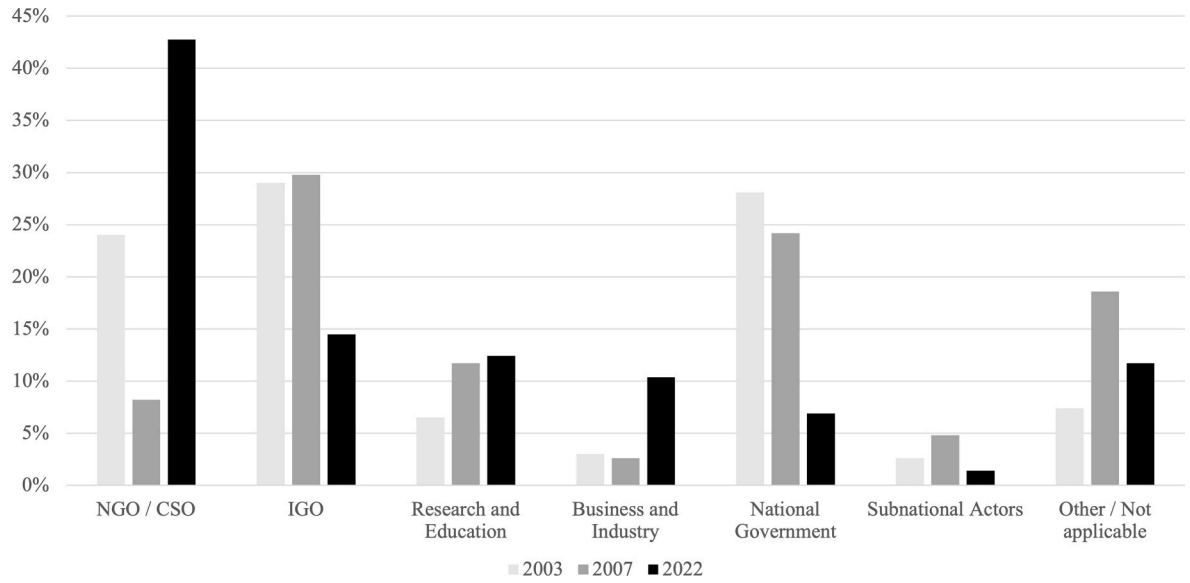


Fig. 7. Lead partners of MSPs for sustainable development by subsector. The graph shows the distribution of lead partners by subsector for the years 2003 (data from Andonova and Levy, 2003, p.23; n = 231), 2007 (data from Pattberg et al., 2012, p.81; n = 321) and 2022 (own data for MSPs; n = 145).

dressing, and financing as powerful means to influence decision-making or define standards according to their own interests (Chan et al., 2019), others may see this as sign of growing corporate social responsibility.

While we find cities to engage most frequently in convening and facilitating participation (50%) as well as implementation (20%), these numbers are almost equal, but reversed, for other subnational actors. This suggests that subnational actors function as orchestrators and implementors in local contexts with a focus on involving stakeholders on the ground. Considering a lively debate on the importance of "localizing" the SDGs, i.e., adapting them to the local context for effective implementation (Valencia et al., 2019), this is an interesting result. Overall, our analysis of agency in CSSPs confirms earlier findings: non-state actors tend to perform rather "soft" activities (except for implementation), whereas state actors assume rather "hard" functions within partnerships. However, by differentiating between societal subsectors, we could find more nuanced differences. For state actors, we see national governments to be primarily responsible for funding, while IGOs and subnational actors often appear to orchestrate partnerships, yet most likely at different levels. For non-state actors, we find partners from research and education to provide expertise and engage in communication, while business actors mostly represent their interests and provide funding to partnerships. Finally, implementation seems to be a joint effort between state and non-state actors, with NGOs taking a particularly prominent role in this regard.

4.4. Governance functions

Table 5 shows the governance functions that partnerships perform, listed by stakeholder type of the leading partner. To relate our results to findings from the previous section, we decided to focus also here on CSSPs only. On average, we find that most CSSPs are concerned with convening and facilitating participation (74%) as well as implementation (73%). Convening and facilitating participation serves a variety of purposes, such as, inter alia, coordination of stakeholders, ensuring accountability and legitimacy, capacity building and knowledge exchange (Betsill and Milkoreit, 2020). According to Betsill and Milkoreit (2020, p.78), it "enables the fulfillment of other governance functions if and to the extent that the agent is not willing or able to provide these on its own". Thus, this being an important governance function of CSSPs was expected given their nature of combining partners from different societal subsectors. Implementation was rated "very important" by the majority of CSSPs, independent of the type of lead partner (except for subnational actors, excluding cities). Interestingly, this contrasts results from Pattberg et al. (2012), who found that partnerships most often focus on institution-building rather than on implementation. We find rulemaking and regulation (33%) as well as standard setting and certification (36%) to be functions less often assumed by CSSPs. Overall, our results suggest that partnerships for the SDGs are predominantly concerned with "getting everyone on board" and "getting things done".

Regarding NGO-led CSSPs, we find that all functions were rated "very important" by at least 60%, except standard setting/certification (30%) and rulemaking/regulation (32%). Implementation (87%), knowledge dissemination and capacity building (both 81%) were rated as core functions of these partnerships. This again confirms the important contribution of NGOs in converting the SDGs into tangible action on the ground. For CSSPs led by IGOs, we find implementation (90%), knowledge production (80%) and capacity building (75%) to be primary functions. Comparing this to main activities that IGOs perform as individual actors in partnerships (see Fig. 8), our results suggest that many partnerships are established and orchestrated by IGOs as lead partners, with a focus on providing information and expertise to implementing partners on the ground. Similarly, we find that governments leading CSSPs do so primarily by funding implementation (89%) and capacity building efforts (78%). These partnerships further rank second in rulemaking and regulation (44%) after other partnerships led by subnational actors (50%). This was expected, as these rather hard governance functions typically performed by state actors. When research and education partners take the leading role, we find, as expected, knowledge production (80%) and dissemination (70%) as well as implementation (80%) to be the main governance functions of these partnerships. This corroborates our argument regarding evidence-based SDG implementation in MSPs, especially under the auspice of partners from the research community. Business-led MSPs are mostly concerned with implementation (92%) as well as capacity building (85%). Since we found that business actors themselves are not primarily involved in implementation (see Fig. 8), their role as lead partners appears to be focused on financing projects implemented by others. On the other hand, business-led CSSPs rank first in standard setting and certification (46%), most likely related to partnerships concerned with private certification schemes.

Fig. 8. Activities assumed by partners in CSSPs. The figure shows the three most frequent activities of partners involved in CSSPs by subsector (n = 114). Percentages relate to the number of actors from the respective sector.

4.5. SDG coverage

An analysis of the SDGs covered by MSPs shows that 56% address two or more SDGs in their work. Interestingly, we find that CSSPs more often than ISSPs address multiple SDGs (59% vs. 42%). Since these results are based on the goals selected to reflect the partnerships' *main* purpose, this suggests that partnerships involving different stakeholder types are more likely to consider interrelations between the goals in practice.

As Fig. 9 shows, SDG 4 (*quality education*) and, as expected, SDG 17 (*partnerships for the goals*) are frequently addressed by both CSSPs and ISSPs. We find CSSPs to address a variety of goals more frequently than ISSPs, i.e., SDG 13 (*climate action*), SDG 11 (*sustainable cities and communities*), SDG 15 (*life on land*), SDG 16 (*peace, justice and strong institutions*), SDG 10 (*reduced inequalities*), and SDG 5 (*gender equality*). Notably, we find no ISSP focusing on SDG 7 (*clean and affordable energy*). In contrast, SDG 2 (*zero hunger*), SDG 3 (*good health and well-being*) and SDG 14 (*life below water*) are more frequently addressed by ISSPs. This indicates a need to foster collaboration between different societal subsectors in these issue areas.

Leaving SDG 17 (*partnerships for the goals*) as referring to the means of implementation aside, CSSPs' work mostly contributes to SDG 13 (*climate action*; 36%), SDG 4 (*quality education*; 35%), and SDG 5 (*gender equality*; 27%). The focus on SDG 13 is noteworthy, given that implementation efforts at the national level were found to prioritize mainly socio-economic goals (Biermann et al., 2022a). CSSPs thus seems to play an important complementing role for integrated SDG implementation. The relatively high focus on quality education (SDG 4) and gender equality (SDG 5) supports this argument, as both goals can be considered cross-cutting issues enabling the attainment of other SDGs (Glass and Newig, 2019; Leal Filho et al., 2022). SDG 9 (*industry, innovation and infrastructure*), SDG 10 (*reduced inequalities*) and SDG 12 (*responsible consumption and production*) are least addressed by CSSPs. It has been noted that SDGs 10 and 12 are generally under-researched (Biermann et al., 2022a), which may explain to some extent the limited attention given to these goals. Previous studies have further shown that SDG 9 is

Table 5
Governance functions of CSSPs by stakeholder type of lead partner (in %). The cells depict the share of CSSPs that rated a governance function as "very important".

	NGO/ CSO	IGO	Research and Education	Business and Industry	National Government (Agencies)	Subnational Actors (excl. Cities)	Other/Not applicable	Mean
	(n = 319)	(n = 119)	(n = 156)	(n = 146)	(n = 81)	(n = 56)	(n = 16)	
Direct action/ Implementation	87	90	80	92	89	0	75	73
Capacity building	81	75	40	85	78	50	75	69
Knowledge production	70	80	80	46	56	0	92	61
Knowledge dissemination/ Campaigning	81	65	70	69	56	50	83	68
Consulting/Policy advice	70	65	20	38	56	50	83	55
Lobbying/Advocacy	60	30	20	31	56	0	75	39
Standard setting/ Certification	30	40	40	46	44	0	50	36
Convening/Facilitating participation	74	65	60	69	67	100	83	74
Rulemaking/Regulation	32	35	20	15	44	50	33	33
Monitoring/Review	64	65	40	46	67	50	50	55
Funding/Sponsoring	62	65	40	69	67	50	33	55

highly synergistic with many other goals (Coenen et al., 2022). Consequently, there appears to be untapped potential for partnerships to create additional co-benefits in SDG implementation by focusing more synergistic action on SDG 9.

We further took a closer look at the SDGs addressed in combination by CSSPs to examine whether they contribute to integrated SDG achievement by considering interrelations between the goals. Fig. 10 shows a heat map of SDG pairs addressed jointly in any combination of two or more goals selected as reflecting a partnership's *primary objectives* in the survey's two-stage selection process.

We find that CSSPs most often address the nexus between quality education and gender equality (SDGs 4 and 5). By targeting these cross-cutting issues jointly, partnerships contribute to integrating both policy domains by combining resources, skills, and knowledge from different stakeholder types in action on the ground. Eliminating gender disparities in education further constitutes a leverage to increase women empowerment and reduce poverty, particularly in countries of the Global South. This is underlined by an observable joint focus on SDG 5 and SDG 1 (*poverty eradication*). SDG 17 (*partnerships*) and SDG 13 (*climate action*) are equally often addressed in combination. This indicates that partnerships work on fostering collaborative action for climate protection, thereby complementing (still insufficient) state-led efforts. SDG 13 is further frequently addressed in combination with SDG 11 (*sustainable cities and communities*). Since cities are both severely affected by climate change and major polluters, collaborative efforts to address both goals simultaneously are crucial to reducing their adverse environmental impact with a parallel view on securing sustainable socio-economic development. In sum, among the most frequent SDG nexuses addressed, we find a dominance of SDG 13 (climate action), SDG 5 (gender equality) and SDG 4 (education). The SDGs least frequently addressed jointly, in contrast, often include SDG 12 (responsible production and consumption) and SDG 10 (reducing inequalities).

We compared our results to a study by Pradhan et al. (2017), who statistically analyzed synergies and trade-offs among the SDGs. With this, we aim to assess whether the patterns we see in partnership approaches to SDG implementation correspond to previously identified interlinkages between the goals. Among the SDG pairs most often addressed in our sample, we find two of the top ten synergistic SDGs identified by Pradhan et al. (2017, p.1174). These relate to the city-climate-nexus (SDGs 11 and 13; synergy pair 1), as well as to the poverty-gender-nexus (SDGs 1 and 5; synergy pair 3). In contrast, four of the least addressed SDG pairs in our sample are among the top ten trade-off SDGs identified by Pradhan et al. (2017). All these concern SDG 12 (*responsible consumption and production*), in combination with SDG 10 (*reduced inequalities*; trade-off pair 1), SDGs 1 (*no poverty*; trade-off pair 2), SDG 6 (*clean water and sanitation*; trade-off pair 3) and SDG 3 (*good health and well-being*; trade-off pair 4). According to Pradhan et al. (2017), SDG 12 to show the most trade-offs with other goals.

Overall, we find that CSSPs are more likely than ISSPs to address multiple SDGs, thus fostering integrated SDG implementation. However, we find that partnerships focus more often on synergistic SDG pairs, while those that potentially involve many trade-offs – e.g., related to SDG 12 – are less often addressed jointly. Based on our results, we suggest encouraging effective CSSPs for potentially conflicting goals in order to reduce trade-offs and other unintended consequences which might be overlooked in silo approaches. As argued above, the combination of knowledge, resources and skills from different societal subsectors render these partnerships particularly suitable to do so. We acknowledge that effectively dealing with trade-offs certainly requires strong coordination between partners. Unfortunately, many partnerships might not be sufficiently equipped with the resources to fulfill this potential, as some indicated explicitly in our survey. On the other hand, more partnerships addressing highly synergistic SDG pairs in combination could further increase co-benefits in implementation efforts. While many of the most synergistic pairs identified by Pradhan et al. (2017) are at least moderately covered by CSSPs in our sample, we find untapped potential regarding other goals, such as e.g., SDG 3 (*good health and well-being*). According to Pradhan et al. (2017), SDG 3 has synergies with many other SDGs, which is however not fully reflected in the work of CSSPs (see Fig. 10). While this may be due to a perception of health care as the primary responsibility of the state, unconventional and cross-sectoral approaches could foster progress on SDG 3 and many other goals simultaneously (ibid.; Buse and Hawkes, 2015).

Finally, we examined which constellations of stakeholder types most frequently address which SDGs. Results show that CSSPs formed solely among non-state actors (including NGOs, research and education, and business and industry) most often work on SDG 4 (*quality education*; 48%), SDG 13 (*climate action*; 39%) and SDG 5 (*gender equality*; 35%). For those eight purely public CSSPs in our sample (including national governments, IGOs, cities, other subnational actors), we find SDG 1 (*no poverty*), SDG 8 (*decent work and economic growth*), SDG 10 (*reduced inequalities*), SDG 11 (*sustainable cities and communities*), SDG 13 (*climate action*), SDG 14 (*life under water*) and SDG 17 (*partnerships for the goals*) all covered by two partnerships each (corresponding to 25%). Notably, purely public partnerships do not address many goals at all, such as SDG 2 (*zero hunger*), SDG 5 (*gender equality*), SDG 6 (*clean water and sanitation*), SDG 7 (*clean and affordable energy*), SDG 9 (*industry, innovation and infrastructure*), SDG 12 (*responsible consumption and production*) and SDG 16 (*peace, justice and strong institutions*). However, as purely public CSSPs

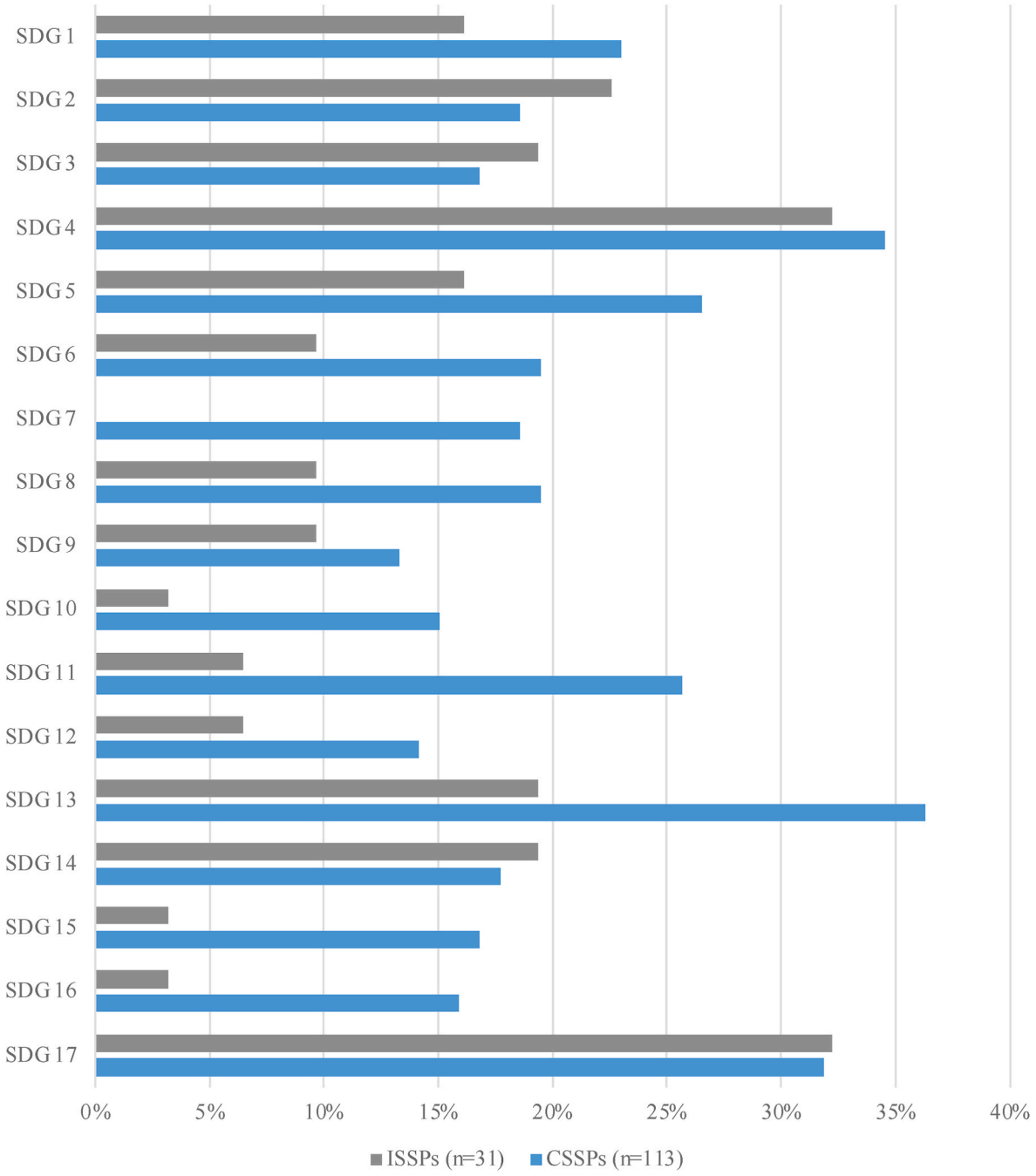
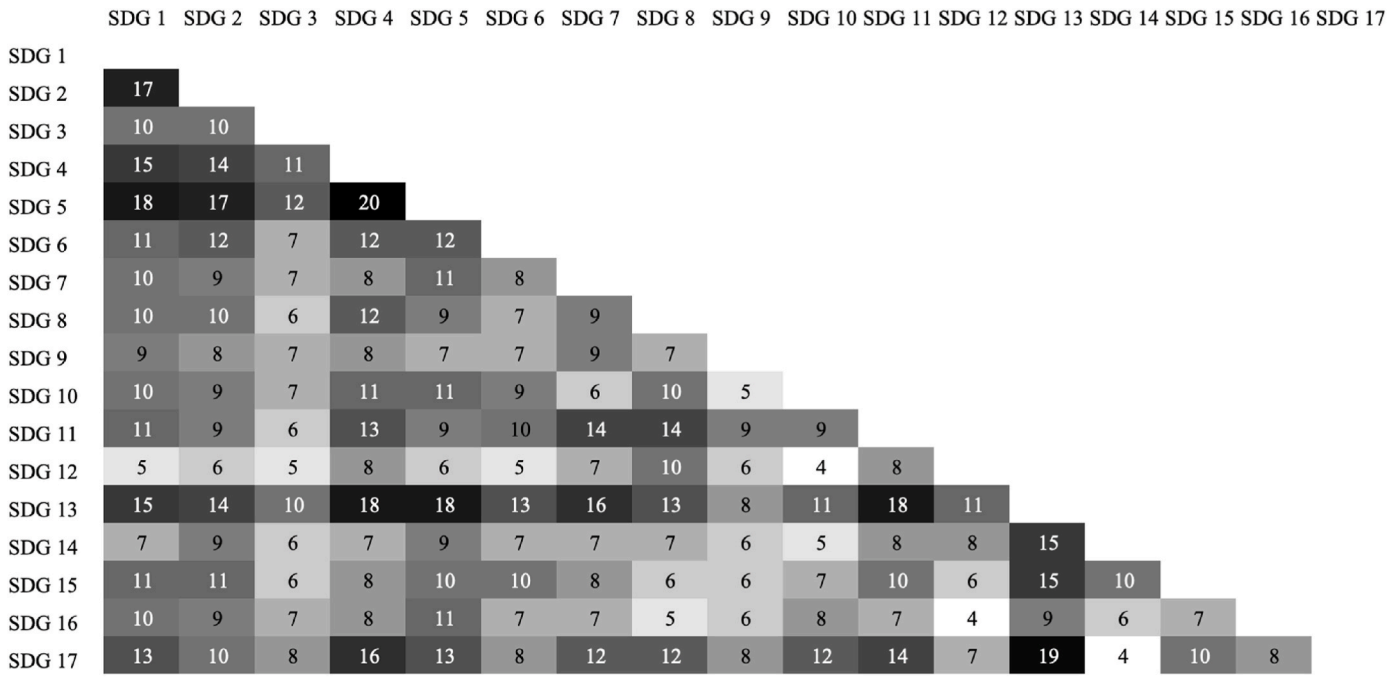


Fig. 9. SDGs addressed by MSPs. The figure shows the percentage of CSSPs (n = 113) and ISSPs (n = 31) addressing the respective SDG as "main purpose" of their action.

represent only 7% in our sample, results should be treated with caution. Lastly, when both state and non-state actors are involved, the SDGs addressed most often concern climate action (SDG 13; 34%), partnerships (SDG 17; 31%), education (SDG 4; 30%) and gender equality (SDG 5; 25%). Thus, results suggest that education, climate action, gender equality and the enhancement of collaborative implementation efforts are topics that are driven forward particularly through cooperation with or among non-state actors in collaborative governance arrangements for SDGs. Again, this underlines the relevance of involving a diverse set of state and non-state actors in SDG implementation efforts since they assume different yet complementary roles and governance functions in fostering global sustainable development.

