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Expert Reports as Epistemic Participation: Knowing and Doing in Artificial Intelligence's Environmental Debate

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This study examines how nonscientific organizations participate in debates on the environmental footprint of artificial intelligence (AI) through the publication of reports, thus shaping the acquisition and distribution of expertise in the technical public sphere. Drawing on Eyal's two dimensions of expertise, as tacit versus explicit and individual versus distributed, we use three concepts that best exemplify the various combinations of expert attributes, namely, communities of practice, epistemic communities, and international knowledge institutions. Our findings show reports on AI's environmental footprint enable organizations to simultaneously engage with communities of practice and epistemic communities, thereby blurring the boundary between practical and epistemic expertise. This development creates challenges for international knowledge institutions, which promote inclusion and global dialogue, but do not always account for disparities in the quality of evidence produced. We conclude by suggesting that reports provide a valuable lens for examining expert organizations' tacit knowledge and discuss the implications for the technical public sphere's capacity to advance notions of objectivity.

Keywords: expertise, technical public sphere, reports, digitalization

There has been no greater transformation of public debates in the last two decades than the widespread adoption of the Internet and ICT. Once relatively centralized around a few gatekeepers, public discussions now involve an increasing number of citizens and stakeholders. A range of institutions, humans, algorithms, platform features, and economic incentives mediate public discussions, offering both new opportunities and constraints for participation in public debates (Ananny, 2018). Key to understanding these changes has been a line of thought uniting science and technology studies (STS) perspectives with theorizing in communication and media studies. First advanced by Boczkowski and Lievrouw (2008) and culminating in an important edited volume with the MIT Press (Gillespie et al., 2014), this "material turn" in the study of publics attempted to bridge the technological, material perspectives of STS and the communicative focus of media studies. Scholars adopted this fusion to study citizens tinkering with communicative tools (Dunbar-

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Hester, 2014), the transformation of news (Anderson, 2013), the rise of algorithms (Ananny, 2016), the culture of Silicon Valley (Turner, 2010), science communication (Wajcman & Jones, 2012), and many other empirical domains where the traditional relationship among technology, politics, knowledge, and public life was coming under stress from the rise of new digital mediators.

Despite ample concerns about changing mediation processes in civic discourse, the question of their influence on expertise and technical discussions has garnered relatively little attention. While a number of studies explore the role of digital technologies in shaping an understanding of either knowledge or expertise, we find these are scattered across multiple subfields concerned with the media (Ananny, 2018; Anderson, 2013), communication (Pfister, 2011), conspiracy theories (Marwick & Partin, 2022), expertise (Eyal, 2019; Nichols, 2017; Townsley, 2023), and social movements (Frickel et al., 2015). In debates about the transformation of expertise, the Internet is often pointed to for causing "the death of expertise" (Nichols, 2017). According to this view, the participation of a large variety of actors in public debates makes it impossible to distinguish "real" from "fake" experts. Indeed, evidence shows that new communities use the affordances of the digital environment to mimic expertise and build alternative epistemic claims that rely on false information (Marwick & Partin, 2022). Mediated through communication infrastructures (Plantin et al., 2018), these novel forms of expertise raise concerns about the very possibility of making informed decisions in democracies. However, pointing at the Internet as the main cause of the problem of expertise in the digital age ignores longstanding debates about the definition of expertise and the limits of experts' participation in public debates (Eyal, 2019; Russel & Patterson, 2025). From this perspective, the "crisis of expertise" largely predates social media and the Internet and is caused by contradictory definitions of expertise and expectations about the role of experts in democracy (Eyal, 2019).

This article takes public debates about the environmental footprint of artificial intelligence (AI) as a case study to explore the nature of expertise in the technical public sphere at a time when an important number of nonscientific organizations make epistemic claims by producing and disseminating gray literature. The technical public sphere refers to the space where debates about technical decision making occur. It is characterized by the active involvement of organizations that publish reports to influence these decisions. With the emergence of digital tools, it is mediated by digital artifacts such as algorithms and platform features on social media (Ananny, 2018). The debate on the environmental footprint of AI offers a particularly relevant case for studying expertise in the technical public sphere. The hype around AI has raised questions about whose voices count in public descriptions of the problems it poses (Gourlet et al., 2024). Though various actors have made expert claims about the environmental footprint of AI through the publication of reports (see Table 1 and Appendix), these organizations are rarely grounded in scientific institutions. Their objectives may be to attain truth about the environmental footprint of AI, but also to gain visibility, advance public or private causes, develop new skills, or acquire new clients, sometimes all at once.

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Table 1. Nonscientific Organizations That Have Published a Report on the Environmental Footprint of AI Between January 2018 and April 2025.

Consultancies	Industry	Market Research Organizations	Think Tanks and Associations	Banks	Intergov. Organizations
Pricewaterhouse Coopers Capgemini Boston Consulting Group Deloitte	Microsoft Schneider Electric Google	SemiAnalysis	Heinrich Böll Stiftung Electric Power Research Institute World Economic Forum	Goldman Sachs Jefferies	Organization for Economic Co-operation and Development Global Partnership on AI International Energy Agency

Note. A full list of the reports is available in the Appendix.

This study asks the main research question:

RQ1: How do the production and circulation of reports by nonscientific expert organizations in the technical public sphere transform the acquisition and distribution of expertise?

