University of Pittsburgh School of Law

Scholarship@PITT LAW

2024

Knowledge Commons Past, Present, and Future

Michael J. Madison

Follow this and additional works at: https://scholarship.law.pitt.edu/fac_articles

Part of the Community-Based Research Commons, Comparative and Foreign Law Commons, Databases and Information Systems Commons, Data Science Commons, Digital Humanities Commons, Intellectual Property Law Commons, Internet Law Commons, Law and Society Commons, Political Economy Commons, Science and Technology Studies Commons, Technology and Innovation Commons, and the Theory, Knowledge and Science Commons

Recommended Citation

KNOWLEDGE COMMONS PAST, PRESENT, AND FUTURE

by
Michael J. Madison*

The project now known as Governing Knowledge Commons, or GKC, was launched more than 15 years ago on the intuition that skepticism of intellectual property law and information exclusivity was grounded in anecdote and ideology rather than in empiricism. Structured, systematic, empirical research on mechanisms of knowledge sharing was needed. GKC aimed to help scholars produce it. Over multiple books, case studies, and other work, the scope of GKC has expanded considerably, from innovation to governance; from invention and creativity to data, privacy, and markets; and from social dilemmas focused on things to governance strategies directed to communities and collectives. This short Article describes the origins, functions, successes, limitations, and ambitions of GKC research, aligning it with questions of law as well as with the many roles of information in 21st century society.

INTRODUCTION

Let us imagine, contra any number of philosophers, economists, and others, that building lives and getting along with others might be possible without relying entirely on public enforcement of private property rights of one sort or another. That liberty and freedom, as twin pillars of human flourishing, might be secured via sharing rather than hoarding, community rather than coercion. Use the word "commons" to denote that beginning. This Article sharpens the point, reintroducing "knowledge commons" and the knowledge commons framework to legal scholars and legal scholarship. The knowledge commons framework is a device, meant to guide research on community- and collective-based governance institutions for shared knowledge, information, and data. Is the imaginative premise correct? The answer is pragmatic rather than ideological.

Knowledge commons research begins with the assumption that sharing knowledge, information, and data effectively is both a substantial public policy challenge and an enormous policy opportunity, not only emerging from questions surrounding contemporary data, software, artificial intelligence, and the like, but also building on equivalent questions of long pre-Internet, even Homeric standing. Until recently, tools did not exist for grappling with either the challenges or the opportunities on a basis that is at once empirical, systematic, and broad as to both research domain and as to social, economic, and cultural sector. The knowledge commons research framework is one such tool. The purpose of the tool is not merely to generate scholarship that fills some conventional "gap" between law and sociotechnical developments or economics. Its purpose is to illuminate a different and powerful way of seeing and understanding social and technical systems primarily in terms of governance.

The framework was launched in 2009 and 2010 in articles published in U.S. law journals: *The University as Constructed Cultural Commons* in 2009[1] and *Constructing Cultural Commons in the Cultural Environment* in 2010.[2] As I explain below, it borrows from the well-known research of Elinor Ostrom but differs from and extends that work in significant ways. Later rechristened the "GKC research framework" or simply the "GKC framework" after the title of the first book of knowledge commons case studies to follow those papers (*Governing Knowledge Commons*),[3] the framework has supported and contributed to dozens of GKC-themed case studies in several edited collections,[4] plus a wide range of additional journal articles, book chapters, and other work.

Knowledge commons research is advancing in various social science disciplines and in a community of researchers oriented to the GKC framework itself. A number of those case studies have used the GKC framework in the context of data governance.[5] Efforts have begun to build on GKC case studies in order to develop policy guidance in data governance contexts.[6]

In law and legal scholarship, the framework has been less visible. Abbreviated discussions of knowledge commons in legal scholarship have been limited largely to

---

[1] Michael J. Madison, Brett M. Frischmann & Katherine J. Strandburg, *The University as Constructed Cultural Commons*, 30 WASH. U. J.L. & POL'Y 365 (2009).

[2] Michael J. Madison, Brett M. Frischmann & Katherine J. Strandburg, *Constructing Commons in the Cultural Environment*, 95 CORNELL L. REV. 657 (2010).

[3] GOVERNING KNOWLEDGE COMMONS (Brett M. Frischmann, Michael J. Madison & Katherine J. Strandburg eds., 2014).

[4] GOVERNING MEDICAL KNOWLEDGE COMMONS (Katherine J. Strandburg, Brett. M. Frischmann & Michael J. Madison eds., 2017); GOVERNING PRIVACY IN KNOWLEDGE COMMONS (Madelyn Rose Sanfilippo, Brett M. Frischmann & Katherine J. Strandburg eds., 2021); GOVERNING MARKETS AS KNOWLEDGE COMMONS (Erwin Dekker & Pavel Kuchař eds., 2021).

[5] *E.g.*, Madelyn Sanfilippo, Brett Frischmann & Katherine Standburg, *Privacy as Commons: Case Evaluation Through the Governing Knowledge Commons Framework*, 8 J. INFO. POL'Y 116 (2018); Michael J. Madison, *Biobanks as Knowledge Institutions*, in GLOBAL GENES, LOCAL CONCERNS 22 (Timo Minssen, Janne Rothmar Herrman & Jens Schovsbo eds., 2019); Michael J. Madison, *Commons at the Intersection of Peer Production, Citizen Science, and Big Data: Galaxy Zoo*, in GOVERNING KNOWLEDGE COMMONS, *supra* note 3, at 209 [hereinafter Madison, *Galaxy Zoo*].

[6] *E.g.*, Madelyn Rose Sanfilippo & Brett Frischmann, *Slow-Governance in Smart Cities: An Empirical Study of Smart Intersection Implementation in Four US College Towns*, 12 INTERNET POL'Y REV. 1 (2023) [hereinafter Sanfilippo & Frischmann, *Slow-Governance in Smart Cities*]; Madelyn Rose Sanfilippo & Brett M. Frischmann, *A Proposal for Principled Decision-Making: Beyond Design Principles*, in GOVERNING SMART CITIES AS KNOWLEDGE COMMONS 295 (Brett M. Frischmann, Michael J. Madison & Madelyn Rose Sanfilippo eds., 2023); Michael J. Madison, *Tools for Data Governance*, 2 TECH. & REGUL. 29 (2020).

research focused on intellectual property issues[7] and property law more generally.[8] A notable exception is a recent article on antitrust law.[9]

Below, to raise the profile of the GKC framework in legal scholarship and to suggest its utility to legal scholars, I describe the basic outlines of the framework and illustrate its application with highly streamlined summaries of GKC case studies, including some that speak to data governance. I offer some definitional clarifications, highlight some key themes in the work to date, and speculate briefly as to next steps and implications. Consider this Article a "tasting menu" of GKC-related topics rather than a deep exploration and review of the field.

Because data and information are essentially ubiquitous in social life and in law, even if their presence and significance are not always recognized, I want to be clear that none of what follows limits the uses of the GKC framework to intellectual property law, or data privacy, or related "hot topics" in law and public policy. Data governance is a critical element of environmental law, public health, corporate law, constitutional law, criminal law, national security, and urban planning, among other fields. Historians, economists, computer scientists, and information scientists all have found the GKC framework accessible and useful. Law professors and legal scholars across a wide range of interests may find it useful too.

I. THE BIG PICTURE

The GKC framework is a device for conducting research, especially research that focuses on case studies at small or large scales. Contrary to the lessons that some legal scholars take from Robert Ellickson's study of social norms among cattle ranchers, *Order Without Law*,[10] norm-driven governance can thrive even outside of small, demographically homogeneous communities. The size and character of the community or collective is a research question rather than an assumption influencing the choice of research subject.

Knowledge commons is not a theory. Nor is it a prescription or normative judgment. The framework was launched on the supposition that knowledge commons governance had been shown to be effective and sustainable in some salient contexts anchored in Internet systems—Wikipedia, for one, and Linux and Apache as open source software systems, for two and three. There persists a strong intuition that knowledge commons may be productively generative, particularly in that it

---

[7] *E.g.*, Zahr K. Said, *Craft Beer and the Rising Tide Effect: An Empirical Study of Sharing and Collaboration Among Seattle's Craft Breweries*, 23 LEWIS & CLARK L. REV. 355 (2019).

[8] James Grimmelmann & A. Jason Windawi, *Blockchains as Infrastructure and Semicommons*, 64 WM. & MARY L. REV. 1097, 1101–02, 1120 (2023).

[9] Amelia Miazad, *Prosocial Antitrust*, 73 HASTINGS L.J. 1637 (2022).

[10] ROBERT C. ELLICKSON, ORDER WITHOUT LAW: HOW NEIGHBORS SETTLE DISPUTES (1991).

serves as a parent concept to the narrower "commons-based peer production" described by Yochai Benkler.[11] It remains to be seen whether, where, and how those instincts generalize empirically and systematically.

