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Global public policy in a quantified world: Sustainable Development Goals as epistemic infrastructures

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All authors have contributed equally to this article. The writing of this collaborative paper began before the passing of Sally Engle Merry, who had kindly stated that she would be happy to be named as a co-author posthumously.
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Abstract

Despite the multiplicity of actors, crises, and fields of action, global public policy has known one constant, that is, the ubiquity of indicators in the production of governing knowledge. This article theoretically engages with the phenomenon of hyper-quantification of global governance in the context of the 17 Sustainable Development Goals (SDGs), debated and introduced in 2015. Increasingly metrics—such as indicators and quantified data to monitor targets and goals—are no longer just tools of governance but rather are emblematic of the new types of political cultures, enabling an interplay of material, techno-political, and organizational structures within which (statistical) knowledge is produced, disseminated, and translated into global public policy. The paper unpacks this complexity by proposing a new theoretical approach to quantification as an "epistemic infrastructure," which emerges across three levels: materialities (such as data and indicators), interlinkages (such as networks and communities), and paradigms (such as new ways of doing policy work). Using the lens of the "epistemic infrastructure" on the SDGs, this article and the others in this special issue analyze the ways that quantified knowledge practices—in widely varying policy arenas, scales, and geographic regions—are at the heart of the production of its global public policy.

Keywords: epistemic infrastructures, SDGs, quantification, global public policy

At the 2019 meeting of the High-Level Political Forum (HLPF) on the Sustainable Development Goals (SDGs), held at the United Nations (UN) headquarters in New York, the idealism expressed by most speakers was quite striking: the SDGs, many of them said, were our best chance to bring about radical change for people and the planet. Although the SDGs represent a broadly global monitoring agenda, the tenor was highly aspirational, with calls to carry forward their transformative vision. Listening to the speakers, those less knowledgeable about the SDGs would never have known that performance measurement is at the core of the endeavor. Speaker after speaker stood up and emphasized the need to leave "no one behind"—the importance of including marginalized populations such as the rural poor,

disabled people, women and girls, indigenous communities, lesbian, gay, bisexual, and transgender communities, and others. They spoke about the interrelatedness of the goals and the urgency to achieve them all by 2030. Many noted that the goals had to be context-specific, i.e., tailored to the specific conditions of each country. Interestingly, this was not a world leaders' forum, nor was it a meeting of highly technical experts; on the contrary, it was a highly diverse meeting with the participation of country representatives, civil society, international organizations' staff, and other groups.

Despite such a multiplicity of actors, goals, and future-making declarations, evident in the event discussed above, global public policy[1] has known one constant: the ubiquity of indicators in the production of governing knowledge. These measurements have become proxies for countries' general well-being and prosperity, and the means by which different entities—multilateral and bilateral funding organizations, nongovernmental and philanthropic organizations, and the countries themselves—make priorities about development investments and policy decisions both internationally and domestically. The evaluatory logic of these tools has created conditions of peer pressure and competition over the accumulation of the softer marks of country status and reputation (Werron, 2015). This prominence of indicators as "technologies of government" (Miller, 2001) in global public policy is enacted not only in their expansion into new spaces but also in the types of political effects they achieve. As they frame issues, link policy instruments, and connect diverse actors, indicators emerge as the central venue for "policy work" (Colebatch, 2006).

And yet, the debate over quantification in public policy rarely goes beyond a focus on specific tools and their effects. This thematic issue aims to offer new theoretical lenses to understand quantification in the context of the 17 SDGs and their affiliated indicators, debated and introduced in 2015. Our starting point of analysis is that the SDGs have not only sped up the process of the quantification of governance (Kelley & Simmons, 2015, 2021), but they have also led to the construction of novel "epistemic infrastructures." Moving beyond the mere focus on the production of quantified data—which still is, undoubtedly, at the very core of these processes—the concept of the infrastructure captures the fabrication of new *materialities*, new *interdependencies*, and new *governing ideas*; we see these three orders as the constitutive elements of the ever-growing role and impact of quantification in global governance. As such, it allows an analytical lens on global public policy that goes beyond merely the contents of policies but instead pays closer attention to structures enabling the production of policies.

A social theory interest in infrastructures first emerged in the science and technology studies (STS) literature (Bowker, 1995; Star & Ruhleder, 1996) to describe the mix of materials, practices, and meanings that comprise interlinked knowledge structures, generating effects, and structuring social relations. In the context of sustainable development, the concept of epistemic infrastructures is particularly useful for capturing the emergence, processes, and consequences of the ways in which quantification has scaled up, linking different sites of calculation and governance. At the same time, even though the concept of "epistemic infrastructures" is becoming increasingly prevalent in the global public policy literature (e.g., Bueger, 2015), it is often used in a vague and under-theorized way. The aim of this introductory article is to develop a heuristic through which the notion of "epistemic infrastructure" will open up the black box of quantification in global public policy.