4.6. *Effectiveness*

Finally, we asked respondents to evaluate the success of their partnership in pursuing its objectives. We find that CSSPs are rated more successful compared to ISSPs, with 51% of CSSPs rated "very successful", meaning that most or all objectives were achieved. Still 40% reported their partnership to be "somewhat successful" (some of the objectives were achieved), while only 9% of CSSPs are judged as "hardly successful" (none or few of the objectives were achieved). By contrast, only 39% of ISSPs were rated "very successful", 42% reported "somewhat successful" and 19% reported "hardly successful". We acknowledge that self-reported success does not constitute an objective measurement of effectiveness and encourage future research to validate our findings, e.g., by building on previous research on external and



SDG Abbreviation

1.	No poverty	7.	Affordable and clean energy	13.	Climate action
2.	Zero hunger	8.	Decent work and economic growth	14.	Life below water
3.	Good health and well-being	9.	Industry, innovation and infrastructure	15.	Life on land
4.	Quality education	10.	Reduced inequalities	16.	Peace, justice and strong institutions
5.	Gender equality	11.	Sustainable cities and communities	17.	Partnerships for the goals
6.	Clean water and sanitation	12.	Responsible consumption and production		

Fig. 10. SDGs addressed jointly by CSSPs. The heat map displays the frequency with which two SDGs are addressed jointly by CSSPs (n = 113). Data relates to the SDGs included in any combination of goals (two or more) indicated as the partnerships' primary objectives.

internal conditions for success (see Pattberg and Widerberg, 2016; Horan, 2019). However, our results suggest a positive impact of collaboration between different societal subsectors on partnership effectiveness.

To provide a more detailed assessment, we further analyzed which organizational and institutional characteristics relate to self-reported effectiveness of CSSPs (see Table 6). First, we find that CSSPs that are still active are evaluated much more successful than those that already ceased their activity. 38% of inactive partnerships were rated "hardly successful", compared to only 7% of active CSSPs. On the one hand, it could be that active partnerships are still in an early phase in which it may be difficult to adequately assess success. On the other hand, the relatively high proportion of inactive CSSPs rated hardly successful could also indicate that they have ceased operations prematurely due to problems such as insufficient funding.

We find no clear relationship between annual project budget and (self-reported) effectiveness. While partnerships with a budget of USD 100,001–250,000 are most often evaluated "highly effective" (67%), so are still 50% of CSSPs with no budget at all. Similarly, and in accordance with previous findings (see Dzebo, 2019), we find no clear link between (self-reported) effectiveness and number of staff.

In contrast, our results show regular communication and monitoring to be positively related to partnerships' self-reported effectiveness. While 50% of CSSPs who do not monitor their activities were rated "hardly successful", 52% of those who do monitor reported meeting all or most of their objectives. Additionally, CSSPs without regular communication among partners were most often rated "hardly successful" (38%). Nevertheless, a higher frequency of exchange does not necessarily seem to be better: Those that communicate (bi-)weekly (68%) or (bi-)monthly (54%) were most often rated "very successful", compared to 30% communicating daily. Overall, our results support the argument that effective monitoring, reporting, and evaluation are crucial for partnership success by enabling organizational learning, increasing transparency and legitimacy, and helping meet internal and external demands for disclosure and accountability (Pattberg and Widerberg, 2016).

Finally, results show considerable differences in CSSP (self-reported) effectiveness depending on the type of lead partner. Remarkably, 90% of IGO-led CSSPs were reported to be very successful. Again, this indicates that IGOs often function as effective orchestrators of partnerships, providing "personnel and resources to support, steer and transform an initiative from idea to practice" (Dzebo, 2019, p.458). Similarly, CSSPs led by national governments were mostly reported to meet all or most of their objectives (67%). Powerful lead partners such as IGOs or governments may not only be important in terms of resource provision, but most likely also add credibility and legitimacy to partnerships, thereby positively influencing their effectiveness. However, previous studies caution against large power asymmetries (Pattberg and Widerberg, 2016), and underline that a clear commitment of powerful, influential partners is key to success (ibid., Beisheim, 2012). In contrast, business-led CSSPs and those led by research and education partners report low levels of effectiveness. While those critical of for-profit organizations' involvement in sustainability governance might interpret these findings as pointing to SDG-washing activities, low levels of (self-reported) effectiveness could also relate to more ambitious goal setting or more critical assessments of success in these partnerships. As

Table 6
Effectiveness of CSSPs. The table shows the relationship between organizational and institutional characteristics of CSSPs and their self-reported effectiveness.

	n	Hardly successful	Somewhat successful	Very successful
Activity status				
Active	113	7%	41%	52%
Inactive		38%	25%	38%
Budget				
No budget	113	6%	44%	50%
Less than USD 25,000		18%	27%	55%
USD 25,001–100,000		5%	48%	48%
USD 100,001–250,000		–	33%	67%
USD 250,001–1,000,000		–	53%	47%
More than USD 1,000,000		14%	36%	50%
Unknown/No answer		25%	38%	38%
Staff (people actively involved)				
1–5	113	17%	34%	48%
6–20		3%	31%	66%
21–50		–	58%	42%
51–200		9%	45%	45%
More than 200		9%	45%	45%
Unknown		50%	–	50%
Communication frequency				
Daily	91	20%	50%	30%
Weekly/Bi-weekly		8%	24%	68%
Monthly/Bi-monthly		–	46%	54%
3–5 times per year		6%	56%	38%
Once or twice per year		20%	40%	40%
None/not regularly		38%	25%	38%
Monitoring				
Yes	113	5%	43%	52%
No		50%	10%	40%
Lead partner				
NGO/CSO	113	11%	43%	47%
IGO		–	10%	90%
Research and Education		10%	70%	20%
Business and Industry		15%	62%	23%
National Government (Agencies)		11%	22%	67%
Subnational Actors (excl. Cities)		–	50%	50%
Other/Not Applicable		8%	42%	50%

we cannot draw a definitive conclusion based on the results of our study, we encourage future research to explore our findings in more detail.

5. Conclusion

In this article, we analyzed the emerging collaborative governance architecture for SDG implementation by means of a survey of 192 MSPs listed on the UN partnership platform. Compared to previous research, our results indicate that partnerships for sustainable development have become more inclusive over time, involving more non-state actors overall, and as leading partners. In particular, we find a strong increase in NGO involvement and leadership. We further note that distinguishing between CSSP and ISSPs as different types of MSPs yields additional insights, accounting for nuanced differences between diverse societal subsectors involved instead of focusing on broader categories such as the public and private sector only. Looking at the activities that state actors perform within MSPs, we find that national governments mostly provide funds, while IGOs and sub-national actors seem to orchestrate partnerships at different levels. For non-state actors, results show that NGOs are primarily involved in direct implementation, research/education partners provide expertise, and business actors fund partnerships. Our findings thus confirm the idea of a "reconfiguration of authority" (Hickmann, 2017) in global sustainability governance, where state action remains central, but is complemented by efforts of non-state actors. Main governance functions assumed by MSPs can be summarized with "getting everyone on board" and "getting things done", i.e., focusing on convening and facilitating participation as well as implementation on the ground. Our findings on SDGs coverage show that CSSPs more frequently than ISSPs address multiple SDGs, which suggests a relatively strong 'nexus'-orientation by partnerships involving actors from different societal subsectors. Their cross-subsector nature combining diverse skills, resources and knowledge of the partners involved seems especially important in this regard. Future research should however assess whether MSPs deliberately consider and, more importantly, actually mitigate trade-offs in the nexuses they address. Our results further suggest an important complementary role of MSPs for SDG implementation, as they often address frequently under-represented and cross-cutting sustainability goals such as climate action (SDG 13), quality education (SDG 4) and gender equality (SDG 5). However, we find untapped potential regarding SDG pairs that potentially involve many trade-offs, such as those concerning SDG 12 (*sustainable consumption and production*) and SDG 10 (*reduced inequalities*). Here, collaboration between different societal subsectors could be particularly helpful in advancing integration between the goals with an eye towards mitigating potential negative spillovers. Finally, we find MSPs to be relatively well institutionalized, which positively relates to their (self-reported) effectiveness. Results further show that leadership by IGOs or national governments are conducive to success, most likely through orchestration efforts and the provision of resources. Overall, our results indicate a positive impact of cross-subsector collaboration for partnership effectiveness. Importantly, we acknowledge the limited representativeness of our sample and encourage future research to reassess our results, both through in-depth analyses and large-n studies applying objective measures of effectiveness.

Based on our findings, we would like to conclude with an appeal to the UN system. First, we strongly encourage the UN to make the underlying data of their partnership platform readily available to the public, especially to advance research, knowledge generation, and ultimately, SDG implementation. Second, there appears to be much room for improvement regarding the monitoring, review and follow-up of partnerships registered. Currently, transparency and accountability seem limited, with data often being missing, incomplete or outdated.

Further, some of the partnerships we contacted during our research process were not even aware of their listing on the platform, and others commented in the survey about the lacking support on behalf of the UN. Additionally, sound monitoring, review and follow-up could help reduce the opportunity for SDG- or blue-washing. Third, greater engagement with partnerships registered on the platform could accelerate SDG achievement. For example, drawing on scientific research, the UN could actively promote the establishment of MSPs for SDGs potentially involving many trade-offs and steer them towards nexus approaches to improve integrated implementation of the goals. They could further help to connect partnerships with a similar issue focus to foster resource and knowledge sharing. We recognize that all of this requires political will and sufficient resources. Yet, operating a transparent and accountable partnership platform – rather than using it as a vehicle for showcasing (sometimes questionable or inexistent) action – could help increase credibility and legitimacy, and mobilize more effective partnerships that as we have shown can serve important complementary functions in efforts to achieve the SDGs.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Simon Ruf is employed by the German Federal Foreign Office. His contributions to the article were made in a personal capacity and do not stand in connection with his professional affiliation.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.esg.2023.100182.

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Appendix

Questionnaire for the survey of partnerships registered on the United Nations Partnership Platform

About your partnership

What is the name of your partnership? *

Please use the same name as registered on the 'United Nations Partnerships for SDGs online platform'. Please do not use any acronyms.

[TEXT]

What is the name of your organization? *

Please do not use any acronyms.

[TEXT]

When was your partnership launched? *

Please enter a date (month & day are optional).

[YYYY-MM-DD]

Is your partnership still active? *

In case your partnership is inactive, please continue responding on the basis of the last year of activity.

[Yes | No]

Is there a final target year for your partnership?

If yes, please enter target year (it may be in the past; month & day are optional). If there is no final target year, please leave blank.

[YYYY-MM-DD]

Why was the partnership initiated? *

[SELECT – MULTIPLE CHOICE]

- Secure access to funding
- Involve local/national organization on the ground
- Joint implementation of projects
- Pooling of resources
- Strengthen an existing partner network
- Establishing new links

What is the annual project budget? *

Including implementation, coordination, fund raising, etc.

[SELECT – DROPDOWN]

- No budget
- Less than USD 25,000
- USD 25,001 - 100,000
- USD 100,00 – 250,000
- USD 250,001 - 1,000,000
- More than USD 1,000,000
- Unknown/ no answer

Does your partnership regularly monitor its activities? *

[Yes | No]

How many people are actively involved in the partnership *

Including implementation, coordination, fund raising, etc.?

[SELECT – DROPDOWN]

- Between 1 and 5
- Between 6 and 20
- Between 21 and 50
- Between 51 and 200
- More than 200
- Unknown

How many organizations are involved in the partnership? *

Including your organization

[NUMBER] ----- NEXT PAGE ----

About the partners (1/2)

What is the type and main role of each partner? *

Please enter the name of each partner organization and select the corresponding type and indicate their respective role in the partnership. Please do not use acronyms.

[TEXT: Name – The own organization name will be displayed automatically]
[SELECT – DROPDOWN: Select type of partner]

- National Government or Government Agencies
- Intergovernmental Organizations
- City
- Other Subnational Actors (e.g. counties, district, province)
- Non-governmental or civil society organization
- Business and Industry
- Research and Education
- Other [if "Other" → New line: "Please indicate type"]

[SELECT – DROPDOWN: Select main role of partner]

- Administration
- Communication
- Convening & Facilitating participation
- Providing information/expertise
- Representation of stakeholders within the partnership
- Fund raising (from third parties)
- Financing (provides funding to the partnership)
- Implementation on the ground
- Other [if "Other" → New line: "Please indicate role"]

----- NEXT PAGE ---

About the partners (2/2)

Is there regular communication (email/phone/personally) between the main partners?

[SELECT – DROPDOWN]

- No / not regularly
- Daily
- Bi-weekly / weekly
- Bi-monthly / monthly
- 3 - 5 times per year
- Once or twice per year

Who has initiated the partnership? *

[SELECT – MULTIPLE CHOICE]

Previously listed partners will be displayed automatically

Who is leading the partnership? *

[SELECT – DROPDOWN]

- Not applicable
- Previously listed partners will be displayed automatically

In which country is the administrative base of your partnership located?

Please indicate the location of the partnership's secretariat or headquarters.

[SELECT – DROPDOWN: Country list]

Which countries is or was your partnership active in?

Please add all relevant countries and indicate the current status for each one.

[SELECT – DROPDOWN: Country list + "Globally / No specific country focus"]

After selection of country → New line: DROPDOWN "Select status"

- Active in the past, inactive now
- Active at the moment
- Activity planned, inactive at the moment

----- NEXT PAGE ----

Sustainable Development Goals

Which SDGs are addressed by your partnership? *

Please choose all that apply, including secondary objectives of your partnership.

[SELECTED SDGs will be colored]

----- NEXT PAGE ----

Now please select only those SDGs that correspond to the main purpose of your partnership *

[Only previously selected SDGs will be displayed; SELECTED SDGs will be colored]

----- NEXT PAGE ---

Functions and activities

What are the functions or activities of your partnership?

Please indicate the importance of each by selecting the corresponding entry from the drop-down menu.

[SELECT – DROPDOWN FOR EACH: not applicable | less important | somewhat important | very important]

1. Direct action / Implementation
   Putting policies, decisions, and/or programs into action

2. Capacity building
   Developing actors' abilities and resources to perform certain activities

3. Knowledge production
   Production of knowledge, information, innovation (scientific or applied)

4. Knowledge dissemination or campaigning (directed at the broader public)
   Sharing knowledge and information, including raising public awareness on a given topic, and education of the public at large

5. Consulting / Policy advice
   Dissemination of knowledge, including dissemination of 'good practices' to counsel policy-makers or decision-making bodies (e.g. through policy briefs, commissioned reports etc.)

6. Lobbying / Advocacy
   Lobbying or advocacy, i.e. actions seeking to influence governmental actors

7. Standard setting / certification
   Establishing and confirming compliance with benchmarks and requirements, including setting minimum-standards

8. Convening / facilitating participation
   Providing a platform for and attracting multiple actors to interact and coordinate activities

9. Rulemaking & regulation
   Developing and establishing enforceable rules (laws, statutes, regulation)

10. Monitoring & Review
    Overseeing, assessing, and evaluating governance activities, esp. implementation

11. Funding / Sponsoring
    Providing funds

12. Other

Overall, how do you judge the success of the partnership in pursuing its objectives?

[SELCT – DROPDOWN]

- Hardly successful – none or few of the objectives were achieved
- Somewhat successful – some of the objectives were achieved
- Very successful – most or all of the objectives were achieved

----- NEXT PAGE –

Additional remarks

Can we contact you for follow-up questions or questions for clarification as we continue our research on SDG partnerships? *

[Yes | No]

Would you like to receive any of our results by email?

[Yes | No]

Email address

If you have selected "Yes" in any of the previous two questions, please indicate your preferred e-mail address.

Do you have any additional remarks you would like to share?

Please write your answer here:

[TEXT]

[Submit button]

----- END -----

Article 4:

Resilience and the Sustainable Development Goals: a scrutiny of urban strategies in the 100 Resilient Cities initiative

Abstract

In the last decades, discourse and practice on urban transformation have centered around the concepts of sustainability and resilience. However, resilience in a narrow understanding – i.e. protecting the status quo – can contradict sustainable development. The 100 Resilient Cities exemplify a network in which cities actively pursued adaptation to future challenges in a way that could link resilience and sustainability. In this article, we analyze the resilience strategies of cities in this network against the Sustainable Development Goals (SDGs) to understand the extent to which they consider sustainable development simultaneously. Overall, we find a positive trend towards resilience and sustainable development in urban strategies, particularly in the Global South. However, cities' resilience efforts often prioritize economic goals over social and environmental objectives. This contrasts with the call for transformative actions to achieve the SDGs.

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Resilience and the Sustainable Development Goals: a scrutiny of urban strategies in the 100 Resilient Cities initiative

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In the last decades, discourse and practice on urban transformation have centered around the concepts of sustainability and resilience. However, resilience in a narrow understanding – i.e. protecting the status quo – can contradict sustainable development. The 100 Resilient Cities exemplify a network in which cities actively pursued adaptation to future challenges in a way that could link resilience and sustainability. In this article, we analyze the resilience strategies of cities in this network against the Sustainable Development Goals (SDGs) to understand the extent to which they consider sustainable development simultaneously. Overall, we find a positive trend towards resilience and sustainable development in urban strategies, particularly in the Global South. However, cities' resilience efforts often prioritize economic goals over social and environmental objectives. This contrasts with the call for transformative actions to achieve the SDGs.

Keywords: resilience; sustainable development; urban governance; city transformation index; comparative analysis

1. Introduction

Cities are frequently considered as innovation hubs that promote transformative change (Bai *et al.* 2018). They often engage in action to adapt to climate change and other social, economic, and environmental challenges of uncertain futures. To address these challenges, urban resilience and urban sustainability have become key topics in research and practice for transformative city action and urban governance (Zhang and Li 2018).

Resilience has different definitions and understandings, although scholars agree that the concept broadly describes system stability or transformation in response to external shocks, disruptions, and changed circumstances (Brand and Jax 2007; Nüchter *et al.* 2021). Resilience can therefore mean that a system "bounces back", i.e. re-establishes the status quo after a disturbance, or that it adapts to changes in an incremental or transformative way. The concept of *sustainability*, on the other hand, is now prominently

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embodied by the 2030 Agenda for Sustainable Development (2030 Agenda) adopted by the member states of the United Nations (UN) in September 2015 (UN [United Nations] 2015). Its 17 interrelated Sustainable Development Goals (SDGs) and 169 targets can be seen as a normative framework to foster sustainable development in its social, economic, and environmental dimension (Biermann *et al.* 2022).

In urban governance, the distinction between both terms is not always clear-cut (Elmqvist *et al.* 2019). However, a narrow understanding of urban resilience as the capacity to "bounce back" and shield cities against risks can hinder sustainable development by maintaining the status quo (Davoudi 2014). Also, narrow definitions often fail to capture the social dimension of resilience (Nüchter *et al.* 2021). By focusing primarily on infrastructure, such understandings can disregard diverse lived experiences and social justice and, at worst, render marginalized groups more vulnerable (Ziervogel *et al.* 2017). Achieving sustainable futures requires transformative action (Allen, Malekpour, and Mintrom 2023). A transformative understanding of resilience in urban governance therefore seems more likely to promote both resilient *and* sustainable futures. One such approach to resilience building is transformative adaptation, which takes not only risks but also root causes for social, economic, and ecological system vulnerabilities into account (Pelling, O'Brien, and Matyas 2015; Pelling 2011; Wisner *et al.* 2004) and is required when incremental adjustments will not suffice to deal with those vulnerabilities (Kates, Travis, and Wilbanks 2012).

Against this background, the present article aims to empirically examine the link between resilience, sustainability (through the lens of the SDGs) and transformative adaptation in cities. To do so, resilience strategies from the global initiative 100 Resilient Cities (henceforth 100RC) provide a suitable empirical context for our study: Partaking cities were required to connect resilience actions to potential external events and underlying root causes of system vulnerability in resilience strategies. These so-called shocks and stresses were identified through a predefined, common framework that included different categories reflecting the three dimensions of sustainability (environmental/social/economic). The assessment of planning documents is a popular method in environmental governance research to evaluate city action that lacks information about actual implementation (Dilling *et al.* 2019). Nevertheless, planning documents provide important insights into policy processes and actions, and can foster effective implementation (Olazabal *et al.* 2019). In this case, the assessment of 100RC strategies provides insights on how cities interpret resilience at the action level in a global network that aims to institutionalize resilience as a policy goal. By including cities of the Global South (GS) and North (GN)[1], we address a gap in empirical research, as urban transformation studies have so far focused on Global North cities (Betsill and Bulkeley 2007; Sharifi 2021). While only a few studies present comparative global analyses, and often with a focus on climate change adaptation (e.g. Araos *et al.* 2016), cities in the GS are mostly – if at all – examined through single or small-N case studies (e.g. Sutherland, Roberts, and Douwes 2019; Shamout and Boarin 2021; Croese, Green, and Morgan 2020). Moreover, ideas of urban resilience are heavily influenced by the practices of Global North cities (Ziervogel *et al.* 2017). Particularly in light of the origins of resilience in the Global North, Global South cities should become a reference point for debate about the concept (Ziervogel *et al.* 2017).

To reveal the relationship between resilience and sustainable development in the urban context, we ask: what is the degree of transformative adaptation in urban resilience strategies? Do more transformative strategies show a greater coverage of SDG targets, pointing to more sustainable adaptation practices?

The remainder of this paper is organized as follows: first, we introduce the concepts of resilience, sustainable development, and the empirical context of the 100RC network. We then present our methodological approach for measuring resilience and SDG coverage of urban resilience actions. Finally, we present and discuss our findings and explore the relationship between resilience and sustainable development in urban strategies.

