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COMPARATIVE ANALYSIS OF INNOVATION FAILURES AND INSTITUTIONS IN CONTEXT

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ABSTRACT

Many different legal and non-legal institutions govern and therefore shape knowledge production. It is tempting, given the various types of knowledge, knowledge producers, and systems with and within which knowledge and knowledge producers and users interact, to look for reductionist shortcuts—in general, but especially in the context of comparative institutional analysis. The temptation should be resisted for it leads to either what Harold Demsetz called the Nirvana Fallacy or what Elinor Ostrom critiqued as myopic allegories.

One easy reductionist step is to focus on a particular dilemma—a particular market failure, for example, ignoring or assuming away others—and then compare institutions in terms of effectiveness in resolving the dilemma. We might, for example, want to use comparative institutional analysis to examine the problem of pharmaceutical development. If we focus on overcoming the potential undersupply of drugs (because they are expensive to develop but cheap to copy), and if we identify the FDA approval process (and specifically clinical trials) as the most important cost driver, then we might compare as potential responses patents and other institutions like prizes, grants, and government provided infrastructure for clinical trials. We might

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then conclude that government funding of clinical trials is best because it lowers the cost of bringing drugs to market and without the deadweight loss associated with patents. That analysis might be useful, as far as it goes, but it would ignore other market failures, such as the demand-side failure that leads to underprovisioning of drugs to smaller or nonexistent markets. This is, of course, not to say that there is anything wrong with comparing institutions as solutions to the clinical-trial cost problem. But it is to emphasize that we can only design institutions to address problems we recognize, and the risk of myopia is strong in comparative institutional analysis. Engaging in meaningful comparison seems to demand a reduction in the scope of problems to which the institutions might be addressed, lest the problem seem intractable.

We suggest that comparative institutional analysis must be accompanied by comparative failure analysis, by which we mean rigorous and contextual comparative analysis of the ways different institutional responses fail. And we argue that several different types of failures are relevant to comparative analysis. Some failures originate at the system level—that is, market systems exhibit certain sets of failures, while political/government and community systems exhibit other sets. In terms of figuring out what society wants (i.e., from the demand side), the systems rely on different signals, information, processes, and so on. And in terms of satisfying societal demand, the systems rely on different actors, distribution methods, and relationships. Other types of failures are system independent—they are a function of the resources at issue or the nature of the problem to which the institution is addressed. Institutional design can, of course, exacerbate or ameliorate these failures, but it is useful to understand their fundamental causes.

So as a starting place, we think comparative analysis should account for characteristics that vary at the system level and shape both failures and institutions—characteristics like demand signaling processes, time horizons/discount rates, evaluative criteria (for projects, investments, or innovation), and the basic capabilities operative within different settings or systems. Failures and institutions obviously don't correspond exactly, and we suspect that comparative analysis of these and other characteristics will provide guidance for continued comparative analysis. We strongly believe that solid comparative analysis will require both theoretical and empirical work, operating in tandem rather than in isolation from each other. Comparative analysis is necessarily contextual.

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I. INTRODUCTION

Scholars engaged in comparative institutional analysis are poised to make significant contributions in the field of intellectual property, or more broadly, in information law and policy. Empirical work continues to show significant variance in the need for, and effect of, intellectual property and other innovation-related laws and institutions—across industries, types of actors, and contexts.[1] The best work going forward will necessarily

1. *See generally* JAMES BESSEN & MICHAEL J. MEURER, PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK (2008) (arguing that current patent law and institutions discourage innovation and investment); DAN L. BURK & MARK A. LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT (2009) (arguing that patent law is in crisis and proposing that courts solve the crisis by tailoring patent law to suit the needs of different industries); Michael W. Carroll, *One Size Does Not Fit All: A Framework for Tailoring Intellectual Property Rights*, 70 OHIO ST. L.J. 1361

involve interdisciplinary collaboration, mixed methods, and humility—the latter precisely because grand theories are unlikely to be sufficiently context-sensitive.

We are already seeing this work blossom. Scholars have performed comparative institutional analysis with respect to a variety of innovation problems. One line of research has compared different types of institutions for incentivizing innovation, considering the respective benefits and drawbacks of patents, prizes,[2] tax incentives,[3] and grants.[4] Several scholars have considered the roles of various types of intellectual property as complements or alternatives to other appropriation mechanisms like lead time, secrecy, and contract.[5] There is a cottage industry of research studying the so-called negative spaces—contexts and communities within which norms govern creative and innovative behavior more strongly than do formal IP rules.[6]

A different line of work deals with the comparative advantages or disadvantages of certain institutions within the existing intellectual property framework—asking whether courts, Congress, or some government agency should make certain kinds of decisions or certain modifications to existing law;[7] what roles state and local regulations or institutions can play in innovation

(2009) (examining and critiquing the United States's uniform approach to patent and copyright law).