We use the notion of epistemic infrastructures to describe the current, transformative moment of the global governance by indicators as a *paradigm shift*:

> Policymakers customarily work within *a framework of ideas and standards* that specifies not only the goals of policy and the kind of instruments that can be used to attain them, but also *the very nature of the problems* they are meant to be addressing. Like a Gestalt, this framework is *embedded in the very terminology* through which policymakers communicate about their work, and it is influential precisely because *so much of it is taken for granted and unamenable to scrutiny* as a whole. I am going to call this interpretive framework a policy paradigm. (Hall, 1993, p. 279)

[1] By global public policy, we follow Diane Stone and Stella Ladi who defined it as "a set of overlapping but disjointed processes of public–private deliberation and cooperation among both official state-based and international organizations and non-state actors around establishing common norms and policy agendas for securing the delivery of global public goods or ameliorating transnational problems" (Stone & Ladi, 2015, p. 840). We use this term over the more common "global governance," as it makes the links to public policy effects more visible. This is particularly pertinent to the analysis of our project, "International Organizations and the Rise of the Global Metrological Field" or "METRO" for short, which focuses on the policy areas of education, poverty, and sustainable development.

Hall's contribution was influential because he described a policy paradigm "shift" as a particularly fundamental type of ideational change, involving "a dramatic departure in policy goals, based on a new theoretical and ideological framework" (Coleman et al., 1996, p. 274). Thus, a policy paradigm shift involves not only changes in individual policy mechanisms or their replacement with other mechanisms, but by changes in the underlying ideas behind policy. The article argues that the SDGs have come to signify a—so far under-studied—paradigmatic shift in global public policy and that the concept of the epistemic infrastructure facilitates an insightful analysis of the practices, networks, and materialities that constitute such a paradigm shift.

Building on the STS literature on infrastructures, as well as on policy studies scholarship on the production of policy paradigms, we offer a conceptualization of the SDGs as an epistemic infrastructure comprising three "orders" of analysis. These orders are not distinguishable and separate; they interlink in the fluid and often chaotic space of transnational governance. These are:

(a) first-order level of analysis: the *materialities* of the infrastructure of measurement (data, indicators, reports, meetings, etc.);
(b) second-order level of analysis: the *interlinkages* of such materialities that hold the infrastructure together (i.e., epistemic communities, communities of practice, networks of experts, interdependencies of international organizations (IOs), and processes of harmonization and commensuration); and
(c) third-order level of analysis: the emergence of *a new global public policy paradigm*—the infrastructuring of measurement as global public policy.

This new paradigm has become the implicit, binding glue for the governance of sustainable development, creating its new logic and structure and legitimizing it. Numbers do not merely influence knowledge that governs action; rather, as we will show, quantification emerges as a new global public policy paradigm that shapes and reshapes the very architecture of the transnational governance of sustainability itself.

SDGs and the infrastructure in the making

The SDGs represent a set of interlinked global goals, established in 2015. They replaced the previous set, the so-called Millennium Development Goals (MDGs), which were developed largely by international experts in the UN and the World Bank and shaped development efforts between 2000 and 2015. In contrast to the MDGs, the SDGs were the product of two and a half years of consultation and deliberation among civil society actors, international organizations, and nation states, including many Global South countries (Fukuda-Parr, 2017; Fukuda-Parr & McNeill, 2019, pp. 9–10). This indicator framework is built on the MDG approach but has dramatically expanded the scope of issues and types of indicators that are included. While the MDGs had eight goals, the SDGs now have 17. The SDGs are also broader and more transformative, with an interrelated set of goals that include reduction of hunger and poverty but also improving the environment, biodiversity, and climate change along with cross-cutting goals of access to justice and reducing inequality. Many of the goals are the product of long struggles by activists, such as work on gender parity and women's empowerment (Sen, 2019), justice (Satterthwaite & Dhital, 2019), and equality (Fukuda-Parr, 2019).

The SDGs have captured the imagination of a wide set of actors in the field, since they purposefully allowed multiple "entry points" in their world: on the one hand, they emphasized the use of technocratic and management principles to create an objectified and measurable field (see, e.g., Kaika, 2017), while also proclaiming to be bottom-up, grass-roots and transformative, distinct from older Western-liberal ideas and practices (Waldmüller & Jamali, 2019). Such an open framing of what the SDGs are—or what they could be—allowed them to move and adapt much faster than previous monitoring exercises, no doubt partly due to the malleability and flexibility of the monitoring framework itself.