There is precedent both for seeing knowledge commons as a significant phenomenon and for investigating commons on a sustained, systematic basis. Benkler and others (particularly those, like James Boyle, who celebrated the normative value of the public domain in intellectual property law)[12] followed the pathbreaking footsteps of Elinor Ostrom and her colleagues. Ostrom was awarded the Nobel Prize in Economics in 2009 for her decades of research on sustainable commons governance in natural resource systems.[13] Late in her career she and her colleague Charlotte Hess took preliminary steps to associate Ostrom's work with knowledge governance.[14] Ostrom and Hess did not build out a template for a full research program, and in some important respects—described below—the effort to simply extend Ostrom's conclusions to knowledge resources was (and is) flawed.

Even if the initial instinct sees commons governance as potentially valuable, no thumb should weigh too heavily on the positive side of the normative scale. There is every reason to suppose—and to research—when, where, and how commons governance is flawed and even harmful. As a research framework, the GKC perspective is a tool for understanding information practices, histories, and values in context, comparatively and institutionally.

II. AN OVERVIEW OF THE GKC APPROACH

A.   The Mechanisms of the GKC Framework

Knowledge commons is governance. That simple statement explains why GKC-based research does not search out instances that meet some definition of "commons" and explore its dimensions. Instead, GKC-based research searches out instances of shared knowledge, information, and data that prompt the need for, even the demand for, governance: mechanisms for people to get along in creating, using, and storing it.

Material in a knowledge commons system is not simply fully free and open; there are rules and guidelines indicating and sometimes determining appropriate

---

[11] YOCHAI BENKLER, THE WEALTH OF NETWORKS: HOW SOCIAL PRODUCTION TRANSFORMS MARKETS AND FREEDOM (2006).

[12] JAMES BOYLE, THE PUBLIC DOMAIN: ENCLOSING THE COMMONS OF THE MIND (2008).

[13] *Elinor Ostrom: Facts*, THE NOBEL PRIZE, https://www.nobelprize.org/prizes/economic-sciences/2009/ostrom/facts (last visited Apr. 28, 2024).

[14] *E.g.*, UNDERSTANDING KNOWLEDGE AS A COMMONS (Charlotte Hess & Elinor Ostrom eds., 2007); Charlotte Hess & Elinor Ostrom, *Ideas, Artifacts, and Facilities: Information as a Common-Pool Resource*, LAW & CONTEMP. PROBS., Winter/Spring 2003, at 111.

production and contribution, appropriate extraction and use, and appropriate cura-
tion, preservation, and even destruction. Knowledge commons is governance by a
community or collective of shared knowledge, information, and data resources.
Governance consists of systems (plural) of formal and informal rules and norms by
which members of that community or collective coordinate to resolve problems,
plan their affairs, and achieve their goals. Governance sometimes consists entirely of
"law," sometimes entirely of "social norms," sometimes of sociotechnical devices,
and often of blends of the three. Governance sometimes exists by design and inten-
tionality; governance sometimes emerges out of history, culture, path dependence,
and accident.

The GKC research framework encourages researchers to examine a case of
knowledge commons governance by breaking that brief summary into clusters of
related questions that can be asked and answered in a systematic way: Is there a
shared knowledge, information, or data resource? What individual and social prob-
lems arise by virtue of the shared character of the resource? Is there a community or
collective that produces or manages that data, and how is that community defined
and organized? What are the various rules and social norms that define the resource,
define the community, and determine how the resource is produced and managed,
presumably to respond to the problems with governance strategies and solutions?
What are the expected and unexpected outcomes, positive and negative, associated
with the practice of those rules and norms? What feedback loops connect responses
to those different questions? What spillover effects follow from this governance sys-
tem?

Relevant clusters of questions are represented schematically in the following
image, which accompanies several of the published GKC papers and books[15]:
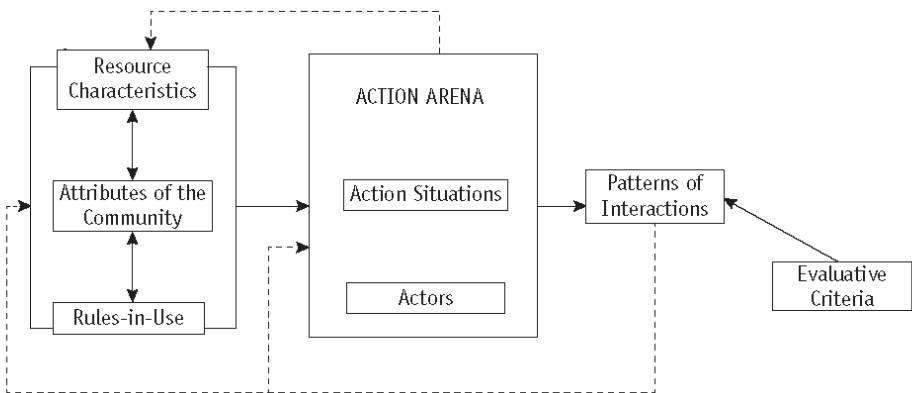

Figure 1

---

[15] *E.g.*, Brett M. Frischmann, Michael J. Madison & Katherine J. Strandburg, *Governing Knowledge Commons*, *in* GOVERNING KNOWLEDGE COMMONS, *supra* note 3, at 14.

The terminology in that schematic corresponds in part to the terminology developed by Ostrom for the Institutional Analysis and Development (IAD) framework published in *Understanding Institutional Diversity*,[16] notably the emphasis on "rules-in-use" (referring to formal and informal rulesets that define the relevant community and its practices) and "action arenas" (contexts in which relevant actors interact on repeated bases with respect to relevant resources). The GKC framework, like Ostrom's IAD framework, encourages researchers to open their examination with questions about social dilemmas caused by or linked to resource sharing, which is to say, conflicts between self-interested individual behavior and social or collective interests. The "classic" social dilemma in a shared resource context is Hardin's "tragedy of the commons,"[17] an echo of the centuries-old philosophical position, often associated with Jean Jacques Rousseau and *The Social Contract* (1762), that civil society is feasible only with a foundation in agreed-upon, enforceable systems of private property.

The affinities between the GKC framework and the IAD framework are important, but differences are important as well.

First, "resources" in the GKC context are not "biophysical" or given as they are in the IAD setting; knowledge, information, and data resources are produced by human systems, including legal systems.

Second, the IAD framework—indeed, virtually the entire corpus of Ostrom's research on commons governance—is premised on "resources" constituting "common pool resources" (CPRs): things that are shared but depletable. A fishery, a grazing meadow, a forest—things to which the "tragedy of the commons" may have applied because of over-consumption (that is, opportunistic behavior) and which Ostrom wished to show could be managed successfully by pro-social collectives. The GKC framework assumes the opposite, initially: knowledge and information resources are non-depletable, though they may be linked in complex ways to depletable resources. GKC research emphasizes openness as to the presence and character of social dilemmas (there may be more than one), without presuming concern about "tragic" commons.[18]

Third, the IAD framework is premised largely on the assumption that "Actors" are individuals operating on a rational decision-making basis; commons governance is explicitly and almost entirely linear and functional, and the individual agent plays a central analytic role. Effective community supervision of a forest can produce a sustainable supply of trees, for example, via rational decision making by community members. The GKC framework makes no such assumption. Story, myth, history,

---

[16] ELINOR OSTROM, UNDERSTANDING INSTITUTIONAL DIVERSITY (2005).

[17] Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243 (1968).

[18] Michael J. Madison, Brett M. Frischmann, Madelyn R. Sanfilippo & Katherine J. Strandburg, *Too Much of a Good Thing? A Governing Knowledge Commons Review of Abundance in Context*, FRONTIERS RSCH. METRICS & ANALYTICS, July 13, 2022, at 1, Article No. 959505.

and culture, including normative values and objectives, play potentially important roles in knowledge commons governance. The community as such may be the central analytic focus. The reciprocal linking of governance patterns to resource and community formation and identity, illustrated in the schematic above, documents that possibility. One key product of the Wikipedia community is, significantly, the Wikipedia community itself.

B.   Why Build the GKC Framework, and Why Use It

One may question the need for a research framework of any sort and the corresponding interest in accumulating learning across cases and other research from a multiplicity of sectors. Legal scholars are prone to focusing on context-specific problems that can be solved by law-specific interventions. The answer is partly pragmatic and partly epistemological.

Pragmatically, GKC research borrows Ostrom's premise that resource production and allocation questions are ordinarily settled in research and policy in one of two ways—and that those two ways aren't broad enough to capture the world as it actually is. One is reference to market exchange, supported by the law of the firm (contract law, commercial law, and property law) and regulated at the margins in the interests of market integrity and safety. Two is production or provision by hierarchies, that is, either by the state itself or by integrated firms.[19] Oliver Williamson, Ostrom's co-Nobelist and a central contributor to the field of New Institutional Economics (NIE), defined markets and states (sometimes referred to as hierarchies) as the two central institutional players in NIE and advanced his work on transaction cost economics and opportunism accordingly.[20] Three, prioritized by Ostrom on empirical grounds, is commons. As she argued, commons governance works.[21] The research question is: how?