2. *See* Michael Abramowicz, *Perfecting Patent Prizes*, 56 VAND. L. REV. 115, 172, 175, 179 (2003); Michael J. Burstein & Fiona E. Murray, *Innovation Prizes in Practice and Theory*, 29 HARV. J.L. & TECH. 401, 449–51 (2016); Benjamin N. Roin, *Intellectual Property Versus Prizes: Reframing the Debate*, 81 U. CHI. L. REV. 999, 1025, 1034 (2014).

3. *See* Brett Frischmann, *Innovation and Institutions: Rethinking the Economics of U.S. Science and Technology Policy*, 24 VT. L. REV. 347, 382–85 (2000); Daniel J. Hemel & Lisa Larrimore Ouellette, *Beyond the Patents-Prizes Debate*, 92 TEX. L. REV. 303, 311, 323–26 (2013); Joshua D. Sarnoff, *Government Choices in Innovation Funding (with Reference to Climate Change)*, 62 EMORY L.J. 1087, 1101, 1119–20 (2013).

4. *See* W. Nicholson Price II, *Grants*, 34 BERKELEY TECH. L.J. 1, 10 (2019).

5. *See id.* at 12; Jonathan M. Barnett, *Private Protection of Patentable Goods*, 25 CARDOZO L. REV. 1251, 1257, 1267 (2004); Michael J. Burstein, *Exchanging Information Without Intellectual Property*, 91 TEX. L. REV. 227, 262 (2012); Robert P. Merges, *Contracting into Liability Rules: Intellectual Property Rights and Collective Rights Organizations*, 84 CALIF. L. REV. 1293, 1303 (1996).

6. *See* David Fagundes, *Talk Derby to Me: Intellectual Property Norms Governing Roller Derby Pseudonyms*, 90 TEX. L. REV. 1093, 1115 (2012); David Fagundes & Aaron Perzanowski, *Clown Eggs*, 94 NOTRE DAME L. REV. 1313, 1327 (2019); Aaron Perzanowski, *Tattoos & IP Norms*, 98 MINN. L. REV. 511, 550 (2013); 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, 395–97 (2019).

7. *See* Stuart Minor Benjamin & Arti K. Rai, *Administrative Power in the Era of Patent Stare Decisis*, 65 DUKE L.J. 1563, 1566–68 (2016); Stuart Minor Benjamin & Arti K. Rai, *Who's Afraid of the APA? What the Patent System Can Learn from Administrative Law*, 95 GEO. L.J. 269, 309–12 (2007); Sapna Kumar, *Patent Court Specialization*, 104 IOWA L. REV. 2511, 2519–26 (2019); Arti K. Rai, *Engaging Facts and Policy: A Multi-Institutional Approach to Patent System Reform*, 103 COLUM. L. REV. 1035, 1065–74 (2003).

policy;[8] whether certain tasks traditionally performed by government agencies should be privatized;[9] what should be the roles of different government agencies in drug development or other health care policy;[10] and whether certain questions of patent validity should be adjudicated in administrative challenges before the Patent Trial & Appeal Board or as part of patent infringement litigation in federal district court.[11] Yet other work compares the various institutions of intellectual property law to each other—evaluating the role of patent, copyright, and trademark laws in achieving certain ends.[12]

As this partial catalog demonstrates, one reason it is hard to describe comparative institutional analysis with much specificity is the openness of the concept of an "institution." These studies variously refer to government and market actors, legal rights and private ordering mechanisms, and even particular legal regimes as relevant "institutions." All of these fit within the broad definition of "institution" typically used by institutional economics, which includes any structure or mechanism that governs the behavior of a set of individuals.[13] This doesn't make

8. *See* Rebecca S. Eisenberg & Arti K. Rai, *Harnessing and Sharing the Benefits of State-Sponsored Research: Intellectual Property Rights and Data Sharing in California's Stem Cell Initiative*, 21 BERKELEY TECH. L.J. 1187, 1196, 1198 (2006); Camilla A. Hrdy, *Patent Nationally, Innovate Locally*, 31 BERKELEY TECH. L.J. 1301, 1334 (2016); Camilla A. Hrdy, *State Patents as a Solution to Underinvestment in Innovation*, 62 U. KAN. L. REV. 487, 498–505 (2013).