The article proceeds as follows: The next section discusses the nature of expertise based on Eyal's (2019) review of literature. It shows expertise can be understood as both explicit and tacit, and as being located inside individuals or outside them (Eyal, 2019). The following section introduces three concepts to explore the expertise of the actors that have published a report on the environmental footprint of AI, namely, "communities of practice" (Wenger, 2000), "epistemic communities" (Dunlop, 2012), and "international knowledge institutions" (Miller, 2007). Digital technologies allow individual members of organizations to enter and actively participate in communities to acquire practical skills (community of practice) and theoretical understandings (epistemic communities) of the phenomena they are interested in. The publication of reports by expert organizations is thus an effort to enter, participate in, and gain authority within these communities using digital tools. Against this background, the international knowledge institution framework highlights the question of the governance of expert organizations' participation in sociotechnical debates. International knowledge institutions in the debate on the environmental footprint of AI portray themselves as facilitating a global dialogue between contradictory points of view, evading the question of their own role in advancing interests and attaining truth. We conclude by examining practical implications, specifically that the publication of reports simultaneously raises questions about and offers avenues to explore the relationship between experts and objectivity in the technical public sphere.

Expertise and the Production of Gray Literature in the Technical Public Sphere

Identifying genuine expertise has always been a challenge, and the digitalization of the public sphere has rendered it even more complex. The difficulty in recognizing who qualifies as an expert predates the Internet and is closely tied to the problem of defining what expertise entails (Eyal, 2019). Even when

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experts are established scientists, when they fill an advisory role, they situate themselves at the intersection of the fields of science and politics, blurring the lines between facts and opinions (Eyal, 2013; Stampnitzky, 2013). In her study of regulatory science, Jasanoff illustrates that the boundaries between science and politics are continually negotiated, especially when scientists provide advice in institutional contexts. These boundaries do not preexist advisory interactions, but rather emerge through the process of negotiation itself, particularly as new issues arise (Jasanoff, 1990).

Collins and Evans (2002) speak of "technical decision-making" to describe "decision-making at those points where science and technology intersect with the political domain because the issues are of visible relevance to the public" (p. 236). In their view, technical decision making is inherently public, and the extent to which the public should be included in specialist debates is a major concern. What they label "the problem of extension" (p. 235), whereby it is difficult to determine a normative position of how far into the general public to extend expertise, echoes longstanding debates in the early 19th century about ideals of democracy and the role of the press in allowing the self-governance of the people (Dewey, 1927; Lippmann, 1922). While technical debates in the 20th century often occurred behind relatively closed doors (Porter, 1995), the proliferation of technological controversies and the increasing engagement of diverse publics concerned with technological developments have moved these discussions out of laboratories and into the public domain (Callon et al., 2011).

The production of gray literature is one way in which new actors make epistemic claims public and enter the technical public sphere. Digital tools have significantly reduced barriers to entry, enabling virtually anyone to edit a PDF and publish it online. The publication of gray literature—material not professionally published—has thus become a tool for seeking public influence (Lawrence, 2017). Such publications empower new kinds of organizations, including think tanks (Medvetz, 2012), financial analysts, R&D-intensive private companies, consultants, NGOs, and intergovernmental organizations, to publicly assert epistemic claims. This shift challenges both universities' traditional monopoly on the production of expertise and the media's longstanding dominance in giving visibility and legitimacy to this power (Arnoldi, 2023).

Debates on the nature of expertise further problematize the relation between expertise and the production of gray literature in the technical public sphere. In his review of literature, Eyal (2019) argues that two central questions have fueled debates over expertise in academic literature: What makes expert knowledge different from lay knowledge? Where is expertise located? Eyal (2019) thus proposes that expertise be understood along two axes, presented in Figure 1. The first axis contrasts explicit and tacit knowledge. On one hand, expertise must be at least partially explicit; it can be taught through textbooks that outline rules and procedures necessary for action. Experts must also offer some justification for their decisions, especially in democratic contexts where technical advice must be subject to public scrutiny and trust. On the other hand, expertise inevitably involves tacit knowledge, acquired through practice. This dimension is difficult to articulate and escapes full accountability, which raises concerns when expert advice informs technical decision making. The second axis concerns the localization of expertise. One view sees expertise residing within individuals, developed through personal experience and training. Yet expertise is never entirely individual. From another perspective, it is a property of networks and is conferred on individuals by technologies, methods, resources, and political support that enable them to act as experts in each place and time (Anderson, 2013). Consequently, the notion of expertise as purely explicit or exclusively

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individualistic has become increasingly untenable. These views are being challenged by the inherently complex and hybrid nature of expertise, highlighting fundamental tensions about not only what expertise is but also, crucially, what it ought to be (Eyal, 2019).