2. Resilience and sustainability in the urban context

2.1. *Resilience as a governance approach to confront uncertain futures*

The concept of resilience, as used in urban governance (Davoudi 2014; Meerow and Newell 2019), originated in ecology (Holling 1973) and has been integrated into various scholarly disciplines with different definitions (Brand and Jax 2007; Nüchter *et al.* 2021). Scholars following the ecological tradition commonly consider resilience as the ability of systems to bounce back when experiencing shocks as well as the capacity to cope with, adapt to, and shape change, and further to learn to live with uncertainty and surprise (Folke, Colding, and Berkes 2003; Folke 2006). Resilience emphasizes adaptation and adaptive capacity in the face of shocks, change, or adverse events, with central characteristics including the degree to which a system is capable of self-organization and learning (Walker *et al.* 2002). A diverse set of actors, also beyond policymakers and administration, is assumed to interact actively based on distributed responsibilities and resources, thereby increasing the resilience of a system (Folke 2006). Adaptation can correspond to different dimensions of change, namely persistence, incremental adjustment, and transformation (Pelling, O'Brien, and Matyas 2015). Transformation describes non-linear change which may materialize in radical shifts, directional turns, or step changes in normative and technical aspects of culture or governance (Pelling, O'Brien, and Matyas 2015; Wilson *et al.* 2020; Berglund *et al.* 2022). Transformative adaptation is required when incremental adjustments will not suffice to deal with the enormity of risks or vulnerabilities (Kates, Travis, and Wilbanks 2012). Pursuing transformative adaptation means to shift the lens through which system vulnerabilities are assessed from the proximate causes of risk to root causes (Pelling 2011; Pelling, O'Brien, and Matyas 2015; Wisner *et al.* 2004). It emphasizes understanding the causal structure of vulnerability, including chronic or creeping stresses over time (Novalia and Malekpour 2020) as well as all system facets – ecological, economic, political, and social (Pelling 2011). Resistance to drivers of hazard and vulnerability to maintain system stability marks the opposite side of the spectrum for policy choices regarding uncertain futures (Pelling, O'Brien, and Matyas 2015). In between are incremental adjustments that preserve system integrity when conditions change (Pelling, O'Brien, and Matyas 2015).

2.2. *The Sustainable Development Goals and their application in cities*

The 2030 Agenda and the SDGs provide an internationally agreed framework that defines and operationalizes sustainable development in its social, economic, and environmental dimension. In contrast to their predecessors, the Millennium Development Goals (MDGs), the SDGs are much broader in scope, focusing on holistic sustainable development not only in the Global South, but equally in countries of the Global North (Koch and Krellenberg 2018; Valencia *et al.* 2019). Although the goals, targets and indicators to measure progress on the SDGs have been criticized for their conceptual ambiguity and lack of data availability (Glass and Newig 2019), they contribute to unifying the way sustainable development is being framed and debated, fostering

mutual learning among actors (Biermann *et al.* 2022). This is particularly important, as achieving these ambitious goals requires transformative and coordinated action across different scales, levels and actors (Allen, Malekpour, and Mintrom 2023). As a recent SDG mid-term assessment has shown, particularly urban areas play a prominent role in attempting to achieve the change envisioned by the SDGs (Biermann *et al.* 2022).

The importance of cities for SDG achievement is recognized through a standalone goal focusing on urban areas (SDG 11): "Make cities and human settlements inclusive, safe, resilient, and sustainable" (UN 2018, 11). The goal is specified through 10 targets and 15 indicators that envision more resilient and sustainable urban areas, covering topics such as affordable housing, sustainable urban transport systems or a city's environmental impact. Nevertheless, and not least because of the high complexity characterizing urban systems, the majority of the 17 SDGs are relevant for sustainable development in the urban context (Zinkernagel, Evans, and Neij 2018). Importantly, implementing the SDGs at the city scale requires an adaptation of the goals to the urban context, taking into account local needs and priorities (Croese *et al.* 2021). This process of localization is challenging, however, as it entails questions of political prioritization, integrated, coherent, and collaborative governance arrangements, effective assessment and management of synergies and trade-offs between the goals themselves and between other development agendas, or data availability and reliability for measuring progress (Croese *et al.* 2021; Valencia *et al.* 2019; Zinkernagel, Evans, and Neij 2018). Nevertheless, an increasing number of cities engage with the SDGs and report implementation progress to the UN through Voluntary Local Reviews (VLRs) (see UN 2023), and frameworks to support localization processes have been developed (e.g. SDSN [Sustainable Development Solution Network] 2016).

Sustainable development in cities, as envisioned under SDG 11, seems to be closely linked to resilience building. Three out of ten targets relate to resilience, namely in relation to reduced human and financial losses from disasters (target 11.5), integrated disaster risk reduction (target 11.b) and resilient buildings (target 11.c). Further, several other targets within the SDG framework contain both explicit and implicit references to resilience (Bahadur *et al.* 2015) that are also relevant to urban areas. Most prominently, it is addressed by target 1.5 ("By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social, and environmental shocks and disasters") and target 13.1 ("Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries"). Overall, the SDG framework includes a variety of indicators that, collectively, can provide a comprehensive overview of a system's capacity to absorb, anticipate and adapt to diverse shocks and stresses (Bahadur *et al.* 2015).

2.3. Resilience and sustainable development in cities

Resilience and sustainability have been used interchangeably in academic literature and public policy (Elmqvist *et al.* 2019). However, vagueness and confusion in theory and practice can reduce the likelihood of urban transformation, particularly as resilience is often defined exclusively by bouncing back to the former status quo (Davoudi 2014; Ziervogel *et al.* 2017). Increasing resilience to flooding by building a sea gate instead of nourishing beaches or improving the drainage system, for example, may be environmentally and economically unsustainable in the long-term (Zhang and Li 2018). Hence, efforts to increase urban resilience and promote sustainable development

are not necessarily mutually reinforcing, but can also undermine each other (Elmqvist *et al.* 2019). Entrenched, unsustainable system structures can also be resilient (Biermann *et al.* 2015; Davoudi 2014). Sustainable development, on the other hand, pursues deep, systemic transformations.

In public policy, particularly climate governance, incremental instead of transformative change prevails as a dominant approach (Berglund *et al.* 2022). Empirical evidence on urban governance also points to a focus on incremental change, as the study of Heikkinen, Ylä-Anttila, and Juhola (2019) on 12 cities of the C40 city network shows. Furthermore, a limited systemic understanding of urban resilience which focuses mainly on technical and infrastructural areas hinders transformative urban agendas that account for social justice (Ziervogel *et al.* 2017). Relatedly, in a review on the use of resilience in sustainability science, Nüchter *et al.* (2021) found that social factors are frequently not included in studies. Resilience scholars following a systemic and transformative approach, such as Walker *et al.* (2002) have thus argued that sustainability should persist as an overarching goal for resilience. For example, it has been argued that the SDGs can foster the development of multidimensional approaches to urban climate change adaptation and resilience building by drawing attention to "the wider social, cultural, economic, political, institutional, and normative elements of adaptation" (Sanchez Rodriguez, Ürge-Vorsatz, and Barau 2018, 181). Thereby, the SDGs can further contribute to bridging the gap between planning and implementation, which often results from siloed approaches, particularly in the Global South (Sanchez Rodriguez, Ürge-Vorsatz, and Barau 2018). Araos *et al.* (2016) show, for example, in a study on climate adaptation in 401 cities globally, that the most active cities that address various climate impacts are located in North America, Europe, and Oceania (except for Cape Town and Durban).

Studies specifically examining the relationship between urban resilience and sustainable urban development often remain at a conceptual level (see Zhang and Li 2018; Elmqvist *et al.* 2019). Empirical studies on the urban sustainability-resilience relationship focus on different, individual perspectives, including, e.g. land management and urban sprawl, but rarely on various urban dimensions (Dehghani, Alidadi, and Sharifi 2022). A notable exception and study particularly worth mentioning is the analysis conducted by Croese, Green, and Morgan (2020), who assessed the resilience strategies of 64 cities partaking in the 100RC network for their reference to the SDGs. Whereas their findings show an increasing uptake of the SDGs after 2017, the majority of strategies examined do not explicitly reference them. Croese and colleagues did not examine strategy content in detail, except for their case study of Cape Town. Results reveal links to 16 different SDGs in Cape Town's resilience actions, which they attribute to the holistic resilience approach applied in 100RC that we outline in the next section. Overall, they emphasize the potential for aligning resilience and sustainable development through the lens of the SDGs, based on the goals' universal applicability as well as their broad scope and reach. Empirical studies are missing, which assess and compare the strategy content of 100RC member cities for the integration of SDGs and examine whether a transformative understanding of resilience aligns with sustainable urban development.

3. Empirical context: the 100 Resilient Cities Network

100RC is considered the "largest co-ordinated effort at implementing resilience thinking into city planning processes internationally" (Fitzgibbons and Mitchell 2019, 648).

The network was a US-based initiative, financed by the Rockefeller Foundation, which existed between 2013 and 2019. 100RC financially supported the development and implementation of a resilience strategy (RS) in selected cities. Cities had to undergo a competitive application process to gain admittance to the network in three consecutive rounds of city uptakes or 'generations' (Coppola, Crivello, and Haupt 2020). In 2019, the Rockefeller Foundation decided to stop financing 100RC but continued to provide funding for ongoing RS development and implementation processes. In 2020, the network re-emerged as two different initiatives, the Resilient Cities Catalyst and the Resilient Cities Network (RCN).

100RC has been characterized as a transnational municipal network (Coppola, Crivello, and Haupt 2020; Nielsen and Papin 2021), described as self-governed formal organizations, committing or encouraging local governments to achieve certain goals or actions (Kern and Bulkeley 2009). Among those networks focusing on resilience, 100RC had by far the broadest definition including social, economic, and physical resilience (Haupt and Coppola 2019). More specifically, resilience is defined by the initiative as "the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience" (100RC, cited in Taylor, Fitzgibbons, and Mitchell 2021, 4). Participating cities had to develop an RS based on this definition. The strategy characterized the key document that a 100RC membership was centered around (Coppola, Crivello, and Haupt 2020; Nielsen and Papin 2021), requiring cities to assess their resilience, preferably by identifying and categorizing the most urgent shocks and stresses for the future. Engagement and participation of a diverse pool of stakeholders and citizens was envisioned to deliver effective and inclusive decision-making (Taylor, Fitzgibbons, and Mitchell 2021). Unlike rather public-governance oriented networks that account for most transnational municipal networks, 100RC had a strong focus on developing public-private partnerships (Haupt and Coppola 2019; Leitner *et al.* 2018; Nielsen and Papin 2021), which scholars criticized (Coppola, Crivello, and Haupt 2020; Leitner *et al.* 2018).

Several empirical studies have been conducted on 100RC that are predominantly characterized by single case studies or comparisons of two cases. Examples include analyses of resilience construction in Amman (Shamout and Boarin 2021) and Durban (Sutherland, Roberts, and Douwes 2019), as well as examinations of the strengths and weaknesses of the resilience-building approach in Rome and Athens (Galderisi, Limongi, and Salata 2020) and Rome and Milan (Coppola, Crivello, and Haupt 2020). Case studies with a small or medium-sized-N either focus on the Global North, such as a study on 14 Global North cities by Taylor, Fitzgibbons, and Mitchell 2021, or on topics related to sustainable development, such as social equity, which Fitzgibbons and Mitchell (2019) find weakly represented in their analysis of 31 cases of Global North and South cities.

4. Methodological approach

For our analysis, we selected a representative, semi-random sample of cases ($N = 30$) of the 84 resilience strategies from the 100RC network. Each ten cases were selected from first, second, and third generation cities, representing the five different 100RC regions (Africa, Asia-Pacific, Europe and the Middle East, Latin America and the Caribbean, and North America) and Global South[2] and Global North cities. Since the SDGs were

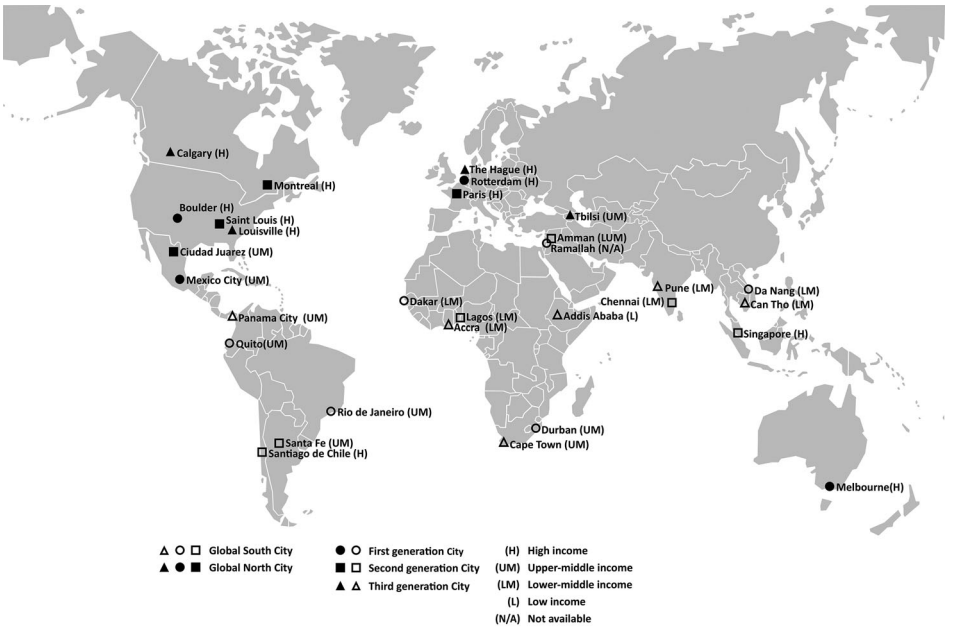

Figure 1. Overview of cases according to the selection criteria. The figure depicts the distribution of cases belonging to the group of Global North or Global South countries (G-77 2022), in terms of generation of city uptake (Resilient Cities Network 2022), and income level (World Bank 2022). Income level was not available for the city of Ramallah, Palestine. See also Appendix A (online supplementary material) for further information on the cases selected.

adopted in 2015, we limited our sample to RS published from 2016 onwards. Figure 1 provides an overview of the cases according to the selection criteria.

We analyzed RS by means of qualitative content analysis using MAXQDA 2020. We applied two different coding schemes to assess (1) the degree of transformative adaptation and (2) the link between resilience actions and broader sustainable development goals. Both coding schemes and processes are described in more detail in the following sub-sections. In total, we analyzed 1,200 resilience actions. The use of indicators for empirical measurements of urban resilience and sustainable urban development is contested because of simplifying complex realities. However, "[…] urban resilience, and sustainable urban development are complex research areas and empirical research is needed to unpack such complexities" (Dehghani, Alidadi, and Sharifi 2022).

4.1. Assessing the degree of transformative adaptation in city resilience strategies

For assessing the degree of transformative adaptation, we followed Suárez *et al.* (2016) in building a composite indicator for urban resilience, for which data were derived through coding the RS. Since it is impossible to determine a city's resilience through coding a single policy document, our approach does not claim to depict the actual resilience of the selected cities or their transformations. Instead, we aim to highlight the governance approach for adaptation presented in strategies as a proxy for transformative "potential", i.e. the possibility for transformative adaptation. Other studies have also focused on the governance approach as an indicator of transformative potential (see Grainger-Brown *et al.* 2022). We capture this governance approach

through variables that relate to the policy coherence, policy content, and policy mode that was followed by a strategy, explained in detail below.

Indicator set I portrays the local context via the most urgently perceived external shocks, i.e. sudden, hazardous events such as heavy rain, and existing systemic stresses, i.e. constant or creeping challenges and vulnerabilities, such as poverty or deficient infrastructure, that city actors see as requiring adaptation endeavors. The identification of shocks and stresses was necessary in the process of RS development, usually captured at the beginning of the strategies. Similar to Feldmeyer *et al.* (2019), the categories for resilience are split into built environment, economy, environment, society, and governance[3]. We added digital environment, since cyber-attacks are an increasing hazard to urban, critical infrastructure

Indicator set II shows the governance approach for adaptation along the line of (1) policy coherence, (2) policy content, and (3) policy mode.

(1) First, we track policy coherence, i.e., whether the developed actions in an RS match with the identified shocks and stresses. Resilience is considered as increasing the tightness of feedback loops on systemic knowledge (Suárez *et al.* 2016). The link between identified resilience challenges and the crafted actions to address these represents a fundamental, initial feedback-loop about the urban environment.

(2) For policy content of actions, we defined the following indicators, which are each divided into two to three sub-categories (see Table 1, Appendix B [online supplementary material]), particularly drawing on the assessment of 'transformational' adaptation projects from Holler *et al.* (2020).

   (a) Capacity building: Capacity building conducive to learning, adaptation, and self-organization are highlighted for resilience (Carpenter *et al.* 2001; Folke 2006; Walker *et al.* 2002). Adaptive capacity of local stakeholders is considered crucial for transformative adaptation in terms of preparing for and dealing with risks (Holler *et al.* 2020). Urban stakeholders can be represented by a community of place, e.g., a neighborhood, or a community of practice, in which participants are connected through a common concern or interest and collaborate for common goals, such as professional networks.

   (b) Communication: Evaluation and dissemination of information and data through monitoring and communication systems from decision-making centers to the general public aid to inform on and prepare for urgent and immediate adaptation needs (Holler *et al.* 2020).

   (c) Economic incentives: The often overlooked economic nature of urban governance has direct implications for sustaining resilience and adaptation innovations (Bellinson and Chu 2019). While cities frequently struggle with acquiring and sustaining funds, the financial support of individuals, e.g., through economic incentives or insurance mechanisms, ensures that resilience does not lead to the mere handing down of responsibilities for self-organization and adaptation from the government to citizens (Wilson *et al.* 2020).

   (d) Institutions: Forging and maintaining formal and informal institutions, i.e., organizations or communities of practice, provide the legal context and normative basis for collective action in resilience and adaptation to emerge from shared norms and strong social networks (Holler *et al.* 2020; Wilson *et al.* 2020).

Table 1. Indicator set for the city transformative adaptation index.

Indicator	Code
Indicator set II: Adaptation policies	
Policy coherence:	
Relation to shocks	• Across the categories of built and digital environment, ecological, economic, social
Relation to stresses	• Across the categories of built and digital environment, governance, ecological, economic, social
Policy content:	
Capacity building	• Training with and/or education for community of practice • Training with and/or education for community of place/citizens
Communication	• Improved monitoring systems • New communication systems
Economic incentives	• Economic incentive mechanisms • Financial funds/insurance
Institutions	• Continuity of programs, regulations, frameworks • Building of community of practice • New institutions/regulations
Knowledge	• Information distribution • Research and technology development
Knowledge co-creation	• Knowledge generation with community of practice • Knowledge generation with community of place/citizens
Physical environment	• Improvements of infrastructure • Infrastructure: diversifying the range of infrastructure systems • Green infrastructure
Policy Mode:	
Distributed responsibilities	• Partnerships/networks with non-state actors • Sectoral integration • Multi-level integration
Reflexive Learning	• Continuity of community-based projects/of innovation • Experimentation • Exogenous learning
Participation in RS development	• Breadth of involvement • Communication • Participant influence

(e) Knowledge: Knowledge building, e.g., through research and technology development, and its distribution provides the basis for feedback loops on systemic knowledge (Holler *et al.* 2020; Suárez *et al.* 2016).

(f) Knowledge co-creation: Local participation for co-creating knowledge is a specific form of knowledge building, which is widely claimed to foster resilience and adaptation planning and implementation (Suárez *et al.* 2016; Walker *et al.* 2002; Wilson *et al.* 2020).

(g) Physical environment: Urban infrastructure systems are key for cities' resilience and adaptation pathways (Meerow and Newell 2019; Suárez *et al.* 2016). Here, not only the improvement but also the diversification of centralized networks of infrastructure, e.g., mobility systems, show a proactive manner in anticipating multi-scale urban crises and challenges (Novalia and Malekpour 2020).

(3) The policy mode depicts the way the RS was developed and is planned to be implemented. Co-ordination between different governance levels and sectors with

distributed responsibilities is seen as essential for flexible systems that can proactively prepare for, and adapt to, disruptive shocks (Novalia and Malekpour 2020; Suárez *et al.* 2016). Empirically, co-ordination is found to be a significant factor for successful adaptive planning (Malekpour and Newig 2020). Second, reflexive learning is perceived as necessary to change a system and prepare for disruptions (Carpenter *et al.* 2001; Pelling, O'Brien, and Matyas 2015). Learning is prescribed to occur through innovation, experimentation (e.g., urban living labs, policy experiments) (Bellinson and Chu 2019; Novalia and Malekpour 2020), and city-to-city learning in the urban context (Wolfram *et al.* 2019). Participation indicates the embeddedness of urban perceptions in the local context (Novalia and Malekpour 2020). We measure participation in RS development via a proxy, following the approach applied in earlier studies, through the (1) breadth of involvement, (2) communication mode, and (3) power delegation or participant influence (Gollata *et al.* 2021; Newig *et al.* 2018; Kochskämper *et al.* 2016). Participant influence is challenging to gauge only from documentary material, so the portrayal of community consensus or dissent in an RS in relation to the plan's diagnosis and actions is additionally coded (see also Taylor, Fitzgibbons, and Mitchell 2021).

Coding was conducted by two coders for different strategies. Intersubjectivity of the coding system was supported by discussions on the clarity and relevance of codes. Indicators were measured on a binary scale based on a clear, continuous measurement rationale (presence or absence of code, see Appendix B [online supplementary material]). To calculate the composite indices, we followed a commonly applied procedure that includes normalization and aggregation of individual indicators (see e.g. Suárez *et al.* 2016, 9; Glass and Newig 2019, 6; Sachs *et al.* 2017). To do this, we first re-scaled each indicator from 0 – 100 using the subsequent equation:

$$x' = \frac{(x - \min(x))}{(\max(x) \ - \min(x))}$$

where x' is the normalized value, x denotes the raw value, $\max(x)$ represents the average of the top five performing cities, and $\min(x)$ denotes the minimum value. Cities exceeding the maximum threshold were scored 100.

In total, indicator set II entails 39 indicators across the three categories policy coherence, policy content, and policy mode. For each category, we aggregated individual indicators to calculate sub-indices. In the calculation of the policy mode, we assigned a higher weight to the indicator capturing "reflexive learning". The 100RC strongly encouraged that RS would be developed with participation and that actions should be accompanied by the identification of implementing partners. Therefore, reflexive learning represents a more deliberate choice for the policy mode. We used the arithmetic mean for aggregation of the sub-indices. Here, we assigned higher weightings to policy content and policy mode, since policy coherence was a required prerequisite for an RS. We assigned no weighting to indicator set I as its purpose is to provide the local context for assessing policy coherence.

4.2. Assessing sustainable adaptation practices: linking urban resilience actions and the SDGs

For investigating whether more transformative RS are linked to more sustainable adaptation practices, we examined the strategies against the SDGs and targets they address.