9. *See* Irina D. Manta, *Privatizing Trademarks*, 51 ARIZ. L. REV. 381, 392–95 (2009).

10. *See* Rebecca S. Eisenberg, *The Role of the FDA in Innovation Policy*, 13 MICH. TELECOMM. & TECH. L. REV. 345, 350–56 (2007); W. Nicholson Price II, *Regulating Black-Box Medicine*, 116 MICH. L. REV. 421, 451 (2017); Rachel E. Sachs, *Prizing Insurance: Prescription Drug Insurance as Innovation Incentive*, 30 HARV. J.L. & TECH. 153, 171–72 (2016).

11. *See, e.g.*, Rochelle Cooper Dreyfuss, *Giving the Federal Circuit a Run for Its Money: Challenging Patents in the PTAB*, 91 NOTRE DAME L. REV. 235, 240 (2015); Saurabh Vishnubhakat et al., *Strategic Decision Making in Dual PTAB and District Court Proceedings*, 31 BERKELEY TECH. L.J. 45, 51–55 (2016).

12. *See generally, e.g.*, Christopher Buccafusco et al., *Intelligent Design*, 68 DUKE L.J. 75 (2018) (arguing that the segmented IP doctrines (design patents, utility patents, copyrights, etc.) result in costly screens that frustrate the creative purpose of IP); Colleen V. Chien, *Reforming Software Patents*, 50 HOUS. L. REV. 325, 354–57 (2012) (noting a disconnect between traditional patents and software patents and recommending reforms within the software industry); Mark P. McKenna, *(Dys)functionality*, 48 HOUS. L. REV. 823 (2012) (critiquing the inconsistencies of the so-called functionality doctrine within trademark law); Viva R. Moffat, *The Copyright/Patent Boundary*, 48 U. RICH. L. REV. 611 (2013) (isolating the differences in copyright and patent law); Gideon Parchomovsky & Peter Siegelman, *Towards an Integrated Theory of Intellectual Property*, 88 VA. L. REV. 1455 (2002) (advocating for the integration of traditionally separate IP segments); Pamela Samuelson, *Strategies for Discerning the Boundaries of Copyright and Patent Protections*, 92 NOTRE DAME L. REV. 1493 (2017) (identifying the costs that accompany imprecise separation of copyright and patent law).

13. *See* DOUGLAS C. NORTH, INSTITUTIONS, INSTITUTIONAL CHANGE AND ECONOMIC PERFORMANCE 3–10 (1990).

the concept of institutions meaningless, but it does mean that the field of study is a much larger one than intellectual property scholars often appreciate.

In this Article we identify and seek to remedy two shortcomings of the existing body of research.[14] First, we criticize ambiguity in normative baselines, by which we mean the objectives, values or ends ultimately driving evaluation. Second, we criticize myopia in the analysis of social dilemmas, and particularly an inappropriately narrow focus on market failures. While we aim our criticisms constructively at comparative institutional analysis in IP, both apply more generally.

Persistent ambiguity about the proper normative baseline infects IP scholarship.[15] Comparative institutional analyses often presume some objective and evaluate different institutions in terms of their ability to accomplish that objective. Sometimes, analysts explicitly identify the objective (for example, increased economic growth); other times, the objective is implied (for example, the analyst describes outcomes as "better" or "worse," presumably in terms of social welfare). But however clearly (or not) the objectives are identified, in many cases they are not defended, at least not as against other possible objectives.

More generally, the various comparative institutional analyses lack a common objective, or at least an objective described at a common level of generality. This makes it difficult—perhaps impossible—to aggregate comparative institutional analyses or to compare them to each other. Given the range of different possible normative justifications for different innovation regimes, it may not be possible for comparative institutional analysis to *solve* this problem. We can, however, ask at least for greater transparency about the underlying normative premises.

We offer a tentative suggestion to address this issue. Specifically, we propose that scenario analysis can help bridge the range of normative premises. Under this approach, the analyst

14. A third shortcoming that we do not seek to address in this Article is the lack of a shared methodology or framework for comparative analysis in this context. Simply put, it is incredibly difficult to put the various studies together and learn from them. Yet surely that must be an important goal for the community of scholars doing the comparative work. One of us is currently involved with the development and use of a framework for institutional analysis for studying knowledge commons. Brett M. Frischmann et al., *Governing Knowledge Commons*, *in* GOVERNING KNOWLEDGE COMMONS 1, 10–11 (Frischmann et al. eds., 2014); Katherine J. Strandburg et al., *Knowledge Commons and the Road to Medical Commons*, *in* GOVERNING MEDICAL KNOWLEDGE COMMONS 1 (Katherine J. Strandburg et al. eds., 2016). There are close affinities between that project and this one, but we do not pursue them here.