Ostrom resisted the markets–states duality partly on conceptual grounds (she was a lifelong intellectual antagonist of Hardin)[22] but also, significantly, on empirical grounds.[23] She demonstrated that community-based resource governance (commons) was not a rare exception to the general institutional rule but instead that commons governance could succeed in a wide variety of contexts, large and small,

---

[19]   *See generally* Elinor Ostrom, *Beyond Markets and States: Polycentric Governance of Complex Economic Systems*, 100 AM. ECON. REV. 641 (2010).

[20]   OLIVER E. WILLIAMSON, THE MECHANISMS OF GOVERNANCE 3–20 (1996); *see* Ann Behan, *Oliver Williamson: Early Life, Academic Career, Impact*, INVESTOPEDIA, https://www. investopedia.com/terms/o/oliver-e-williamson.asp (June 2, 2022).

[21]   Ostrom, *supra* note 19.

[22]   Brett M. Frischmann, Alain Marciano & Giovanni Battista Ramello, *Retrospectives: Tragedy of the Commons After 50 Years*, J. ECON. PERSPS., Fall 2019, at 211–12, 219.

[23]   Ostrom, *supra* note 19.

with local adaptations of a general set of principles.[24] With her IAD framework, Ostrom set out a technique for gathering relevant evidence. The GKC framework aims to do the same, both as to method and as to eventual conclusions.

Epistemologically, GKC research relies on that view of case study research holding that qualitative research can yield generalizable results without giving up the significant richness and nuance available in individual studies.[25] That approach works only when the number of case studies is sufficiently large (although the precise number is indeterminate) and the manner of collecting case study data is appreciably congruent. Some legal scholars have argued that generalizable commons-y results can be obtained from single studies of very large contexts.[26] Their data are useful, but their conclusions likely are overdrawn. These studies and others in the style of "Intellectual Production without Intellectual Property" (or "IP without IP") largely do not follow any consistent research approach.[27] Incommensurable data don't help establish propositions beyond the scope of an individual study. A research framework, and especially a research framework that is not limited to use by researchers only in one field, is functionally essential.

C. The Uses and Limits of the GKC Framework

How might someone use the GKC framework, particularly if they are coming from or coming into a career as a legal scholar? As anyone who has done case study research knows, the work is labor-intensive and time-consuming, and case study research involving field work (not all does) requires special skills and careful planning around ethics and other issues. On the whole, law professors aren't trained for this sort of thing or encouraged by peers to invest in it. And any law professors who have read this far will have noticed a marked absence of references to the core of traditional legal scholarship: the law itself. Conceptually, putting the law in its place amid complex community-based governance practices is no simple feat. In sum, barriers to entry here are significant; pursuing any research and scholarship along these lines requires an unusual amount of intellectual and professional fortitude.

The research questions highlighted by the GKC framework are useful nevertheless, even in the absence of full-bore case study strategies and even in (and perhaps especially because of) the absence of pride of place for law itself. The questions

---

[24] *Id.*

[25] ROBERT K. YIN, CASE STUDY RESEARCH AND APPLICATIONS: DESIGN AND METHODS (6th ed. 2018); Kathleen M. Eisenhardt & Melissa E. Graebner, *Theory Building from Cases: Opportunities and Challenges*, 50 ACAD. MGMT. J. 25 (2007).

[26] *See, e.g.*, BJ Ard, *Creativity Without IP? Vindication and Challenges in the Video Game Industry*, 79 WASH. & LEE L. REV. 1285 (2022); Amy Kapczynski, *Order Without Intellectual Property Law: Open Science in Influenza*, 102 CORNELL L. REV. 1593 (2017).

[27] *See* CREATIVITY WITHOUT LAW: CHALLENGING THE ASSUMPTIONS OF INTELLECTUAL PROPERTY (Kate Darling & Aaron Perzanowski eds., 2017).

highlight critical institutional dimensions of law and policy problems that might be obscured by a conventional focus on the agency of individual actors or on bilateral transactions (at the micro end) and on sweeping "classic" values like autonomy, opportunity, equity, and justice (at the macro end). Public health and environmental policy issues of all sorts depend critically on data collection and sharing in communities.[28] Privacy is significantly a social dilemma (or set of social dilemmas) rather than a matter only of individual interest vis-à-vis the state or corporate power.[29] Even contracts and commercial law, given its centrality to the first-year law school curriculum, can be productively re-cast in part, away from one-to-one bargaining and assent. The "IP without IP" literature, referred to earlier, would benefit considerably across the board from greater attention to knowledge commons dimensions of the creative sectors studied by IP scholars. Zahr Said's research on knowledge-sharing by craft brewers, illustrates one strategy for doing that.[30]

The breadth and potential power of the GKC framework should not be taken as an argument either for its omnipresence or its universality. Making the case for broad use of the GKC framework risks imposing an intellectual hammer on a society and economy of resource governance nails, particularly in the sense that community and collectivity are universal human phenomena and have been studied by researchers for centuries. For now, the point of GKC research is to draw out distinct elements of community governance with respect to knowledge, information, and data, rather than to imagine a comprehensive worldview for law and policy.

III. ILLUSTRATIONS

Research grounded in the GKC framework isn't the only program to adopt and apply Ostrom's instincts to knowledge and data settings. In information science, Christine Borgman argued that Ostrom's commons governance perspective is an essential tool for investigating data governance and offered a useful catalog of data-specific commons governance illustrations.[31] But Borgman and others following her lead have not focused on ways in which knowledge governance differs from the natural resource governance that lies at the heart of Ostrom's program and the IAD framework, leading to a premature reliance on the "design principles" for ef-

---

[28] THE ENVIRONMENTAL KNOWLEDGE COMMONS: CASES AND LESSONS FOR KNOWLEDGE SHARING (Anjanette Raymond, Scott Shackelford, Jessica Steinberg & Michael Mattioli eds., forthcoming 2025) (manuscript on file with author).

[29] Sanfilippo & Frischmann, *Slow-Governance in Smart Cities*, *supra* note 6, at 4.

[30] Said, *supra* note 7.

[31] CHRISTINE L. BORGMAN, BIG DATA, LITTLE DATA, NO DATA: SCHOLARSHIP IN THE NETWORKED WORLD (2015).

fective commons governance that Ostrom offered in her pioneering work, *Governing the Commons.*[32] Other investigations of knowledge-sharing institutions inspired by or referring to Ostrom have not fully embraced distinctions between natural resource pools and knowledge pools.[33]

Here, I illustrate the mechanics and uses of the GKC framework with a lightning-quick tour of knowledge commons case studies that I have written or taken a lead role in. I summarize them in chronological order.

A.   The University as Knowledge Commons

In *The University as Constructed Cultural Commons*, we offered the university itself as a paradigmatic case of knowledge commons governance.[34] Universities arose in the first place in medieval Europe as collective responses by both students and professors to challenges associated with sustaining one-to-one instruction in the arts and in the professions. Institutional pluralism produced significant variations in Germany, France, England, the United States, and eventually across Asia, Africa, and Central and South America, joined not merely by the name "university" but also by individual institutions and systems aligning with the university's central knowledge-producing and knowledge-sharing missions.

Social dilemmas—how to spread and store existing and new knowledge among researchers and among new generations of practitioners and scholars who were often motivated only by their own scholarly objectives—were solved significantly by steering away from knowledge production in proprietary contexts and toward knowledge stewardship governed by communities of scholars. Those communities operated not only as collectives of the whole but increasingly as sub-communities in schools, colleges, faculties, and departments. Fast forward several centuries, and medieval university forms remain recognizable today; knowledge commons research helps us see the evolution of the university form as well as its origins. Modern university life has been significantly affected by privatization and corporatization; the ideal of a "company of scholars"[35] setting and enforcing its own rules regarding institutional membership and

---

[32] ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION (1990).

[33] JEROME H. REICHMAN, PAUL F. UHLIR & TOM DEDEURWAERDERE, GOVERNING DIGITALLY INTEGRATED GENETIC RESOURCES, DATA, AND LITERATURE: GLOBAL INTELLECTUAL PROPERTY STRATEGIES FOR A REDESIGNED MICROBIAL RESEARCH COMMONS (2016); CHARLES M. SCHWEIK & ROBERT C. ENGLISH, INTERNET SUCCESS: A STUDY OF OPEN-SOURCE SOFTWARE COMMONS (2012); CHRISTOPHER M. KELTY, TWO BITS: THE CULTURAL SIGNIFICANCE OF FREE SOFTWARE (2008); Tommaso Venturini, Pablo Jensen & Bruno Latour, *Fill in the Gap: A New Alliance for Social and Natural Sciences*, J. ARTIFICIAL SOC'YS & SOC. SIMULATION, Mar. 2015, at 18.

