9

The IPCC as Expert Knowledge Commons

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9.1 INTRODUCTION

"Knowledge commons" describes a research framework aimed at characterizing and understanding processes of governing knowledge and information shared in collective or community settings. The rhetoric of commons is often linked to the intuition that knowledge commons is, or ought to be, associated with inclusive and collaborative knowledge production and distribution. This chapter describes and builds on the opposite intuition, that knowledge commons governance may be associated with the construction of expertise and expert authority, which is to say, governance of a sort of collective epistemological exclusivity. It offers a brief review of the Intergovernmental Panel on Climate Change (IPCC), as an illustration of what the chapter refers to as expert knowledge commons.

The IPCC was established in 1988 as an intergovernmental body of the United Nations, charged with advancing scientific knowledge about climate change in order to inform public policy decision-making. As an institution and instrument of authority grounded in scientific expertise, the IPCC has come to play a critical role in advancing political, cultural, and economic awareness of the character of climate change. The IPCC has been the subject of a great deal of research, none of which has focused directly on the manner in which its authoritative status rests both formally and informally on multiple layers of shared knowledge, information, and data. Examining the IPCC as expert knowledge commons highlights the essential role that knowledge commons analysis plays in understanding intersections between knowledge governance and scientific expertise both generally and with respect to environmental policy and the applications of climate science specifically.

The chapter is organized as follows. Section 9.2 describes the Governing Knowledge Commons (GKC) research framework and earlier GKC studies connecting it to expert scientific knowledge and to expertise and authority generally. Section 9.3 describes a model of expert knowledge commons inferred from the GKC case studies summarized in Section 9.2 and links that model to key research on the character of expertise and authority. Section 9.4 illustrates the model with a

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brief review of the IPCC as expert knowledge commons. The GKC research framework is deployed not as a device for a full-fledged case study of the IPCC as knowledge commons but instead as a means of drawing out elements of the IPCC, and earlier research on the IPCC, that can be productively characterized in knowledge commons terms. Section 9.5 concludes with some implications and suggestions for further research.

9.2 GOVERNING KNOWLEDGE COMMONS AND THE INSTITUTIONS OF EXPERTISE

GKC research has previously addressed knowledge commons governance in the context of scientific knowledge. This section extracts key elements of that earlier research in order to direct attention to the uses of the GKC framework in understanding institutions of expertise and authority themselves.

9.2.1 *The Elements of the GKC Framework*

The GKC research framework is used to capture key elements of governance contexts involving (i) knowledge, information, and data resources that are (ii) shared within or by a community or collective, and (iii) subject to social dilemmas (Frischmann et al. 2014). "Commons" and "knowledge commons" are, in this framing, labels that attach to the governance strategies used to respond to those dilemmas rather than to the resource(s) or to the community/ies involved. Full open access, sometimes associated with the public domain in intellectual property law, is a governance strategy that partly solves social dilemmas associated with next-generation innovators needing access to earlier technological inventions. (The public domain, in short, is not "a commons.") Open source licenses for computer software are governance strategies that solve a dilemma associated with software developers to coordinate with one another in building complex computer programs. The GKC framework is described in the Introduction to this volume.

The pairing of shared knowledge resources and institutional context stands in contrast to a typical focus in the history of ideas and the progress of knowledge on individual contributions by individual thinkers, inventors, creators, and practitioners. Conventionally, where knowledge or information is treated as a pooled resource, it is often characterized in both cultural and legal senses as "open" or "public." The GKC perspective navigates between those two poles, by observing that individual actors are characteristically operating in important communal or collective contexts, and that even "open" or "public" information either poses or responds to social dilemmas.

The term "commons" offers only a modest amount of normative or categorical guidance, aside from aligning the framework with the earlier work of Elinor Ostrom describing commons governance largely with respect to natural or biophysical

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resources (Ostrom 2005). Instead, the key contribution of the GKC framework is its focus on the production and distribution of shared (often pooled) information and knowledge resources in their institutional settings. Whether or not a case study of knowledge commons is directed to a "commons" as opposed to "a corporation" or "a clearinghouse" or some other institutional setting is far less significant than whether the analytic framework offered by GKC research contributes significantly to understanding institutional dynamics (Madison 2024).

9.2.2 *GKC Case Studies Addressing the Origins of Expertise*

GKC research has proceeded to date largely via qualitative case studies. Four of those stand out here for their utility in illustrating how GKC-style analysis helps to frame research on expert knowledge commons.

In "The University as Constructed Cultural Commons," I, along with Frischmann and Strandburg, interpreted the evolving form of the research university through history as a story of the evolution of a multilayered or polycentric knowledge commons (Madison et al. 2009). Whether looking at the US experience, the history of higher education in Continental Europe, in the UK, or elsewhere around the world, any given model of the university and any given specific institution constitutes primarily an exercise in governing the production and distribution of specialized, shared bodies of knowledge through teaching, research, scholarship, and the composition and curation of libraries, archives, and collections. Bureaucratically, universities are organized into faculties, schools, colleges, and centers and institutes, formally marking the boundaries of communities that we know as research fields and disciplines, sometimes joining them in the pursuit of "interdisciplinary" collaboration. University administrators and faculty develop and apply rules for admitting both students and faculty colleagues to the rank of "inside" community participants of different sorts, granting them specialized training, capabilities, and control over the intellectual contours of different disciplines, practices, and professions. In many countries, especially the US, the specialized knowledge communities that define the university (and are defined by it) are marked physically by the boundaries of the university campus.