15. It is possible that there is no ambiguity and that normative baselines are simply embedded, but undefended, and perhaps ultimately simply assumed.

would consider a range of normative premises and evaluate institutional structures in light of those premises. Particular institutional arrangements might appear to be optimal across a variety of different premises such that second-order agreement might be possible.[16] Scenario analysis also might illuminate the relationship between normative premises and institutional arrangements by highlighting the ways different normative premises lead to preferences for different institutional arrangements.

The bulk of this Article is devoted to our argument for a more inclusive approach that involves *comparative analysis of failures and institutions in context*. We particularly emphasize the role of comparative failure analysis in this process. We differentiate failures that are a function of a particular institutional arrangement (which we call system-dependent failures) and failures that transcend those arrangements and affect a variety of different types of institutions (system-independent failures).

We conclude with some brief applications of our ideas. Specifically, we sketch some potential studies relating to short-sightedness and the concept of "progress," and we highlight a few examples of existing work that we think serve as exemplars of what we are advocating.

II. NORMATIVE BASELINES FIRST

Comparative institutional analysis requires careful attention to the basis for comparison. What all of the types of studies we have mentioned have in common is that they attempt to compare institutions in their effectiveness in achieving some end.[17] That end, however, is often either taken for granted, left unspecified, or could be identified and described at such different levels of generality that the end might as well be unspecified. Take, for example, "Progress of Science and useful Arts," the constitutional basis for patent and copyright law in the United States.[18] What counts as progress in this sense?

Much of the IP literature assumes that the constitutional mandate should be understood in utilitarian terms, commanding

16. *See* Cass R. Sunstein, *Incompletely Theorized Agreements*, 108 HARV. L. REV. 1733, 1741–43 (1995).

17. We thus are focused on comparative institutional analysis that purports to evaluate rather than just describe. We thank David Fagundes for reminding us that comparative analysis can be purely descriptive without judgment or normative evaluation. We are not focused on that category, however. *See generally* Frischmann et al., *supra* note 14 (developing and applying a descriptive framework for systematic study of knowledge commons).

18. U.S. CONST. art. I, § 8, cl. 8.

maximization of utility (or, sometimes, welfare). There are a number of problems with that assumption. Despite all that has been written about the Progress Clause, there is really no solid legal evidence that the clause commits us to any particular normative framework.[19] Utilitarianism is a plausible choice, but it is just that—a choice. Casting utilitarianism as constitutionally mandated has important consequences: it marginalizes alternative normative objectives and stunts both normative debate and comparative analysis of institutions across various objectives, which we describe below. At worst, it precludes deeper consideration of the range of objectives society might pursue through copyright and patent. But even short of preclusion, the utilitarian frame sets a strong default position, putting a heavy burden on proponents of alternative, equally reasonable, objectives.

Even if we accept that the Progress Clause imposes a consequentialist frame, such that copyright and patent are conceived of as *means* and Progress in Science and the Useful Arts as the *ends*, we are left with precious little information or guidance about what Progress in Science and the Useful Arts actually entails. As one of us has previously argued,

> Within the legal community, where we debate the contours of the legal systems nominally designed to promote cultural and scientific Progress, we know too little about that which we seek to promote. We place too much emphasis on easily observable and measurable outputs—works and inventions—and figure the more the merrier. As Boyle noted, the romantic conception of the author/inventor is intimately connected with our narrow product-focused vision. But that is only one of many possible paths along which our culture may progress, by which our cultural environment may evolve. There are others. We might, for example, imagine Progress as measured by the degree of participation in creative and inventive activities; participation in such activities yields outputs, to be sure, but participation also educates, builds human capital, skills, and ultimately may unlock human potential.[20]

"Progress of Science and useful Arts" is simply too abstract a concept to serve as a baseline for evaluation. Indeed, any of the

19. We make this argument more extensively in Brett Frischmann & Mark P. McKenna, *Intergenerational Progress*, 2011 WIS. L. REV. 123.