[34] Madison et al., *supra* note 1.

[35] JULIUS GETMAN, IN THE COMPANY OF SCHOLARS: THE STRUGGLE FOR THE SOUL OF HIGHER EDUCATION (1992).

practice may be difficult to discern at ground level. Universities today are, to a sizable degree, platforms for data governance rather than engines of new knowledge.[36] Those transitions may make the GKC framework more, rather than less, relevant to appreciating the stakes of contemporary educational policy.

B.   *Citizen Science as Knowledge Commons*

In *Commons at the Intersection of Peer Production, Citizen Science, and Big Data: Galaxy Zoo*, I examined the practice of a sizable and successful citizen science project, in which thousands of volunteers undertook to participate in a scientific research project (Galaxy Zoo) involving the classification of galaxies that appeared in a large-scale dataset produced initially as part of the Sloan Digital Sky Survey.[37]

What appeared from the outside to be simply a celebrated example of "peer production" turned out to have at least two key features that were made salient by virtue of GKC-inspired questioning. Yochai Benkler, among others, has recognized the shift in framing of knowledge-based collaborations, from an emphasis on networks-qua-networks to an emphasis on the details of the institution's social structure.[38]

One, the origins of the Galaxy Zoo project lay not in amateur interest in astronomy but instead in a Ph.D. project organized by a graduate student at Oxford University who had a large dataset to explore and limited resources for exploring it. With encouragement from advisors, some technological resources, and partnerships in leadership (including a public endorsement from astronomer-turned-guitarist Brian May of Queen), what became the Galaxy Zoo originated in one person's ambition to build a successful research career.[39] Peer production may be a feature of knowledge commons governance, but hierarchy and structure are important as well, and sometimes more so.

Two, amateur engagement with the Galaxy Zoo citizen-science platform was motivated significantly by a kind of identity transformation, with active participants

---

[36]   Michael J. Madison, *Data Governance and the Emerging University*, *in* RESEARCH HANDBOOK ON INTELLECTUAL PROPERTY AND TECHNOLOGY TRANSFER (Jacob H. Rooksby ed., 2020).

[37]   Madison, *Galaxy Zoo*, *supra* note 5.

[38]   Yochai Benkler, *Law, Innovation, and Collaboration in Networked Economy and Society*, 13 ANN. REV. L. & SOC. SCI. 231 (2017).

[39]   That researcher eventually secured a faculty position at ETH Zurich in Switzerland, later founded the Citizen Science Center Zurich, and is now CEO of an AI-based research company. *Company: About Us*, MODULOS, https://www.modulos.ai/company (last visited Apr. 28, 2024); *Kevin Schawinski*, WIKIPEDIA, https://en.wikipedia.org/wiki/Kevin_Schawinski (last visited Apr. 28, 2024). I met and interviewed him while he was completing a postdoctoral research fellowship at Yale.

transitioning from roles as "citizens" to roles as amateur "scientists"—from individual agents to community members, adopting at least some of the values and behaviors of the scientific community, contributing new knowledge, and participating in governance as well as executing tasks specified by the team leaders. The price of "admission" to the community was quite low, along with the obligations of "membership," and sanctions for misbehavior were low to non-existent. Yet the pace and type of "citizen scientist" engagement with the Galaxy Zoo data pool revealed a kind of enthusiasm and a depth of enthusiasm suggesting strongly that commons governance "worked" because of a shared cognitive commitment to the scientific values of the project and validation of that commitment by the original research leaders.

C.   Enlightenment Science and Scientific Communication as Knowledge Commons

In *The Republic of Letters and the Origins of Scientific Knowledge Commons*, I traced the origins and functions of the 17th and 18th century community of letter writers known as the "Republic of Letters" as an early contributor to the formation of the practice of Enlightenment science.[40] The idea to tackle this historical case study emerged from an earlier provocation by the economic historian Joel Mokyr, who argued that the Republic of Letters, as a continent-wide (and sometimes trans-Atlantic) institution that evolved for knowledge-sharing and documenting what came to be known as "science," was a central element of Europe's path toward sustainable economic growth as it emerged from the medieval era.[41] Mokyr, in effect, took knowledge commons governance as a given, arguing that the practice was socially and economically productive.

The GKC case study building on that argument investigated the origins and practices of the Republic as knowledge commons. That effort set the economic implications of the Republic of Letters mostly to one side and asked, instead, where the practice came from and what determined its functionality, for better (usually) and for worse (sometimes). Those questions led to conclusions that focused on how the institutionalization of knowledge sharing encouraged early "scientists" (a word that emerged only much later) to convert their private and personal investigations into material that formed the corpus of a body of publicly accessible "scientific" data. In the Republic of Letters, collections of letters between individual correspondents became journals distributed among subscribers and members of early scientific societies, reinforcing the identity and legitimacy of those entities and helping to shape a sort of Habermasian community of interest and practice.

---

[40] Michael J. Madison, *The Republic of Letters and the Origins of Scientific Knowledge Commons, in* GOVERNING PRIVACY IN KNOWLEDGE COMMONS, *supra* note 4.

[41] *See generally* JOEL MOKYR, A CULTURE OF GROWTH: THE ORIGINS OF THE MODERN ECONOMY (2017); Joel Mokyr, *The Commons of Knowledge: A Historical Perspective, in* 4 THE ANNUAL PROCEEDINGS OF THE WEALTH AND WELL-BEING OF NATIONS 2011–2012, at 29 (Emily Chamlee-Wright ed., 2012).

D.   The Modern City as Knowledge Commons

In *The Kind of Solution a Smart City Is: Knowledge Commons and Postindustrial Pittsburgh*, I used the GKC framework to dive deeply into the history of a specific American city to understand how contemporary urban planning practices collected under the "smart city" rubric align with the needs and interests of different sectors of the place, or fail to.[42] Around the world, the city is the site of the "datafication" of individuals and widespread but often unregulated data sharing among public authorities and between public authorities and private companies. In the smart city, concern about data privacy and human opportunity abuts the imperative to govern the city efficiently and fairly. That intersection turns the smart city into a large-scale sociotechnical knowledge commons.

Examining the city using the GKC framework did not tell a story of Pittsburgh that differs materially from histories anchored in political economy, geography, or material culture,[43] but it brought out the significance of data- and information-layers in urban experience both historically and in contemporary practice. Individual "smart city" projects that emanate from public administration imperatives (at times), from academic research contexts (at times), and from public–private collaborations (at times) can be catalogued and seen as parts of both larger and smaller patterns of public administration, elite governance, and community engagement—or lack thereof—with appropriate nuance added to preconceptions that might dismiss most or all "smart city" initiatives under "money" and "power" rubrics. The "smart city" is not a purely novel form of commons governance; all urban planning is, in a way, commons-based in its attention to how multiple groups of people and multiple uses must coexist. In cities, space must be shared, especially space that is "open"—streets, sidewalks, parks, and communal living, working, and entertainment–recreation areas. The GKC framework adds explicit attention to governing shared data and information in the urban setting.

IV.   SOME DEFINITIONS AND OTHER PARAMETERS

Any catalog of illustrations prompts questions about details of the GKC framework. On concepts and terminology, some typical questions follow, with comments.

I begin with a general observation. The purpose of the GKC framework is to prompt systematic study of resource-sharing practices. It is possible, even typical, for law professors to ask: "Is this a commons?" as a definitional matter before judging

---

[42]   Michael J. Madison, *The Kind of Solution a Smart City Is: Knowledge Commons and Postindustrial Pittsburgh*, in GOVERNING SMART CITIES AS KNOWLEDGE COMMONS 157 (Brett M. Frischmann, Michael J. Madison & Madelyn Rose Sanfilippo eds., 2023).

[43]   Michael J. Madison, *Contrasts in Innovation: Pittsburgh Then and Now*, in ENTREPRENEURSHIP AND INNOVATION IN EVOLVING ECONOMIES 144 (Megan M. Carpenter ed., 2012).

some context or setting to be suited to GKC research. And how would one know? Asking those questions often puts a definitional cart before a research horse. I appreciate the lawyer's instinct to define with precision in order to put both questions and answers in a well-ordered box, but I resist it. GKC research and commons research generally do not fit in pre-determined boxes, and definitions take us only so far. GKC research is pragmatic rather than ontological. Experience teaches that some contexts can be examined productively under the GKC framework (for example, those involving shared knowledge resources) because the GKC framework teaches what conditions matter and what to look for (and to avoid), and why. Others likely cannot be (for example, those involving claims to complete dominion over a specific knowledge object, such as a book or a patent). Yet it would be unwise to exclude those (possible) cases from commons examination as a categorical matter; thoughtful and innovative researchers may yet reveal in them important nuances and lessons for knowledge governance.