Specifically, we analyzed whether the resilience actions described align with the SDGs by coding the textual information provided for specific references to the SDGs at goal- and target-level. Importantly, we excluded SDG 17 as it refers to the means of implementation, which we covered in the transformative adaptation index. The coding scheme thus included 16 SDGs and 150 targets. The targets addressed were coded only once per action. For this, we adopted the SDG coding scheme applied by Coenen, Glass, and Sanderink (2022) to the urban context. However, some targets explicitly reference state actors and/or focus on the (inter-)national level and thus cannot be addressed by cities[4]. The applicability of the targets to the urban context was first evaluated by one author, and in case of doubt discussed among three authors. Similarly, ambiguities during the coding process were discussed and resolved among two authors. As described above, while the SDGs aim for universal applicability, their implementation is highly dependent on contextualization and localization. SDG 14 ("Life below water"), for instance, which includes targets on coastal and marine protection or fishing industries, is arguably less relevant for landlocked locations than for those with extensive coastal areas. Consequently, full alignment of resilience actions and SDG targets is unlikely. Importantly, we do not aim at quantifying SDG achievement within the respective cities. Rather, we aim at identifying which SDGs and targets are addressed within the RS and assess the distribution of targets addressed in relation to the three pillars of sustainability. Finally, we investigate whether 'more' transformative strategies show a greater coverage of SDG targets, pointing to more sustainable adaptation practices.

We intentionally refrained from adhering to the official SDG indicators in our coding process; mainly as we echo the claim that the proposed indicators often do not (or only to a limited extent) capture the intention of the respective target (Glass and Newig 2019). This problem of operationalization and measurement becomes visible, for example, in target 11.3 on "inclusive and sustainable urbanization", for whose two proposed indicators – as per April 2023 – no data is available on the official Global SDG Indicators Data Platform[5]. Additionally, scholars have highlighted shortcomings of the SDG indicators in the context of urban resilience. Indicators for target 11.b on integrated disaster risk reduction, for instance, are measured through the adoption and implementation of national and local disaster risk reduction strategies. While measuring the sheer existence of such plans does not say anything about their quality and effectiveness (Valencia *et al.* 2019); it also misses out on capturing the actions of non-governmental actors such as communities or neighborhoods (Koch and Krellenberg 2018).

Although some RS explicitly reference the SDGs in their framework, we did not rely on the information provided to ensure high comparability and reliability of results: first, since qualitative content analysis always entails subjective interpretation to some extent; second, because some RS reference the SDGs in different parts of the strategy and in different depth (i.e. some relating to the goal-level, others indicating the specific targets); and third, as the coding process revealed instances of erroneous SDG identification (e.g. labeling SDG 13 as addressing "sustainable cities and communities" instead of "climate action"). Thus, we opted for coding these strategies independently from the goals and targets mentioned in the RS.

5. Results and discussion

The following section summarizes our findings on transformative adaptation in urban resilience strategies and the link between resilience actions and the SDGs.

Subsequently, we explore whether more transformative adaptation in cities is linked to more sustainable adaptation practices.

5.1. *Adaptation planning in the city resilience strategies*

The assessments of shocks and stresses in RS show that cities identified those across all categories (see Figures 2 and 3). The distribution of identified shocks and stresses indicates that cities applied the systemic resilience understanding promoted by the 100RC. As put forward in the literature on transformative adaptation, not only disruptive shocks but also chronic stresses have been acknowledged in all system facets (Novalia and Malekpour 2020; Pelling 2011). Emphasis was clearly put on the

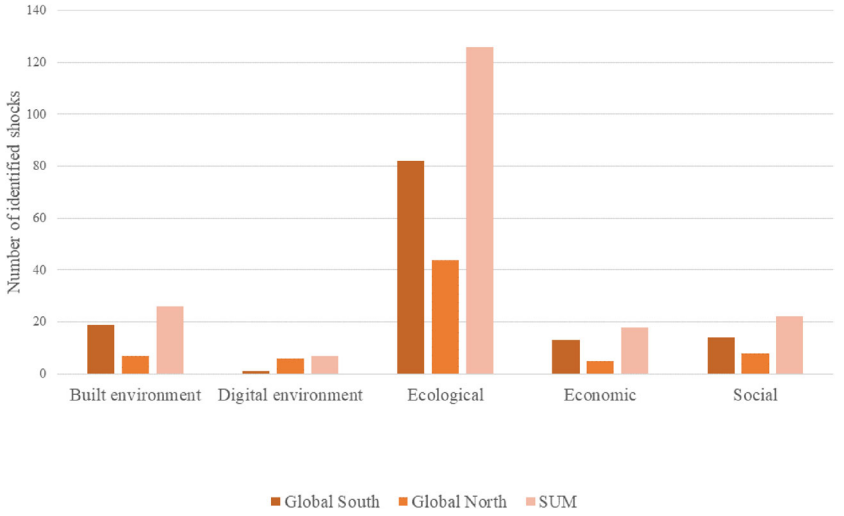

Figure 2. Identified shocks in Global South and Global North cities.

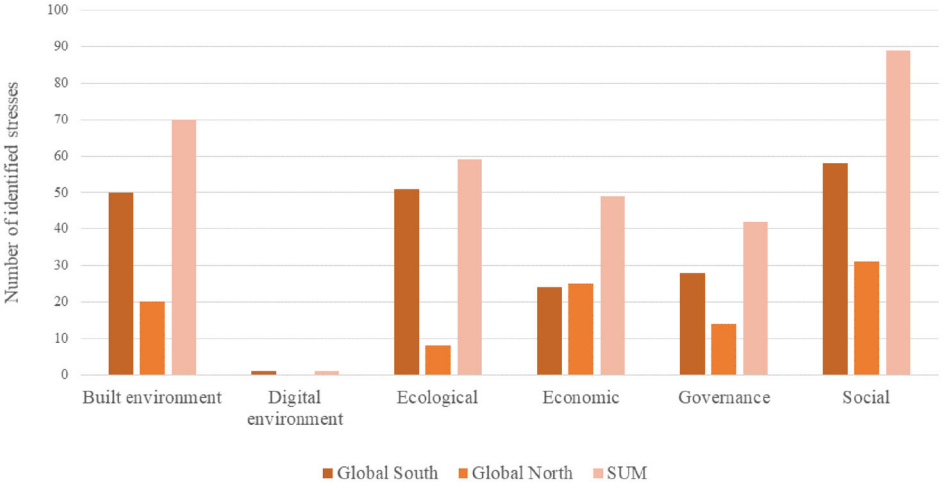

Figure 3. Identified stresses in Global South and Global North cities.

ecological sphere for shocks, such as heavy rainfall or heat waves, particularly in the Global South. Almost all cities recognized ecological shocks and stresses, except for Louisville, Santa Fe, Durban and St. Louis. Interestingly, for stresses, the main importance was given to the societal sphere. Examples of the latter include social inequality, lack of affordable housing, homelessness, and poverty.

For the content of policy actions, most actions addressed 'institutions' in total (GS: 278, GN: 189, see Figure 4), which refers to the building of formal and informal institutions and the continuity of programs, regulations, and frameworks. In the Global South, 'knowledge' (GS: 277), which comprises information distribution and research, ranks almost as high as 'institutions'. Whereas 'economic incentives' (GS: 52, GN: 44) are unsurprisingly ranked last because of cities' frequently limited funding opportunities, it seems nonetheless telling that 'knowledge co-creation' (GS: 277, GN: 189) is given a comparatively low priority in the actions of the Global South and North. Even though the effectiveness of participation in general is debated, diversity in perspectives, interests, and place-based knowledge can prevent a uniform, expert-driven resilience understanding (Fitzgibbons and Mitchell 2019, Ziervogel *et al.* 2017).

In the indicator categories of the policy mode, for 'distributed responsibilities' in implementation most actions included 'partnerships and networks' (GS: 446, GN: 294), followed by 'sectoral integration' (GS: 245, GN: 147) and 'multi-level integration' (GS: 191, GN: 63). The majority of partnerships were stated to be with civil society and academia (GS: 287, GN: 166) in comparison to business (GS: 159, GN: 128), especially in the Global South. However, major business partners, particularly the companies functioning as 100RC platform partners, were often not directly indicated in specific actions, but rather as general partners of the RS. The RS of Santiago de Chile represents an example for this procedure: Veolia, a transnational company for water

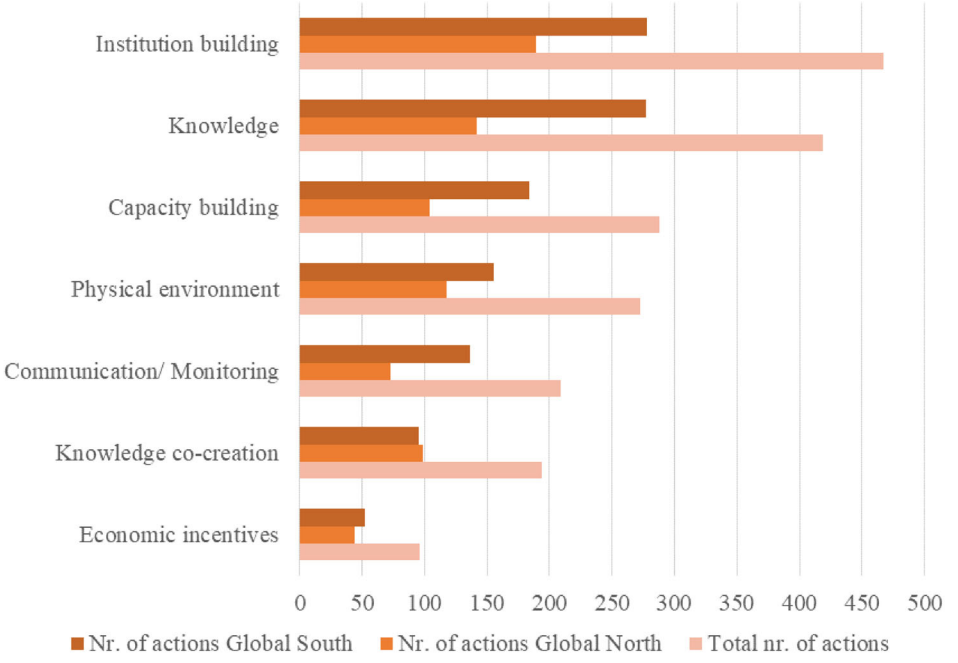

Figure 4. Policy content in Global South and Global North cities.

and waste management and energy services, is named in the beginning without further specifying their involvement. Another practice that obscures the potential implementation process is that civil society actors were repeatedly mentioned in actions as implementing partners without specifying their identity in more detail – again exemplified by the RS of Santiago de Chile. The strong emphasis on non-state partners in implementation compared to state actors can point in two directions: on the one hand, the involvement of a diverse set of stakeholders or, on the other, a rather neoliberal understanding of governance that bypasses sectoral and multi-level coordination. With their strong focus on partners from civil society and academia, Global South cities seem to tend more towards the former, the diverse set of stakeholders. 'Reflexive learning' formed part of around a third of actions (332, GS: 155, GN: 177), in the Global South mainly through 'experimentation' (GS: 67, GN: 53) and in the Global North predominantly through 'exogenous learning' from other cities (GS: 57; GN: 90). 'Continuity of community-based projects/innovation' scored lowest for both (GS: 31, GN: 34). Finally, participation for the RS development was substantially higher in the Global South, with a mean of 9.28 out of 14 possible points (SD: 2.99), in comparison to 6.17 (SD: 3.38) in the Global North. Once more, Global South cities indicate a more inclusive resilience understanding than cities in the Global North.

Table 2 shows the results of the city transformative adaptation index. Cities from the Global South dominate the first ranks. Of the twelve cities in the Global North, only Louisville, Ciudad Juarez, and Rotterdam are in the first quartile (Q1: 72.16), and The Hague is above the median (Mdn: 53.16). The remaining eight cities are ranked below the median. In comparison, ten out of eighteen cities from the Global South are located above the median. The majority of cities rank below 60 out of 100 points, which raises doubts on the overall transformative potential of cities through resilience policies. The results mirror the observation that transformation pathways in climate and urban policies are planned incrementally (Berglund *et al.* 2022; Heikkinen, Ylä-Anttila, and Juhola 2019) and also confirm them for the field of urban resilience governance.

5.2. The link between urban resilience actions and the SDGs

At the goal-level, we find that cities in the Global North, on average, address 13 of the 16 SDGs included in our study, while Global South cities address 15 goals. Three cities of the Global South (Lagos, Panama City, Cape Town) address all 16 SDGs, whereas none of the Global North do so. Results show considerable differences between both groups regarding SDG 2 (zero hunger; GS: 83%, GN: 58%), and SDG 7 (affordable and clean energy; GS: 94%, GN: 58%). SDG 7 contains targets on access to energy services, the expansion of renewables and energy efficiency improvements. Considering the principle of "Common but Differentiated Responsibilities" within the UN Framework Convention on Climate Change (UNFCCC), i.e. the leading mitigation role that developed countries are expected to assume, the relatively low focus on this goal within the RS from the Global North is a cause for concern. Repercussions of the Russian aggression against Ukraine have further emphasized the importance of reliable and clean energy for social, economic, and environmental resilience, particularly in countries that previously relied heavily on Russian energy imports. The goals least addressed in resilience actions are SDG 5 (gender equality; GS: 67%, GN: 58%) and SDG 14 (life below water; GS: 39%, GN: 8%). The findings on SDG 14 were

Table 2. Index of transformative adaptation in city resilience strategies.

	City	Global South/ North	Generation	Adaptation Index Value (0-100)	Policy coherence (0-100)	Policy content (0-100)	Policy mode (0-100)
1	Addis Ababa	GS	III	93.71	93.75	95.02	91.74
2	Cape Town	GS	III	88.94	100	95.79	73.15
3	Santiago de Chile	GS	II	85.73	23.44	100	85.11
4	Louisville	GN	III	75.59	39.06	100	53.18
5	Ciudad Juarez	GN	II	74.82	54.69	64.74	100
6	Rotterdam	GN	I	73.35	70.31	64.76	87.75
7	Panama City	GS	III	72.42	54.69	59.94	100
8	Chennai	GS	II	71.90	46.88	99.58	42.88
9	Ramallah	GS	I	68.34	93.75	58.63	70.21
10	Santa Fe	GS	II	64.30	39.06	63.20	78.58
11	Lagos	GS	II	62.78	93.75	49.75	66.83
12	Pune	GS	III	57.30	31.25	71.82	48.55
13	The Hague	GN	III	55.19	23.44	35.90	100
14	Da Nang	GS	I	53.85	93.75	63.44	19.52
15	Quito	GS	I	52.95	70.31	45.54	55.40
16	Tbilsi	GN	III	48.90	31.25	55.99	47.10
17	Melbourne	GN	I	47.15	100	33.03	41.91
18	Dakar	GS	I	46.76	62.50	36.76	53.90
19	Paris	GS	II	46.28	70.31	55.37	20.63
20	Accra	GS	III	43.02	54.69	30.23	56.37
21	Mexico City	GN	I	42.74	31.25	64.39	16.01
22	Montreal	GN	II	39.24	62.50	28.79	43.30
23	Amman	GS	II	33.73	31.25	41.96	22.63
24	Rio de Janeiro	GS	I	32.37	62.50	26.77	25.71
25	Can Tho	GS	III	29.67	31.25	35.18	20.61
26	Calgary	GN	III	26.12	46.88	7.01	44.42
27	St. Louis	GN	II	22.71	15.63	40.21	0.00
28	Boulder	GN	I	20.03	70.31	12.93	5.55
29	Singapore	GS	II	9.98	15.63	4.18	15.86
30	Durban	GS	I	4.54	0.00	0.00	13.62

Note. Gray colors mark the first city above the quartiles and the median.

expected, given the goal's focus on coastal areas and the fact that our sample contains ten Global South cities located on the coast, compared to only two from the Global North. Regarding SDG 5, however, results are both surprising and concerning. While we find that at least more than 50% in both groups address gender equality in their RS, this number is still too low, considering strong gender-based differences in vulnerability to shocks and women's important contribution to resilience building (Smyth and Sweetman 2015).

Analyzing SDG coverage at the target level shows that, on average, cities address 58 different targets in their resilience actions (GN: 51, GS: 63). Notably, our results indicate that Global South cities demonstrate a more comprehensive understanding of adaptation linked to broader sustainable development (see Figure 5). Among the ten highest-ranked cities, only two are from the Global North, i.e. Louisville and Ciudad Juarez.

By grouping the SDGs into social, economic, and biosphere-related goals according to the categorization proposed by Rockström and Sukhdev (2016), we can further examine the coverage of, and balance between, the targets addressed in relation to the

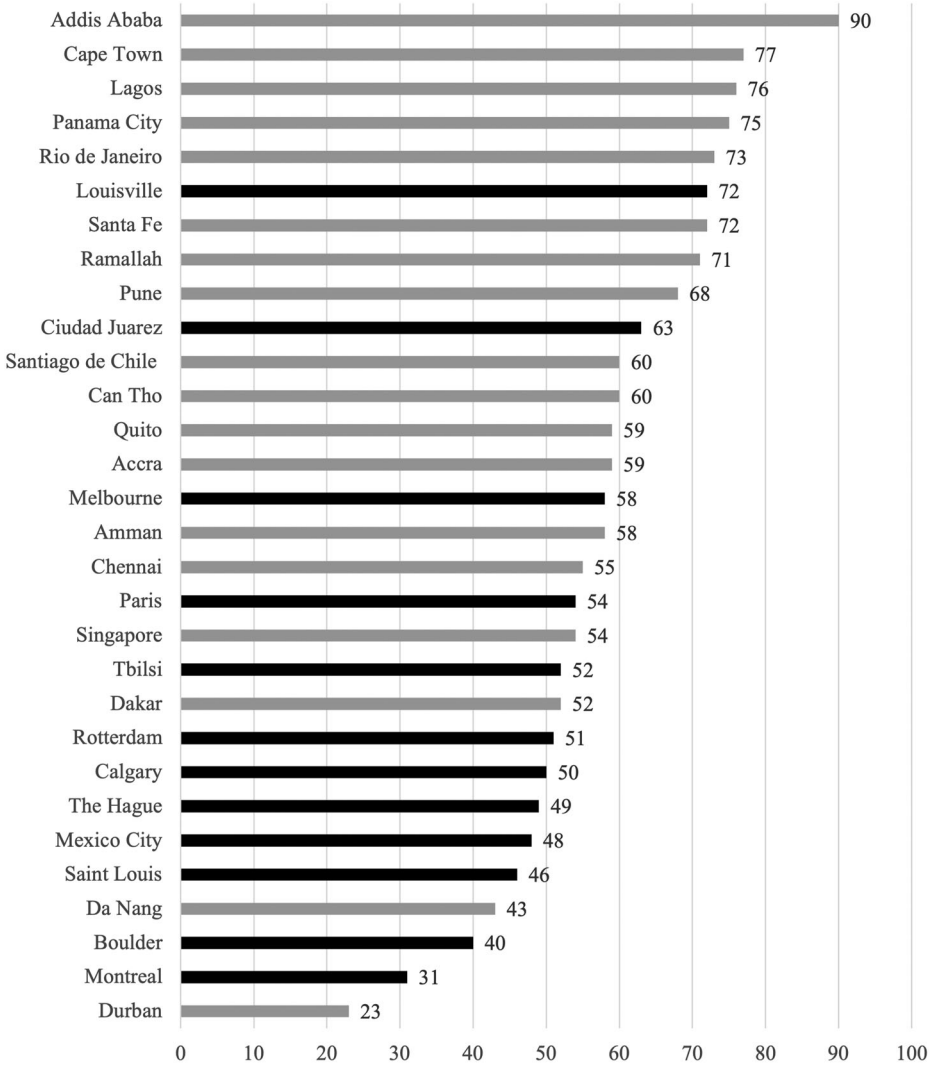

Figure 5. Number of SDG targets addressed in urban resilience actions. GS cities are marked in grey, GN cities in black.

three pillars of sustainable development[6] (see Figures 6 and 7). Since the total number of targets per category varies considerably (Society: 74, Economy: 41, Biosphere: 35), numbers are expressed in percentages for better comparability.

Our results show that resilience actions address a greater share of economic and societal targets. This tendency is visible both in the Global South and North (see also Table 3).

In relative terms, RS cover most targets related to economic development. The targets that stand out refer to the "social, economic and political inclusion of all" (target 10.2; GN: 37%, GS: 31%), and the development of "sustainable and resilient infrastructure" (target 9.1; GN: 29%, GS: 27%). This is an interesting finding, as previous studies have highlighted the potential of SDG 9 in simultaneously fostering progress towards targets under the Paris Agreement and the 2030 Agenda (Coenen, Glass, and Sanderink 2022). Regarding societal targets, we find that cities mostly address target

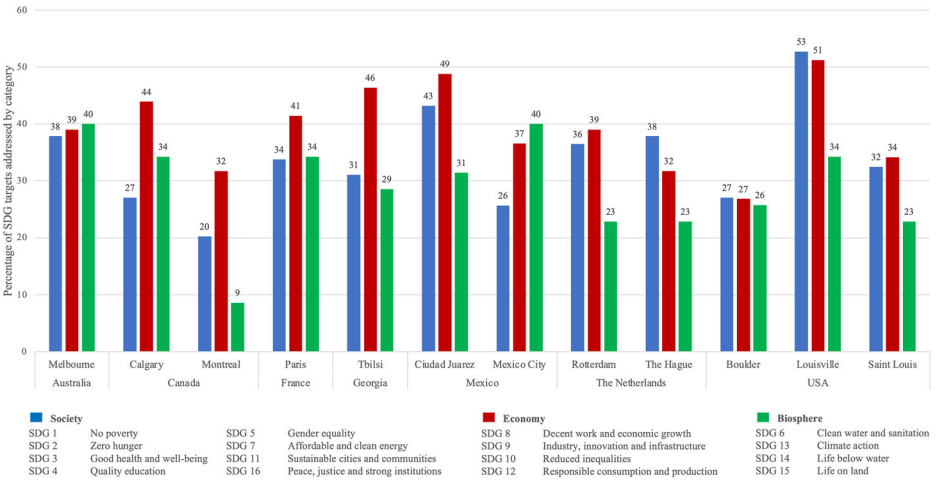

Figure 6. Percentage of SDG targets addressed by category and city, Global North.