20. Brett M. Frischmann, *Cultural Environmentalism and* The Wealth of Networks, 74 U. CHI. L. REV. 1083, 1095–96 (2007) (footnotes omitted).

following understandings of "Progress" are perfectly reasonable from an interpretive, historical, and normative standpoint:

A. advancement of the relevant knowledge frontiers—scientific, technological, aesthetic, cultural, etc.[21]

B. advancement in the distribution of existing knowledge—making more of what is known by some, known to all—framed in terms of education, human capital, or otherwise[22]

C. greater quantity of outputs—works and inventions (of some types)

D. qualitatively better outputs—works and inventions, subject to ambiguity regarding the criteria for judging some outputs "better"

E. broader participation in creative and inventive activities—possibly framed in terms of education, human capital, and/or access to the means of production[23]

F. increased social welfare, subject to ambiguity about the meaning of "welfare"

G. economic growth

H. sustainable development

These objectives may seem only subtly different, but the variations can matter quite a bit in terms of institutional design. Different institutional configurations will better promote different configurations of objectives. For example, we strongly suspect that different institutional configurations would be necessary if we sought to optimize (i) *production* of works and inventions, (ii) *distribution* of knowledge, or (iii) *participation* in creative and inventive activities. Yet the Progress Clause gives absolutely no guidance about which particular objective or mix of objectives we ought to pursue, much less prioritize. It is tempting to ignore these

21. *See* Barton Beebe, Bleistein*, The Problem of Aesthetic Progress, and the Making of American Copyright Law*, 117 COLUM. L. REV. 319, 376–85 (2017).

22. *See, e.g.*, Malla Pollack, *What Is Congress Supposed to Promote?: Defining "Progress" in Article I, Section 8, Clause 8 of the United States Constitution, or Introducing the Progress Clause*, 80 NEB. L. REV. 754, 776–79 (2001).

23. *See, e.g.*, Stephanie Plamondon Bair & Laura G. Pedraza-Fariña, *Anti-Innovation Norms*, 112 NW. U. L. REV. 1069, 1082–83 (2018); Stephanie Plamondon Bair, *Impoverished IP* 13–14 (BYU Law Research Paper No. 19-15), http://ssrn.com/abstract=3365290 [https://perma.cc/9FF8-8QYQ]; Colleen Chien, *Inequality, Innovation, and Patents* 20 (Santa Clara Univ. Legal Studies Research Paper No. 2018-03), http://ssrn.com/abstract=3157983 [https://perma.cc/MCS3-7Z2U].

complexities and simply assume that the Progress Clause refers to one or another of these objectives, or simply to brush the issue under the rug by hiding the ambiguity in a general claim that IP should promote "innovation"—as if "innovation" were one thing. In fact, claims that certain legal systems better "promote innovation" are quite common despite all the evidence that has accumulated about the differential effects of various policies across industries. As Frischmann argued in a different context: "Innovation rivals capitalism among modern American gods, and it is blasphemous to question progress or attempt to slow down innovation and consider which path society might choose."[24]

We recognize the temptation to characterize the ends of intellectual property or innovation policy at this level of generality in order to make the analysis, but settling for tractability is hardly a defensible way to settle such a complex normative question. Nor do we think analysts can ignore differences in normative baseline on the ground that normative analysis is beyond the scope of institutional design or comparative institutional analysis. First, as we explain further below, the normative question must be addressed for comparative institutional analysis to be meaningful. One cannot evaluate institutions without some sense of what the institutions are supposed to accomplish. Second, while it is true that the choice between different objectives is not itself an institutional design question, the allocation of the decision about which objectives to pursue—effectively, the "who decides" question—quite clearly is one of institutional design.[25]

At the most basic level, the "who decides" question appears settled because, in the context of IP, Congress more or less decides the objective(s).[26] In theory, this means that the political process should provide information about what the public needs, wants, or

24. Brett Frischmann, *Thoughts on Techno-Social Engineering of Humans and the Freedom to Be Off (or Free from Such Engineering)*, 17 THEORETICAL INQUIRIES L. 535, 538 n.9 (2016) (citing NEIL GAIMAN, AMERICAN GODS (10th ed. 2011)).

25. *See* NEIL K. KOMESAR, IMPERFECT ALTERNATIVES: CHOOSING INSTITUTIONS IN LAW, ECONOMICS, AND PUBLIC POLICY 42 (1994) [hereinafter KOMESAR, IMPERFECT ALTERNATIVES]; NEIL K. KOMESAR, LAW'S LIMITS: THE RULE OF LAW AND THE SUPPLY AND DEMAND OF RIGHTS 31–32 (2001) [hereinafter KOMESAR, LAW'S LIMITS].