A. What Is "Governance"?

Governance is among the most difficult "fields" to define in all of law and political theory, if it is a field at all. Consistent with the GKC approach to investigate with a broad brush and paint with fine details, in the GKC context "governance" means combinations of institutions and practices that characterize a community's or collective's approach to intellectual resource sharing. That's a focused version of a general observation. Generally, governance means individuals working together in groups to solve their problems.[44]

That's a purposefully broad definition. It includes the specification of the environment (what game theorists may call the game and what Ostrom called the "action arena");[45] the identities of relevant actors and resources; and, with respect to all of those, formal rules, positive law, social norms of different types,[46] and the interplay between what Douglass North called the "rules of the game"[47] and what Williamson called "the play of the game."[48]

---

[44] *See* DONALD E. BROWN, HUMAN UNIVERSALS (1991).

[45] *See* OSTROM, *supra* note 16.

[46] Seth Frey, Qiankun Zhong, Beril Bulat, William D. Weisman, Caitlyn Liu, Stephen Fujimoto, Hannah M. Wang & Charles M. Schweik, *Governing Online Goods: Maturity and Formalization in Minecraft, Reddit, and World of Warcraft Communities*, PROC. ACM ON HUM-COMPUT. INTERACTION, Nov. 2022, at 10, 19–20, Article No. 300.

[47] DOUGLASS C. NORTH, INSTITUTIONS, INSTITUTIONAL CHANGE AND ECONOMIC PERFORMANCE 3 (1990).

[48] Oliver E. Williamson, *The New Institutional Economics: Taking Stock, Looking Ahead*, 38 J. ECON. LITERATURE 595, 599 (2000).

The rules themselves can be organized systematically via research on the grammar of institutions, another strand of research that can be traced to Ostrom.[49] The play might be examined systematically with tools drawn from economics, as Williamson did with his studies of transactions,[50] or from sociology or anthropology, as Gabriella Coleman did in her study of hacking[51] and Christopher Kelty did in his work on free and open source software,[52] or from elsewhere, including various threads of science and technology studies, including those associated with Bruno Latour,[53] information science,[54] and management studies.[55]

Three details of that summary bear extra emphasis. One is the claim that any method for identifying, describing, and excavating "rules" and "play" may be consistent with research conducted under the GKC rubric. Two is how formal, positive law is one, but only one, component of this concept of governance. Governance is the super-category; "law" is a subcategory. Relationships among the two may be complex and multi-layered; those relationships are not necessarily channeled only through property law nor through law and economics concepts. For example, "commons" is neither only a species of property law nor an antagonist of property. Property, like commons, is a species of governance, and in the context of specific communities and resources, the two governance systems may coexist along with the intermediate property regime sometimes labeled "semicommons"[56] and intersecting doctrinal frameworks anchored in tort law, competition law, contract law, and labor and employment law, among others. Three is how casual references to social norms and norm-based governance (along with governance by what Lessig called "architecture"[57] and what today is often characterized as "algorithmic" governance)[58] must be starting points for research rather than conclusions. Social norms and informal community practices can define social problems as well as solutions; set membership

---

[49] Christopher K. Frantz & Saba Siddiki, *Institutional Grammar 2.0: A Specification for Encoding and Analyzing Institutional Design*, 99 PUB. ADMIN. 222 (2021).

[50] *See* Williamson, *supra* note 48.

[51] E. GABRIELLA COLEMAN, CODING FREEDOM: THE ETHICS AND AESTHETICS OF HACKING (2013).

[52] KELTY, *supra* note 33.

[53] Alain Pottage, *The Materiality of What?*, 39 J.L. & SOC'Y 167 (2012).

[54] BORGMAN, *supra* note 31.

[55] Muralidharan Ramakrishnan, Anup Shrestha & Jeffrey Soar, *Innovation Centric Knowledge Commons—A Systematic Literature Review and Conceptual Model*, J. OPEN INNOVATION: TECH., MKT. & COMPLEXITY, Jan. 16, 2021, at 1, Article No. 35.

[56] Henry E. Smith, *Semicommon Property Rights and Scattering in the Open Fields*, 29 J. LEGAL STUD. 131 (2000).

[57] LAWRENCE LESSIG, CODE: VERSION 2.0, at 38–60 (2d ed. 2006).

[58] Mireille Hildebrandt, *Algorithmic Regulation and the Rule of Law*, PHIL. TRANSACTIONS ROYAL SOC'Y A, Sept. 13, 2018, at 1, Article No. 20170355.

criteria; create and define community and individual expectations; describe sanctions; and more.

B.   What Is "Commons"?

The word "commons" itself needs disambiguating. In the context of knowledge commons, building on Ostrom's work, "commons" means governance of a shared resource, by a community.[59]

Both in everyday use and in various research and practitioner communities, "commons" has additional meanings. There are family resemblances, in the Wittgensteinian sense that these are linked by similarities but don't share a single set of attributes.

To many researchers and activists, especially those committed to reform in knowledge and information law, such as copyright and patent, "commons" is a shorthand for "the public domain," that reserve of knowledge and information that either cannot be covered by forms of copyright, patent, or other proprietary right or whose coverage has expired. Commons in this sense means fully open and fully free.[60] This use of "commons" combines a metaphoric sensibility as to place (commons is a location or area or physical resource that is open and free to enjoy)[61] and a metaphoric sensibility as to openness and universality (the commons contains what is common, meaning both accessible to all and standard as to all potential uses, at least to begin with). Within this usage, "knowledge commons" becomes much like what many people imagine to be a physical "common" or "commons," a place that is open to all, a type of public and publicly accessible environment. Particularly in modern literature, the commons and the public domain are simultaneously descriptive and normative as to law and policy. Scholars and advocates push against expansions and extensions of the scope and term of copyright and patent. That push often includes a strong normative alignment between commons and "gift" economies.[62]

A second, related use of "commons" connects the term explicitly to the political economy of resource governance with respect to both biophysical (natural) resources

---

[59] *See* Sheila R. Foster & Christian Iaione, *Ostrom in the City: Design Principles and Practices for the Urban Commons*, *in* ROUTLEDGE HANDBOOK OF THE STUDY OF THE COMMONS 235 (Blake Hudson, Jonathan Rosenbloom & Dan Cole eds., 2019).

[60] LEWIS HYDE, COMMON AS AIR: REVOLUTION, ART, AND OWNERSHIP (2010); BOYLE, *supra* note 12; LAWRENCE LESSIG, FREE CULTURE: HOW BIG MEDIA USES TECHNOLOGY AND THE LAW TO LOCK DOWN CULTURE AND CONTROL CREATIVITY (2004).

[61] *See* Yochai Benkler, *Free as the Air to Common Use: First Amendment Constraints on Enclosure of the Public Domain*, 74 N.Y.U. L. REV. 354 (1999).

[62] LEWIS HYDE, THE GIFT: IMAGINATION AND THE EROTIC LIFE OF PROPERTY (First Vintage Books ed. 1983).

and also knowledge and information. Here, "commons," as a context and govern-ance strategy for shared resources, is often linked explicitly to "commoning," as a set of practices and political commitments.[63] Commoning practices in the commons may and should reflect explicit political commitments to openness, reciprocity, eq-uity, and inclusion as to communal membership and participation, to a relative ab-sence of hierarchy and formalized rule enforcement, and to justice and community sustainability as goals. Scholarship on urban commons—partly addressing physical resource governance and partly addressing cultures of commoning practices—is rep-resentative of how this "commoning" perspective is distinct from the commons gov-ernance perspective on which knowledge commons research depends.[64]

Even as I've tried to disambiguate "commons," the family resemblance among these several usages is helpful in distinguishing commons governance from transac-tion cost economics, which otherwise might appear to offer a helpful way of framing knowledge-sharing institutions. Robert Merges, for example, pointed to cases of li-ability rules in intellectual property law—stipulated permission to use legally-pro-tected material for a fee—emerging from voluntary contracting by rights-owners and users in repeat-play scenarios.[65] The focus on transaction costs typically shines an analytic spotlight on decision-making by individual actors rather than on com-munities as a whole, on the origin and evolution of institutions, and on the details of their associated rules and various social norms. Zeroing in on transaction costs tends to flatten distinctions among social dilemmas and the possibility that different governance strategies might arise to respond to them. It also typically prioritizes economic efficiency and related forms of social welfare as a primary metric for nor-mative assessments of resource governance systems.

C.   What Is "Knowledge"?

The GKC framework takes a broad and inclusive view of "knowledge" for pur-poses of researching commons governance. The word refers simultaneously to hu-man-generated material at any position in the now-standard pyramid that situates "data" at the lowest (least refined semantically) level, "information" and "knowledge" at intermediate levels, and "wisdom" at the highest level.[66] That breadth captures a multitude of different sorts of resources, including cultural, sci-entific, creative, innovative, and social resources and resource systems,[67] material

---

[63] PATTERNS OF COMMONING (David Bollier & Silke Helfrich eds., 2015).