In "Commons at the Intersection of Peer Production, Citizen Science, and Big Data: Galaxy Zoo," I described a citizen science research project in astronomy (Madison 2014). A pair of junior astronomy researchers, then at Oxford University, faced a research question where the relevant data (images of galaxies) could be analyzed only by hand and eye (given the technology of the time) and therefore, using conventional "insider" faculty and student labor, only over an extended period of time. To accelerate the research, the insiders built a web-based system that shared the image data with the public and invited "ordinary" citizens to participate in the data analysis. The result was, among other things, the formation of an especially successful "citizen science" collective, known as the Galaxy Zoo for its breadth, demographic diversity, and unifying theme. Without expressing the intention to

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do so directly, the project's academic leaders in effect created modest "researcher identities" among many of those who contributed their time and talents, without the certification or validation that typically accompanies the pursuit of disciplinary training, and without the tight control over development and distribution of disciplinary knowledge that is often characteristic of the academic enterprise.

In "The Republic of Letters and the Origins of Scientific Knowledge Commons," I looked to the earlier practices of scientific communication in late seventeenth- and eighteenth-century Europe, the UK, and colonial America that came to be called the "Republic of Letters," after the fact that the bulk of the communications constituted letters written and delivered by individual investigators to other individual investigators (Madison 2021). What we recognize today as early forms of scientific knowledge were produced and documented in the first place by individuals who were in the process of developing versions of a scientific method in the isolation and privacy of their respective homes. Transmitting their findings to one another, and then, per customs that evolved across decades, retransmitting the letters and ultimately authorizing their publication in early scientific journals, enabled the emergence of an early community of publicly identified scientists, even if that modern label did not exist at the time. They were individually engaged in communal scientific practice, including early forms of peer review, built on the foundations of purely private, and often recreational, inquiry.

In "The Kind of Solution a Smart City Is: Knowledge Commons and Postindustrial Pittsburgh," I examined practices of technology- and data-reliant urban administration in one modestly scaled American city, Pittsburgh, beginning in the early twentieth century and continuing through the contemporary "smart city" era (Madison 2023). The "smart city," I concluded, represents a synthesis of technological and administrative expertise and political and administrative power, collecting data from citizens and deploying analytics technologies with scant participation or oversight from the community, broadly considered. The shared or commons character of the phenomenon lies in the manner in which data is shared across a technocratic polycentric order, organized institutionally in public sector actors (city and county governments), private sector actors (large and small technology vendors), private philanthropies (funding much of the administrative systems necessary to build effective collaborations between the two), and the region's two major universities (sources of both technological expertise and public policy expertise).

Section 9.3 builds on these case studies, offering and illustrating a preliminary model of expertise knowledge commons that will be illustrated in Section 9.4 by the IPCC.

9.3 A MODEL OF EXPERT KNOWLEDGE COMMONS

Robin Mansell (2013), following Nelson and Sampat (2001), uses the phrase "social technology" to describe different patterns of authority and control over shared

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information resources. She describes versions of "constituted authority" (longer-standing, more formalized forms and procedures of authority, more likely to be useful where the relevant knowledge accumulates in durable forms over time) and "adaptive authority" (more fluid forms and procedures, more likely to be useful where information and knowledge is developed for near-term application).

Expert knowledge commons characteristically is an instance of the former: constituted authority. But that label begins the inquiry rather than closing it. The question remains: Where does expertise come from? How does the authority of expert knowledge commons arise? How does it operate, change, and perhaps expire? In what respects does looking at expert knowledge commons in terms of the conceptual syntax of commons and knowledge sharing add to or refine existing scholarship on expertise and expert communities?

A model anchored in the GKC framework gets us started on responses to those questions.

9.3.1 *Expertise: Lessons from GKC Research*

GKC researchers to date have largely avoided characterizing their research in terms of building models and instead have relied, as Ostrom often did, on the idea that GKC research builds from a common research framework. Here, I undertake preliminary steps in the direction of offering one model of knowledge commons in one domain: expertise and expert communities.

The three GKC case studies described earlier yield, preliminarily, the following attributes that are characteristic of expert knowledge commons:

[1] *New knowledge, or mechanisms for generating knowledge resources. The relevant resources may constitute a pool of "resource units" or a body of propositional knowledge or knowledge of methods, processes, (at times) associated skills, that is not necessarily decomposable into units or flows.*

The protoscientists of the Republic of Letters generated knowledge via observation and experiment, documenting their results and sharing them with one another; the citizen scientists of the Galaxy Zoo generated almost innumerable small-scale items of knowledge – observations and classifications of galaxies – that were pooled via the Zoo mechanism. University-based researchers throughout history have developed new knowledge via study, analysis, observation, and experiment. The "smart city" generates new knowledge and information via the collection of massive quantities of observational data.

The knowledge or information in question need not always be novel or inventive, as if expert communities are grounded in concepts often associated with patent law. "Expertise" often is associated with decision-making or action by others (Grundmann 2017), but as I derive the model, I assimilate that narrower reading of "expertise" to the broader category of "knowledge." Here, the substance of the resource has some specialized character, because of the costs of obtaining

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it or documenting it (in time, labor and skill, or money). Collecting, gathering, analyzing, organizing, or synthesizing previously developed knowledge, located metaphorically both "inside" or "outside" the community, may be a useful foundation for a body of expertise. The uses of expertise may vary from field to field and over time.

[2] *Codified knowledge, or mechanisms for embodying knowledge durably as true, factual, and/or authoritative within the community or collective.*

The Republic of Letters produced an actual body of letters, many of which later found their way into printed scholarly publications. The data collected via the Galaxy Zoo were gathered in a massive database, which was the basis for a number of scholarly publications. (The citizen "scientists" were included as "authors" of some of those works, to the extent that scholarly publishers permitted that.) Academic researchers working in university settings produce journal articles, monographs, datasets, and other "scholarly" works. Smart city practitioners collect and house data in massive databases and construct computer interfaces for accessing them that may be accessible to expert public sector administrators.