Thus, the scope and complexity of the SDGs lend themselves to a focus on the structures and interlinkages between data, actors, and politics. The focus on infrastructure—and in particular its role in knowledge production and information systems—originated in the work of Star. In her discussion of the ethnographic study of infrastructure, she points out that

> People commonly envision infrastructure as a system of substrates – railroad lines, pipes and plumbing, electrical power plants, and wires. It is by definition invisible, part of the background for other kinds of work. It is ready-to-hand. (Star, 1999, p. 380)

However, she argues that the relational dimension of the infrastructure is important. Among an infrastructure's core qualities are its embeddedness in other structures, technologies, and social arrangements learned as part of becoming a member of a community, in addition to conventions of practice and political ideas. It is organized by standards that enable it to link to other infrastructures and is typically built on previous infrastructures rather than created from scratch (Star, 1999, pp. 381–382). Infrastructure is typically built up incrementally from local initiatives in a modular fashion and is layered and complex. Additionally, as Star says, "nobody is really in charge of the infrastructure" (1999, p. 382), and as such, it lends itself easily to fragmentation. Although she and many others argue that infrastructures become visible only when they break down, Larkin (2013) notes that some infrastructures can be highly visible and symbolic, such as skyscrapers or elaborate rail stations.

Much social science research on infrastructures explores the social effects of these technologies which appear to be neutral and often unnoticed. Infrastructures represent a varied field that includes not only physical structures but also modes of gathering, organizing, and producing knowledge, as well as social and digital networks. Although its origins refer to physical infrastructures such as roads and water pipes (e.g., Anand, 2017), the term has been applied to a wide range of social and informational technologies that govern the flow of information, ideas, and people (Rankin, 2009). As Star points out, the study of information systems implicitly involves the study of infrastructure (1999, p. 377). In an overview of anthropological work on infrastructure, Larkin (2013, p. 328) defines it as "built networks that facilitate the flow of goods, people, or ideas and allow for their exchange over space." Infrastructures are things as well as the relations between things. He suggests focusing on three kinds of things: built things, knowledge things, and people things (2013, p. 329). Studies of infrastructure sometimes focus on particular devices, such as a water meter (e.g., Von Schnitzler, 2016) or a formula or an index that organizes knowledge, such as a formula for calculating the price of water that conforms to the human right to water (Ballestero, 2015), and sometimes on larger systems, such as the water pipes, reservoirs, and technicians who manage the water, and the bureaucrats who decide how to distribute it (Anand, 2017) or undersea cables and the legal and economic factors that determine their location (Starosielski, 2015).

In this paper, we focus on the notion of the infrastructure as an analytical lens to explore the processes and practices of measurement. The sociology of quantification has already eloquently described how the power to influence what is counted shapes the knowledge available about the world and guides political, economic, social, and cultural decisions. From a Foucauldian power/knowledge framework, the power to decide what to count and how to count it produces knowledge that is an effect of this power. What is counted becomes defined in a particular way, while what is not counted disappears. To understand what gets counted and what is forgotten, it is important to examine counting as a political and social process. This is when applying an analytical perspective on the infrastructure becomes central: infrastructures bring together technologies of counting that make counting possible and affordable such as data models and computers, bureaucracies to organize the counting, experts to determine what to count and how to categorize it, statisticians to organize the data and interpret it, workers to collect data, organizations to pay for it, and policy makers to make use of it in their day-to-day decision-making. Counting is difficult and expensive, and it has effects.

Furthermore, we also know by now that counting is a deeply political process despite its claims to rationality and objectivity (Merry, 2016). Quantification relies on de-politicization, in order to claim legitimacy and authority; this is the main reason "Why International Organisations hate politics," according to the recent book by Louis and Maertens (2021). Indeed, the sociology of quantification has richly explained the processes of technicization that social problems often go under, in order for experts to render them technical, and thus factual and neutral, distinct from obstructive political struggles and ideologies (Flinders & Wood, 2014). Similarly, Stone used the term "scientization" to describe the processes of transforming social issues into problems amenable to the scientific cause–effect relationship that is seen as authoritative enough to control or even reduce uncertainty and risk (Broome et al., 2018; Stone, 2017). Its political dimensions include decisions about what to count and what to ignore, which

variables to disaggregate by characteristics such as race and gender, and how much to spend on collecting and analyzing information. There are political implications to these decisions, particularly when measuring complicated concepts such as race, access to justice, or even gender.

Counting is also dependent on social and material resources. As suggested, its operation is channeled by access to money, expertise, bureaucracy, and technology. This social and material basis to quantification can be fruitfully analyzed as an infrastructural system. This system includes questionnaires; templates; training protocols for data collectors; digital resources for data collection and analysis; expertise in data collection and analysis; and bureaucracies for managing, analyzing, and disseminating data, training data collectors, and cleaning data. Big data has opened up a new terrain of measurement. Since quantification is increasingly fundamental to questions of accountability and law (Espeland & Vannebo, 2007), issues surrounding the production of quantitative knowledge have enormous significance for governance.

To conclude, infrastructures are politically produced and can have significant and often unanticipated social and political effects. In the same vein, measurement infrastructures similarly are technical systems with embedded political agendas. They also have significant social and political effects, such as their contribution to knowledge or their selective ignorance of populations and problems.