[64] *See* SHEILA R. FOSTER & CHRISTIAN IAIONE, CO-CITIES: INNOVATIVE TRANSITIONS TOWARD JUST AND SELF-SUSTAINING COMMUNITIES (2022); Foster & Iaione, *supra* note 59.

[65] Robert P. Merges, *Contracting into Liability Rules: Intellectual Property Rights and Collective Rights Organizations*, 84 CALIF. L. REV. 1293 (1996).

[66] R. L. Ackoff, *From Data to Wisdom: Presidential Address to ISGSR, June 1988*, 16 J. APPLIED SYS. ANALYSIS 3 (1989).

[67] GOVERNING KNOWLEDGE COMMONS, *supra* note 3.

that may be wholly or partly "raw" and wholly or partly "cooked," to borrow Lévi-Strauss's labels.[68]

The definition acknowledges that the many forms and flows of knowledge are blends of "found" and "made"; that law and legal systems may contribute substantially to what "counts" or not as a knowledge resource (as in the case of a copyright work or a patented invention); and that the design and character of cultural resources are frequently embedded in feedback loops at multiple levels simultaneously. That final point spans research and practice across centuries, noted in Robert Merton's famous *On the Shoulders of Giants*[69] and in contemporary discussions of the "data lifecycle."[70]

Because of the significance of data and data governance to modern politics, economics, and collective experience, three related observations are in order.

One is that concern with "ownership" of data as a general matter may be misplaced, whether that concern is expressed in the law of personal property or otherwise. Data may not constitute a "thing" in any meaningful legal sense, despite ongoing efforts to rationalize a law of data-as-property.[71] In information science terms, data are only partly "thing"-like.[72] Generally, data are evidence, that is, they are epistemological and practical tools: observational, experimental, and associational traces of activity that are keys to understanding human, animal, and biophysical phenomena.[73] Knowledge is itself power;[74] control of data often means control of knowledge, and legal scholars have become accustomed to asking about control in the language of property.[75] But property need not exhaust the "control" inquiry; governance is the better framing. Our earliest stories about control of knowledge are

---

[68] CLAUDE LÉVI-STRAUSS, 1 THE RAW AND THE COOKED: MYTHOLOGIQUES (John Weightman & Doreen Weightman trans., 1983) (1969).

[69] ROBERT K. MERTON, ON THE SHOULDERS OF GIANTS: A SHANDEAN POSTSCRIPT (1965).

[70] Alexander Ball, *Review of Data Management Lifecycle Models*, UNIV. OF BATH (Feb. 13, 2012), https://purehost.bath.ac.uk/ws/portalfiles/portal/206543/redm1rep120110ab10.pdf.

[71] James Grimmelmann & Christina Mulligan, *Data Property*, 72 AM. U. L. REV. 829 (2023); Daniel Kiat Boon Seng & Kelvin F.K. Low, *Data Objects: New Things or No-Thing More Than Ignis Fatuus*, 17 LAW, INNOVATION & TECH. (forthcoming 2025), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4308631; Johan David Michels & Christopher Millard, *The New Things: Property Rights in Digital Files?*, 81 CAMBRIDGE L.J. 323 (2022).

[72] *See* Michael K. Buckland, *Information as Thing*, 42 J. AM. SOC'Y FOR INFO. SCI. 351 (1991).

[73] *See* BORGMAN, *supra* note 31.

[74] The aphorism "knowledge is power" is often attributed to Bacon. DANIEL R. COQUILLETTE, FRANCIS BACON 260 (1992). But Hobbes likely should get the credit. Bacon wrote: "*ipsa scientia potestas est*"; Hobbes wrote: "*scientia potentia est*." THOMAS HOBBES, LEVIATHAN 55 (A.R. Waller ed., 1904) (1651).

[75] Anthony M. Honoré, *Ownership*, *in* OXFORD ESSAYS IN JURISPRUDENCE 107 (A.G. Guest ed., 1961).

anchored in oral traditions that predated the invention of writing, traditions that we understand to be essentially communal and not bounded by more recent legal conventions concerning "ownership." Homeric stories were data. But they were not property in a 20th or 21st century "thing-ness" sense.

Two is the necessity of referring to knowledge as a resource. If knowledge (or data) isn't a "thing," then what is it? Using the word "resource" carries the unfortunate connotation that knowledge is worth studying and understanding only to the extent that it is useful or used. "Resources" are people or things that are developed, extracted, processed, and used—as in oil, a common metaphor for data. That's not necessarily the right model for knowledge. Given our broad interest in cultural phenomena, it's fair to expect that significant amounts of knowledge are "useful" for nothing at all. Knowledge may be valuable, or a value, in itself. But unhelpful metaphors here are impossible to avoid. Even defending the non-utility of knowledge involves references to "amounts" of knowledge, a metaphor of materiality that may be linked, semantically, to the exploitation premise that I'm trying to avoid. The bottom line is that researchers need to be alert to the implications of the language that they choose to describe knowledge commons cases that they examine.

Three is that data, like knowledge, is not a single overarching domain subject to commons governance (or not), despite the hint by Hess and Ostrom that "knowledge" is a fair object of governance research.[76] "Knowledge" is, instead, a macro-category that includes numerous meso- and micro-level sectors, systems, and cases for independent research.

V. KEY THEMES

GKC research to date has brought out several important sub-themes that bear brief comment here. These are topics that were anticipated in the initial design of the GKC framework, but perhaps not precisely in the shape that they have taken in light of the research itself. Partly, these are topics that emerged in the research and deserve extra attention going forward. A list of this sort is necessarily incomplete.

A. There Are No Panaceas

GKC research adheres to Ostrom's admonition to avoid looking for single solutions to pluralistic, complex problems. She insisted that there was no "one size fits all" commons-based solution to resource governance problems, no panacea, to borrow her

---

[76] Charlotte Hess & Elinor Ostrom, *Introduction: An Overview of the Knowledge Commons*, *in* UNDERSTANDING KNOWLEDGE AS A COMMONS, *supra* note 14, at 3–7.

phrase.[77] That guidance remains a premise of GKC research.[78] A multiplicity of case studies may in time lead to a set of guidelines for building and managing sustainable, valuable knowledge commons systems. In the meantime, the cases are useful as data in themselves, part of what David Graeber and David Wengrow in *The Dawn of Everything* expressed as a spirit of being imaginatively open to the possibility of entirely different modes of sustainable, even productive, human interaction.[79]

B. *Commons Have Political Economy: There Are Good Commons and Bad Commons*

For understandable reasons, much of the early research on knowledge commons focused on successful and sustainable knowledge commons cases. In many instances, this was "proof of concept" research, demonstrating that the GKC framework could provide a useful template for case study research by researchers from different disciplines looking at cases in different sectors. Much GKC research will continue in this "good commons" vein because one of the goals of the program is demonstrating empirically that knowledge commons governance works in a variety of different settings.

For equally understandable reasons, it should be obvious that knowledge commons governance may cause problems and may cause problems that are, on the whole, greater than the problems that commons governance was designed to solve in the first place.

Some of that is implicit in the "no panaceas" premise. Some of it is implicit in the fact that knowledge governance involves feedback loops at multiple levels. Complex systems may support emergent order but also emergent disorder.

And some is evident from empirical evidence of other sorts. Political, economic, and sociocultural power may warp or destabilize community-based knowledge governance. As forms of collective action in a community, cartels are knowledge sharing institutions that are well-recognized for their harmful effects. Members of patent pools and standard-setting organizations may behave as oligopolists, with negative spillover effects on innovation. Community-based governance of all sorts may originate as or turn into tribalism, sectarianism, vigilantism, and worse, steering away entirely from rule of law principles, for example, and into authoritarianism and violence.

Those effects are typically observed at the interface between the community and those outside the community. Inside the community, members may be subject

---

[77] *E.g.*, Elinor Ostrom, Marco A. Janssen & John M. Anderies, *Going Beyond Panaceas*, 104 PNAS 15176 (2007).

[78] *See* Brett M. Frischmann, *Two Enduring Lessons from Elinor Ostrom*, 9 J. INST'L ECON. 387 (2013).

[79] *See* DAVID GRAEBER & DAVID WENGROW, THE DAWN OF EVERYTHING: A NEW HISTORY OF HUMANITY 480–502 (2021).

to coercion and worse.

Looking at the political economy of knowledge commons means using questions about the origins and distribution of money and power (among other things) as starting points rather than as conclusions or judgments. GKC research asks questions not only about the functions of a commons governance system but also about interactions between that system and other values.

C.   Knowledge Commons Often Involves Material and Other Immaterial Resources Too

The fact that the GKC framework focuses on knowledge resources, which are immaterial by definition, should direct attention toward, rather than away from, the facts that: (i) governance of immaterial resources is often bound up closely with governance of material (tangible) resources, that is, artifacts and related systems; and (ii) not all immaterial resources are knowledge resources. Disentangling different resources, characterizing them appropriately, identifying and describing various social dilemmas associated with each one, and mapping intersections, overlaps, and dependencies among them require an enormous amount of care.