Knowledge not only has to be shared from person to person but also has to be documented, in text or other embodied form – scientific instruments, for example – for it to persist across a population and across time and for it to be capable of being shared more widely. The mechanisms of embodiment might include forms of human practice, particularly where "expertise" consists of methods associated with craft or trades rather than forms of knowledge production associated with educational systems or scientific research. The mechanisms may be informal and normative, as in the case of prestige economies; may be systematized, as in the case of peer review for scientific publication; and may be anchored in law, as in certain provisions of copyright law that exclude certain forms of knowledge and human creation from copyright coverage, that is, that characterize certain material as "ideas," in order to render them accessible for downstream uses.

The fact that the codified knowledge resource and its mechanisms should be "durable" does not mean that they should be inflexible, nor that they should be, in effect, permanent. Universities usually have buildings, including housing and social spaces for faculty and students (at times), libraries (traditionally), and places for teaching and researching (classrooms, laboratories). But not all do. Mechanisms of knowledge production and contribution have to interrelate productively with mechanisms of codification. The "progress of science," a phrase that appears in the US Constitution as a justification for Western intellectual property law, means, among other things, that the progress of knowledge is associated with both expansion of communities and domains of expertise and also with changes to both. Codifying expert knowledge entails mechanisms for resolving conflicts among different claims to truth.

Codified or durable forms of shared knowledge may be and often are accompanied by shared tacit knowledge, some of which may be directed to means of codification, some of which may be directed to means of transmission or distribution, and

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some of which may be directed to means of adaptation and evolution. Those three dimensions of tacit knowledge are, to be sure, not sharply distinct from one another.

[3] *Associated knowledge, or mechanisms for confirming the association of individuals who create or embody knowledge with a collection of "experts" recognized internally (that is, within the group) as an authoritative custodian of both the resources and the processes of codification.*

The Republic of Letters was recognized as such in its own time by members of the correspondence network. The citizens in the Galaxy Zoo seem to have bonded themselves to the collective scientific effort by adopting some of the trappings and habits of professional scientists; the bonding was ratified and documented by the leaders' practice of publicly acknowledging the citizens' "authorial" contributions to their published work. In the university setting, in modern times the terminal degree is the standard currency used to recognize a person as a member of an expert community, even if not all full-time academic researchers have earned the PhD and not all holders of PhD degrees work as academic researchers. Academic rituals, notably installations of university presidents and vice chancellors and conferral of degrees, retain the color and pomp of medieval academic ceremony. The smart city phenomenon has become brand as well as practice, meaning that those who design, implement, and supervise the operation of smart city systems are well-aware of their insider status as practitioners of the smart city.

The expert community has formal and/or informal means of determining who is an expert and who is not, which is to say, for identifying and then reproducing itself, constituting itself as a body with privileged understanding of the knowledge that constitutes the "expertise." This entails a reasonable degree of purposefulness and collective self-awareness; it seems unlikely that a group of individuals would identify itself as an expert community, or would include or exclude a member, by inadvertence or accident. These may include educational pathways and certifications, such as the PhD; may include professional associations for disciplines and professionals; licensing systems administered wholly or partly by the state; rituals of communal recognition; and informal normative systems, again, perhaps more frequently associated with amateur or hobbyist practitioners who aspire to recognition as experts.

Membership rules may be more porous or more rigid, so that the expertise in question may be formally open to anyone, but understanding and use of that expertise may require formal or informal association of individuals with the expert community. Once "in" the community of experts, membership may erode over time (for example, an expert practitioner may change the direction of their research or practice) or, at the margin, the incumbent members may eject a noncompliant or nonparticipating individual. Expert communities may wither away as the relevant body of "expertise" loses its authoritative status (for example, in the late nineteenth century, as the "practice" of "patent medicine" gave way to science-based medicine, the "community" of charlatan practitioners gave way to a new community of trained

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physicians) or as subgroups split off and form their own expert groups, perhaps combining with other expert communities.

[4] *Translated knowledge, or mechanisms for groups and individuals outside the expert community for recognizing its existence, its status as custodian of a relevant body of expertise, and, where and when appropriate, the privilege of the group and its individual members to speak outside the group with legitimacy and authority on matters within its subject matter domain.*

The citizens of the Republic of Letters had no voice or audience for their correspondence until some of the letters were collected and published as parts of earlier scientific journals. The citizen scientists of the Galaxy Zoo saw their work rewarded via the development of online Galaxy Zoo research products and by the spillover of the "Zoo" citizen science model into other crowdsourced data analysis projects, as one lay-group-turned-expert modeled the pathway for others to do the same. Academic researchers are tasked with the central purpose of educating and training their own disciplinary successors and also transmitting relevant portions of their expertise to nonexperts, which is to say, undergraduates and other trainees. Smart city practice depends in the first place on ongoing trusted relationships among technical experts and administrative experts, and in the second place on reliance by the broader citizenry on the expertise of those who "run" their communities.

Polycentricity is, among other things, the term that captures the concept that governance practices, including knowledge commons governance, are constituted by interactions among rules and actors operating in intersecting and overlapping institutions or informal groups (Aligica and Tarko 2012). "Translated knowledge" signifies that expert knowledge commons are characteristically polycentric. There are expert insiders and both nonexpert outsiders and other expert outsiders; the presence of boundaries and divides among them is cause for exploring patterns of porosity and influence rather than a means of isolating expertise only on one side of the proverbial line. Acknowledgment of an expert knowledge commons by other experts or by outsiders is often central to the authority and legitimacy of the group and of its efforts to share its knowledge via teaching, participation in public policy dialogues, and advocacy and decision-making of other sorts. That makes explicit the idea that legitimacy and authority are social phenomena, generated via mechanisms of transferring trust and judgments of credibility from the relevant audience to the relevant expert community, rather than phenomena associated inherently with the truth or accuracy claims of the expert knowledge commons passing from the inside to the outside.

These are, in short, recursive, feedback-driven processes. Once generated, the legitimacy and authority that build on that trust require continued credible internal expert practice. If the expertise-producing or membership-policing functions of the expert community fail or are corrupted, the broader legitimacy and authority of the expert community may be at risk. But internally consistent expert practice may not be sufficient to preserve the expert knowledge commons relative to outside

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audiences. The fact that expert knowledge commons always operate at the intersection of insider expert communities and various outside nonexpert or different expert communities means that legitimacy and authority may be challenged by political, economic, cultural, and social influences emanating from outside the expert knowledge commons.