SDGs as epistemic infrastructures in global public policy

In this section, we build on this rich literature in order to unpack and theorize the concept of epistemic infrastructures in the context of global public policy. The starting point of this discussion is an observation that knowledge and governance are closely interlinked (Jasanoff, 2004), and an exploration of the epistemic base of any governance program is central to an understanding of its structure and also its change over time. Consequently, an exploration of the emergence of global public policy—and we argue that the SDGs are powerful levers in the production of new policy directions globally—requires a closer focus on the knowledge structures underpinning it. However, this is not simply a focus on "evidence-making," but rather a complex interplay of material, techno-political, and organizational structures within which (statistical) knowledge is produced, disseminated, and translated into global public policy.

First-order level: the material underpinnings of the infrastructure

When thinking about the infrastructure, its material underpinnings (pipes, roads, bridges, etc.) are often the first element that comes to mind. In discussing the epistemic infrastructure, its material aspects are as equally important as building blocks. Hence, the first-order level of our theorization are the material objects for data collection and analysis. The epistemic infrastructure of the SDGs is grounded in these particular types of building blocks—data and the techniques of its collection, indicators and their categorization into different tiers, reports, scorecards, PowerPoint presentations, minutes of meetings, and all other relevant inscriptions.

These elements are the foundation of the infrastructure as they act as material representations of the phenomena at the center of the SDGs—including poverty, education, and health. The process of measurement occurs through inscription, which according to Latour are "all the types of transformations through which an entity becomes materialised into a sign, an archive, a document, a piece of paper" (Latour, 1999, p. 306). Numbers, indicators, and data within the epistemic infrastructure of the SDGs are such inscriptions, and consequently, they are both material and semiotic—they are the physical manifestations of the areas of interest of the SDGs, but at the same time, they aim to reflect, but also actively construct the meaning of these phenomena themselves. As such, they are not strictly representational—they are not constructions of the real world, but rather they are entities in their own right (Power, 2015).

Unlike the physical infrastructures constructed around an idea of stability, the material underpinnings of the epistemic infrastructure—such as indicators, data, or reports—are powerful because they are mobile (Latour, 1986). Within the epistemic infrastructure, these different elements are interacting within one system—as it is a mix of technical, social, and organizational materialities at interplay at all times (Bowker et al., 2010). Crucially—the infrastructure as a system does not emerge at once but rather it is a prolonged process of uneven development—and consequently, some material elements of the infrastructure will become obsolete or outdated before the infrastructure emerges as a whole (Star & Ruhleder, 1996).

This malleability of the epistemic infrastructure leads to its other central quality—the openness of its knowledge system. The role of the material underpinnings of the SDGs (including the elaborate system of indicators, targets, report cards, custodian agencies, etc.) is not to strive for completeness but rather to keep the infrastructure open, incomplete, and in constant movement. This point was made poignantly by Lampland (2010) who argued that the process of rationalization of a different socio-political domain does not necessarily mean that each stage is becoming more and more rational. Rather, there is a key role here to be played by the conditionality and transitionality of numbers. Hence, the "placeholder" numbers or provisional numbers (Knorr Cetina & Preda, 2006) play an important role in sustaining the structures and practices within the infrastructure. Incompleteness is a motivating factor to keep the measurement going.

A clear example of such an approach is the Tier system for evaluating indicators—the Inter-agency and Expert Group on SDG Indicators (IAEG-SDGs) have divided all the indicators into three tiers depending on whether there is adequate data and an acceptable methodology for measuring each one. Tier I indicators have established methods and available data, Tier II indicators have established methodology but little data available, and Tier III indicators lack established methodology and require further work and development. Even though the understanding here is clear that the goal is to strive for the production of Tier I indicators, Tier II and III indicators are "placeholder numbers" which enable and direct further action, even if still imprecise or incomplete. Consequently, the Tier II and III indicators have important generative power—they are the subject of meetings (e.g., the HLPFs or Expert Group meetings), countless documents, analysis, developing networks, negotiation, and consensus-building activities. And indeed, Tier II and Tier III indicators for a long time significantly outnumbered the Tier I ones. Nonetheless, the IAEG-SDGs have been working with UN agencies to develop methodologies and data that would eventually "pull" indicators into Tier I. According to the IAEG-SDGs, as of July 17, 2020, there were 123 Tier I indicators, 106 Tier II indicators, and 2 indicators with different components classified into different tiers.