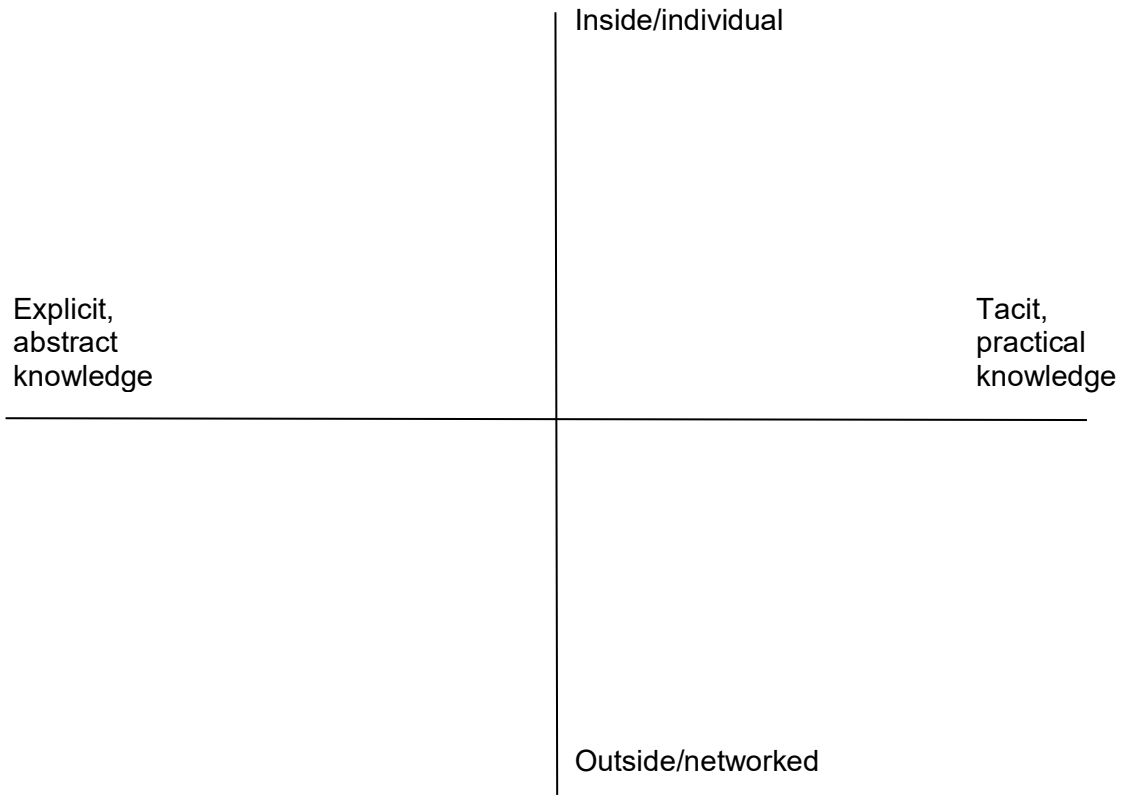

Figure 1. Two dimensions of expertise, based on Eyal (2019, p. 33).

Given these competing dimensions, it is unsurprising that changes in the conditions governing participation in the technical public sphere reshape both the concept of expertise and expectations toward experts involved in technical decision making. First, by facilitating the publication of gray literature, the digital environment transforms the distribution of expertise. Social media makes the networked nature of expertise, as a quality distributed by social actors, particularly prominent (Hermida, 2010). Traditionally, media organizations held a "monopoly on publicly recognizing experts" (Arnoldi, 2023, p. 514), playing a critical role in legitimizing particular individuals as experts. Today, algorithms and market incentives on social media platforms significantly influence which forms of expertise become visible (Bishop, 2020), enabling new influencers to claim expert status. Producing gray literature is one way in which they can do so. Gray literature also represents an emerging format that, alongside traditional scientific papers and media articles, recognizes the expertise of others. From this perspective, such literature is a central component of the technical public sphere. It enables new actors to claim expert status while granting them authority to recognize and validate the expertise of others.

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Second, the publication of gray literature in the digital environment influences how expertise is acquired, reinforcing the idea that expertise is an individual attribute. Online platforms provide access to expert knowledge through do-it-yourself videos and popular science channels and by amplifying the work of credentialed experts (Chinn & Hasell, 2023). More content than ever before is available to help individuals educate themselves across a wide range of subjects, as experts can now design programs and teach courses independently of established institutions. In this line of thought, gray literature allows the public to access forms of knowledge that lie outside traditional channels of science and journalism. It forms part of the evidence trail that individuals can consult to inform themselves on various phenomena. However, this raises questions about the quality and reliability of the evidence produced. For example, conspiracy theorist communities actively contribute to the production of "populist expertise," which imitates scientific methods to generate evidence that appears robust enough to be cited in online forums (Marwick & Partin, 2022). As populist forms of expertise intersect with populist discourse on social media, scientific methods can be delegitimized as an elitist form of knowledge production that hinders the ability of individuals to defend their interests (Collins et al., 2023).

The Case of the Environmental Footprint of AI

We take the debate on the environmental footprint of AI to explore the various facets of expertise highlighted above and their evolution in the digital environment. The important energy demands of AI have been an object of public discussion for several years, which has gained prominence with the emergence of new energy-consuming models. In a context of rapid evolution of the technology and simultaneous widespread adoption of AI services such as ChatGPT, accurately measuring the environmental footprint of AI has become a challenge for governments engaged in CO_2 emission reductions.

The difficulties researchers in the field of AI face echo what Pasek et al. (2023) have documented on the debate on the environmental footprint of ICT, namely, that using either bottom-up or top-down approaches, defining what counts as ICT (or AI), relying on local measures or global averages, and estimating more or less strong efficiency improvements in the future can all alter the results by several orders of magnitude. Thus, estimations of the environmental footprint of AI can vary greatly. In 2019, Microsoft and PricewaterhouseCoopers (PwC) anticipated a 4% global emission reduction from improved efficiency in the agriculture, energy, and transport sectors (Microsoft & PwC, 2019). Following the emergence of large language models, Schneider Electric estimates the energy demand caused by AI in 2035 to be between 2 and 13 times its 2025 value (Paccou & Wijnhoven, 2024). In addition, some companies report their emissions using market-based methodologies that take into account the purchase of green energy, while others refer to location-based methods that reflect the energy actually used in a given data center, with important differences in the results (O'Brien, 2024).