9.3.2 *Antecedent and Allied Research on Experts and Expertise*

Why add a model to the GKC research framework? The framework itself offers a mechanism for aligning research on expert knowledge commons with research on other institutions that may be characterized as knowledge commons, such as data commons, open code, biobanks, and infrastructure commons. The model adds two important features. One, the model helps to make explicit the premise of GKC research that resources and institutional contexts – here, expertise and governance of expertise – are closely intertwined knowledge commons phenomena that can be, nevertheless, disentangled. The "expert community" (the institutional context) both generates and is generated by the production and transmission of expertise (the resource). Two, the model offers accessible analytic clarity ("is this institution a case of expert knowledge commons?"), prescriptive guidance ("how might this institution develop into an expert knowledge commons?"), and diagnostic utility ("what are the causes of the prosperity of the expert knowledge commons, or its fragility?"). The uses of those questions are illustrated in Section 9.4.

Intellectual continuities should be noted along with these departures. Other scholars have hinted at least briefly at the concept of the "expert commons" as a species of knowledge commons (De Moor 2011) but have not pursued the subject in any depth. Other research traditions and key earlier work wrestles with some of the themes included in the GKC approach but often not in the comparativist vein that motivates it nor consistently in attention to governance processes alongside the character of knowledge or authority as such. Inevitably, given the brevity of this chapter, the following review is incomplete.

In the history and philosophy of science, in different respects Michael Polanyi (1962), Robert Merton (1974), and Thomas Kuhn (1962) each emphasized community, community identity, and the cultivation and uses of knowledge both within structured groups or by structured groups, as fundamental to the development of knowledge, and particularly scientific knowledge, by individual researchers. Similarly, Haas (1992) consolidates research on epistemic communities, operating both within and beyond scientific research. Jasanoff (2005, 255) uses the phrase "civic epistemology" to describe institutionalized practices by which members of a given society test and deploy knowledge claims uses as a basis for making collective choices. Though much of the work organized around those contributions has focused on science, the development and codification of what we know today as the humanities similarly progressed through a series of institutional or collective

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forms, culminating in the refinement of universities and their schools and faculties (Wellmon 2016). Snow's division of the world of knowledge into scientific and humanistic "cultures" builds on that institutional foundation (Snow 1959).

Work on knowledge, learning, and material culture has been consistently attentive to institutional implications and to resulting implications for knowledge classification (Blair 2010), for canons of literatures (Searle 1990), and to the construction of material infrastructures, including scientific instruments (Daston and Galison 1992) and archives (Daston 2017), among other things. The concept of the "community of practice" as a model for learning apprenticeships (Wenger 2010) has long since escaped its original research and practice context and been used to model collective knowledge practices of different sorts, including copyright and creativity (Madison 2004).

Turning from scientific knowledge communities to research on expertise and disciplines, researchers in information science, sociology, and social epistemology have explored patterns of community definition (Brown and Duguid 2000; Abbott 2001) and the development of trust in expert communities in the context of formal epistemology (Goldman 2001). Histories of higher education draw attention to intersections among formal, public-facing institutions, on the one hand, and "invisible colleges" or intellectual networks (Kealey and Ricketts 2014), such as disciplines, on the other hand, where the latter may or may not be formalized via professional societies, conferences, journals, and otherwise.

Questions of trust in and reliance on expert communities bring in larger issues of institutional design and political legitimacy, recalling Hayek (Hayek 1945) as well as the different views of Walter Lippmann (for) and John Dewey (against) as to the proper role of technical experts in confronting public policy problems arising from the complexity of modern society (Lippmann 1922; Friedman 2019). Debates over the relative merits of decentralized and centralized collections of experts and expertise in public administration persist to this day (Chandler 1998; Lofthouse and Schaefer 2024).

Last but far from least, the legal system itself makes important contributions to understandings of expertise in institutional context. In *Daubert v. Merrell Dow Pharmaceuticals, Inc.*,[1] the US Supreme Court adopted an interpretation of the Federal Rules of Evidence mandating that expert testimony may be admitted into evidence in federal cases only so long as the testimony is grounded in "scientific knowledge," that is, so long as the testimony relies on knowledge generated according to scientific methods. The *Daubert* approach aims specifically to exclude from judicial proceedings so-called junk science and pseudoscience (Golan 2007).

In sum, it appears that (to date) the interrelated dynamics of bodies of expert knowledge ("expertise"), bodies of experts ("expert communities"), and governance of knowledge and information sharing within and across those communities and

[1] 509 U.S. 579 (1993).

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adjacent communities have not been summed up into a model or system that permits ready comparative institutional analysis. Gustafsson (2021) comes close, blending substantive expertise, relational expertise, technical knowledge, situated knowledge, and communitarian perspectives, but not recognizing the sum of those pieces as a system of knowledge governance.

Relative to the IPCC itself, O'Reilly and coauthors, in an extensive ethnographic study of the scientific review processes operating inside the IPCC, distinguish the organization from the "traditional" epistemic community described by Haas (1992) yet draw a sharp line between the review processes undertaken by IPCC authors and governance, which seems to be what happens elsewhere, in the policy and decision-making spheres (O'Reilly et al. 2024). Miller and Edwards link expert knowledge with environmental policy (Miller and Edwards 2001), rightly steering away from a linear model by which expertise migrates from knowledge communities to decision-making communities, but without developing a single concept usable for analyses of knowledge governance generally. That is the contribution of a model of expert knowledge commons.