Finally, the materiality of the infrastructure is invisible (as discussed in the "SDGs and the infrastructure in the making" section)—it works when it becomes a taken-for-granted part of the background. As such, the infrastructure is visible when it breaks down—which is evident in cases where the contested SDG indicators and missing data are clearly visible in debates (whereas consensual measures are not, they simply become reporting background). An important aspect of this (in)visibility of material components of the epistemic infrastructure is their missing parts—what is excluded from the infrastructure and why. This is what Bowker et al. (2010) referred to as the centrality of "articulation work" in the infrastructure where dedicated professionals focus on absences. The focus on what is missing in the infrastructure is not only a matter of invisibility but also a matter of *strategic ignorance* (McGoey, 2012), where the lack of specific material forms or their explicit exclusion from the infrastructure could be politically or strategically motivated.

Second-order level: interlinkages

The second-order level of the epistemic infrastructure is where "rituals of verification" occur (Power, 1999), consisting of the practices and the networks that convert numbers into governing tools. Like an infrastructural system that brings a city into life, this "second-order" level links together the materialities of quantification, discussed in the previous section, into a web of relations, processes, and practices. These new linkages are achieved through the interdependencies of different agencies and through practices of harmonization. Investigating the constitution of the epistemic infrastructure at the second-order level allows us to analyze how quantification in the SDG era has changed the way that different agencies in the global governance space—including UN agencies, member states, philanthropic organizations, and civil society groups—engage with each other and produce policy agendas. It is at this level that we can see how numbers—with their ability to simplify, stabilize, and travel—reconfigure relationships, dependencies, and structures of organizations and fields in fresh and politically salient ways. For international organizations in particular, this has led to complex interdependencies, as they increasingly mobilize their resources through their interaction with other IOs with comparable knowledge-producing abilities and interests: an IO's success may be seen as its power and influence over a larger regime of organizations that work toward specific policy directions, rather than through their insularity and autonomy (Raustiala & Victor, 2004).

Infrastructures are not static or passive. Instead, the process of "infrastructuring" happens through the formation of networks of both human and non-human agents. Drawing from actor–network theory (Callon, 1986; Law, 2009) and the theory of communities of practice (Lave & Wenger, 1991), we argue that epistemic infrastructures are institutionalized through webs formed between these different agents and the knowledge production practices that reify such webs. Dynamic intra- and inter-organizational relationships (Fox, 2000) are central to the SDGs' global policy agenda. International organizations, member states, and civil society groups and their quantification practices constitute an interdependent network for monitoring and producing globally agreed-upon goals. While previous definitions of epistemic communities in the transnational space have focused on the role that elite communities with specialist knowledge have on influencing national policy (Haas, 1992), we argue that communities in epistemic infrastructures have become much more expansive; as a result, global governance expertise has become much more diverse. These communities have been structured explicitly to include previously excluded voices from member states from the Global South, civil society representatives, and philanthropic and bilateral donor organizations. In the global governance space, knowledge does not travel from elite technical communities to policy spheres; instead, the production of knowledge by and through the SDG epistemic infrastructure is an iterative practice and always a negotiation between the technical and the political.

In the SDG epistemic infrastructure, networks are made up of human agents from different positionalities in the transnational space and the non-human agents of indicators, protocols, data, and so on. It is a chaotic and fragmented network of organizations and member states with different interests, the data and indicators for monitoring sustainable development, and the digital and analog data platforms and practices of harmonization that link them. These organizations and member states have distinct mandates and priorities in promoting sustainable development. At this level of the epistemic infrastructure, it is evident that the deliberative and participatory governance established through the SDGs works to bring together these fragmented organizations and actors to produce consensual new global policy directions and to produce transparency and accountability as a result. Through the SDGs' particular form of network governance (Provan & Kenis, 2008), epistemic infrastructuring dedifferentiates these organizations and commensurates diverging social, political, economic, and environmental phenomena through practices of data harmonization. This is a continuous and often informal process, one of constant making and remaking of partnerships, connections, and evidentiary claims.

A particularly important example of this network formation and maintenance is the IAEG-SDGs—mentioned in the section above—which the UN Statistical Commission formed in 2015 and consists of "28 representatives of national statistical offices and [includes], as observers, representatives of regional commissions and regional and international agencies, including those responsible for global reporting on the MDGs, to provide important technical advice and support as needed" (UNSD, 2015, p. 1). The work of turning the policy goals and targets of the 2030 Agenda into measurable indicators was given to the IAEG-SDGs; the network with the ultimate say for this translation work was explicitly to comprise representatives from national statistics offices rather than UN agencies, who had been responsible for deciding on the MDG indicators. Attempting to upend the top-down approach to development goals, the SDGs established protocols for putting member states in the driver's seat of evaluating and promoting diverse development policies, which were to be worked with synergistically rather than in silos. Crucial to this work is the verification and standardization of methodologies for measuring each indicator.