The following analysis is based on an exploration of 19 reports on the environmental footprint of AI. The debate is characterized by the participation of diverse organization types that include intergovernmental organizations (the Organization for Economic Co-operation and Development [OECD], the International Energy Agency [IEA]), consultancies (Accenture, Capgemini, PwC, the Boston Consulting Group [BCG]), industrial actors (Microsoft, Schneider Electric), and financial services (Goldman Sachs, Jefferies). While nothing a priori unites these organizations, all have engaged in the epistemic debate about

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the environmental footprint of AI, which thus offers a particularly relevant case for studying the technical public sphere under conditions of digitalization. The reports were coded according to the category of actor that published a report, the type of methodology they rely on (survey, model, aggregation of literature, aggregation of use cases), and the general orientation of their argument (AI has an environmental cost, AI offers opportunities for the environment).

Three Frameworks to Study the Expertise of Organizations

We explore how to understand the expertise of organizations that make epistemic claims about the environmental footprint of AI. To do so, we identified several frameworks that attempt to describe the work of groups of individuals seeking to intervene in technical public debates, namely, communities of practice, epistemic communities, and international knowledge institutions. Our original assessment also included the concepts of advocacy coalitions, discursive communities, interpretive communities, and issue networks, but we decided to focus our investigation on three frameworks that best exemplify three of the four quadrants of the dimensions of expertise. We consider each framework as fitting in Figure 2 as follows:

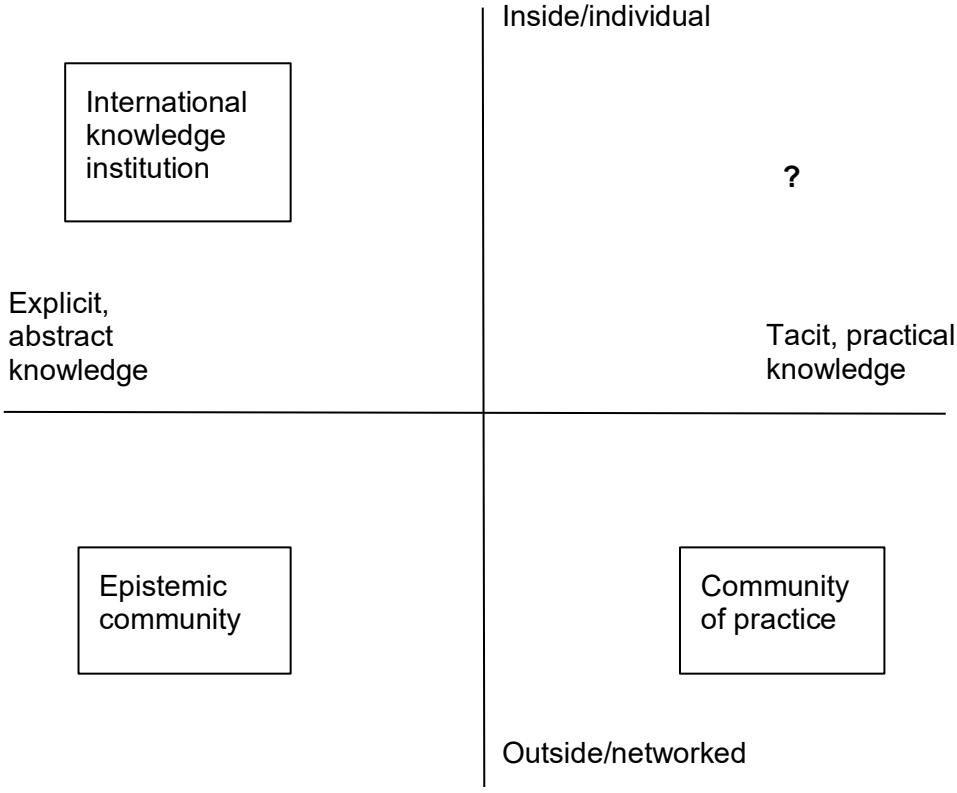

Figure 2. Three concepts to explore the expertise of expert organizations, based on Eyal (2019).

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In the next sections, we start by considering the networked nature of expertise in the technical public sphere under conditions of digitalization by looking at the concepts of communities of practice and epistemic communities. We then focus on international knowledge institutions as individual organizations seeking to build and acquire expertise. The lack of a framework for understanding the individual, tacit dimension of expertise in the participation of organizations in the debate on the environmental footprint of AI is then discussed.

Communities of Practice

Starting from the bottom-right quadrant, the experts who participate in technical decision making on the environmental footprint of AI can be studied as communities of practice. The concept of a community of practice was first developed by anthropologists Lave and Wenger (1991) to describe learning processes in human organizations. The authors propose a model of situated learning that sees learning as a social activity that involves some form of engagement in a community of practice. According to Wenger (2000), there are three dimensions to communities of practice: They are centered around a specific goal or topic, they are defined by the processes of mutual engagement that bind the community together, and they produce outcomes such as a set of shared practices that members have developed over time.

The starting point for the concept of a community of practice is that learning is fundamentally a social activity. Drawing on insights from anthropology, the authors explore the environments learners must engage with to develop expertise. They pay particular attention to how identities are shaped and expressed within the community. Practices are viewed as "patterned, meaningful action that knowledgeable actors engage in within a particular organizational context" (Cross, 2013, p. 146). A significant part of knowledge acquisition is tacit, emerging through participation in social groups. However, Cross (2013) notes the concept tends to focus too narrowly on what actors do rather than on the interactions between them and the power dynamics at play. In her view, this undermines individual members' agency, as the practices they engage in end up shaping their actions and values rather than the other way around.