Contemporary electronic data and digital networks often obscure relationships between material and immaterial knowledge forms, requiring expert labor to "see" the differences, particularly for law and policy purposes.[80] Unfortunately, even Hess and Ostrom contributed to confusion on this point in their early work on knowledge commons; the title of their 2003 article *Ideas, Artifacts, and Facilities: Information as a Common-Pool Resource* precisely illustrates the conflation of different resources with potentially distinct social dilemmas, compounding that error by characterizing all of them as common-pool resources.[81]

Some are. Historians and information scientists have long been aware of the materiality of recordkeeping, often evidenced in loss: the destruction of the original Library of Alexandria; the loss of massive amounts of recorded ancient Greek and Roman culture following the fall of Rome; the disastrous London fire of 1834 caused by the disposal by fire of the Exchequer's obsolete tally sticks; the inaccessibility of much electronic data created during the 20th century as a result of changes in data formats and the lack of backward compatibility of computer systems.[82] All of those historical events were blends of accident and human intention. To turn a

---

[80] Dan L. Burk, *Copyright and the New Materialism*, *in* INTELLECTUAL PROPERTY AND ACCESS TO IM/MATERIAL GOODS 44 (Jessica C. Lai & Antoinette Maget Dominicé eds., 2016).

[81] Hess & Ostrom, *supra* note 14.

[82] LISA GITELMAN, PAPER KNOWLEDGE: TOWARD A MEDIA HISTORY OF DOCUMENTS (2014); *The Fire of 1834*, U.K. PARLIAMENT, https://heritagecollections.parliament.uk/stories/the-fire-of-1834 (last visited Apr. 28, 2024).

phrase, data, like artifacts, have politics.[83]

While that caution should push researchers in the direction of thoughtful inclusivity because information and knowledge problems may be material resource problems of different but related sorts, a different caution should direct researchers to be careful about unhelpfully or too quickly treating knowledge resources as "things" that may be intangible but that may be better classified and analyzed under distinct rubrics. Most prominent among those, because they often appear in knowledge commons contexts, are human expertise, human labor, and trust, both individual and social. I don't urge excluding questions about expertise and knowledge, or trust and knowledge, from knowledge commons research. The point is to exercise care in defining these as shared knowledge resources that are subject to social dilemmas that are resolved, at least substantially, by community-based governance. Dave Fagundes's treatment of the names and other cultural artifacts used by roller derby participants in *Labor and/as Love* is emblematic of the careful treatment of different types of shared resources, knowledge and otherwise.[84]

D. *Polycentricity*

Knowledge commons are often best understood as parts of polycentric social systems, with multiple different commons governance systems interacting with one another and with other non-commons systems. In environments raising data governance questions, platforms and other technical infrastructures raise especially important knowledge commons questions precisely because of their polycentric relationship with other, overlapping governance systems.[85]

What does "polycentricity" mean? The following paragraphs are adapted from an article on human–machine combinations in adjudicative settings, in which polycentricity anchors the analysis.[86]

Generally, polycentricity means that governance of social systems is best described as having multiple, systemically-linked centers and sponsors of order, giving

---

[83] Elena Aronova, Christine von Oertzen & David Sepkoski, *Introduction: Historicizing Big Data*, 32 OSIRIS 1 (2017); Langdon Winner, *Do Artifacts Have Politics?*, DÆDALUS, Winter 1980, at 121.

[84] David Fagundes, *Labor and/as Love*, *in* GOVERNING KNOWLEDGE COMMONS, *supra* note 3.

[85] *See* Ilia Murtazashvili, Jennifer Brick Murtazashvili, Martin B.H. Weiss & Michael J. Madison, *Blockchain Networks as Knowledge Commons*, 16 INT'L J. COMMONS 108 (2022); CONNECTING THE KNOWLEDGE COMMONS—FROM PROJECTS TO SUSTAINABLE INFRASTRUCTURE (Leslie Chan & Pierre Mounier eds., 2019); BRETT M. FRISCHMANN, INFRASTRUCTURE: THE SOCIAL VALUE OF SHARED RESOURCES (2012).

[86] Michael J. Madison, *Fair Play: Notes on the Algorithmic Soccer Referee*, 23 VAND. J. ENT. & TECH. L. 341, 384–86 (2021).

those systems important degrees of stability, adaptability, resilience, and effectiveness in dealing with complex social problems. A system may be defined as a collection of actors and resources that are coordinated over time to produce some patterned result.[87]

Polycentricity is a long-standing social science term, first deployed by Mihály (Michael) Polanyi and Vincent Ostrom,[88] later embedded in the work of Elinor Ostrom,[89] and now anchoring contemporary research in institutional pluralism in governance studies.[90] Formal definitions of polycentricity require that those centers of order within a system be fully autonomous of one another. Less formally, the concept of polycentricity has been elaborated, stretched, and reinterpreted. Recently, more elastic elaborations of the concept focus less on the formal independence of different decision-making centers and more on their alignment in an overall self-organizing complex social system. I adhere to a simple formulation. Polycentricity means, descriptively, a system-level equilibrium with multiple centers of decisional power and governance. Some or all of those centers may be systems in themselves.[91]

This is an explicitly institution-focused perspective, to be distinguished from a view that takes individual agency and values as the premise and destination of functional analysis. Any knowledge commons case study should respect both individual and institutional dimensions, but implicating polycentricity necessarily foregrounds the former. Some governance centers in a polycentric system operate at or within smaller scales and are nested within larger centers. Some centers coexist not in hierarchical relationships but in overlapping or semiautonomous lateral relationships.

The identity of each center prompts questions about its own complexity relative to the social problems that governance at the corresponding level is meant to address: its internal organization (centralized, decentralized, formal, informal, and so on) and its external relationships and accountability relative to other centers (hierarchical, lateral, overlapping, autonomous, semiautonomous, plenary review, and so on). What pathways, linkages, dependencies, and spillovers exist among different governance centers? What are their respective conceptual and material sources of power and influence? What results or outcomes do they produce, and how do those results or outcomes feed back into the same or different governance centers? In that

---

[87] DONELLA H. MEADOWS, THINKING IN SYSTEMS (2008).

[88] Ramiro Berardo & Mark Lubell, *The Ecology of Games as a Theory of Polycentricity: Recent Advances and Future Challenges*, 47 POL'Y STUD. J. 6 (2019).

[89] Elinor Ostrom & Michael Cox, *Moving Beyond Panaceas: A Multi-Tiered Diagnostic Approach for Social–Ecological Analysis*, 37 ENV'T CONSERVATION 451 (2010).

[90] Martha Finnemore & Kathryn Sikkink, *International Norm Dynamics and Political Change*, 52 INT'L ORG. 887 (1998).

[91] Paul D. Aligica & Vlad Tarko, *Polycentricity: From Polanyi to Ostrom, and Beyond*, 25 GOVERNANCE 237 (2012).

regard, in what respects can a polycentric system be conceived and described as a system, and possibly as a set of systems within a system, rather than simply a process? What criteria, external or internal, are deployed to assess the legitimacy of the system, its elements, and its impacts?

E.   The Power of Stories

James Grimmelmann titled a short article about data governance *The Platform Is the Message*,[92] and that McLuhan-esque phrase nicely captures the necessary and inescapable roles of metaphors, stories, histories, and myths in understanding and explaining what is happening in knowledge and information systems, along with all systems of human activity. In Grimmelmann's telling, contemporary media platforms are social communication systems akin to the out-of-control, enchanted brooms in Goethe's (and later Disney's) "Sorcerer's Apprentice."

That reference is my story-based retelling of Grimmelmann's argument; he and other readers can judge its fit and its fairness. That, of course, illustrates what we all do, consciously or subconsciously, in making sense of our worlds: we create and fit stories to experience, measuring their worth not only functionally but also aesthetically.[93] People on their own and in groups and communities behave "rationally" sometimes and "irrationally" at other times; in other words, as we learn from stories, they behave as humans do. Governance is no different, and GKC research accepts that fact. Knowledge and data governance have origins, pathways, and destinations, even if we don't always appreciate or value all of their details (because storytelling is editing as well as borrowing and creating), and even if those origins, pathways, and destinations are evolutionary and sometimes accidental rather than purposeful. Communities, like stories, have character and characters; plots and settings; value and values; conflicts and resolutions; journeys, endings, and renewals, both happy and sad. Hardin's "tragedy of the commons"[94] is in many ways a powerful, persuasive story; its counterpart in legal scholarship, Carol Rose's influential *The Comedy of the Commons*,[95] is likewise a highly engaging tale. Similar judgments as to narrative persuasiveness are fair with respect to work as diverse as Shoshana Zuboff's *The Age of Surveillance Capitalism*[96] and Gillian Hadfield's *Rules for a Flat World*.[97] Labelling these things "stories" does not diminish them; the label recognizes the

---

[92]   James Grimmelmann, *The Platform Is the Message*, 2 GEO. L. TECH. REV. 217 (2018).