9.3.3 *Dealing with Drawbacks and Gaps in the Expert Knowledge Commons Model*

Models simplify. Using models presses researchers to examine conformity between the abstractions of the model and the case on the ground. Elements of the GKC research framework are subsumed in judgments associated with modeling expert knowledge commons, suggesting drawbacks and gaps. At the same time, models press researchers to examine alignment and consistency in how institutional concepts extend from one setting to another; operating manifestations of underlying structural patterns may be more important than functional details. In practice, the model and the framework should be deployed alongside one another, so that the possible absence of nuance and flexibility in the model can be recovered via the framework. Section 9.4 illustrates that rhythm in its case study of the IPCC. Section 9.3.3.1 briefly anticipates that illustration with a catalog of material that the model appears to exclude and that the framework might reintroduce.

9.3.3.1 What the Model Omits

Research using the GKC framework characteristically begins by exploring institutional history, both purposive and accidental or inadvertent. The model captures only a snapshot of institutional practice at a given moment in time.

The framework encourages attention to the character of shared "resources," including knowledge goods or items that compose a knowledge "pool," an adaptation of focus in the Ostrom tradition on shared "goods" and, by extension, on characterization of those goods in terms of the economics of property: private goods,

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public goods, club goods, and "common pool" resources. By contrast, even if the GKC framework were invested in that taxonomy, the model as outlined earlier may assume a body or pool of expertise that is not decomposable into units or flows of information. As a result, the GKC framework may be used to analyze knowledge-sharing practices in which shared knowledge is manifest even while the shared material does not constitute a collection of immaterial "things." Frischmann's study of "common sense" commons offers an illustration (Frischmann 2021).

The GKC framework emphasizes specific "action arenas" and specific governance strategies deployed within them often referred to as "rules in use." Those strategies may be polycentric and nested. By contrast, the model defaults to identifying unspecified "mechanisms" rather than "rules in use." Expertise may or may not have material or virtual "venues" or "locations."

Last, even though the GKC framework is in itself a means for engaging in descriptive research, it encourages researchers to develop and apply clear standards for evaluating the normative implications of knowledge governance institutions. The standard starting point is the institution's success in addressing the social dilemmas that prompted development of knowledge commons governance strategies. Looking beyond that beginning, however, evaluating commons governance effectively and consistently has proved elusive, because questions inevitably arise as to the virtues of assessing institutional performance using externally imposed criteria (such as responsiveness to social need; compliance with formal legal systems; sustainability; efficiency; or fairness) or internally imposed criteria (such as the extent of voluntary community participation; transparency; and responsiveness or accountability to community members). By contrast, the expert knowledge commons model includes no normative assessment features. That omission is salient in light of material that the model highlights, which is considered next.

9.3.3.2 What the Model Highlights

The expert knowledge commons model sharpens awareness and understanding of certain features that research using the GKC framework may otherwise obscure.

The model draws attention to the nuanced character of the purposes motivating the development of expertise. Expert knowledge commons typically have designs, even if those designs may emerge over time. GKC research has long acknowledged that "commons happen" sometimes; not all knowledge commons are purposeful responses to social dilemmas involving shared knowledge resources. The focus on purpose brings forward key questions about the development, constitution, and evolution of disciplines, fields, and professions. How do these come into being? What patterns of collaboration and leadership, on the one hand, and technological, economic, and cultural conditions, on the other hand, contribute productively to the cultivation of expertise and expert communities, both inside and outside practitioner groups? What patterns undermine the development of expertise? In the

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modern era, data science is an example of a new field of expertise motivated largely by technological and economic conditions. A century ago, recognition of the field of forensic science received a substantial boost in the Sherlock Holmes stories of Sir Arthur Conan Doyle.

The model draws attention to distinctions between centrally managed commons, in which mechanisms guiding the use and maintenance of resources are determined largely by actors operating outside the community, and user-managed commons, in which the opposite condition applies. Any given expert community is likely to involve a combination of the two, leading potentially to conflicts between the difference governance strategies and the actors involved in each and to attention to power dynamics within an expert community (between junior and senior experts, for example) and between expert communities and external institutions or actors (such as nonexpert community groups or political actors).

The model draws attention to the role of expertise as a vehicle for social and cultural authority. Because expertise is largely relevant to the extent that it is incorporated into governance processes or strategies of other sorts, the uses of expert knowledge commons in mediating between actors on the inside of the expert community and actors and institutions on the outside are particularly significant. The model therefore brings the politics of expertise and expert communities into focus, engaging questions of normative and descriptive legitimacy and of possible harm produced by reliance on outdated or corrupted expertise and expertise improperly equated with social status or uncritically aligned with political power, in ways that the GKC framework, as a mechanism primarily aimed at descriptive analysis, is not obviously equipped to do. The collected GKC case studies focusing on governance of urban data and "smart city" technologies illustrate the tensions between normative framings (planning experts' overreliance on technocratic solutions to urban governance dilemmas) and descriptive ones (surfacing the details of technology implementations and human oversight) (Frischmann et al. 2023).

Last, the model anticipates understanding the erosion and possible demise of authority. Much knowledge commons analysis depends conceptually on identifying conceptual and material boundaries of various sorts, along with the processes through which contests over boundaries are initiated, conducted, and resolved. Boundaries may be more or less clear, distinct, firm, fixed, fair, and accurate, or durable. Understanding how boundaries are built and managed is to take, usually, an optimistic view of governance; understanding the failure of boundaries is, usually, to look cynically or pessimistically. The changing patterns of recognized expertise over time turns the erosion of boundaries into a central theme.

9.4 THE IPCC AS EXPERT KNOWLEDGE COMMONS

This chapter originated in the instinct that the IPCC would offer a full-blown knowledge commons case study. The quantity of scholarly literature examining the

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IPCC in different respects made that approach seem unproductive, in the sense that the IPCC's status as an institution synthesizing scientific knowledge for public policy decision making has been uncontroverted for a long time (Beck 2011).