By nature, communities of practice are also inherently networked. Knowledge is distributed along the network of participants who comprise the community. New entrants into a community of practice will interact at the periphery, when longstanding and more recognized experts will be closer to the center (Lave & Wenger, 1991). From this perspective, knowledge is not only about what someone knows but also about where one positions oneself in a social field. The community of practice concept is thus particularly well-suited to online environments. Various authors have used it to describe learning practices intermediated by new communication tools (Gray, 2005; Gunawardena et al., 2009; Kirschner & Lai, 2007), for example, to describe citizens' participation in decentralized scientific endeavors with social media (Liberatore et al., 2018).

Some policy networks might be considered communities of practice (Adler, 2008; Pouliot, 2008). Experts measuring the environmental footprint of AI quite clearly participate in such a community, where all members work toward this shared goal. As shown in Table 1, individuals are scattered across several forms of organizations, such as academia, NGOs, businesses, and intergovernmental organizations. The quantification of the environmental footprint of AI also requires diverse skills. For example, actors inside

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industry are the best positioned to know of the latest trends and have up-to-date information, and academics have methodological competences to build robust estimations. Participants share best practices on ways of estimating and issues that arise in the process in social contexts. They meet at conferences, in working groups, and at events organized by "boundary organizations" that serve as bridges between these worlds (Medvetz, 2012).

Exploring the debate on the environmental footprint of AI through the lens of a communities of practice framework brings to light two elements of the transformation of the technical public sphere with digital technology. The first element is the ability of learners to interact with a community of practice. Expert practices used to estimate the environmental footprint of AI are diverse. Some experts use life cycle analyses as a tool to estimate the environmental cost at various stages of development (Ligozat et al., 2022), others build software (such as Code Carbon) to measure the energy associated with the computing power required for specific tasks, and still others propose energy scores to help end users evaluate models (Luccioni, 2025). In parallel, some advertise the possibility of using AI to solve the climate crisis, providing long lists of individual use cases deployed inside organizations (Columbia, 2024; IEA, 2025). In the digital environment, the publication and circulation of reports are means to access knowledge about emerging practices to inform future actions. Thus, experts can both gain and share knowledge through these reports. The second element of the transformation of the public sphere affecting communities of practice concerns the mechanisms that allow some members to become authorities within the community. As social interactions move online, expert organizations are eager to gain visibility. This motivates them to publish reports to participate in a global conversation (Microsoft & PwC, 2019; Paccou & Wijnhoven, 2024). For example, the Schneider Electric Research Institute, a research institute based at a technology company in electrification, writes in the "Welcome and Key Insights" section of its 2024 *Artificial Intelligence and Electricity* report, "Our hope is that this research will contribute meaningfully to ongoing conversations about sustainable AI development, energy policy, human prosperity balanced with frugality, and technological innovation" (Paccou & Wijnhoven, 2024, p. 1).

Communication teams are involved before publishing and sometimes help draft the narrative around the report and, therefore, its conclusions. The acquisition of authority by expert organizations within a community of practice is thus also the result of practices of engagement with the media and other experts online.

Epistemic Communities

Moving to the bottom-left quadrant, experts participating in the assessment of the environmental footprint of AI can also be analyzed as an epistemic community. The concept of epistemic community originates from the field of international relations. It was proposed by Haas (1992), taking inspiration from the sociology of science. An epistemic community is "a network of professionals with recognized expertise and competence in a particular domain and an authoritative claim to policy-relevant knowledge within that domain or issue-area" (Haas, 1992, p. 3). Epistemic communities are defined by the following four elements:

1) a shared set of values

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2) a shared set of causal beliefs that help one understand the links between policy action and outcomes
3) shared notions of validity
4) a common policy enterprise, that is, a common will to shape the world around them through policy action

Unlike communities of practice, which primarily focus on the tacit dimensions of expertise, epistemic communities produce explicit knowledge claims. By participating in policy debates, they offer analyses of the issues at hand, sometimes with the goal of informing decision makers. Members of epistemic communities also debate the best methods for studying a given phenomenon. These methodological judgments rely on shared notions of validity, which must be at least partially articulated and agreed on within the community.

The collaboration within epistemic institutions is fully designed toward the production of explicit knowledge, although we point to several considerations that highlight the tacit dimension of knowledge in the formation of shared principles in epistemic communities. For example, the framework considers the way individuals' preconceptions shape their understanding of issues, recognizing that "faced with a new situation, we identify and interpret problems within existing frameworks and according to past protocols and then try to manage the problems according to operating procedures that we have applied in analogous cases" (Haas, 1992, p. 28). Similarly, some researchers note that a member's national culture can shape their views, especially in globalized environments (Krebs, 2001). The knowledge acquired by the members of the community is therefore influenced by nonexplicit elements that shape their understanding of what counts as a causal mechanism, for instance.

To overcome the limit of identifying the internal cohesion of epistemic communities, Cross (2013) proposes looking at processes of professionalization. She suggests considering several variables that lead an epistemic community to gain what Abbott (1986) calls a "jurisdiction" over a specific form of expertise. Being attentive to processes of selection and training, shared professional norms, or the frequency with which experts of the community meet can help describe epistemic communities as a coherent whole. In other words, looking at the coherence of an epistemic community means attending to the ways it transfers tacit knowledge into explicit form and vice versa through processes of professionalization.