In this way, we can see how the process of harmonization is central to the second order of epistemic infrastructuring. Numbers' work of making commensurate and incommensurate materialities requires social milieux, and it is a social practice (Espeland & Stevens, 1998). Practices of commensuration, standardization, and harmonization are central to the power of numbers to govern (Bowker & Rottenburg et al., 2015; Star, 1999; Timmermans & Epstein, 2010) and in the context of the SDGs, key to creating a unified field for global public policy. Along with the IAEG-SDGs work of harmonizing methodologies, UN agencies have been given the responsibility for harmonizing nationally produced data for the purposes of "international comparability," to make available the means by which they "produce and validate modelled estimates," and to coordinate with other international organizations in order to verify such internationally comparable and sometimes imputed data (UNSD, 2017, p. 3). In order to compare social, economic, political, or environmental conditions in two geographically different locations, statisticians

harmonize data that may have been created with different methodologies, including different sampling techniques or differently worded answers to questions on household surveys.

Thus, the epistemic infrastructure of the SDGs demands a diverse set of actors to harmonize in these dual senses of the term—"infrastructuring" participatory governance *and* commensurating global public policy through the harmonization of data production and indicator monitoring. It is certainly an open question whether this infrastructuring of participatory governance actually disrupts the power asymmetries that have long structured the relationships between UN agencies and countries in the Global North on the one hand, and countries in the Global South on the other. However, we argue that the epistemic infrastructure of the SDGs explicitly creates interdependencies between all these actors in the act of producing a common global public policy because of and despite these power differentials, making quantification the common global policy language in the process. The MDGs included eight goals that singled out development problems for member states in the Global South as conceived by organizations from the Global North, and they were focused much more on basic needs rather than promoting a platform for thriving. The SDGs produced a much more comprehensive global public policyscape, and one which interpellated all countries as developing, thus producing a global governing paradigm. This is the third-order level of the epistemic infrastructure, discussed further in the next section.

Third-order level—a policy paradigm shift?

As this article has so far discussed, quantification has come to represent more than the measurement of people and practices. Rather, it emerges as a new governing paradigm, since it has brought together two entangled infrastructural elements in the field of global governance: that is, the epistemological underpinnings of the production of global public policy as well as the social organization to bring it into fruition. By using the term "epistemic" infrastructure (rather than measurement or knowledge infrastructure) here, we aim to highlight the contribution of quantification to the rise of a broader epistemological agenda rather than simply denote the power of numbers to bring about cognitive change. Instead, the notion of epistemic infrastructure aims to capture larger epistemological questions (i.e., the basic frames under which we understand the world around us) as well as combine these new epistemologies with the structures and institutions that support, sustain, and grow the measurement agenda into an all-encompassing governing one. New ideas emerge and bring new directions for envisioning and doing governing by numbers: interpretative flexibility, openness, (re)politicization, reflexivity, and democratization are key discourses and proclaimed aims in the new governing paradigm that the SDGs represent. This is because the SDGs, analyzed as an epistemic infrastructure, do not recast quantification merely as a tool in the arsenal of policy instrumentation and change (see, e.g., Erkkilä, 2016). Instead, quantification is institutionalized as the very core of the governance of sustainable development.

Furthermore, in the context of the SDGs, quantification does not merely produce objective evaluations of the current state of the world. Although numbers have always been seen as powerful in their ability to offer neutral, apolitical, fast, and stable knowledge, giving legitimacy and authority to their producers and users alike, quantification within the SDGs represents a more fundamental shift than simply continuing to capitalize on the raw power of numbers to persuade. Instead, we see the proponents of quantification as gathering steam and building on the incremental gains achieved in the second half of the 20th and early 21st centuries, in order to consolidate the ideas, norms, values, and cultures of the epistemic turn in global governance. Their efforts have resulted in a deep shift that now renders quantification in the sole and most powerful infrastructural complex, which has acquired the qualities and affordances of a macro-social policy paradigm (Hall, 1993); that is, it has consolidated previously disparate and even contradictory ideas into the making of a new *leitmotiv*, which can simultaneously be as complex as the vast datasets that feed it, or as simple as a new motto: "leave no one behind." Such metaphors and all their attendant elaborations structure the future: in the context of global public policy and the SDGs, quantification has become embedded in processes, decision-making, monitoring, and accountability mechanisms that cannot be "undone." Decision-making in virtually all fields of global public policy takes place within the context of a particular set of ideas that recognize quantification as the governing frame that is more legitimate than others; as a result, quantification privileges and fosters some lines of policy direction over others.