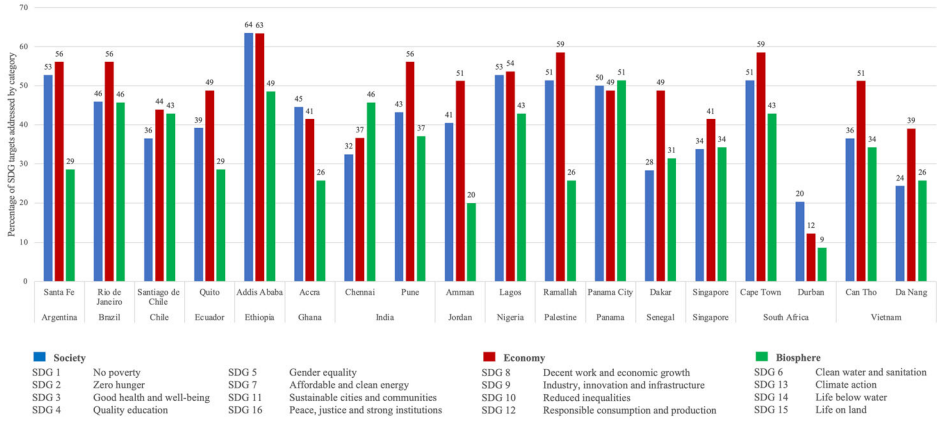

Figure 7. Percentage of SDG targets addressed by category and city, Global South.

Table 3. Mean of SDG targets addressed by category, in %.

	Society	Economy	Biosphere
Total	38	44	32
Global South	42	48	34
Global North	34	39	29

11.3 on inclusive urbanization and participatory human settlement management (GN: 45%, GS: 47%), followed by the resilience-focused targets 1.5 (resilience of the poor and vulnerable; GN: 33%, GS: 37%) and 11.5 (reduced human and financial losses from disasters; GN: 33%, GS: 29%). Additionally, many actions also address the development of effective institutions (target 16.6; GN: 29%, GS: 30%), mostly regarding public service delivery and capacity building of public servants.

For biosphere-related targets, there is strong alignment with the climate resilience targets of SDG 13 across the sample, with most resilience actions addressing target

13.3 (knowledge and capacity building for climate change mitigation, adaptation, impact reduction and early warning; GN: 47%, GS: 50%) and target 13.1 (resilience and adaptive capacity to climate-related disasters; both 48%). Still roughly one-third of all actions address target 13.2 (integrate climate change measures into policy and planning; GN: 31%, GS: 33%). However, we note that targets under SDG 13 are intentionally very broad, recognizing the UNFCCC's primary responsibility to address climate change (UN 2018). Targets 13.1 and 13.3 were thus coded to encompass a variety of different, more specific climate resilience targets, including some that Rockström and Sukhdev (2016) categorized as "social" and "economic" targets. Examples include access to resilient housing or the reduction of disaster-related human and financial losses. Besides SDG 13, much less attention is given to other biosphere targets in resilience actions, such as integrating ecosystem and biodiversity values in planning and development (target 15.9; GN: 8%, GS: 6%) or increasing water-use efficiency and alleviating water scarcity (target 6.4; GN: 7%, GS: 6%). In Montreal and Durban, RS do not cover any other biosphere-related targets besides those under SDG 13. The only cities that relatively address more biosphere-related targets are Melbourne and Mexico City (both 40%) in the Global North, and Chennai (46%) and Panama City (51%) in the Global South.

In general, we find that the relative distribution of the targets addressed most in urban resilience actions is similar across our sample. However, Global North cities put a stronger focus on inclusivity and equality (targets 10.2: +5%, 10.3: +4% and 16.b: +4%), whereas Global South cities emphasize resilience of the poor and vulnerable (target 1.5: +4%), as well as the reduction of cities' environmental impacts, particularly through waste management improvements (targets 11.6: +8%, 12.4: +5% and 12.5: +4%). While the dominance of SDG 11 and resilience-building targets was expected, the focus of urban RS on societal and economic targets corroborates previous findings indicating that socio-economic SDGs are prioritized over biosphere-related ones in line with pre-existing neoliberal development agendas (Biermann *et al.* 2022).

5.3. Merging resilience and SDGs

Having presented the results of the city adaptation index and the SDG coding, we now turn to our main research question on whether city action in the 100RC proposes policies which foster resilient and sustainable urban futures. The relationship between the cities' transformative adaptation index and the number of SDG targets addressed shows, in general, a positive trend, i.e. cities that show greater transformative potential also align more closely with the SDGs (see Figure 8). We found a significant positive correlation between both indices using Spearman's correlation coefficient ($r(28) = 0.625$, $p < 0.005$). This trend can be observed for the Global South and Global North alike, although it is stronger in the Global South. The Global North does not seem to take a leading role regarding resilience and sustainable development. Building on this, overall results indicate that resilience actions in the Global South seem to be linked to more comprehensive sustainable adaptation practices. This finding contrasts with the results of Araos *et al.* (2016) study on climate change adaptation, which found that the most active cities addressing various climate impacts are located in North America, Europe, and Oceania. In our sample, Global South cities have caught up and, comparatively, draw more strongly on a systemic, transformative resilience understanding.

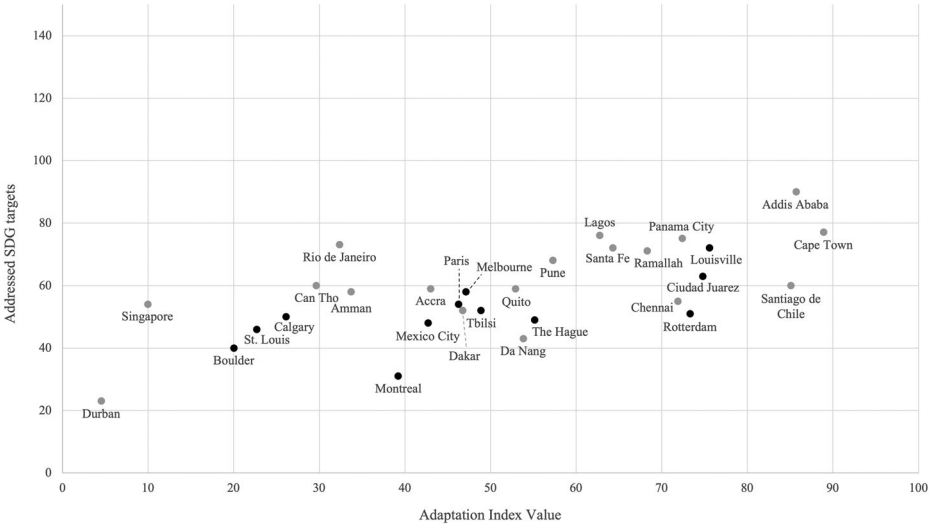

Figure 8. Sustainable development and transformative adaptation coding combined. GS cities are marked in grey, GN cities in black.

Strategic plans in city networks are an opportunity to attract funding, which, at first sight, might be more relevant for the Global South than the Global North. Also, the design of development plans in the Global South could be influenced by international organizations and external donors (Forestier and Kim 2020), who endorse more comprehensive actions as being in line with the 2030 Agenda. However, the income level does not seem to have a major influence on the link between resilience and sustainable development. While cities in high income countries ($N = 11$), on average, show slightly lower values for transformative adaptation (45.5) and SDG target coverage (51), the difference to upper-middle income countries (51.6 and 60, respectively; $N = 10$) and lower-middle income countries (52.2 and 59, respectively; $N = 7$) is not very strong. While we note that the only city in our sample located in a low income country (i.e. Addis Ababa) scores comparatively high for both indices (85.7 and 90, respectively), we cannot draw any robust conclusions, as our sample does not include additional cases from this category. Further, an examination of the cities ranked 60 to 100 on the adaptation index shows that four of the seven Global South cities are located in high or upper-middle income countries. This suggests that the opportunity to attract funding may not be the main factor in combining resilience and sustainable development. Global South cities may have a better understanding of the root causes of their vulnerabilities and prioritize sustainability as a normative direction for their adaptation efforts due to acute economic, social, and environmental shocks and stresses. These results support the claim of Ziervogel *et al.* (2017) to make Global South cities a reference point for debate about the concept of resilience, especially because 100RC's resilience understanding is influenced by the Global North.

Given that the cities in our sample vary considerably in size (see Appendix A [online supplementary material]), we examined the relationship between population size and both indices. However, results show neither a significant correlation with the degree of transformative adaptation ($r(28) = -0.005$, $p < 0.1$), nor with the number of SDG targets addressed ($r(28) = 0.208$, $p < 0.1$). Further, the generations of cities, i.e. when cities entered the network, have only a marginal effect on the consideration of

sustainable development. Two of the ten cities that rank between 60 and 100 on the adaptation index are from the first generation; the remaining ones are distributed equally among the second and third generation. The stronger consideration of sustainable development after the first generation points to the increased uptake of SDGs over time, at least at a discursive level (Biermann *et al.* 2022), and is consistent with the findings of Croese, Green, and Morgan (2020).

Our analysis shows that many of the resilience actions can potentially contribute to sustainable development. Differences in target coverage indicate that besides varying local contexts, resilience actions can be designed in line with broader sustainability targets. This might be influenced by the broad 100 RC resilience definition including different dimensions such as a societal sphere, which is frequently neglected when it comes to resilience implementation (Nüchter *et al.* 2021). However, outliers in the generally positive trend of the results, such as Singapore and Montreal, show that resilience and sustainable development do not automatically go hand in hand. An initial relationship between 100RC action and the combination of resilience and sustainability has been established, but the outliers in this study require further investigation.

By looking at RS only, we cannot assess the effectiveness of proposed interventions, nor do we examine other local agendas that potentially focus on sustainable development. Our results, however, provide insights into the integration of resilience and sustainable development by analyzing how the concepts are understood, envisioned and – at least on paper – tackled jointly. Harnessing the synergies of resilience and sustainable development seems paramount for urban transformation processes (Elmqvist *et al.* 2019). Therefore, we argue in line with others (e.g. Zhang and Li 2018) that urban resilience and sustainability strategies should be combined and designed in an integrated way. Many of the RS indeed referred to other existing local and national programs and plans related to (sustainable) development, which we see as a positive sign of aligning both topics.

Aggregate results can, of course, only reflect tendencies without capturing priority-setting depending on the local context. For example, in their case study, Amman, Shamout and Boarin (2021) highlighted the pressure put on the city due to rapid population growth resulting from domestic migration as well as high numbers of refugees fleeing from nearby conflict zones. This explains why we found Amman to be the city that most often addressed SDG target 10.7 on migration policies in their resilience action, and its focus on societal and economic SDG targets more generally. Further, the importance of anti-discrimination measures (SDG target 10.3) in resilience actions of Saint Louis (55%), Melbourne (44%) and Lagos (42%) reflects the cities' history of systemic discrimination on the basis of ethnicity, gender, race, religion or disabilities. Mexico City's comparatively strong focus on SDG 6 targets (clean water and sanitation) can be explained by heavy rainfalls and water scarcity putting pressure on the urban system. In a similar vein, Durban scores zero in policy coherence in the resilience ranking, which can be explained by the structure of the RS that defined the two main resilience challenges of informal settlements and integrated and innovative planning between municipal and traditional governance systems. The strategy clearly states that focusing on these challenges is considered most beneficial for the city's resilience, which tailors resilience actions to its own, local needs. Sutherland, Roberts, and Douwes (2019) describe that the meaning of resilience was deliberated by multiple actors in the city, which supported a context-specific understanding, embedded in the power struggles and realities of the city. In comparison to other cities, Durban falls behind though, also in the category of policy content.

We do not contend that priority-setting is wrong; indeed, it is necessary and important to tackle pressing context-specific challenges. However, resilience in a broad understanding aiming to foster transformative adaptation relates to a systemic view (Carpenter *et al.* 2001; Folke 2006, Pelling 2011) that includes different dimensions of the city (Meerow and Newell 2019). Similarly, the indivisible nature that characterizes the SDGs implies that excessive prioritization of one goal over another could threaten integrated sustainable development pathways (Forestier and Kim 2020). Most of the targets provide much leeway for implementation (Biermann, Kanie, and Kim 2017) and thus allow for adaptation to the respective local context. To illustrate this, target 3.8 on universal health coverage can mean ensuring access to well-trained physicians in Lagos, while in The Hague it means providing digital healthcare solutions to the elderly.

Our study has several limitations. First, in terms of assessing resilience for the adaptation index, indicator set I depends on how city actors perceive and talk about their local context. We conducted no additional context analysis since this would have exceeded the scope of this study. Second, the resilience and SDG assessments do not include effectiveness or actual implementation; they are exclusively based on the strategies and therefore the envisioned governance approach, including design and content. Our sample includes cities such as Addis Ababa, Dakar, and Ramallaha, which face governance challenges including political conflict and low human development. The cities' resilience strategies might be more of a vision board than a policy instrument, but nevertheless provide important insight into the cities' imaginaries of urban futures. Studies on 100RC have also included these cities (see Fitzgibbons and Mitchell 2019). Third, many RS use acronyms to refer to other actors and/or policy documents related to resilience actions. Given the scope of this study, we excluded these in the coding process. Also, we do not capture trade-offs between SDGs, and between resilience actions and broader sustainable development targets. For example, some RS propose actions on transit-oriented development to increase the social inclusion of all. However, these actions might lead to excessive urbanization, housing density and property values, which can negatively affect social equity and the environment if not designed and implemented in an integrated way. Finally, the methodological approach of coding on a binary variable scale instead of an ordinal scale conceals possible degrees of variable presence.

6. Conclusion

Cities take action to prepare for major challenges they are facing today and in the future. 100RC (now RCN) exemplifies this action as a network that strives for city transformations through resilience. Urban resilience and sustainable urban development are often used interchangeably to describe transformative city action (Elmqvist *et al.* 2019). However, resilience in a narrow understanding that only accounts for re-establishing the status quo without tackling systemic stresses likely hinders sustainable development as envisioned by the SDGs. Or as Ziervogel and colleagues put it: "[…] the concept of resilience is intuitively attractive, yet is messy and at times regressive, particularly in its implementation and policy articulation" (2017, 123). We asked whether resilience is seen in a way that includes or excludes sustainability as the main umbrella framework for transformative action. For doing so, we developed a coding scheme for building a composite transformative adaptation index that shows how cities' resilience actions are planned. We then applied a coding scheme for

assessing SDG coverage of urban resilience actions. Finally, we explored the relationship between resilience and sustainable development in urban strategies for transformation.

Confirming and further extending the results of Croese, Green, and Morgan (2020), we found a general positive trend between resilience and sustainable development in the actions of city strategies, particularly in the Global South. Resilience planning can have a normative direction towards a sustainable future when understood in a broad way that includes both potential shocks and underlying stresses in different thematic areas, and when it includes transformative actions rather than just maintaining (or minimally improving) the status quo. Therefore, our empirical analysis corroborates conceptual considerations suggesting integrated governance approaches that address urban resilience and sustainable development simultaneously (Zhang and Li 2018). A clear understanding of the commonalities and differences between the concepts can help minimize trade-offs between resilience and sustainability goals, avoid duplication of efforts and save valuable limited resources. Scholars and practitioners should thus strive for conceptual clarity in academic and policy practice, rather than using the terms interchangeably.

Cities in the Global South and North alike identified their main challenges in a broad spectrum of categories, mainly regarding climate risks and the societal sphere. This result shows that resilience has been understood in a broad, systemic way in 100RC, such as envisioned by the common resilience definition and strategy development process of the network. The broad definition incentivized resilience pathways including social issues and potentially social justice, which has been rare for resilience applications in urban practice (Ziervogel *et al.* 2017). For the resilience challenges that cities defined, our results mirror the latest World Cities Report (UN 2022), which identifies climate change, inequality, inclusivity and infrastructure as key priorities to be addressed for resilient and sustainable urban futures. Nonetheless, the SDG coding shows that the economic dimension plays the most important role on the action level, even though economic shocks and stresses were not defined as the main challenges. Sustainable development and resilience seem to be understood mainly in economic terms. This indicates that action in the 100RC follow a somewhat neoliberal path dependency, similar to observations of SDG implementation (Biermann *et al.* 2022) and confirming critiques of the 100RC network in this regard (Coppola, Crivello, and Haupt 2020, Leitner *et al.* 2018).

On the other hand, cities put emphasis on non-state partnerships with civil society and especially academia for implementation, which again points to a broader resilience understanding that involves a diverse set of actors (Walker *et al.* 2002). Case studies further highlight the importance of science-policy partnerships for the integrated implementation of global policy agendas such as the SDGs at the local level, particularly by improving city officials' understanding of development frameworks and facilitating learning across cities (Croese *et al.* 2021). However, it remains questionable whether local action with non-state actors can be effective without being embedded in national policies, as necessary capacities are lacking at the urban level (Otto *et al.* 2021). This seems to apply particularly to the Global South, although our analysis shows that the Global South is more advanced in the imaginaries of a future that combines both resilience and sustainability. This result for urban resilience contrasts with the identified leading role of the Global North in urban climate change adaptation (Araos *et al.* 2016).

In most cases, cities' resilience efforts resemble predominantly incremental pathways, which reflects the dominant governance mode in public policies (Berglund *et al.* 2022)

and transnational municipal networks (Heikkinen, Ylä-Anttila, and Juhola 2019). However, incremental change that accumulates over time may also lead to transformations (Berglund *et al.* 2022). More in-depth studies are needed to test these claims, so are studies that go beyond planning documents and examine actual implementation of the resilience plans and their effectiveness. Future research could further explore the results of both coding exercises presented in Section 5.1 and 5.2 in more detail, e.g. by examining the influence of the individual indicators used to measure transformative adaptation on SDG coverage. Studying city action incentivized by the 100RC is of particular interest because of the ceasing and reinvention of the network, and the tension/synergy between broader efforts towards resilience and sustainability. While our analysis focused on 30 semi-randomly selected cities from the Global South and North, a replication and comparison of our study with other 100RC members or other city networks could yield valuable additional insights. Finally, acknowledging the context-sensitive nature of governance approaches, resilience and sustainable development, subsequent studies could control for additional variables such as the political and administrative system, institutional structures or power relationships among the actors involved. This could be particularly supported by qualitative studies. Such efforts could further increase our understanding of the relationship between urban resilience, sustainable development, and transformative adaptation across different urban contexts.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

Supplementary material

Supplemental data for this article can be accessed online at https://doi.org/10.1080/09640568.2023.2297648.

Notes

1. Following Koch and Krellenberg (2018, 2), we use the terms Global South/Global North to "describe countries, which are in a privileged societal, political, and economic position (Global North) or in disadvantaged position globally (Global South)".
2. Countries of the Global South refer to members of "The Group of 77" (G-77). See also footnote 1 for an elaboration on the use of the term "Global South".
3. Governance is only assessed for stresses, not for shocks.
4. Targets that cannot be addressed at the city level include, for example, those aiming to increase representation and participation of developing countries in international institutions (targets 10.6 and 16.8), or those referring to financial commitments made by nation states (e.g., targets 8.a and 13.a).
5. See https://unstats.un.org/sdgs/dataportal (accessed April 26, 2023).
6. A description of the SDGs and their respective categorization can be found in Appendix C (online supplementary material). See Appendix D (online supplementary material) for absolute counts of SDG targets addressed by city and category.

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Appendix

Appendix I: Overview of cases

Cities' resilience strategies can be accessed at https://resilientcitiesnetwork.org/member-cities/.

City	Country	Region[1]	Year[1]	Generation[2]	Global South/North [3]	Income level (country)[4]	Population 2022 (in Mio)[5]
Dakar	Senegal	Africa	2017	1	South	Lower-middle	3.32
Durban	South Africa	Africa	2017	1	South	Upper-middle	3.19
Quito	Ecuador	Latin America and the Caribbean	2017	1	South	Upper-middle	1.92
Rio de Janeiro	Brazil	Latin America and the Caribbean	2017	1	South	Upper-middle	13.63
Rotterdam	Netherlands	Europe and the Middle East	2016	1	North	High	1.01
Ramallah	Palestine	Europe and the Middle East	2017	1	South	n/a	0.047 (2023)
Boulder	USA	North America	2016	1	North	High	0.103
Mexico City	Mexico	Latin America and the Caribbean	2016	1	North	Upper-middle	22.08
Melbourne	Australia	Asia Pacific	2016	1	North	High	5.15
Da Nang	Vietnam	Asia Pacific	2016	1	South	Lower-middle	1.18
Lagos	Nigeria	Africa	2020	2	South	Lower-middle	15.38
Santa Fe	Argentina	Latin America and the Caribbean	2017	2	South	Upper-middle	0.576
Santiago de Chile	Chile	Latin America and the Caribbean	2017	2	South	High	6.85
Ciudad Juarez	Mexico	Latin America and the Caribbean	2018	2	North	Upper-middle	1.56
Paris	France	Europe and the Middle East	2017	2	North	High	11.14
Amman	Jordan	Europe and the Middle East	2017	2	South	Upper-middle	2.2
Montreal	Canada	North America	2018	2	North	High	4.27
Saint Louis	USA	North America	2019	2	North	High	0.286
Singapore	Singapore	Asia Pacific	2018	2	South	High	6.03
Chennai	India	Asia Pacific	2019	2	South	Lower-middle	11.5

Accra	Ghana	Africa	2019	3	South	Lower-middle	2.6
Addis Ababa	Ethiopia	Africa	2019	3	South	Low	5.22
Cape Town	South Africa	Africa	2019	3	South	Upper-middle	4.8
Panama City	Panama	Latin America and the Caribbean	2018	3	South	Upper-middle	1.93
Tbilisi	Georgia	Europe and the Middle East	2019	3	North	Upper-middle	1.08
The Hague	Netherlands	Europe and the Middle East	2019	3	North	High	1.37
Calgary	Canada	North America	2019	3	North	High	1.61
Louisville	USA	North America	2019	3	North	High	0.625
Can Tho	Vietnam	Asia Pacific	2019	3	South	Lower-middle	1.78
Pune	India	Asia Pacific	2019	3	South	Lower-middle	6.98

[1] Resilient Cities Network. 2022. Our Member Cities. https://resilientcitiesnetwork.org/member-cities/

[2] Rodas Espinel, Mauricio, and David Jácome Polit. 2017. Resilient Quito - Resilience Strategy, Metropolitan District of Quito. Quito.