Many organizations estimating the environmental footprint of AI participate in epistemic communities. In addition to sharing a common enterprise, they navigate the world of policy at both national and international levels. Their objective can be to raise awareness about the environmental footprint, although some members of the epistemic community may have divergent views. For example, some attempt to document the ways AI can reduce CO_2 emissions (Microsoft & PwC, 2019), while others investigate the energy demands of AI (Goldman Sachs, 2024). Expert organizations sometimes push their arguments by participating in transnational working groups in intergovernmental organizations such as the OECD or at standardization organizations. They debate the shared set of causal beliefs that help clarify the links between policy action and outcomes.

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The transformation of the technical public sphere further affects the epistemic community working on the environmental footprint of AI. The democratization of participation in technical public debates through digital tools allows more participants to make epistemic claims, based on diverse methods. Various actors mobilize quantification to build authority (Porter, 1995). This can entail different notions and acceptances of central values such as objectivity. For example, some reports use surveys to quantify omitted emissions; they ask experts at organizations to estimate these emissions with AI applications and use these numbers as representations of the effective measurement of avoided emissions (BCG, 2022; Capgemini, 2020). Other organizations build multivariate simulation models to estimate future evolutions (Paccou & Wijnhoven, 2024). Still others estimate the future sales of AI infrastructure components, such as graphics processing units (GPU), to anticipate their energy costs (De Vries, 2023; IEA, 2024). By publishing and communicating reports, expert organizations make contributions to a discussion on the best ways to document the environmental footprint of AI. For example, numerous organizations have built and published scenarios to anticipate the future energy demands of AI (Deloitte, 2024; Jefferies, 2024; Paccou & Wijnhoven, 2024). These efforts sometimes build on one another, citing previous predictions and further developing them. Thus, the 2025 IEA report is able to build on previous predictions to offer its view of a more accurate estimation (IEA, 2025).

As digitalization broadens access to epistemic communities, it raises questions about the quality of evidence in the technical public sphere. In particular, the ability of community members to assess whether a method is appropriate for supporting a given claim depends on their epistemic culture (Knorr-Cetina, 1999). In science, researchers share as much information as possible to enable others to understand their methods, challenge their assumptions, or reproduce their experiments. Making methodologies transparent and convincing is an essential part of their professional training. By contrast, actors outside scientific institutions often lack the expertise needed to develop publicly robust methodologies.

In this context, the participation of businesses in both epistemic communities and communities of practice raises important concerns. Business publications frequently fail to disclose the data used or the assumptions underlying their analyses (Kaack et al., 2022; Pasek et al., 2023), and their work is often perceived as incomplete or inaccurate, if not deliberately misleading (O'Brien, 2024). For instance, in the case of surveys discussed below, there is often no acknowledgment of the risk that experts might exaggerate their claims to highlight how their actions have reduced CO_2 emissions, an issue that would receive scrutiny in academic circles. This leads to doubts about whether industry actors share the values and practices of these communities or merely claim to do so, which justifies questioning the extent to which businesses are integral members. This is particularly relevant given the significant benefits industries can gain from participating in international discussions on estimating AI's environmental footprint, such as influencing the standardization of methods and the scope of their application (Veale et al., 2023).

The previous two sections have documented the ways in which expert organizations participate in networks that take the forms of both communities of practice and epistemic communities. In the next section, we turn to individual organizations that play a prominent role at an international level in aggregating and centralizing expertise.

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International Knowledge Institutions

Moving to the top-left quadrant, Miller (2007) uses an institutional lens to look at expertise in international environments. His interest lies in the democratic processes that lead to the production and validation of knowledge in international contexts. Taking the International Panel on Climate Change (IPCC) as one example, he asks to what extent international institutions can establish "legitimate limits on the global exercise of power through their ability to structure processes of reasoning and deliberation in global society" (Miller, 2007, p. 327). In his view, international knowledge institutions are driven by the following three mechanisms:

1) by setting international knowledge standards, that is, by fixing rules for modeling and monitoring global systems and for deploying evidence in global policy debates;
2) by making global kinds, that is, by bringing into being new ontological frameworks, classifications, and mappings that frame the conceptual underpinnings of global deliberation; and
3) by constructing new deliberative spaces in which claimants acquire standing through claims to knowledge and expertise. (Miller, 2007, p. 328)

International knowledge institutions standardize and centralize research, data collection, and analysis methods to produce shared knowledge at an international level. They do so by gathering groups of experts who define methods to collect and analyze data. They contribute to fostering global conversations about the phenomena at hand and allow emergent voices to be heard.

The framework is driven by the relationship between states and civil society and the checks and balances that the latter can impose on the former. As Miller (2007) notes,

> These institutions signal the existence of a struggle to deploy scientific knowledge and expertise as the basis for a global civic epistemology—a set of evidence, facts, logics, rationales, and styles of reasoning on which to ground policies that encompass the globe—that emerge out of deliberation rather than exclusion. (p. 350)

International knowledge institutions seek to challenge state power by including the interests of various actors in the process of deliberation. They emerge from the "increasing preoccupation with struggles over the truth status of knowledge claims" (Miller, 2007, p. 330). Although knowledge in these institutions is directed toward action, it is mostly explicit and produced through processes of deliberation. At the same time, international knowledge institutions internalize the expertise they produce. They are recognized as organizations that possess expertise others do not.