A quick, superficial analysis of the SDGs would see them as following the line of work which began with the MDGs; indeed, many still see the SDGs as simply the renewed commitment of nations to development, using goal-setting as the key instrument to nudge countries into increased attention to areas such as education and poverty (e.g., Muchhala & Sengupta, 2014). In this paper, we have argued that the SDGs have brought about a much larger and fundamental shift of direction. If the MDGs represented a new infrastructure of measurement at a global scale, quantification in the context of the SDGs can be conceptualized as

> ideas on steroids: such powerful ideas that they become unspoken. These are similar to the price of entry, where if one does not share the paradigm, one is not part of the conversation. (Baumgartner, 2014, p. 476)

Hence, we see the epistemic infrastructure of the SDGs as portraying a paradigmatic shift in the governance of global public policy. First, as this article has shown, the interdependencies of expert international organizations, with country representatives, civil society, philanthropists, and professional entities, have heralded a new era of the *re-politicization of quantification*: the discourses of democratization, participation, and bottom-up country buy-in were a key fundamental change from the previous MDGs' era. The SDGs were from the start premised on a new, horizontal structure, where countries were considered center-stage; that is, countries are not merely participants, but are—theoretically, at least—in charge of the process. Crucially, this shift was the outcome of struggle and of the determination of countries of the Global South to change the narrative.[2]

Second, the SDGs acquired *global scope and reach*, as for the first time they framed development as not a requirement for the South only; instead, all countries are seen as continuously developing. Additionally, the scope of the agenda is much larger: goals have been set for a much larger spectrum of public policy arenas, even when there were no data to back up the vast majority of the goals put forward. More importantly, these policy arenas and the goals associated with them were seen as interlinked and as interacting with one another, giving rise to the emergence of a global public policy field centered around the notion of sustainability. Nonetheless, their translation into quantified targets soon gave rise to criticisms that some goals were contradictory and achieving one would be counterproductive for achieving another. Examples of such critique have primarily been expressed in relation to the economic growth goals contradicting the climate change or the global health ones (Hangoma & Surgey, 2019).

Third, as this article has shown, there is *interdependency and fragmentation* of the knowledge producers. The range of producers of statistical knowledge for the SDGs has grown substantially: IOs, civil society, NGOs, national statistical offices, donors, and others. These actors are required to work together, while simultaneously maintaining their unique contribution and presence in the field. Such polar demands have generated a complex knowledge production arena that simultaneously works together to standardize and integrate, while continuously growing the need for expanding the statistical capacity of nations. Despite the construction of global measures, these numerous "statistical intermediaries" (Tichenor, 2022, this volume) create a sense of fragmentation and disjointedness, often necessary for the governing of such complex and fluid procedures.

Fourth, the SDGs are not an add-on to national policies; instead, they enter national agendas by being re-contextualized within national priorities and plans. Each country is expected to *nationalize* the SDGs—to produce a measurement infrastructure that matches as closely as possible to the global SDG framework to shape and be shaped by national priorities. One of the key modes of monitoring and enforcing this nationalization is through Voluntary National Reviews, which are annually presented to the UN HLPF.

Finally, and perhaps most importantly, the SDGs are not merely a performance monitoring agenda, sitting alongside the plentiful other global indexes and measurement tools. It has become pervasive in the everyday discourse of public and private sector marketing and corporate branding, in the civil society, and generally in a multitude of social institutions which want to be seen as adhering to the principles of sustainability and equality. It is precisely this influential positioning that sets it apart from previous endeavors of this kind.

[2] Colombia's role in pushing for such a bottom-up governing structure (Gasper, 2019) has been notable and set the tone for a radically different path.

To conclude, as the nature and breadth of transnational links and networks have expanded and the global diffusion of ideas, standards, and policy practice has intensified (Stone, 2008, 2019), we observe new and changing geographies of policy (Peck & Theodore, 2015). Despite the complexity, fragmentation, and instability of global public policy, sets of ideas can and do develop considerable coherence and persistence at the international level (Kennett, 2010). It is perhaps precisely the diversity and fragmentation of the global public policy space that necessitates the construction of global paradigms that actors can subscribe to, before adapting and translating them at home. The analytical lens of an epistemic infrastructure allows to not only explain these expanding connections but also propose an alternative theorization of what global public policy is. As argued in this paper—and explored further in the articles in the rest of the thematic issue—the theorization of global public policy as an infrastructure goes beyond understanding policy in terms of its contents. Global public policy is not just an assemblage of decisions affecting the global sphere but rather it should be understood precisely as a set of structures enabling forms of decision-making and interlinkages between actors. In that sense, global public policy is a process of infrastructuring problems—creating materialities, interlinkages between actors, and common logics for action through which problems can be solved rather than offering specific solutions to policy challenges.

Overview of themed issue articles

The articles in this themed issue provide a varied view of the policy and knowledge effects of the SDG monitoring framework in various contexts. The authors carefully investigate these materialities, networks, and governance paradigms across many different policy arenas, geographic regions, and scales of governance.

Grek (2022) focuses on the temporal and spatial elements of infrastructuring as a social-semiotic practice, in order to show the ways that the education SDG (SDG4) built an epistemic infrastructure which led to a key paradigmatic policy shift in the education arena: this is the move from the measurement and policy focus on education input metrics (in the form of access to schools, completion rates, gender equality, and others) to a focus on learning outcomes (through the measurement of skills and competencies). This shift, although rooted in the developments in the education policy field in the 1980s and the 1990s, took shape discursively and in measurement terms through the incremental buildup of the SDG4 epistemic infrastructure. The paper shows how failed metrics and clashes among actors and organizations not only did not break the infrastructure but in fact made it stronger and more effective in producing policy change.