The character of the IPCC's status as an expertise-based organization has long been contested, especially within the community of scholars of scientific knowledge and environmental policy (Boehmer-Christiansen 1993; Shackley and Skodvin 1995; Shackley 1997; Beck and Forsyth 2015; Grundmann 2023). That contest leads to the proposition advanced here, that the expert knowledge commons model derived earlier offers a novel and useful way to understand the IPCC both in its own settings and as an illustration of the utility of the GKC approach generally, beyond climate policy and beyond scientific expertise.

9.4.1 *What Is the IPCC?*

The following uncritical, abbreviated history of the IPCC and its operations sets the stage for using it to illustrate the expert knowledge commons model, borrowing generously from earlier research results that echo the themes of the GKC research framework.

The IPCC was established in 1988 as an intergovernmental organization initially formed by the World Meteorological Organization (WMO) and the United Nations Environment Programme and endorsed shortly thereafter by the United Nations General Assembly. The formation of the IPCC followed flurries of international activity as to climate, including convenings and syntheses of climate research by the WMO and by the International Council of Scientific Unions (Zillman 2007). Its purpose, as outlined in the corresponding United Nations Resolution,[2] has been "to prepare a comprehensive review and recommendations with respect to the state of knowledge of the science of climate change; the social and economic impact of climate change, and the potential response strategies and elements for inclusion in a possible future international convention on climate."

The IPCC has been, ever since, part of the organizational hierarchy of the UN, delivering expert knowledge to participants in negotiations under the United Nations Framework Convention on Climate Change (UNFCCC, adopted in 1992). The IPCC is governed by 195 member governments, acting through national delegations, who nominate and elect an IPCC Bureau of expert scientists (itself governed by an IPCC Executive Committee) to serve through an assessment cycle – usually six to seven years.

The IPCC Bureau supervises three Working Groups (climate science, impacts of climate change, and economic and social dimensions) and a task force, which undertake the IPCC's scientific work and produce periodic consensus-based "Assessment Reports" for use by policymakers and others. The Working Groups and

[2] UN General Assembly Resolution 43/53, December 6, 1988.

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their chairs are supported internally by Technical Support Units and rely on hundreds of external contributing authors and thousands of expert reviewers. A document titled "Principles Governing IPCC Work" (which includes three appendices), approved initially in 1998 and amended periodically since then, sets out the formal principles, practices, and procedures that govern the work of the IPCC, the IPCC Bureau, and the Working Groups and Task Forces.[3]

The IPCC has produced a total of six Assessment Reports to date and a handful of supplemental reports. The length and density of the Assessment Reports means that policymakers are more likely to rely on briefer "Summaries for Policymakers" for each of the Working Groups. Following the release of the Fourth Assessment Report in 2007, the IPCC was awarded the Nobel Peace Prize, along with former US Vice President Al Gore, in connection with contributions to the state of knowledge about man-made climate change. The Fifth Assessment Report was part of the scientific foundation for the Paris Climate Accords in 2016. Nevertheless, the reputation and quality of the IPCC's work has been called into question, especially since the leak to the public in 2009 of certain internal documents that criticize the IPCC's methods for evaluating different scientific contributions and indicate various sources of bias in constituting participation in the IPCC's consensus-based processes, coming from within the organization and from external critics.

Even in this uncritical review, clear themes emerge that feed directly into using the IPCC to illustrate the expert knowledge commons model. As observers have said from the earliest days of the IPCC, the IPCC is not purely a scientific organization; it combines formal governance by political actors (hierarchically organized member governments) with both formal and informal governance by scientists, acting as twentieth- and twenty-first-century scientists typically do: in self-governing, peer-assessed scientific communities (Boehmer-Christiansen 1993). Both "wings" of that polycentric governance architecture are supported in large part by formal, technical, hierarchical bureaucracies of the sort familiar to anyone experienced in international relations but foreign, at least at the scale at which the IPCC has operated, to research science. The IPCC combines centralized bureaucratic governance and decentralized community governance in unprecedented and still unmatched ways.

The fact that the IPCC has been as successful as it has been in producing Assessment Reports, acquiring widely if not universally recognized status as an authoritative voice on matters of climate science and influencing international climate treaties is remarkable, in a way, given the fact that it addresses two noteworthy, interrelated social dilemmas (Madison et al. 2022). One, scientists working in climatology and related fields up through the mid 1980s, together with corresponding government actors, realized that the proper way to address the harms of human-made climate change was to coordinate decisions and actions by national governments. This was, in Ostromian terms, a classic "tragic commons" social

[3] All of the foregoing is both summarized and available in detail at the IPCC's website, ipcc.ch.

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dilemma at a global scale. Two, addressing the governance dilemma as to global environmental policy and action required organizing a mechanism that had never before been produced successfully: a means for compiling and synthesizing scientific evidence to inform coordinated global decision-making. This was, in GKC terms, a knowledge commons social dilemma, one framed partly by the need to make sense of an abundance of diverse scientific information and data (Madison et al. 2022), including not only geophysical data but also social science data, and partly by the need to make sense of that data in a way that would be useful and persuasive to lay audiences.

9.4.2 *The IPCC as a Model Expert Knowledge Commons*

The chapter concludes by pulling together observations and research about the IPCC to support its claim that the IPCC meets the criteria of the model expert knowledge commons, both supporting and extending arguments for reform of the IPCC and also enabling comparative research that aligns analysis of the IPCC analysis not only of other organizations undertaking research on climate change but also of other expert institutions, organizations, and communities, scientific and otherwise, as forms and practices of knowledge governance.

[1] *New knowledge, or mechanisms for generating new knowledge resources.*

[2] *Codified knowledge, or mechanisms for codifying knowledge durably as true, factual, and/or authoritative within the community or collective.*

These two features of the IPCC should not be in doubt, given the summary earlier and what is widely known about the purposes, practices, and products of the IPCC. As O'Reilly and coauthors write: "While the IPCC claims to not produce new knowledge, our previous studies disagree. The IPCC process and its reports synthesize and reorganize existing knowledge, drive research agendas, and inspire new research questions" (O'Reilly et al. 2024, 8) (citations omitted).