Several organizations that participate in the debate on the environmental footprint of AI could be considered international knowledge institutions. In June 2020, France and Canada launched the Global Partnership on AI (GPAI), a multistakeholder initiative that aims at sharing research on AI and identifying key issues in the field. As part of its mission, the GPAI (2021) "assesses—on a comprehensive, objective, open, and transparent basis—the scientific, technical, and socio-economic information relevant to understanding AI impacts" (p. 6). It published a report that both identifies best practices in evaluating and

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reducing the footprint and provides recommendations for governments (GPAI, 2021). In parallel, the OECD (2022) gathered an AI Expert Group on AI Compute and Climate to publish a paper on the methods to measure the environmental footprint of AI before the widespread adoption of ChatGPT. Both organizations have joined forces, and the OECD now hosts the secretariat of the GPAI. Finally, the IEA, an intergovernmental organization, launched an Observatory on Energy and AI to facilitate the development of estimation methods and policy recommendations to address the rising energy demands of AI (Coalition for Sustainable AI, 2025). It published a report that summarizes existing literature on both positive and negative effects of AI (IEA, 2025).

The publication and circulation of reports in the technical public sphere bring new questions for international knowledge institutions. The report format enables nonscientific organizations to extend their reach beyond their immediate circles, sharing practices and insights related to AI's environmental footprint. At the same time, individuals and organizations seeking to learn about how AI can be applied to environmental issues or how its footprint might be reduced frequently turn to such reports as key resources. This leads to a multiplication of actors, both making epistemic claims public and having an interest in reading them. This increase in the number and diversity of organizations participating in discussions about technical decision making echoes concerns raised by Collins and Evans (2002) about the participation of the public in technical discussions and the problem of extension.

In its introduction to its 2025 report, the IEA states,

> Recognizing the need for global dialogue on energy and AI, the IEA organized the Global Conference on Energy and AI in December 2024—the largest-ever gathering of the technology and energy industries, governments, and civil society to discuss the energy sector implications of the rise of AI. This conference in turn contributed to the AI Action Summit held in Paris in February 2025. This special report on energy and AI further analyses the major themes that emerged from the conference. (IEA, 2025, p. 25)

The IEA implies its legitimacy derives from both facilitating and actively participating in a global dialogue on the environmental footprint of AI. It convened a wide-ranging international conversation, bringing together experts from sectors including energy, technology, government, and civil society. This effort fostered a community interested not only in accessing explicit knowledge about AI's environmental impact but also in sharing best practices and insights on how various organizations are responding to AI's emergence.

From the perspective of international knowledge institutions, a key challenge in today's technical public sphere is balancing inclusivity—that is, welcoming a broad range of voices that have a legitimate interest in participating—and epistemic rigor, which entails ensuring the credibility and methodological soundness of knowledge claims. As more organizations release reports on AI's environmental impacts, international institutions are keen to recognize the diverse contributions. However, framing the debate as a global dialogue legitimizes a wide spectrum of epistemic claims, thereby shifting the burden of credibility assessment onto expert organizations and individuals, who must independently evaluate the reliability of the information they encounter. The technical public sphere in which reports are produced and circulated

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demands vigilance against the circulation of poor-quality evidence because of either a lack of appropriate expertise or that the evidence is produced in bad faith, a longstanding issue for other mediators of expertise, such as journalists.

The Tacit Dimension of Institutional Expertise

Each framework highlighted thus far can be used to analyze different dimensions of expertise in the context of the technical public sphere. The publication of reports in the technical public sphere transforms the way expertise is acquired and distributed. It allows experts to participate in communities of practice at the same time as it enables various actors to intervene in the making of epistemic communities and the definition of the best epistemic methods to study the environmental footprint of AI. Against this background, international knowledge institutions act as facilitators of a global dialogue without fully acknowledging the difficult task of evaluating the validity of expert claims when endorsing their role as mediators of technical public debates.

Institutions face significant challenges when trying to present themselves as objective within the technical public sphere. Daston and Galison (2007) show that the rise of mechanical objectivity in the 19th century was intertwined with scientists' efforts to eliminate their own subjectivity when making observations. This form of objectivity came to dominate the modern era and continues to be an implicit reference in institutions (Jasanoff, 2011; Laurent, 2023). However, it has also drawn criticism. Recognizing the "view from nowhere" that mechanical objectivity implies is an illusion, one that can obscure the power dynamics among social groups, Haraway (1988) advocated for "the view from a body, always a complex, contradictory, structuring, and structured body, versus the view from above, from nowhere, from simplicity" (p. 589).

Exploring the situatedness of institutions requires analyzing their tacit knowledge. At the international level, Jasanoff (2011) notes that "global policymaking unfolds in a zone of tacit knowledge and inexplicit rules" (p. 1). Because objectivity in expert circles is a cultural product, expert organizations develop distinct techniques for establishing objectivity depending on their context. For example, Jasanoff observes that in Germany, deliberative processes are favored to validate knowledge claims, whereas in the United Kingdom, authority tends to be vested in elite figures who speak publicly on technical matters. In the United States, objectivity is primarily grounded in scientific evidence. At the level of the European Union, Laurent (2023) highlights how institutions acknowledge the national backgrounds of experts involved in technical debates as a way of representing member states' interests. These varied conceptions of objectivity are closely tied to the practices used to mobilize and display expertise in the technical public sphere.

Further study of the tacit dimension of expertise in institutions is therefore essential to better understand how objectivity is constructed in these contexts. To our knowledge, no existing framework captures the tacit knowledge of organizations that aim to build and claim expertise. The publication and dissemination of reports in the technical public sphere offer a valuable opportunity to do so. Reports often include forewords, executive summaries, and methodology sections that offer insights into how their authors understand objectivity. These documents can also reveal the tools institutions use to structure dialogue. For instance, institutions may need to identify and engage relevant individuals or organizations, issue calls for

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contributions, or invite input from civil society and industry actors on draft documents. They may assign different weights to contributions based on methodological rigor or stakeholder interests. Institutions can also formalize participation rules to help balance power dynamics between civil society and industry and may invoke international legislation to legitimize their actions. The ways in which these processes are made visible or remain hidden in reports can provide critical insights into the values institutions uphold as they shape discourse in the technical public sphere (Hilgartner, 2000).