[3] The Group of 77 (G-77). 2022. The Member States of the Group of 77. http://www.g77.org/doc/members.html

[4] World Bank. 2022. World Bank Country and Lending Groups. https://datahelpdesk.worldbank.org/knowledgebase/articles/906519

[5] World Population Review. https://worldpopulationreview.com/

Appendix II: Coding Scheme for assessing the degree of transformative adaptation in city resilience strategies

Indicator	Code	Value	Description
Indicator set I: Shocks and Stresses			
Categories	- Built Environment - Digital Environment - Social - Economic - Ecological - (Governance)	None	The categories are used for the identified shocks and stresses. Stresses have one additional category: Governance. Examples for shocks are "infrastructure and building failure" (RS Addis Ababa 2020, p. 54) for built environment, "Growing risk of cyber-attack and telecommunications breakdown" (RS Calgary 2019, p.13) for digital environment, "terrorism" (RS Addis Ababa 2020, p. 54) for social, "inflation" (RS Addis Ababa, p. 54) for economic, and "extreme weather incidents" (RS Calgary 2019, p.13) for ecological. Examples of stresses are "access to housing and homelessness" (RS Calgary 2019, p.14) for the built environment, "digitisation" (RS The Hague 2017, p. 24) for digital environment, "poverty and debt" (RS The Hague 2017, p.24) for social, "high unemployment" (RS Addis Ababa, p.51) for the economy and "corruption" for governance (RS Addis Ababa, p.51).
Indicator set II: Adaptation policies			
Policy coherence:			
Relation to shocks	- Built Environment - Digital Environment - Social - Economic Ecological	Binary (yes = 2/ no = 0 for every addressed category [n = 0,..,10])	Actions linked to the vulnerability assessment indicate a systematic planning approach.
Relation to stresses	- Built Environment - Digital Environment - Social - Economic - Ecological - Governance	Binary (yes = 2/ no = 0 for every addressed category [n = 0,..,12])	
Policy content:			
Built environment	- Improvements of infrastructure - Infrastructure: diversifying the range of infrastructure systems - Green infrastructure	Binary (yes = 1/ no = 0) Binary (yes = 2/ no = 0) Binary (yes = 2/ no = 0)	Planned infrastructure improvement is an important, incremental strategy. Planned green infrastructure and diversifying the range of infrastructure systems indicates the envisioning of city futures in the long-term.
Economic incentives	- Economic incentive mechanisms - Financial funds/ insurance	Binary (yes = 1/ no = 0) Binary (yes = 2/ no = 0)	Economic incentive mechanisms and especially financial funds or improved insurance systems show the support and political will for adaptive solutions.
Knowledge	- Information distribution - Research and technology development	Binary (yes = 1/ no = 0) [for both]	Information is key in raising awareness for future disruptive events or system stresses. Research supports essential knowledge gain for adaptive planning and innovative solutions.

Knowledge co-creation	- Knowledge generation with community of practice - Knowledge generation with community of place/ citizens	Binary (yes = 1/ no = 0) Binary (yes = 2/ no = 0)	Knowledge co-creation shows the ongoing inclusion of local knowledge. A community of practice is the according governance network for the topic at hand. Actors can be public, from business or organized civil society, but have to be related to the topic. A community of place could be a neighborhood or district.
Capacity building	- Training with and/or education for community of practice - Training with and/or education for community of place/ citizens	Binary (yes = 1/ no = 0) Binary (yes = 2/ no = 0)	Capacity building of the community of practice (see definition above) aids fast responses. Community capacity building fosters the overall adaptive capacity of an urban society.
Communication	- Improved monitoring systems - New communication systems	Binary (yes = 1/ no = 0) Binary (yes = 2/ no = 0)	Fast and efficient monitoring systems strengthen preparedness and responsiveness of cities. New institutions and communication systems – including data collection and sharing, law and policy -, show profound system change.
Institutions	- Continuity of programs, regulations, frameworks - Building of community of practice - New institutions/ regulations	Binary (yes = 1/ no = 0) Binary (yes = 2/ no = 0) Binary (yes = 2/ no = 0)	Institutionalisation of adaptation pathways is important for ingraining resilience thinking.
Policy Mode:			
Distributed resources	- Partnerships/ networks with non-state actors - Sectoral integration - Multi-level integration	Binary (yes = 1/ no = 0) [for all]	Indication of an integrative planning approach based on participatory governance networks and coordination among sectors and levels.
Reflexive Learning	- Continuity of community-based projects/ of innovation - Experimentation - Exogenous learning	Binary (yes = 1/ no = 0) [for all]	Continuing – including upscaling -community-based projects and social or technical innovation show planning that includes lay-local knowledge and expert knowhow. Experimentation such as policy experiments, urban living labs and pilots is seen as a main policy instrument in adaptive planning/ governance. Exogenous learning, i.e. learning from other examples such as other cities or policy areas, constitutes an important element in governance learning.
Participation in strategy development			
Breadth of involvement	- Type of actor group (non-experts, citizens/ expert stakeholders) - Number of participating actors	Binary (yes = 1/ no = 0/ per actor group) (x = {1, 2, 3}:1 ≤100/ 2 ≥200/ 3 ≥300/)	Quantities serve as evaluation proxy for a diverse and extensive participatory process. The threshold for the code "numbers of participating actors" is assessed and if necessary adjusted after a first, random sub-sample.

Communication	- Type of participation format (consultation/ interaction) - Iteration of formats	Incremental per participation format in this order (x = {1, 2} x1=1; x2=2) (x = {1, 2, 3}:1 = 1/ 2 ≤ 3/ 3 ≥ 3)	Quantities serve as evaluation proxy for a participatory process design conducive to input from diverse and balanced voices and perceptions. The threshold for the code "iteration of formats" is assessed and if necessary adjusted after a first, random sub-sample (perhaps only binary).
Participant influence	- Contestation in text - Clear indication in text	Binary (yes = 1/ no = 0) Binary (yes = 2/ no = 0)	Participant disagreement is made transparent. Documentation of results informed by participant input show the possibility for participants to actually shape actions. Both categories serve as evaluation proxy for participant influence.

Appendix III: List of the Sustainable Development Goals (SDGs) and their categorization according to Rockström & Sukhdev (2016).

SDG	Description	Category
1	No poverty	Society
2	Zero hunger	Society
3	Good health and well-being	Society
4	Quality education	Society
5	Gender equality	Society
6	Clean water and sanitation	Biosphere
7	Affordable and clean energy	Society
8	Decent work and economic growth	Economy
9	Industry, innovation and infrastructure	Economy
10	Reduced inequalities	Economy
11	Sustainable cities and communities	Society
12	Responsible consumption and production	Economy
13	Climate action	Biosphere
14	Life below water	Biosphere
15	Life on land	Biosphere
16	Peace, justice and strong institutions	Society
17	Partnerships for the goals	Partnerships

Appendix IV: Absolute count of different SDG targets addressed by city and category. SDG targets per category: Society: 74, Economy: 41, Biosphere: 35, Total: 150.

Global North	**Society**	**Economy**	**Biosphere**	**Total**
Boulder	20	11	9	40
Calgary	20	18	12	50
Ciudad Juarez	32	20	11	63
Louisville	39	21	12	72
Melbourne	28	16	14	58
Mexico City	19	15	14	48
Montreal	15	13	3	31
Paris	25	17	12	54
Rotterdam	27	16	8	51
Saint Louis	24	14	8	46
Tbilsi	23	19	10	52
The Hague	28	13	8	49
Global South	**Society**	**Economy**	**Biosphere**	**Total**
Accra	33	17	9	59
Addis Ababa	47	26	17	90
Amman	30	21	7	58
Can Tho	27	21	12	60
Cape Town	38	24	15	77
Chennai	24	15	16	55
Da Nang	18	16	9	43
Dakar	21	20	11	52
Durban	15	5	3	23
Lagos	39	22	15	76
Panama City	37	20	18	75
Pune	32	23	13	68
Quito	29	20	10	59
Ramallah	38	24	9	71
Rio de Janeiro	34	23	16	73
Santa Fe	39	23	10	72
Santiago de Chile	27	18	15	60
Singapore	25	17	12	54

Supplementary contribution 1:

Planetary Integrity

Abstract

This chapter asks whether the Sustainable Development Goals have advanced planetary ecological integrity, that is, strengthened policies towards the preservation of global commons at various levels of governance. We start with a brief account of the concept of planetary integrity, before engaging in a theoretical debate about the potential role of the Sustainable Development Goals in advancing planetary integrity, drawing on a literature survey. Finally, we assess the transformative potential of the goals for planetary integrity by focusing on governance interventions at international, regional, local and transnational levels. Our research shows that while the Sustainable Development Goals have raised concern about environmental protection, they do not motivate transformative change towards planetary integrity. Specifically, the literature raises doubts about the actual steering effects of the goals owing to their poor additionality with respect to existing environmental agreements, their inherent contradictions, and their weak ambition when it comes to planetary integrity.

6

Planetary Integrity

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The priorities of the 2030 Agenda for Sustainable Development revolve around 'people', 'planet' and 'prosperity'. Yet, the precise relationship between these three concerns remains vaguely defined in the 2030 Agenda, as does the place of the 'planet' in this plan of action. Implicit in the 17 Sustainable Development Goals is that we can ensure global prosperity and equality only within a stable ecological context. Commentators acknowledge that how countries pursue ecological objectives will directly affect their 'ability to address the majority of the Sustainable Development Goals' (Vasseur et al. 2017: 732). The Sustainable Development Goals must therefore, in principle, seek to secure the basis of human well-being, while maintaining the biophysical capacity of our planet. Although it remains debatable what this implies in practice, it is reasonable to assume that the integrity of the earth's life-support systems, or *planetary integrity* in short, must be maintained for long-term sustainability. Then the following questions arise: To what extent have the Sustainable Development Goals advanced planetary integrity, and where can we see positive changes towards planetary integrity in governance efforts that can be attributed to the global goals?

This is the central question in this chapter. We first offer a brief account of the concept of planetary integrity as a global public good that is maintained by keeping the earth system within its ecological limits (Westra, Bosselmann and Gwiazdon 2018). By drawing on an extensive literature survey, we then reflect on a theoretical debate about the actual and potential role of the Sustainable Development Goals in advancing planetary integrity; a debate that, while ranging between optimism and scepticism, is predominantly sceptical about such potential. Next we provide four examples situated at the international, regional, local and transnational levels of governance within which the Sustainable Development Goals aim to steer (see, for a similar approach, Biermann and Kim 2020a). At the international level we consider key environmental institutions, namely, the United Nations Environment Assembly and the international regimes on climate change

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and biodiversity, and contrast this perspective with an analysis of the International Labour Organization, which is not explicitly concerned with environmental matters. Regionally, we shift our analysis to the European Union and the Economic Commission for Latin America and the Caribbean, which offers contrasting perspectives from the Global South and Global North on how regional institutions use the Sustainable Development Goals to pursue planetary integrity. At the national level, we discuss how South Africa, a hugely diverse country and an influential political and economic player in Africa, engages with the Sustainable Development Goals to pursue socio-economic development in the context of planetary integrity. We then focus on the role of transnational corporations, as increasingly influential global actors, in employing the Sustainable Development Goals in their efforts to advance, or hinder, the pursuit of planetary integrity. We conclude with a summary of our findings, a reflection on theoretical implications, and suggestions for future research.

We do not claim to cover the entire spectrum of perspectives, or that the findings from the international, regional, national and transnational examples we discuss are generalizable. However, we seek to contribute to theory-building on when and how governance through global goals work (Kanie and Biermann 2017), and to make policy-relevant recommendations for the second half of the 2030 Agenda and the discussions for the period after 2030.

Conceptualization and Methods

The idea of the Anthropocene suggests that humans are embedded in the earth system and able to alter its vital functions. Human activities are now being exercised on a planet that is not passive, but increasingly hostile and unpredictable, with important consequences for governance and law (Biermann 2014; Kotzé 2020). Our future will be determined as much by the earth system of which we are an integral part as by our choices and behaviour, which, in turn, are shaped by grand development visions such as the Sustainable Development Goals (Stengers 2015). Planetary integrity will therefore have to be maintained to sustain all life on earth. The notion of planetary integrity derives from its root term ‘ecological integrity’, which was initially developed to describe the declining state of biodiversity on a sub-global scale (Hurley and Tittensor 2020; Westra 2005). In this context, ‘integrity’ is a way of thinking about ecological health affected by human activities (Burdon 2020; Kim and Bosselmann 2015).

The concept of planetary integrity is becoming popular at several levels of analysis (Parnell 2018). It is, for example, implied in the notion of planetary boundaries – a conceptual framework that seeks to quantify the ‘safe limits outside of which the Earth system cannot continue to function in a stable, Holocene-like

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state' (Rockström et al. 2009: 474; also Steffen et al. 2015). Here, planetary integrity is used, and has been critiqued (Biermann and Kim 2020b; French and Kotzé 2021), to describe a 'safe operating space' beyond which the earth system will behave in unpredictable ways, and to describe a threshold for the ability of ecosystems to support human society (Bridgewater, Kim and Bosselmann 2014). The boundaries include, among others, those for a safe climate, for protecting biodiversity, and to avoid serious pollution.

The safe operating space for humanity is, however, getting smaller, at a rate much faster than initial predictions. Evidence from earth system science shows unprecedented and accelerating levels of global environmental change and associated deepening of socio-ecological injustices between and within generations, which affect humans and non-humans. The signs of decaying planetary integrity are apparent in terms of epistemic frameworks such as the Anthropocene and predictions showing that we are fast approaching global tipping points (Lenton et al. 2020), and possibly even a Sixth Mass Extinction event (Briggs 2017). There now seems to be general agreement that planetary integrity is being impacted in unprecedented ways, and that deliberate and thoroughgoing steering mechanisms, such as through the Sustainable Development Goals, are urgently needed (French and Kotzé 2018). Yet, have the global goals also advanced planetary integrity, and where do we see positive changes towards planetary integrity in governance efforts that can be attributed to the global goals?

This chapter offers a range of perspectives that trace out preliminary answers to these questions. We conducted a systematic qualitative literature survey using *Scopus*. We searched for publications published in English before 2021 that include the Sustainable Development Goals or the acronym in their title, abstract or keywords with reference to the environment in conjunction with governance.[1] This search returned 101 studies, among which we found 15 publications to be particularly relevant for our chapter. This choice of highly relevant publications has informed the core findings of our analysis. We then also drew on other sources that reference, or are referenced by, these publications, which we relied on to guide, elaborate and substantiate our discussion of the literature we surveyed. Very few of these publications explicitly discuss the actual or potential steering effects of the Sustainable Development Goals in relation to planetary integrity, and where they do, they predominantly focus on the potential instead of the actual steering effects of the Goals. Concrete empirical analysis of the actual steering effects of the Sustainable Development Goals in relation to planetary integrity is therefore still lacking, which points to a clear research gap and the need for future analyses. As a result of this gap, for present purposes, we complemented this theoretical discussion with a meta-assessment that draws on grey literature and the multidisciplinary expertise and perspectives of the authors. These focused

discussions offer a snapshot of perspectives from the Global South and Global North, and the multiple complex concerns that lie at the heart of the 2030 Agenda, including views on the potential and actual environmental steering effects of the Sustainable Development Goals in varied contexts.

Research Findings and Practical Insights

In this section we present key findings of the literature review on the potential and limits of the Sustainable Development Goals in steering societies towards planetary integrity. We understand the steering effects of the Sustainable Development Goals here through the lens of institutionalism. The Sustainable Development Goals reflect the interests, ideas and aspirations of differentially endowed actors (Kashwan, MacLean and García-Lopéz 2019), and they reflect dynamic settlements (Mahoney and Thelen 2009). As all institutions, the Sustainable Development Goals are human creations within socio-economic and political contexts and remain susceptible to continuous manoeuvring by many actors. In our analysis of the steering effects of the Sustainable Development Goals, we are therefore sensitive to the configuration of the purposes that the specific framings and designs of the goals are oriented to serve in the context of planetary integrity. Our analysis also broadly embraces an understanding of the types of steering effects as elaborated in Chapter 1. To this end, the assessment specifically looks at whether and in what ways the Sustainable Development Goals have led to changes (positive and negative) in relation to how political, economic and societal actors pursue planetary integrity. We seek to determine whether it is possible to observe actual or potential policy, legal and broader regulatory framework (normative) changes; institutional changes such as the creation of new governance structures; and discursive changes in and of civil society actors.

The Potential for Environmental Steering by the Goals

Several studies refer to the Sustainable Development Goals as an important frame for sustainable development (e.g., Racioppi et al. 2020). Yet, these studies do not attribute any primary steering powers to the Sustainable Development Goals, and the goals are not seen as *directly* steering behaviour (De Schutter et al. 2019; Mansourian 2018; Smith et al. 2019). Instead, researchers find rather indirect steering where Sustainable Development Goals act as 'orchestrators' (Biermann, Kanie and Kim 2017; Underdal and Kim 2017). One example is when the Sustainable Development Goals facilitate the clustering of international agreements or serve as collective 'headlines' (for example, Sustainable Development Goals 14 and 15 for biodiversity). One study concludes that 'clear lines of sight between

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the SDGs and their impacts are unlikely to emerge. Rather, the SDGs are likely . . . to have a range of "messy, contradictory and refractory effects"' (Hirons 2020: 322).

Several factors might complicate the ability of the Sustainable Development Goals to have environmental steering effects. For example, environmental targets under the Sustainable Development Goals often sit in non-environmental goals, with indicators ending up diluting or contradicting the environmental 'mission' of the 2030 Agenda as a whole (Elder and Olsen 2019). Some scholars, for example, have argued that the goals for eradicating poverty or economic growth could result in environmental degradation (Liverman 2018; Sexsmith and McMichael 2015). At the same time, most environmental targets under the Sustainable Development Goals were extracted from earlier agreements, which might draw resistance from other bodies or agreements in the same area, and even give rise to conflicting priorities (Elder, Bengtsson and Akenji 2016; Kim 2016). The potential for turf wars in such a setting is real, as is the lack of ambition of the goals (Kotzé and French 2018). Such turf wars could limit the steering effect of Sustainable Development Goals and significantly weaken efforts to pursue ambitious environmental protection through law, policy and governance. Some commentators hence argue that the goals may help to highlight environmental protection as a concern in achieving sustainable development, but that their rationale and content remains still structurally incompatible with steering towards the more ambitious goal of planetary integrity (Griggs et al. 2013).

Inherent Design Limitations

Some studies also argue that the Sustainable Development Goals might even have a negative steering effect on planetary integrity in that they could incentivize countries to further subordinate environmental priorities in their developmental plans (Zeng et al. 2020). In other words, doubts about the steering qualities of the Sustainable Development Goals towards environmental protection arise not only from their ability to steer, but also from the fact that they do not seem to prioritize environmental protection in the first place (Craig and Ruhl 2020). The 2030 Agenda's explicit inclusion of the 'planet' as one of its main concerns might signal some focus on a planetary perspective, although the agenda does not refer explicitly to 'planetary integrity', or to 'planetary limits' or 'planetary boundaries' (Elder, Bengtsson and Akenji 2016; Randers et al. 2019). The absence of an overarching environmental or 'planetary' goal is remarkable (Brandi 2015), with environmental protection left to a cluster of environment-focused Sustainable Development Goals down the list at numbers 13, 14 and 15. While including these explicit environmental goals might advance environmental protection, some also

argue that Goals 13, 14 and 15 could compartmentalize environmental issues (climate, land and oceans) without an overarching SDG on 'planetary integrity' (Costanza et al. 2015; Kim 2016; Kim and Bosselmann 2015; Young et al. 2017). Therefore, simply based on a textual analysis of the Sustainable Development Goals, the goals do not pursue planetary integrity as such, but do recognize the importance of protecting environmental aspects such as climate, land and the oceans.

Where environmental protection was integrated into several non-environmental goals, the Sustainable Development Goals also adopted some conservative and unambitious perspectives on the tensions between economic growth and environmental sustainability (Adelman 2018; Eisenmenger et al. 2020; Kotzé 2018). This is evident, for example, in their emphasis on longstanding but dubious claims about decoupling and resource efficiency as technological solutions to the environmental crisis (Elder and Olsen 2019; Fletcher and Rammelt 2017). Governments also rejected as potential core ideas underpinning the Sustainable Development Goals the more transformative objective of looking beyond gross domestic product as an indicator of prosperity (Costanza et al. 2015); the notion of planetary boundaries and the limits this would imply for unrestrained neoliberal development (Elder and Olsen 2019); and the need for robust implementation measures, which are currently considered to be 'not carefully thought out or systematic' (Elder, Bengtsson and Akenji 2016: 6). For example, Gasper, Shah and Tankha (2019) show that while the emergence of Sustainable Development Goal 12 (to ensure sustainable consumption and production patterns) as a stand-alone goal resulted from pressure by developing countries on industrialized countries, it was in the end business interests that shaped the targets and indicators under this goal. This explains why Goal 12 reflects a narrative of 'sustainable growth', which some critics consider a business-friendly, neoliberal approach embedded in sustainable development, and which places much faith in yet-to-be-developed future technological innovations (Adelman 2018).

Several intergovernmental environmental agencies and civil society groups took part in the formulation of the Sustainable Development Goals, which could have increased the ambition of these goals towards environmental protection (Sénit 2020). However, the influence of governments and business organizations prevailed and resulted in unambitious and vague targets of a non-committal nature (Gasper, Shah and Tankha 2019). Similarly, growth as envisaged in Sustainable Development Goal 8 is seen to be inherently incompatible with environmental protection targets, such as those articulated in Goals 6, 13, 14 and 15 (Hickel 2019). Some therefore argue that the Sustainable Development Goals' focus on sustainable *economic* development is inevitably detrimental to planetary integrity and justice (Kotzé 2018), which require both limits to economic growth

and the removal of 'developmental' disparities between the rich and the poor (Kashwan et al. 2020; Lydgate 2012).

A Matter of Window Dressing?