It is an error to limit understanding of the commons-relevant elements of the IPCC to the fact that its formal and informal review processes for gathering and integrating scientific research yield synthesized and documented new knowledge produced, formally, by "consensus" among scientific researchers, IPCC authors, and IPCC reviewers. Stopping there reinscribes a misleading linear framing of expertise production and delivery to decision-makers (Beck 2011). An equivalent error treats the IPCC and related scientific organizations as intellectual and bureaucratic infrastructures, feeding higher-order decision-making systems (Edwards 2017).

[3] *Associated knowledge, or mechanisms for confirming the association of individuals with a body of "experts" recognized internally (that is, within the group) as an authoritative custodian of both the resources and the processes of codification.*

With respect to the relative "self"-awareness of the IPCC as a community of expertise, the key is understanding the IPCC itself as a collection of people who constitute expertise but who may not produce expert knowledge in themselves,

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located both inside IPCC processes and adjacent to it. They are reviewing, sorting, assessing, and prioritizing the results of scientific research produced elsewhere.

Because the IPCC does not itself conduct scientific research, it faces a social dilemma caused rather than solved by its design as institution intended to collect and synthesize scientific research product by others. The expertise presumptively associated with individual researchers, aligning them with their home institutions (in part) and with their respective scientific or technical disciplines (in part), needs to be shared, in some salient, legible way, with the IPCC itself.

The governance solution to this dilemma, as it so often is in the world of academic research, lies in the character of reputation and prestige as a form of professional currency. Reputation and prestige in any field are partly institutional, so that a person taking a position in that organization may benefit by the institution's prestige being shared with the individual. The relationship works in the opposite direction: Individuals acquire reputations and prestige, which may be shared with an institution as part of the individual's becoming a member. Reputation and prestige circulate recursively within the institution and its constituent members, cross-cutting with reputation and prestige effects of individuals associating with fields, disciplines, professional associations, and the like. Prestige is far from free-floating; individuals must do the work, and be known for doing the work, that generates prestige effects. Function and symbol go together, if rarely hand in glove. There is no assurance that the dynamics of prestige will foster cooperation and prosocial behavior – that is, that governing prestige as an intangible resource will solve social dilemmas productively – but some evidence suggests that prestige effects may do just that (Henrich et al. 2015).

O'Reilly and coauthors focus on precisely this phenomenon in the IPCC context. Those administering IPCC processes both borrow and confer prestige benefits in order to align individual expertise with the institutional authority of the IPCC:

> Writing reports for the Intergovernmental Panel on Climate Change (IPCC) is a sociocultural experience shared among authors. Being selected as an IPCC author is generally considered a high-status service gig, one that offers no financial compensation. To be an IPCC author is to be identified by your nation, which nominates you, and the IPCC itself, which confirms you, as a leading climate scholar. One author noted that "my university president now knows who I am," suggesting, at a minimum, reputational benefits to the role. Authors also note the serious fun of scholarly assessment, getting to know other climate experts, having the opportunity to travel, and helping to make a difference with one of the most critical issues of our time. Authors also often publish with members of their chapter team or other people they work with in the IPCC; so along with the report citation, authors may get some publications or projects – the major expectation for university researchers' jobs – or secure new positions from the effort. (O'Reilly et al. 2024, 7–8) (citation omitted)

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The end point of this governing "prestige as knowledge commons," as this pattern might be known, is not simply reinforcement of the IPCC's status in itself. The IPCC acquires a sort of "prestige shell" or shield, an outer coating of authoritative status as the leading singular voice in climate science, that permits the IPCC to exercise that voice, and be accepted in decision-making processes, in intergovernmental processes and public dialogue on climate change.

In an analogous sense, in corporate law, Gindis and Cole argue that an equivalent process of knowledge governance bundles the entirety of a corporation's complex functions and identities beneath a singular "corporate mask," through which the corporation acts and should be held accountable in commerce and in law (Gindis and Cole 2025).

Likewise, the prestige and authority of the IPCC as an organization clearly depends on its sharing the prestige of the IPCC's associated scientific researchers, authors, and reviewers, along with the extended prestige associated with their collective reliance on accepted scientific methods in research and peer review. But the IPCC's prestige also stands on its own, in the sense that the shared prestige that the IPCC absorbs is also paid forward, in a way, as the IPCC's products (principally the Assessment Reports) are accepted as authoritative by the IPCC's stakeholders and audiences, or are at least intended to be accepted as such.

Finally, acceptance of and reliance on the IPCC's products by government actors and others reinforces the status and authority of the IPCC and its associated scientists and technical experts. These are recursive processes, complicated enormously by the many ways in which the state and science intersect, as Miller and Edwards (2001) noted long ago.

[4] *Translated knowledge, or mechanisms for groups and individuals outside the expert community for recognizing its existence, its status as custodian of a relevant body of expertise, and, where and when appropriate, the privilege of the group and its individual members to speak outside the group with legitimacy and authority on matters within its subject matter domain.*

The last element of the expert knowledge commons model focuses precisely on the spaces and practices where those recursive processes take place, where expert communities and audiences intersect. In this instance, it is the boundary where science and the state abut one another and overlap. Prestige is one form of shared knowledge resource in this instance; expertise itself is the general knowledge resource that spans and connects different communities. In both respects the shared character of the resource is a sort of institutional glue, holding the multiple centers of authority in a pattern that defines a coordinated whole. The dynamics of "prestige" in that pattern are described earlier. The dynamics of expertise as a resource need some additional explanation. Expertise is not a single, static thing to which experts contribute and on which others rely. Instead, what we refer to as expertise, even in its codified or documented forms, constitutes an evolving body of propositions and practices that takes on different colors and attributes in the hands of different stakeholders

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and their purposes. "Expertise" in this sense renders the definition of the expert knowledge commons model disappointingly unclear, at least at the edges. But it is the very fluidity of the boundary condition that permits "translated knowledge" to bind multiple communities into a single expert knowledge commons.