[93]   *See* Pierre Schlag, *The Aesthetics of American Law*, 115 HARV. L. REV. 1047 (2002).

[94]   Hardin, *supra* note 17.

[95]   Carol Rose, *The Comedy of the Commons: Custom, Commerce, and Inherently Public Property*, 53 U. CHI. L. REV. 711 (1986).

[96]   SHOSHANA ZUBOFF, THE AGE OF SURVEILLANCE CAPITALISM (2019).

[97]   GILLIAN K. HADFIELD, RULES FOR A FLAT WORLD: WHY HUMANS INVENTED LAW AND HOW TO REINVENT IT FOR A COMPLEX GLOBAL ECONOMY (2017).

rhetorical strategies that accompany the research.[98]

Because judgments about the merits and uses of stories are partly functional and partly aesthetic, those judgments may be difficult to render in systematic ways. Similarly, in many knowledge commons cases, sustainability and success seem to be linked closely to community values and alignment between identity and function. Capturing and describing those judgments is critical; documenting them in a systematic, comparative way is difficult.

The GKC framework permits researchers to step away from the framework's origins in functionalist social science and embrace and benefit from at least some of this historical contingency via types of Geertzian "thick"[99] description. Capturing nuance at micro levels may help the researcher characterize the world as it is and to see it in broader context. But too much detail risks leading the researcher in less helpful directions. Oliar and Sprigman's excellent *There's No Free Laugh (Anymore)*, a study of evolving social norms that stand-up comedians use to police their community,[100] is partially re-contextualized in a systematic way as a GKC case study by Katherine Strandburg.[101] She focuses on the relationship between comics' norm against joke-stealing and story-oriented questions about the character of standup comedy as a creative community, rather than on the copyright-specific question: where do jokes come from?[102] Similarly, analysis of so-called "data trusts" as governance solutions to data privacy problems has been re-cast in knowledge commons terms, not abandoning but separating the functional elements of the case from the multiple semantic associations of the word "trust."[103]

F. Knowledge Commons Through History

Knowledge commons are not new. Contemporary research on knowledge commons is obviously motivated by the development of free and open-source communities and community-produced resources linked to the Internet. But communal governance of both material and immaterial resources has a powerful historical pedigree. The oral tradition of knowledge preservation and transmission, exemplified

---

[98] Donald N. McCloskey, *Storytelling in Economics*, *in* NARRATIVE IN CULTURE: THE USES OF STORYTELLING IN THE SCIENCES, PHILOSOPHY, AND LITERATURE (Cristopher Nash ed., Taylor & Francis 2005) (1990).

[99] CLIFFORD GEERTZ, THE INTERPRETATION OF CULTURES 3 (1973).

[100] Dotan Oliar & Christopher Sprigman, *There's No Free Laugh (Anymore): The Emergence of Intellectual Property Norms and the Transformation of Stand-Up Comedy*, 94 VA. L. REV. 1787 (2008).

[101] Katherine J. Strandburg, *Who's in the Club?: A Response to Oliar and Sprigman*, 95 VA. L. REV. ONLINE 1 (2009).

[102] *Id.*

[103] Teresa Scassa, *Designing Data Governance for Data Sharing: Lessons from Sidewalk Toronto*, 2 TECH. & REGUL. 44 (2020).

by Homer, is an obvious knowledge commons case. The original Library of Alexandria is in many ways a precursor to medieval universities and modern libraries.[104] Brad Pasanek and Chad Wellmon argue that one way to read Kant's writing on books is to understand that proprietary rights (copyright in its early form) were governance responses to the problems posed by the proliferation of texts.[105] The printing press created a kind of crisis of knowledge; learned men could no longer keep up the pretense that they knew all that should be known. Far from encouraging the production of more books, copyright was intended to suppress printing and thus to put reasonable boundaries around what counted as knowable "truth."[106] Knowledge commons and copyright have been inextricably intertwined for centuries.

G. Governance of Governance

Governance itself is a knowledge resource that has governance attributes, as a diverse range of scholars have noted.[107] Governance originates in human activity; governance is subject to social dilemmas; governance may be produced by the state, by the market,[108] and as the GKC research project suggests, in structured community governance-producing processes.[109] Most knowledge commons cases likely have at least two levels or layers of social dilemma: one affecting the underlying knowledge, information, or data resource and a second affecting the production of governance of that resource. The future of knowledge commons governance research may lie, in part, amid questions about producing and sustaining law, the rule of law, and justice itself.

---

[104] IRENE VALLEJO, PAPYRUS: THE INVENTION OF BOOKS IN THE ANCIENT WORLD 34–37 (Charlotte Whittle trans., 2022).

[105] Brad Pasanek & Chad Wellmon, *The Enlightenment Index*, 56 EIGHTEENTH CENTURY 359, 370–75 (2015).

[106] *Id.*

[107] Simon Chesterman, *The Tragedy of AI Governance*, JUST SEC. (Oct. 18, 2023), https://www.justsecurity.org/89432/the-tragedy-of-ai-governance; Gillian K. Hadfield & Barry R. Weingast, *Microfoundations of the Rule of Law*, 17 ANN. REV. POL. SCI. 21 (2014); Gillian K. Hadfield & Barry R. Weingast, *Constitutions as Coordinating Devices*, in INSTITUTIONS, PROPERTY RIGHTS, AND ECONOMIC GROWTH: THE LEGACY OF DOUGLASS NORTH 121 (Sebastian Galiani & Itai Sened eds., 2014); Dan Rohde & Nicolás Parra-Herrera, *Law as Architecture: Mapping Contingency and Autonomy in Twentieth-Century Legal Historiography*, 3 J.L. & POL. ECON. 509 (2023); Carol M. Rose, *Commons and Cognition*, 19 THEORETICAL INQUIRIES L. 587, 614 (2018).

[108] Kate Klonick, *The Facebook Oversight Board: Creating an Independent Institution to Adjudicate Online Free Expression*, 129 YALE L.J. 2418 (2020).

[109] Brigham Daniels, *Legispedia*, in GOVERNING KNOWLEDGE COMMONS, *supra* note 3, at 445.

CONCLUSION

This Article has consisted mostly of a review of the GKC research framework, and its origins, uses, applications, and conceptual elements, for the benefit of the legal scholarly audience in the United States. Scholars elsewhere and in other fields may, of course, find it helpful, and I hope that they do. The framework has been circulating and in use in research and scholarship around the world for nearly 15 years but has been touched on only briefly in by U.S. legal scholars. Making the work visible in this way is no panacea (to borrow one of the themes of the GKC framework itself), but it is a step in the direction of extending the community of GKC interest and practice. Like any research field or intellectual discipline, knowledge commons practice is itself a form of knowledge commons, an intellectual resource shared in structured ways among community members.

I have tried also to point out places where the framework is incomplete, where it asks questions that have yet to be answered in satisfactory ways, and where its utility may be limited. Knowledge commons research is a work in progress, with many frontiers to explore and lessons to integrate, and with boundaries to establish.

In many ways, both the opportunity and the incompleteness are evidence of a sort of dialogue: between existing research and scholarly trajectories in property law, new economic institutionalism, and institutional sociology and history, on the one hand, and new blends of training, research strategies, queries, and judgments, and new training and questioning altogether, on the other hand. Many of the former struggle to extend analytic models built for a world of industrial capitalism and state-making toward worlds of post-industrial economic and political life. Even the best and most ambitious world-making writing often tends to see continuity rather than discontinuity in principles governing social life, economic organization, and ethical behavior. Here, I am invoking Katharina Pistor's *The Code of Capital: How the Law Creates Wealth and Inequality* and Thomas Piketty's *Capital in the Twenty-First Century*.[110]

As a research project, knowledge commons may represent simply a related incremental advance and a small part of that ongoing project, adding new and interesting details to existing portraits. Or knowledge commons may herald the early stages of a kind of Kuhnian paradigm shift, from attention to individuals, things, and places toward large- and small-scale interest in communities, groups, and the shared products of the mind. Questions of power and political economy are never too far from the investigation, but researchers and those who would rely on their work should take heed of the trees within the forest, or the notes within the music; understanding governance requires both, and it requires systematic empiricism. The

---

[110] KATHARINA PISTOR, THE CODE OF CAPITAL: HOW THE LAW CREATES WEALTH AND INEQUALITY (2019); THOMAS PIKETTY, CAPITAL IN THE TWENTY-FIRST CENTURY (Arthur Goldhammer trans., 2014).

intellectual antecedents of that transition are close at hand, including John Dewey, Ivan Illich, Jürgen Habermas, Friedrich Hayek, Ronald Coase, Elinor Ostrom, Douglass North, Robert Putnam, Theda Skocpol, and James Scott among them. Does knowledge commons point in that direction? A possible synthesis of their work and its connections to knowledge commons is a project for another day.