Some studies point to the dangers of 'cherry picking', 'window dressing' and 'greenwashing' (e.g., Forestier and Kim 2020). On paper, the 17 Sustainable Development Goals are unprioritized and all equal (see also Chapter 4 of this book): The goals are at least in spirit a 'network of targets' (Le Blanc 2015). However, they do not come as a truly indivisible package, but leave room for governments to strategically prioritize certain goals in their implementation (Forestier and Kim 2020). One study claimed that the goals are all 'characterized by an absence of any top-down priority setting mechanisms [and] States have the freedom to pursue (or ignore) the goals however they want' (Hirons 2020: 325). For instance, it has been argued that governments and businesses actively prioritize the social and economic goals over the environmental goals in both rhetoric and practice (Craig and Ruhl 2020). Even the 2030 Agenda explicitly says that environmental threats merely 'add to and exacerbate' the list of challenges faced by humanity (UNGA 2015: 5). This ignores evidence that environmental degradation is caused by a narrow focus on economic growth, and it undermines the goals of broad-based development that is at once just, fair and equitable and that can only be achieved in the context of a healthy ecosystem (Adelman 2018). Studies suggest that instead of promoting a more holistic form of ecologically friendly development, many governments still prioritize economic growth while neglecting environmental protection (Custer et al. 2018). Commentators have shown that among the 169 targets under the Sustainable Development Goals, environmental targets are often less easily trackable and measurable, and require larger and more uncertain investments (Craig and Ruhl 2020). As we show below, the prioritization of non-environmental goals also results from political–business cycle dynamics: short-term economic growth and ill-conceived ideas of development trump longer-term planetary integrity, and then create a vicious cycle that further subordinates planetary integrity (Kotzé 2018). All this goes to the heart of concerns about the ontological design and ethical orientation of the Sustainable Development Goals: their focus seems to remain, as one study argues, on 'growth and use of resources … and [it] departs from an individual, not collective, point of view'; and they remain 'underpinned by strong (Western) modernist notions of development: sovereignty of humans over their environment (anthropocentricism), individualism, competition, freedom (rights rather than duties), self-interest, belief in the market leading to collective welfare, private property (protected by legal systems), rewards based on merit, materialism,

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quantification of value, and instrumentalization of labour' (van Norren 2020: 453; see also Liverman 2018).

These insights in the literature lead one to question whether the Sustainable Development Goals are the *appropriate* vehicle to pursue planetary integrity. Some critics argue that the goals are inappropriate for this purpose and show, for example, that the goals do not acknowledge the centrality of healthy ecosystems to the optimal functioning of the vast majority of social and economic systems (Kotzé and French 2018). In other words, the Sustainable Development Goals fail to recognize that planetary, people and prosperity concerns are all part of one earth system, and that the protection of planetary integrity should not be a means to an end, but an end in itself.

Some studies also see the Sustainable Development Goals as essentially anthropocentric and mainly aimed at promoting economic development for (some) humans, despite their high rhetoric to the contrary. These studies argue that the goals are therefore unlikely to help solve the fundamental planetary problems that arise from the specific type of unbridled neoliberal economic development that the Sustainable Development Goals promote (Adelman 2018; Kotzé 2018). A principal concern is that the Sustainable Development Goals remain fixated on the idea that economic growth is foundational to achieve all pillars of sustainable development; as one author argues, 'the SDGs are not biocentric aiming to respect nature for nature's sake, enabling reciprocity with nature. They embody linear growth/results thinking which requires unlimited resource exploitation, and not cyclical thinking replacing growth with well-being (of all beings)' (van Norren 2020: 431).

In sum, owing to ontological and systemic factors, and limitations in their design and purpose, the available literature does not see the Sustainable Development Goals as having any significant potential to steer governance towards a prioritization of planetary integrity. Whatever indirect steering effects the Sustainable Development Goals might have in this respect are merely implied through the environmental goals at the bottom of the list of the Sustainable Development Goals. On the one hand, these environmental goals might facilitate discussions about the importance and potential of the Sustainable Development Goals to pursue planetary integrity. They also might inspire future initiatives that eventually drive positive change (Kopnina 2018). Indeed, there is 'an increased recognition of the importance of the environment in the SDGs' (Vasseur et al 2017: 732). On the other hand, the findings of our literature survey support the view that the Sustainable Development Goals are not fully geared towards steering, and capable of facilitating, the pursuit of planetary integrity. Zeng et al. (2020) put this in even starker terms, that 'environmental destruction [has not been] avoided with the Sustainable Development Goals'.

We further explore this insight below, with reference to experiences at the international, regional, national and transnational levels of governance in order to determine in more practical terms what the steering effects of the Sustainable Development Goals in mainstreaming planetary integrity have been.

Experiences from International Governance

We start with experiences from international governance. Here, the United Nations Environment Assembly is often considered to be the world's most influential international institution for global environmental governance. Considering the centrality of the Sustainable Development Goals to the world's development vision and the prominence of the Assembly and its pivotal role in global environmental governance, one would expect that the Sustainable Development Goals are a key consideration in the agenda of the United Nations Environment Assembly. Such a consideration is supported by literature on the relationship between international institutions and organizations and the Sustainable Development Goals, with studies on whether and how international bodies can contribute to the 2030 Agenda, including environmental protection (Cormier 2016). Much scholarly attention has therefore been on the contribution of international institutions, such as the United Nations Environment Assembly (e.g., Ivanova 2021), to environmental protection, although not explicitly as part of the Sustainable Development Goals (Perrez 2020). This reflects public statements and policy documents by these institutions, which all stress their commitment to living up to the challenge of global environmental protection. Yet, it remains unclear to what extent the United Nations Environment Assembly has actually promoted planetary integrity through incorporating the environmental dimensions of the Sustainable Development Goals in its programmes.

At first glance it seems that the Assembly has done rather well. For example, the titles of several meetings of the Assembly embrace concerns of the Sustainable Development Goals, such as the first United Nations Environment Assembly, which focused on 'Sustainable Development Goals and the Post-2015 Development Agenda, including sustainable consumption and production'; and the fourth assembly on 'Innovative solutions for environmental challenges and sustainable consumption and production'. The choice of theme for the fifth United Nations Environment Assembly, 'Strengthening Actions for Nature to Achieve the Sustainable Development Goals', suggests further attention to the links between the Sustainable Development Goals and planetary integrity. This holds out considerable potential for the Assembly to govern the complex interactions arising from the Sustainable Development Goals, with a view to ultimately promoting environmental concerns as its core mandate (Kaniaru 2014; Rantala et al. 2020).

On closer examination, however, it seems that the United Nations Environment Assembly has undertaken only tentative steps towards governing these interactions in pursuit of planetary integrity. Attention to nexus issues that could support broader environmental and societal benefits has gradually increased as has support for cross-sectoral policy coherence (Rantala et al. 2020). For example, the Assembly has emphasized the need to improve links between pollution, climate change, biodiversity loss and ecosystem degradation (UNEA 2018), and the need to strengthen links between soil pollution, land use and the Sustainable Development Goals (UNEA 2017). Another area where the Assembly has much potential to facilitate synergies between the Sustainable Development Goals and environmental protection is sustainable consumption and production, which it considers essential to improve sustainability and to support the achievement of all other goals that relate to Goal 12 (Rantala et al. 2020).

In other areas, again, the Assembly fares worse than expected. For example, an opportunity to address interactions was missed at the fourth United Nations Environment Assembly, which failed to approve a draft resolution 'Deforestation and agricultural commodity supply chains', which was intended to halt deforestation (Goal 15) while contributing to ensure food security and nutrition (Goal 2) (Rantala et al. 2020). Therefore, while the United Nations Environment Assembly is a proponent of the Sustainable Development Goals, it mostly uses the goals to facilitate synergies between disparate environmental regimes, and to 'contemporize' the work it does through the label of the Sustainable Development Goal. The Assembly has not yet offered anything radically different that would suggest an ambitious change of course towards planetary integrity within the context of the Sustainable Development Goals.

As far as the climate regime is concerned, the Intergovernmental Panel on Climate Change recognizes the links between the Sustainable Development Goals and climate change. It has done so in its special report on *Global Warming of 1.5°C*, where it highlighted the Sustainable Development Goals as a key consideration in how countries can engage in decarbonized development pathways for sustainable development (IPCC 2018). Chapter 5 of the report, in particular, looked at how climate change might undermine the Sustainable Development Goals, and at possible synergies and trade-offs between responses to climate change and the goals. With the forthcoming Intergovernmental Panel on Climate Change Sixth Assessment Report also likely to connect climate change to the Sustainable Development Goals, such links are encouraging insofar as influential global scientific climate change assessments at least seem to rely on, and to reflect, the many dimensions propagated by the Sustainable Development Goals, including their environmental dimensions. Interestingly, however, the 2030 Agenda is not a major reference in the Paris Climate Agreement and climate governance debates,

although the co-evolution of the negotiations on the 2030 Agenda and the preparation of the Paris Climate Agreement in 2015 have mobilized some of the core principles of the 2030 Agenda. For example, the SDG-linked notion of 'co-benefits' between decarbonization and economic development, and between decarbonization and the reduction of inequalities (Deep Decarbonization Pathways Project 2015), has been central to ensuring support for the Paris Climate Agreement by some emerging economies and their corporations. Despite valid concerns that this might merely amount to greenwashing (Johnsson et al. 2020), it at least highlights interactions between key Sustainable Development Goals and climate change in global climate change negotiations. The inclusion of Nationally Determined Contributions and national Long-Term Strategies in the Paris Agreement is also consistent with the centrality of country-specific transformation pathways to reach the Sustainable Development Goals, as some proponents of the 2030 Agenda point out (Kőrösi 2015). Although it is difficult to say whether this is as a direct result of the Sustainable Development Goals, the need to develop decarbonization pathways that can protect biodiversity has also been put at the centre of climate negotiations (Deprez, Vallejo and Rankovic 2019) – an effort that emphasizes possible synergies, but also conflicts, between two directly related Sustainable Development Goals. With respect to climate finance, some financial actors have begun to align their investment portfolios with the Paris Climate Agreement (for example, by aligning Goals 8 and 9 with Goal 13), both as a pilot initiative and long-term learning process aimed at more fully synergizing their portfolios with the 2030 Agenda over the long term (OECD and UNDP 2020; Riaño et al. 2020). A redirection of global investment strategies alongside the framework of the Sustainable Development Goals, including, for example, increased investment in renewable energy, could in time promote more sustainable corporate practices that have planetary integrity as a major focus.

Reference to the Sustainable Development Goals is more explicit in the biodiversity regime. For example, the Global Assessment Report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services emphasizes the contribution of biodiversity and ecosystem services to realize all the Sustainable Development Goals (IPBES 2019). The draft texts under discussion for the proposed 2030 framework of the 1992 Convention on Biodiversity also reference the 2030 Agenda and the institutions in charge of this agenda through two entry points. One is the proposed global biodiversity goals for 2030 that will be decided at the 2021 conference of the parties. These will likely include not only goals centred on biodiversity but also on the contribution of biodiversity to reaching Sustainable Development Goals and their targets, such as food security (Convention on Biodiversity 2020). The overall aim of these goals is to anchor biodiversity integrity in the broader development perspectives of countries.

Another entry point is efforts related to facilitate mainstreaming, where the Convention on Biological Diversity could define a collective work programme with other institutions that are responsible for sectors that impact biodiversity conservation (such as the Food and Agricultural Organization for food systems transformation, and the World Trade Organization for global trade). To legitimize such a co-defined work programme, which is aimed at strengthening synergies, some studies have proposed that the High-level Political Forum on Sustainable Development should be the overarching institution for such a process (Kinniburgh and Rankovic 2019).

While the Sustainable Development Goals seem to have shaped discussions around the climate and biodiversity regimes and to have drawn attention to and consolidate support for specific concerns and their interlinkages, many key issues of planetary integrity had been part of negotiations well before the adoption of the 2030 Agenda. In climate governance, for example, negotiations on issues that could create wider environmental co-benefits beyond Sustainable Development Goal 13 – such as land use, land-use change and forestry – precede the 2030 Agenda. In 2011, states set guidelines for activities on land use, land-use change and forestry under the United Nations Framework Convention on Climate Change that should '[b]e consistent with the objective of environmental integrity and take into account the multiple functions of forests and other ecosystems' and '[b]e consistent with Parties' national sustainable development needs and goals' (UNFCCC 2010). In biodiversity governance, the Sustainable Development Goals are grounded in earlier commitments from several international agreements and soft law instruments, rather than the other way around. This is reflected, for example, in the Aichi Targets, which form the basis of the targets under Sustainable Development Goal 15, including target 15.1 on conservation and target 15.3 on reversing biodiversity degradation. The post-2020 global biodiversity framework that will define goals for global biodiversity governance up to 2030 further builds on these targets, but also aims to raise ambition, especially those targets under Goal 15 that end by 2020 (for example, targets 15.1, 15.2 and 15.3) (Rantala et al. 2020). While the Sustainable Development Goals can build on previous commitments, some studies highlight the adverse distributional consequences of biodiversity conservation regimes that are concentrated in countries with high levels of economic inequality and poor democratic institutions (Kashwan 2017). This is an instance of potential trade-offs between the centralizing tendencies of goal-oriented governance against the potential for process-oriented approaches that offer alternative opportunities to resolve deliberations over the prioritization of goals.

So far, we have discussed international institutions with an explicit environmental policy mandate. How about institutions that have environmental protection

not as their primary task? Are they influenced by environmental components of the Sustainable Development Goals? The limited literature on this issue (the bulk of information is drawn from studies conducted by these institutions themselves) observes here mostly 'secondary' steering towards environmental protection by upgrading an institution's environmental profile to contribute to the overall success of the 2030 Agenda (e.g., IMF 2021; World Bank 2015). Secondary steering refers to change that happens 'in the name of the Sustainable Development Goals'. For example, one study has shown a trend towards more environmental integration in the International Labour Organization's approach to sustainability, in normative and institutional terms (Montesano et al. 2021). This trend seems to have accelerated and coincides with the vision of the 2030 Agenda. However, when it comes to environmental protection, the link between the International Labour Organization and the Sustainable Development Goals is not straightforward. On the one hand, the negotiation and adoption of the goals has left its mark on the evolution of environmental ideas, norms and institutions within the International Labour Organization, particularly regarding framing programmes such as Green Jobs and partnerships for sustainability (ILO 2019). On the other hand, the International Labour Organization sees itself more as a manager than a recipient of the goals, stressing its active and deliberate role in shaping the 2030 Agenda in line with its priorities and in selectively using the goals as a platform to catalyse its socio-economic mandate (ILO 2015; 2016).

In sum, *the literature studies do not support claims that the Sustainable Development Goals reorient international organizations towards planetary integrity*, especially when such organizations are only indirectly concerned with environmental protection, such as the International Labour Organization (Montesano et al. 2021). The Sustainable Development Goals at best only seem to have secondary steering effects in this regard. Their impact on international organizations, as far as advancing planetary integrity is concerned, is indirect to the extent that they only offer a loose framework for creating synergies and emphasising the need to pursue environmental protection goals, many of which have already been agreed well before the 2030 Agenda came into being. Considering our earlier arguments about the limited prominence of planetary integrity in the 2030 Agenda and conceptual doubts about the ability of the Sustainable Development Goals to steer towards planetary integrity, expectations related to their impact on international organizations to pursue planetary integrity must be further diluted.

Experiences from Regional Governance

It is often claimed that the European Union is a frontrunner in regional environmental governance. It is, for example, one of the few major regional actors

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to have enshrined the concept of planetary boundaries in its legal system (Fernández and Malwé 2019). Some early European Parliament resolutions already featured the idea of planetary boundaries, including one mentioning them as being 'imperative' for the 2030 Agenda (European Parliament 2013a), while the 7th Environment Action Programme, titled 'Living Well, within the Limits of Our Planet', includes references to planetary boundaries and ecological limits. More recent studies by European Union agencies, such as the European Environment Agency, further apply the concept and develop the idea of a 'safe operating space for Europe' (European Environment Agency 2020). The Environment Action Programme also directly links its ambitious vision of ecological limits with the Sustainable Development Goals: the goals constitute 'politically binding environmental commitments' (European Parliament 2013b: paragraph 13), and both the European Union and its member states are to ensure that such commitments are implemented (Corrado et al. 2020). The Environment Action Programme further calls on the European Union to ensure that its post-2015 approach to development, including its reliance on the Sustainable Development Goals, reflects an integrated understanding of sustainable development. It specifically mentions environmental concerns such as climate change and biodiversity (European Parliament 2013b: paragraph 106.i).

Likewise, a 2016 European Commission communication explicitly links the need to transform European Union production and consumption to achieve a 'low-carbon, climate resilient, resource efficient and circular economy' to Sustainable Development Goals 8 and 12 (European Commission 2016: 2). More recently, the European Union Circular Economy Action Plan and the Bioeconomy Strategy of 2018 have showcased the growing awareness of the importance of an integrated approach to production and consumption when addressing environmental impacts (Sanyé-Mengual et al. 2019). The European Union Commission's Directorate-General for International Partnerships also explicitly links European Union development initiatives to the Sustainable Development Goals (European Commission 2020a). For example, with reference to Goal 13, it stresses European Union assistance to partner countries to transition to low-carbon sustainable development. All this shows that the Sustainable Development Goals have played a role in orienting the European Union's environmental laws and policies towards the pursuit of planetary integrity – at least on paper.

While these are all positive signs that could advance planetary integrity under the guidance of the Sustainable Development Goals, the European Union's goals-inspired sustainability roadmap still sees economic growth as a key enabler, in stark contrast to scientific evidence about the incompatibility of economic growth and long-term environmental protection (Hickel 2021). For example, for Goals 14 and 15, there are no specific indications in European Union law and policy

about new initiatives that would follow the Sustainable Development Goals, only a cursory mention of earlier programmes, such as Biodiversity for Life, which was launched in 2014.

Nevertheless, environmental concerns linked to the Sustainable Development Goals seem to become more central in Brussels. For example, the Juncker Commission published in 2019 a reflection paper titled 'Towards a Sustainable Europe by 2030' (European Commission 2019), which mentioned the Sustainable Development Goals as an agenda for the European Union to address interdependent challenges. The paper emphasizes 'ecological debt' as the greatest challenge to ensuring sustainability for future generations, and explicitly mentions planetary boundaries as the ecological limits that must shape socio-economic systems (European Commission 2019: 10). In its text on Sustainable Development Goal 15, the link between the 2030 Agenda and planetary integrity discourse is especially strong. The von der Leyen Commission later launched the European Union Green Deal as an umbrella for a range of policy initiatives to make Europe a climate-neutral continent. One such initiative is the European Union 2030 Biodiversity Strategy (European Commission 2020b); another is a new industrial strategy (European Commission 2020c). In some of these initiatives, links to the Sustainable Development Goals are explicit, and the initiatives are often presented as an integral part of the European Union's efforts to achieve the 2030 Agenda (European Commission 2020b: 19), highlighting some convergence between global and European sustainability agendas.

Across the Atlantic, the Latin America and the Caribbean region is important in leading up to the adoption of the 2030 Agenda and the Sustainable Development Goals. Here, many countries and regional governance bodies were involved in the negotiations on the Sustainable Development Goals (Nicolai et al. 2016). As a response to the United Nations' call for regional cooperation in implementing the 2030 Agenda, the members of the Economic Commission for Latin America and the Caribbean (ECLAC) established a forum on sustainable development in 2016 (ECLAC 2016). This forum is open to stakeholders but remains a state-led regional institution that seeks to contribute to the 2030 Agenda by, among others, strengthening coordination and cooperation, sharing best practices and providing political guidance and reviewing regional progress. The forum also seeks to foster the integration of the three dimensions of sustainable development in a holistic and cross-sectoral manner, including environmental protection and the promotion of living well in harmony with nature. Since its creation, the forum has recognized in several of its meetings the environmental dimensions of the Sustainable Development Goals (UNEP and Centro de Pensamiento Estratégico Internacional 2020). For instance, it has been noted that development policies 'must take into account the environmental dimension' and that policy-making should 'promote

structural progressive change towards sustainable development in order to protect ecosystems and biodiversity'; 'break the link between production and pollution'; 'move towards low carbon economies'; 'detoxify the air, soil and water' and promote a shift towards sustainable use of natural resources (ECLAC 2017, 2018). Governments also stressed that the '2030 Agenda, more than having environmental goals, was environmental as a whole, because progress could not be made on health or industrialization without taking the relevant environmental considerations into account' (ECLAC 2018: 41). While all these references indicate some efforts of the forum to integrate the environmental dimension of the Sustainable Development Goals into regional policies, these are still limited and do not include specific commitments (UNEP and Centro de Pensamiento Estratégico Internacional 2020). Critics also question to what extent this might lead to a form of socio-economic growth that respects planetary integrity in Latin America and the Caribbean, especially when environmentally destructive investment policies continue being prioritized (Ray and Gallagher 2016). The forum, for example, still prioritizes economic issues, while stressing the need for economic growth (ECLAC 2017, 2019), which will presumably be based on the extraction-based model prevailing in Latin America and the Caribbean (Silva 2012).

The Forum of Ministers of Environment of Latin America and the Caribbean contributes to the integration of environmental priorities into the implementation of the 2030 Agenda (UNEP 2016; UNEP and Centro de Pensamiento Estratégico Internacional 2020). In 2016, the forum revised and updated the Latin American and Caribbean Initiative for Sustainable Development to support the 2030 Agenda (UNEP 2016). The Initiative for Sustainable Development includes priority areas, goals and purposes for actions linked to environment-related Sustainable Development Goals, such as water management (Goal 6); energy (Goal 7); and climate change (Goal 13). The forum also agreed to promote the conservation and sustainable use of biodiversity and its mainstreaming in sectors such as agriculture, mining and energy (UNEP 2016, 2018).

Yet, despite such alignment of policies with environment-related Sustainable Development Goals, some studies doubt the benefits in relation to advancing planetary integrity in the region. For example, Hirons' (2020: 327) study on the interplay of the goals and mining argued that 'the prospects for the Sustainable Development Goals contributing positively to efforts to address environmental and social issues in ASM [artisanal and small-scale mining] are poor'. With reference to Goal 12, the Initiative for Sustainable Development refers to the need to improve resource efficiency and sustainable patterns of consumption and production to support economic growth (UNEP 2016). But in a region where national economies heavily rely on natural resources extraction and exports (Silva 2012; UNEP 2017), sustained economic growth inevitably leads to an increased

demand for these resources while amplifying environmental degradation (UNEP and World Conservation Monitoring Centre 2016).

In 2016, the Organization of American States adopted the Inter-American Program for Sustainable Development 2016–21 (Organization of American States 2017a). It defines strategic actions to ensure that the work of the organization's secretariat is aligned with the implementation of the 2030 Agenda, and that its objectives are guided by the Sustainable Development Goals (Organization of American States 2017a). The programme supports actions in focus areas, such as sustainable management of ecosystems (Goal 15); integrated water resources management (Goal 6); and sustainable energy management (Goal 7). While the Organization of American States has agreed on an institutional policy instrument that integrates environmental concerns, and while its members have reaffirmed their 'inalienable prerogative to defend Mother Earth, the planet, and life with consistent policies and practices' (Organization of American States 2017b: 95; original in Spanish), the declarations and resolutions adopted by its General Assembly since 2016 show that no significant actions have been taken to establish an ambitious regional scheme towards safeguarding planetary integrity.