Boundaries imply a certain number of relatively fixed poles or nodes. In that sense the IPCC is, like expert knowledge communities generally, an example of polycentric social order. Scientific expertise is gathered, weighed, and documented, according to both scientific practices (peer review and consensus mechanisms) and hierarchical bureaucracies descended significantly external state-related constraints on the IPCC's design. Within the scientific center of order, there are multiple sources of scientific knowledge and expertise to be gathered, weighed, and documented; on the "state" side, the interests of different member states have to be identified and sorted.

Among the poles or nodes, rhetorical practices of documentation, translation, and persuasion can be collected as so-called boundary work, but here I distinguish the meaning of that term from its historical association with efforts by scientists to negotiate the separateness of their work from entanglements with market practices or with interference by the state. Examining the IPCC, Beck and Mahon (2018) usefully summarize recent research that casts the IPCC as a "boundary organization" practicing "boundary work" both in "proceduralist" terms (in which the scientific world and the policy world each retains a significant degree of autonomy around a boundary that defines their negotiating interface) and in "interpretive" terms (in which the boundary itself represents the negotiated interdependence of the two worlds. That judgment seems correct, and it helps to confirm the status of the IPCC as an expert knowledge commons within the scope of this last element of the expert knowledge commons model.

To this characterization of the "boundary" function represented and performed by the IPCC, I would add only the note that Beck and Mahon, like virtually all of the other researchers whose work they cite and discuss, spend far more time and effort disentangling the sociopolitical attributes of the IPCC as an organization and far less time disentangling the similarly multifaceted attributes of the knowledge resources that the IPCC is intended to marshal, document, and distribute. In that regard, the research of Star and Griesemer on "boundary objects," knowledge objects subject to different interpretations in the context of different, adjacent interpretive communities, is instructive (Star and Griesemer 1989). The IPCC's Assessment Reports are not quite "boundary objects" in that sense, but they perform an analogous function, enabling multiple communities of interest to coordinate their activities around common focal points. A system – an institution – results: the expert knowledge commons, oriented to a shared conceptual "map" of climate knowledge that is always simultaneously fixed, given its documentary character, and fluid, given the different intersecting ways that it may be "read" by different experts. The allusion to Schelling (1960) and research on focal points as coordination

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mechanisms is purposeful. Maps of knowledge create conceptual legibility; they help both researchers and practitioners see where their interests intersect, and how, and where they do not (Madison 2009). The knowledge commons literature resists reifying "commons" as a space or as a place, but on occasion the metaphor suits.

9.5 CONCLUSION: IMPLICATIONS AND FURTHER RESEARCH

This chapter has described a model of expert knowledge commons derived from research using the GKC framework, and it has illustrated the model via brief review of the IPCC. Modeling knowledge commons governance in any sector is necessarily tentative. The review here is preliminary, particularly in the sense that it takes as its subject mostly formal and stylized representations of the IPCC. The chapter relies on the premise that GKC research to date justifies taking this step in the direction of model building, and on the related premise that existing literatures on experts, expertise, and epistemology leave open space to document expert knowledge commons as the chapter proposes.

Specifying the elements of an expert knowledge commons model clarifies the implications of seeing the IPCC as an expert knowledge commons, meaning that those who would diagnose its successes, failures, and future opportunities have firmer specific grounds on which to base their assessments. Flaws, biases, gaps, and missed opportunities remain to be woven into the narrative, though the hope is that alignment of the IPCC with the model provides a guide for doing so, consistent with the model's derivation from the GKC framework. Continued exploration of the IPCC using the GKC framework gives both researchers and analysts the means to understand, in systematic ways, how the IPCC continues to evolve and adapt as an institution whose purpose is to support thoughtful policymaking. The model-based approach is necessarily comparatively static; the complementary framework-based approach is comparatively dynamic.

What difference does it make that the IPCC is viewed as an instance of expert knowledge commons, rather than as (for example) a cross-institutional scientific institution, an information clearinghouse or repository, an instrument of international relations, an instance of "civic epistemology," or something else?

The answer likely lies in the ways in which GKC analysis is used in multiple respects, but always comparatively, to draw attention to overlaps and parallels between knowledge commons institutions with related structural functions despite dissimilar outward appearances, and to overlaps and intersections among the different insider and outsider communities that participate in governance of shared knowledge and information. Future research and analysis might compare the IPCC as expert knowledge commons to other governance institutions building expertise and expert knowledge communities focused on climate science. The IPCC as an expert knowledge commons might be situated directly alongside other expert knowledge commons with recognizable (that is, legible and sometimes

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bureaucratized) expert knowledge commons: universities, schools, research organizations (industrial, academic, and independent), departments, degrees, certifications and licensing, disciplines, professions, and trades, each involving different blends of substantive shared knowledge, decision-making modalities, and intellectual and embodied skills.

Comparative analysis need not be limited to climate science expertise or to scientific expertise of any sort. Expert knowledge commons governance may be observed in practice in any number of domains of human activity, ranging from the general to the specific, from literary analysis to competitive sport. Literature on norm-governed creative communities, which produce original, creative material without relying on incentives offered by intellectual property law (Darling and Perzanowski 2017), may be assimilated easily to the expert knowledge commons model.

With respect to the IPCC itself and climate science generally, this case study and follow-on research can refine a general model for the role of shared expertise in environmental policy design, one that focuses not only on governance that addresses the social dilemmas associated with combining scientific research across multiple disciplines but that also addresses social dilemmas associated with documenting that body of knowledge and translating and transmitting it persuasively to nonexpert audiences. Scientific authority, like political authority, cannot and should not be taken simply as givens. Instead, scientific expertise should be examined – like any other community-based knowledge institution – for the dynamics of its construction, evolution, and effective application.

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