Conclusion

The publication and dissemination of reports have become an integral component of expertise within the technical public sphere. We have shown how reports raise fundamental questions about how expertise is acquired and distributed in technical public debates. We have also examined the inherent tensions within the concept of expertise and how these tensions manifest through three analytical frameworks: the community of practice, the epistemic community, and the international knowledge institution. The notions of a community of practice and an epistemic community highlight the networked and relational character of expertise. Digital tools now allow individuals within organizations to engage with these communities, developing tacit skills and practices (communities of practice) and producing or accessing codified knowledge (epistemic communities). Through the publication of reports, organizations and experts can attempt to join or gain standing within these communities, establish credibility, enhance their expertise, or influence decision-making processes. With these networked models in the background, the international knowledge institution framework draws attention to how institutions navigate the challenge of legitimizing certain perspectives within sociotechnical debates. However, these institutions often present themselves as neutral platforms fostering global dialogue across conflicting viewpoints, and this stance can obscure important questions about the quality of evidence, institutional biases, and the situated nature of knowledge production.

The proliferation of reports in the technical public sphere reinvigorates Collins and Evans' (2002) "problem of extension" (p. 235), that is, the challenge of determining who is a legitimate contributor to technical decision making. By framing controversies as global dialogues, international knowledge institutions often promote inclusivity, reflecting democratic ideals. However, this inclusive approach can clash with the pursuit of epistemic rigor, particularly when actors strategically use quantification to advance their own interests. Research has shown that businesses may adopt the appearance of scientific credibility to legitimize their positions and sway technical debates (Franta, 2022; Oreskes & Conway, 2010). Our concern is that emphasizing inclusion as a core value may obscure the need to uphold robust mechanisms that protect epistemic integrity and distinguish credible knowledge from strategic or self-serving claims.

These issues carry both theoretical and practical implications. At their core, debates over the technical public sphere are also debates over how objectivity is understood, performed, and mobilized in public discourse. Scholars in STS have long warned against an uncritical reliance on experts, noting that experts are never entirely neutral, as they carry assumptions and values and often intervene in spaces where the boundary between science and politics is not fixed (Callon et al., 2011; Epstein, 1995; Jasanoff, 1990). In this context, the publication of reports both raises questions about and offers avenues to explore the relationship between experts and objectivity in the technical public sphere. In publishing reports,

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nonscientific expert organizations do not merely adopt a passive role, waiting to be consulted, but actively assert epistemic claims to offer their own perspective in public. These reports offer a lens into the tacit dimensions of expertise, revealing what experts choose to highlight or obscure in their own ideals of objectivity. This opens new avenues for examining the objectivity of both individual experts and emerging expert institutions, with the broader aim of enhancing the quality and accountability of debates in the technical public sphere.

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Appendix

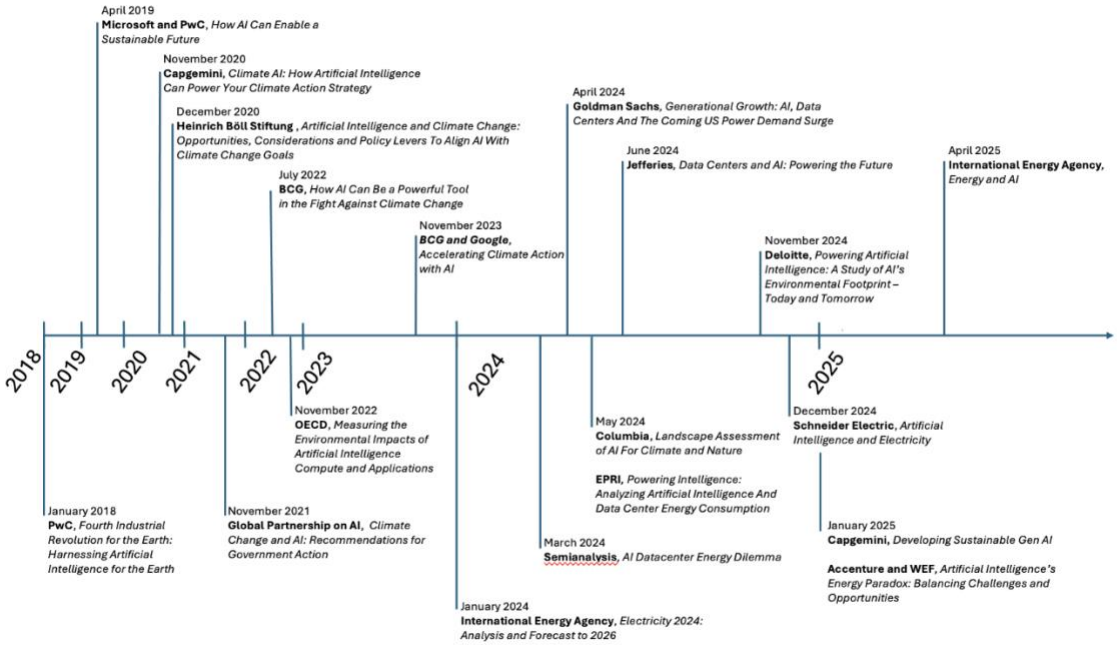

Figure 3. Chronology of the reports on the environmental footprint of AI considered in this study.

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