In sum, the Sustainable Development Goals seem to be more central in regional governance bodies as compared to international organizations. Our analysis suggests that it is especially the European Union that has most significantly advanced in linking its governance agenda with the 2030 Agenda and developing environment-focused policies because of the Sustainable Development Goals. In the Global South, Latin American and Caribbean institutions seem to be rhetorically committed to integrating the Sustainable Development Goals' concerns into regional policies, but they fall short on more concrete action plans (Lucci, Surasky and Gamba 2015; Páez Vieyra 2019; UNEP and Centro de Pensamiento Estratégico Internacional 2018) While both of these regional institutions seem to actively recognize the importance of the Sustainable Development Goals and their environmental goals, which have been incorporated into some regional policies and plans, *the actual environmental steering effects of the Goals seem to be limited, while efforts to strengthen environmental protection in the face of unconstrained socio-economic development remain a challenge*. We therefore doubt whether the Sustainable Development Goals as such will suffice to drive radical change towards planetary integrity in a developed European region where economic development remains a key priority, and in the Latin American and Caribbean region, which continues to face numerous environmental conflicts and developmental challenges.

Experience from National Governance

We now turn to national governance. Here we focus on the example of South Africa, a highly unequal country with many socio-economic challenges, including

poverty, unemployment and low and unequal levels of access to water, sanitation and adequate housing. These must all be addressed within the context of a fragile ecological system.

Some progress has been reported: for example, access to electricity has increased from 36 per cent at the end of apartheid to 95 per cent by 2017 (Bekker et al. 2008; Government of South Africa 2019). This contributes to achieving Sustainable Development Goal 7, which in turn helps realize other goals (Fuso Nerini et al. 2018; Santika et al. 2019). However, South Africa's economy still heavily depends on coal, which supplies most of South Africa's electricity; this is contrary to the clean energy objective of Goal 7 and the goal of combating climate change (Goal 13). While climate change is receiving more attention in South Africa (as evidenced by stronger climate policies), the Integrated Resource Plan 2019 provides that coal power will still account for 59 per cent of South Africa's electricity supply by 2030, while wind and solar power will supply only 25 per cent. Although this increased share of renewable energy – which today is less than 2 per cent – is promising and can contribute to the achievement of Goals 7, 12 and 13, it remains insufficient. Importantly, the reliance on coal will bring adverse impacts on health (Goal 3), water (Goal 6), and life on land (Goal 15). Coal-based electricity generation also adds to climate change (Goal 13) and ocean acidification (Goal 14). In short, climate and energy-related governance in South Africa is not yet consistent with advancing planetary integrity, despite the Sustainable Development Goals. Although this must be seen in the context of the principle of common but differentiated responsibilities and respective capabilities that direct the climate policies and governance of many Global South countries, South Africa's progress on Goal 13, in particular, has been described as 'stagnating' (De la Mothe Karoubi et al. 2019). The country's Nationally Determined Contribution under the Paris Climate Agreement has also been rated as 'highly insufficient', as it would contribute to a global temperature increase of three to four degrees Celsius (Climate Action Tracker n.d.). In turn, the South African government highlights that climate change is complicating efforts to address the country's socio-economic challenges (Government of South Africa 2019; Mugambiwa and Tirivangasi 2017). This experience is in line with the broader observation that climate change may exacerbate socio-economic risks and vulnerabilities, particularly in developing countries (El Bilali et al. 2020; Islam and Khan 2018; Reyer et al. 2015).

Even though South Africa's 2012 National Development Plan preceded the 2030 Agenda for Sustainable Development, the government still reports that is has a '74 per cent convergence' with the Sustainable Development Goals (Government of South Africa 2019: 5). While the National Development Plan includes a chapter dedicated to environmental sustainability and refers to many ecological challenges, the focus of the National Development Plan is on socio-economic development. For example, the plan argues that to address poverty and inequality (the country's

main challenge), 'the economy must grow faster and in ways that benefit all South Africans' (National Planning Commission 2012: 24). This focus is reiterated in the latest 2019–24 Medium-Term Strategic Framework, a five-year plan through which the National Development Plan is implemented. The centrality of the National Development Plan in the South African policy context is clear. For instance, in assessing progress on the Sustainable Development Goals generally, the government uses the National Development Plan as a starting point (Government of South Africa 2019). Also, when considering progress on the environmental goals and climate change, the government refers to 'policies, strategies and programmes, with the National Development Plan as the overarching policy' (Statistics South Africa 2019: 155). While the government highlights policies towards the more environment-oriented Sustainable Development Goals, most of these predate the Sustainable Development Goals. Only four out of 12 energy- and climate-related policy documents published since 2016 mention the Sustainable Development Goals, with only a few containing explicit links to the goals (for example, the Draft Post-2015 National Energy Efficiency Strategy). Most of these policy documents, however, are meant to be in line with the National Development Plan. Thus, while they are relevant to the Sustainable Development Goals, the goals themselves have not shaped these policy measures. Furthermore, as suggested above, most economic growth measures are not necessarily consistent with safeguarding planetary integrity. Rather, the government has attempted to 'align the implementation of the Sustainable Development Goals with its domestic development agenda' (Haywood et al. 2019: 557).

Importantly, *there is not much evidence that the Sustainable Development Goals had any significant steering effects to advance planetary integrity in South Africa*, a country that still focuses on economic growth in order to achieve its main objective of addressing poverty and inequality. This appears to be consistent with experience elsewhere. Some research has shown, for example, that countries of varying income levels prioritize those Sustainable Development Goals that are consistent with their earlier development policies (Forestier and Kim 2020), and that the Sustainable Development Goals serve to 'legitimis[e] development goals and policies that have already been decided on' (Horn and Grugel 2018: 74). The general trend is that many countries prioritize the socio-economic goals over the environmental goals (Randers et al. 2019); as Forestier and Kim (2020: 1269) concluded, poverty eradication and economic growth were 'by far most widely prioritized' by developing and developed countries alike.

Experiences from Transnational Governance

While Chapter 3 of this book focused, among others, on the more general steering effects of the Sustainable Development Goals in relation to corporate actors, this

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section specifically interrogates the environmental steering effects of the Sustainable Development Goals in the transnational corporate sector. Here we ask the question: Do the Sustainable Development Goals have any steering effects in relation to transnational corporate actors as far as the promotion of planetary integrity is concerned? Some studies find that some companies go beyond the growth-paradigm in their operations through innovative sustainability business models (Coscieme et al. 2019). Yet, many companies still seem to support the view that prioritizes 'productive functions of ecosystems over non-productive life supporting functions such as, in particular, biodiversity and climate stabilization' (De Schutter et al. 2019: 2). Accordingly, business leaders are encouraged to understand that 'the firm exists as part of, and because of, the socio-ecological system, and competitive advantage is found through the combination of internal competencies and from the full consideration of external drivers' (Sullivan, Thomas and Rosano 2018: 245).

Amidst such concerns, and as shown in Chapter 3 of this volume, the Sustainable Development Goals seem to have sparked a renewed push for corporate participation in the 2030 Agenda. Networks like Businesses for 2030 (United States Council for International Business 2020) and the World Business Council for Sustainable Development's Sustainable Development Goals Business Hub (World Business Council for Sustainable Development 2020), for instance, seek to showcase best practices and to support the integration of the Sustainable Development Goals into corporate practices. The United Nations Global Compact, with over 5,000 companies participating, provides tools and information to 'drive business awareness and action in support of the SDGs' (United Nations Global Compact 2020). Its Action Platforms on issues such as Sustainable Ocean Business and Decent Work in Global Supply Chains aim to foster collective action and underline how business activities need to operate within planetary boundaries.

Generally seen, research suggests that, on balance, integration of the Sustainable Development Goals into the business sector is growing (Dahlmann et al. 2020; Williams, Whiteman and Parker 2019). Since 2017, the share of companies publishing sustainability reports in line with Goal 12.6. has nearly doubled (United Nations 2020), and over 85 per cent of the world's 500 largest corporations include the Sustainable Development Goals in their annual reporting (United Nations Global Sustainability Index Institute 2019). Goal 13 was found to be the most frequently referenced goal (88 per cent), whereas Goal 15 (51 per cent) and Goal 14 (32 per cent) lag behind (World Business Council for Sustainable Development 2019), drawing a less optimistic picture of corporate engagement in pursuing planetary integrity. Scholars therefore stress the urgent need to transform traditional business models to better protect the global environment (Coscieme et al. 2019; De Schutter et al. 2019; Scheyvens, Banks and Hughes 2016; Shrivastava 2018).

Despite a growing integration of the Sustainable Development Goals into sustainability performance assessments of corporations, studies have criticized the insufficient contribution of the goals to 'helping companies diagnose the proximate and systemic causes of poor performance' (Fleming et al. 2017: 98). Of even greater concern is the widespread perception that businesses engage in so-called 'SDG washing', that is, using the Sustainable Development Goals to increase social legitimacy while concealing only modest sustainability efforts or malpractices (Dahlmann et al. 2020). Moreover, one survey indicates that international businesses rather engage with the Sustainable Development Goals internally (along their value chain), than externally (in collaboration with partners), and they are keener to address targets under the Sustainable Development Goals that mitigate negative externalities than those directed at generating positive externalities (van Zanten and van Tulder 2018). Specifically, high engagement was found with Sustainable Development Goals 5, 8, 12, 13, 16 and 17. Slight or no contributions, in turn, were found regarding Goals 11, 14 and 15. While this points to a worrying trend in corporations' inability to address social, environmental and economic targets collectively, it also suggests that corporations only marginally engage with those Sustainable Development Goals that relate more explicitly to planetary integrity (such as Goals 14 and 15). On a more positive note, some studies indicate that non-state transnational sustainability governance can also complement state efforts; but this is also dependent on an internationally agreed framework and regulation of, and cooperation with, state actors to increase accountability and long-term sustainability effects (Chan et al. 2019; Kumi, Yeboah and Kumi 2020). In that sense, the presence of Sustainable Development Goals as a common denominator or normative guiding framework might contribute to providing a shared vision for corporations, enabling a collective drive towards integrated sustainability governance that respects planetary integrity.

In sum, our analysis suggests that *the extent to which corporations rely on the Sustainable Development Goals to bolster their efforts in pursuit of planetary integrity remains a mixed bag*. Overall, corporations seem to be more receptive towards embracing the Sustainable Development Goals generally, which is positive. But the environment-focused Sustainable Development Goals apparently play only a peripheral role in steering corporations towards the integration of planetary integrity concerns into their activities. This is worrisome considering, on the one hand, that corporations remain major drivers of ecological destruction, and on the other hand, that corporations can also be hugely influential in initiating and driving transformative change in pursuit of planetary integrity (e.g., Wright and Nyberg 2015). More fully embracing the environmental dimensions of the Sustainable Development Goals could offer corporations a valuable opportunity to drive such positive transformations.

Conclusions and Future Directions

The Sustainable Development Goals are clear on the need to protect the planet. However, the extent to which the goals could mainstream planetary integrity into laws, policies and practices, and to steer towards planetary integrity, remain debatable. Some studies argue that the Sustainable Development Goals are incapable, or only marginally able, of doing so; yet other studies contend that the goals may still help mobilize resources and galvanize action in pursuit of planetary integrity.

Based on the findings from our analyses, the balance of evidence leans towards the critics, which leads us to conclude that the Sustainable Development Goals have not (yet) become a significant transformative governance force aimed at the advancement of planetary integrity through the process of goal-setting. Therefore, *on balance, we find that the steering effects of the Sustainable Development Goals with respect to planetary integrity are rather indirect and not too significant*. At best, the Sustainable Development Goals seem to have played a role in the orchestration of disparate environmental policies and regimes, but they surely did not manage to radically change the course of global governance to advance planetary integrity. While we observe some political and institutional changes as a result of the Sustainable Development Goals, and while the goals seem to have been cited as an inspiration or motivation by many actors, numerous doubts remain: about additionality (whether changes we observed would not have materialized without the goals); about ambition (whether the goals call for something drastically new and sufficiently ambitious); about coherence (whether the goals are themselves coherent enough to be able to foster a push towards planetary integrity); and about implementation (whether the means of implementation in the goals actually have the ability to improve their steering effects).

What explains this lack of impact remains unclear; and these are all issues that require further research. Is it the design of the Sustainable Development Goals themselves? In other words, had the Sustainable Development Goals been differently designed (or agreed through a different process), would we see a more (or even less) impactful set of global goals? Here we can think of design elements such as the number of goals, the structure of the goal framework (for example, the non-hierarchical structure), the coherence between the goals, the specificity or measurability of the targets, the language used in the text, and their reliance on neoliberal economic development-oriented sustainable development as their core orientation. Furthermore, one may argue that sustainability on a planetary scale is only achievable under an overarching Planetary Integrity Goal that recognizes the biophysical limits of the planet, as we have shown above. Some scholars have also raised questions about the relationship between the nature of the negotiations of the

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goals, targets and indicators and their impact, especially on mainstreaming environmental concerns (Gasper, Shah and Tankha 2019).

Yet, no matter the design of Sustainable Development Goals, they are only non-binding and aspirational. Any form of 'governance through goals' is inherently not an effective alternative to 'governance through rules' (Kanie et al. 2019), although these approaches could, and arguably should, usefully reinforce one another. Furthermore, the Sustainable Development Goals are a mere reflection of the existing normative framework of international law (Kim 2016). Any 'governance through goals' approach under the Sustainable Development Goals banner must be sensitive to the problem of path-dependency: Do the goals have a realistic chance to be something truly transformative if they are merely a collection of earlier commitments, reflecting already agreed language? While we remain doubtful of the transformative potential of the goals, we are hopeful that global institutions such as the High-level Political Forum can help mainstream environmental concerns of a planetary nature at global, regional, national and transnational levels, if further strengthened with the necessary resources and authority (Abbott and Bernstein 2015; Stevens and Kanie 2016).

Clearly more research is needed to understand the impact of the Sustainable Development Goals on planetary integrity and the extent to which they, and their successors, could contribute to steering human development in a way that pursues and respects planetary integrity. For one, the lack of empirical data and the concomitant critical research gap that we have identified in this chapter dealing with the actual ability of the Sustainable Development Goals to steer in relation to planetary integrity must be addressed. This could be done, for example, by documenting conditions under which the Sustainable Development Goals are operating and comparing these to identify necessary or sufficient conditions for the Sustainable Development Goals to make a positive impact. Causality is always difficult to prove between the Sustainable Development Goals and any changes we see, especially in the environmental domain. To overcome this hurdle, we need both more in-depth case studies and large-*n* quantitative data analysis, as well as medium-*n* comparative analysis in between.

Finding out how, when and why the Sustainable Development Goals could put the planet at the centre of concern will be a key challenge in the years to come. This epistemic endeavour will be rewarding for generating specific and generalizable insights on how and why global goals work or do not work. Only an advanced understanding of the mechanisms through which the Sustainable Development Goals have impacts on planetary integrity will lead to policy-relevant knowledge that could help guide a post-2030 goal-setting process, and enable actors such as states, regional organizations, institutions and corporations to decide

on whether to adopt and to pursue in a dedicated manner post-2030 global goals, and if so, in what form and through what process.

Note

1 Search string ((TITLE ("sustainable development goals"))) OR TITLE ("sdgs") AND ((TITLE-ABS-KEY ("environment*"))) AND ((TITLE-ABS-KEY ("governance"))).

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Overview of articles included in this cumulative dissertation

(in accordance with the guideline for cumulative dissertations in Sustainability Science [January 2012], in the following termed "the guideline")

[1] Glass, L-M. & Newig, J. (2019). Governance for achieving the Sustainable Development Goals: how important are participation, policy coherence, reflexivity, adaptation and democratic institutions? Earth System Governance, 2, 100031. https://doi.org/10.1016/j.esg.2019.100031

[2] Coenen, J., Glass, L-M. & Sanderink, L. (2022). Two degrees and the SDGs: a network analysis of the interlinkages between transnational climate actions and the Sustainable Development Goals. Sustainability Science, 17, 1489–1510. https://doi.org/10.1007/s11625-021-01007-9

[3] Glass, L-M., Newig, J. & Ruf, S. (2023). MSPs for the SDGs – Assessing the Collaborative Governance Architecture of Multi-stakeholder Partnerships for Implementing the Sustainable Development Goals. Earth System Governance, 17: 100182. https://doi.org/10.1016/j.esg.2023.100182

[4] Kochskämper, E., Glass, L-M., Haupt, W., Malekpour, S., Grainger-Brown, J. (2024). Resilience and the Sustainable Development Goals: A scrutiny of adaptation strategies in the 100 Resilience Cities initiative. Journal of Environmental Planning and Management, 1–27. https://doi.org/10.1080/09640568.2023.2297648

Authors' contributions to the articles and articles publication status (according to §16 of the guideline):

Article #	Title	Specific contribution of all authors according to the Contributor Roles Taxonomy (CRediT)	Author status	Weighting factor	Publication status	Conference contributions
1	Governance for achieving the Sustainable Development Goals: how important are participation, policy coherence, reflexivity, adaptation and democratic institutions?	LMG, JN: Conceptualization; Methodology LMG: Project administration; Investigation; Formal analysis; Visualization; Writing - original draft; Writing - review & editing JN: Writing - review & editing	Co-author with predominant contribution	1.0	Published in *Earth System Governance* (JIF: 5.6*)	ECPR 2018, ESG 2018, AKU/DVWP 2020
2	Two degrees and the SDGs: a network analysis of the interlinkages between transnational climate actions and the Sustainable Development Goals.	JC, LMG, LS: Conceptualization; Writing - original draft; Writing – review & editing JC, LMG: Project administration; Methodology; Investigation; Formal analysis; Visualization	Co-author with important contribution	0.5	Published in *Sustainability Science* (JIF: 6)	ESG 2019, GlobalGoals 2020
3	MSPs for the SDGs – Assessing the Collaborative Governance Architecture of Multi-stakeholder Partnerships for Implementing the Sustainable Development Goals.	LMG, JN: Conceptualization; Methodology LMG: Project administration; Investigation; Formal analysis; Visualization; Writing - original draft; Writing - review & editing JN: Writing - review & editing SR: Software	Co-author with predominant contribution	1.0	Published in *Earth System Governance* (JIF: 5.6*)	ESG 2021, ESG 2022

4	Resilience and the Sustainable Development Goals: A scrutiny of adaptation strategies in the 100 Resilience Cities initiative.	EK, LMG: Conceptualization; Project administration; Investigation; Formal Analysis; Methodology; Visualization; Writing - original draft; Writing - review & editing WH: Conceptualization; Writing - original draft; Writing - review & editing SM: Methodology; Writing – review & editing JGB: Writing - review & editing	Co-author with equal contribution	1.0	Published in *Journal of Environmental Planning and Management* (JIF: 3.4)	ICPP 2021, ESG 2021, DVPW 2021†, ECPR 2022†, IOER 2022†, ESG 2022†

Explanations

Specific contributions of all authors
EK: Elisa Kochskämper; JC: Johanna Coenen; JGB: Jarrod Grainger-Brown; JN: Jens Newig; LMG: Lisa-Maria Glass; LS: Lisa Sanderink; SM: Shirin Malekpour; SR: Simon Ruf; WH: Wolfgang Haupt

Author status
according to §12b of the guideline:
Single author [Allein-Autorenschaft] = Own contribution amounts to 100%.
Co-author with predominant contribution [Überwiegender Anteil] = Own contribution is greater than the individual share of all other co-authors and is at least 35%.
Co-author with equal contribution [Gleicher Anteil] = (1) own contribution is as high as the share of other co-authors, (2) no other co-author has a contribution higher than the own contribution, and (3) the own contribution is at least 25%.
Co-author with important contribution [Wichtiger Anteil] = own contribution is at least 25%, but is insufficient to qualify as single authorship, predominant or equal contribution.
Co-author with small contribution [Geringer Anteil] = own contribution is less than 20%.

Weighting factor according to §14 of the guideline:

Single author [Allein-Autorenschaft]	1.0
Co-author with predominant contribution [Überwiegender Anteil]	1.0
Co-author with equal contribution [Gleicher Anteil]	1.0
Co-author with important contribution [Wichtiger Anteil]	0.5
Co-author with small contribution [Geringer Anteil]	0

Publication status

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Conference contributions (acronym, title, date, venue, website)

ECPR 2018, European Consortium for Political Research (ECPR) General Conference, August 22 – 25, 2018, Hamburg, Germany, https://ecpr.eu/Events/115

ESG 2018, Utrecht Conference on Earth System Governance, November 5 – 8, 2018, Utrecht, Netherlands, https://www.earthsystemgovernance.org/event/2018-utrecht-conference-on-earth-system-governance/

ESG 2019, Mexico Conference on Earth System Governance, November 6 – 8, 2019, Oaxaca, Mexico, https://www.earthsystemgovernance.org/event/2019-mexico-conference-on-earth-system-governance/

AKU/DVPW 2020, Arbeitskreis Umweltpolitik / Global Change - Deutschen Vereinigung für Politische Wissenschaft (DVPW) & Schrader Stiftung: Fachtagung „Die Nachhaltigkeitsagenda der Vereinten Nationen: Konzept, Entstehung und Wirkung der Sustainable Development Goals“, March 5 – 6, 2020, Darmstadt, Germany, https://www.ak-umwelt.de/ak-umwelt_wp_2013/wp-content/uploads/DVPW_SDG_Tagung_Programm.pdf

GlobalGoals2020, International SDG Research Symposium GlobalGoals2020, June 9 – 11, 2020, online, https://globalgoalsproject.eu/symposium/

ICPP 2021, 5th International Conference on Public Policy, July 5 – 9, 2021, online, https://www.ippapublicpolicy.org/conference/icpp5-barcelona-2021/13

ESG 2021, Bratislava Conference on Earth System Governance, September 7 – 9, 2021, online, https://www.earthsystemgovernance.org/event/2021- bratislava-conference-on-earth-system-governance/

DVPW 2021, 28. Wissenschaftlicher Kongress der Deutschen Vereinigung für Politikwissenschaft (DVPW), September 14 – 16, 2021, online, https://www.dvpw.de/dvpw2021/

ECPR 2022, European Consortium for Political Research (ECPR) General Conference, August 22 – 26, 2022, Innsbruck, Austria, https://ecpr.eu/Events/185

IOER 2022, Leibniz Institute of Ecological Urban and Regional Development (IOER) Annual Conference 2022, September 21 – 23, 2022, Dresden, Germany, https://jahrestagung.ioer.info/en/

ESG 2022, Toronto Conference on Earth System Governance, October 20 – 24, 2022, Toronto, Canada, https://www.earthsystemgovernance.org/2022toronto/

† Paper presented by first author

Declaration (according to §16 of the guideline)

I avouch that all information given in this appendix is true in each instance and overall.