Berten (2022) investigates the International Labour Organization's (ILO) contested production of indicators of decent work. By investigating the obstacles and contestations toward quantifying decent work, the article contributes to the theorizing of epistemic infrastructures in highly politicized fields. While involving the ILO's tripartite membership (with government, employer, and worker representatives) was intended to lend legitimacy to the project, it also brought to the fore opposing ideas of economic and social relations that were manifested in conflicts over quantification. The article discusses the ways that indicator production was mediated by political interests; whereas workers' representatives pushed for quantification to enable better recognition of decent work principles in global public policy, employers' representatives opposed the specification of decent work through quantified metrics.

Waldmüller et al. (2022) discuss how, while the SDGs appeared inclusive in their design, the reliance on official measurement infrastructures has meant upholding a narrow definition of both sustainability and development. Such a limited perspective on what sustainability is or could be has been questioned by indigenous and non-indigenous "governance beyond the state" approaches. The article analyzes relational indigenous epistemologies and practices that have contributed to alternative epistemic infrastructures, e.g., claiming data sovereignty (Australia, Aotearoa) or Buen Vivir indicators (Andes). In their paper, the authors discuss three examples from the Andean-Pacific region in order to explore the need to renegotiate the relationship between indigenous communities and the global measurement infrastructure.

Rocha de Siqueira and Ramalho (2022) continue the exploration of the epistemic infrastructure on the local level in the case of Brazil. They explore how the SDG agenda of the "data revolution" is shaped by non-traditional forms of data collection, including participatory methodologies, such as citizen-generated data. Such an analysis points to two key insights into the way participatory principles interact

with the technocratic cultures of measurement. First, the paper highlights the role of the strategies of localization to leverage the SDGs as means to promoting the rights' agenda. Second, the authors point to the role of local narratives as venues for communicating data captured by the SDGs. Overall, the paper, through rich theoretical discussion, argues for "politics of care" as the central aspect of quantified global public policy.

Bandola-Gill (2022) mobilizes the notion of an epistemic infrastructure to answer to a key question of quantification: what makes some indicators more successful than others? The paper investigates this question through a case study of SDG 1 and focuses specifically on the multidimensional poverty measurement. The paper argues that the development of the epistemic infrastructure around this relatively new approach to measurement required a combination of bottom-up experimentation and advocacy for the measure and top-down processes of legitimation by the key global organizations. Crucially, the paper highlights the role of agency in the processes of quantification by introducing a concept of "statistical entrepreneurs" who work toward promoting innovation in measurement at the country and global levels.

Williams (2022) explores the organizational dynamics of knowledge production and its impact on global knowledge within the SDGs. The paper focuses on the World Bank as a hybrid organization, drawing its legitimacy across multiple fields, including academia, media, and politics. The paper takes on a novel perspective by exploring how the internal processes of evaluation (such as performance reviews and promotions) shape the epistemic outputs of the Bank. As such, the paper explores how the internal infrastructures of the key international players impact the broader epistemic infrastructures of the SDGs.

Carefully interrogating the process of epistemic infrastructuring in the context of global health security, Fukuda-Parr (2022) analyzes the inclusion of Indicator 3.d.1 in the SDG framework. This indicator monitors global and national capacities to manage potential pandemics and other global health risks using metrics developed under the umbrella of the International Health Regulations. However, the coronavirus disease pandemic showed how ineffective this indicator was in quantifying a country's ability to manage a global pandemic, as many of the countries that had scored the highest—including the USA and the UK—were hit the hardest by the pandemic in both caseloads and mortality rates (Cash & Patel, 2020). Showing how the quantification of pandemic preparedness sits within an influential paradigm of health security that has prioritized surveillance and emergency response over other health infrastructures, Fukuda-Parr (2022) provides an important view into how "faulty metrics" come to have such epistemic power within global public policy paradigms.

Finally, Tichenor (2022) takes a closer look at the issue of statistical capacity development, which has become a development problem in its own right particularly in the wake of the increasing demand for data on both the national and global levels due to both the MDGs and the SDGs. With five indicators included within the SDG framework to monitor statistical capacity and its development—including an indicator to monitor a country's ability to monitor the SDGs themselves—statistical capacity development is the epistemic infrastructure of the SDGs laid bare: the conditions for building the global public policy through quantification are built into the debates about how to measure the epistemic infrastructure itself. Debates over *whose* capacities and the capacity to measure *what* amplify the tensions at the heart of the SDGs themselves, including the tensions between the push for national ownership and democratic participation in deciding policy priorities and the existing momentum for UN agencies and donor organizations to carve out development problems.

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Conflict of interest

None declared.

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