26. Under the Supreme Court's current jurisprudence, this seems correct. The Court will apply rational basis review to IP legislation and will not give substance to the Progress Clause. *See* Golan v. Holder, 565 U.S. 302, 329 (2012); Eldred v. Ashcroft, 537 U.S. 186, 217–22 (2003). Alternatively, courts might interpret the Clause to have some substantive meaning that guides and/or constrains Congress. Read on its own or in conjunction with the First Amendment or even other sources of normative commitment, the Progress Clause could support a range of objectives, as suggested in the text above. *See supra* notes 21–23 and accompanying text.

demands.[27] But there are plenty of circumstances in which courts, administrative agencies, and even private actors necessarily make judgments about objectives. This is especially true where Congress assigns certain decision-making tasks to those other parties and leaves those actors interpretive room.[28]

Legal scholars are well-suited to engage in descriptive analyses of legal frameworks and prescriptive analyses of institutional designs given existing legal frameworks and some external normative objective. A lawyer's expertise is, after all, institutional design. Lawyers generally do not supply the ends; they supply means to achieving the ends supplied by others, typically by crafting institutional solutions to overcome obstacles to achieving their clients' objectives. Lawyers' normativity makes the most sense when they are engaged in comparative institutional analysis and the normative evaluation is really a comparison of means. That is, when a lawyer says *A* is preferable to *B*, they are making a normative statement. But that normative statement only makes sense (as a product of legal analysis, reasoning, or expertise) when the lawyer is comparing *A* and *B* as means to achieving some particular objective, and the objective is not itself up for grabs, ambiguous, or selected by the lawyer.[29]

One way of dealing with the intractability of the normative baseline problem is to engage in a variety of analyses that expressly assume a particular objective and evaluate the institutional arrangements best suited to achieving those objectives. Rather than simply determining how different

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27. We raise at least two very difficult questions about societal needs/wants/preferences/values:

> First, how do we know what we want? Second, how do we learn to want whatever it is that we want? Answering these questions requires considerable analysis of the dynamic interplay between how we figure out what we want, how we manifest our demands, who gets to do the valuing (or ranking of values), and how the environment within which we are situated and the opportunities it affords simultaneously enable[], constrain[], and shape[] our wants/values.

Frischmann, *supra* note 20, at 1095.

28. In the landmark decision Chevron U.S.A. Inc. v. Nat. Res. Def. Council, 467 U.S. 837, 842–45 (1984), the Supreme Court held that, where Congress has either delegated interpretive authority to an executive agency or failed to give explicit direction on the legal interpretation of a statute administered by the relevant agency, the Court will defer to the agency's reasonable interpretation of the organic statute. For an instance of an agency action that interprets a nominative directive from the government, here, the President, see Sherley v. Sebelius, 689 F.3d 776, 785 (D.C. Cir. 2012). We leave aside for now a discussion of how the systems in which these actors operate generate the information needed to make these determinations of objectives and the various ways in which system failures might distort the articulation of public needs/wants/demands.

29. Indeed, absent comparative analysis, it is hard even to evaluate normative claims. Not surprisingly, the basic "compared to what" question is a tried-and-true favorite at faculty workshops.

copyright regimes fare as means for promoting one or another of the objectives we identified above, for example, we might do better—collectively, as researchers—by conducting a comprehensive series of comparative analyses of the regimes best suited to promote different objectives. This might take the form of scenario analyses where scenarios are defined according to different objectives.[30]

One can imagine, for example, one scenario (*S1*) in which Congress decides the public needs/wants/demands institutions that meet objective *A*, scenario two (*S2*) in which Congress decides the public needs/wants/demands institutions to meet objective *B*, . . . scenario *n* (*Sn*) in which Congress decides the public needs/wants/demands objective X_n. And we might consider scenarios in which the objective might be some function of *A*, *B*, . . . X_n, where the various objectives are weighted. Thus, one scenario might involve an equal weighting across possible objectives or even complete uncertainty about what the public needs/wants/demands.[31] It may turn out that particular institutional arrangements make sense across a range of objectives, and that might allow us to draw some conclusions without having to settle on any particular objective. Or it might allow us to determine that particular institutional arrangements make sense for a certain cluster of objectives, and that different arrangements make sense for another cluster. This approach would at least help illuminate the relationship between institutional structure and normative goal—to see which institutional design features are sensitive to normative goals and under what circumstances.

There is, of course, a risk that this could quickly get messy and possibly intractable, depending on the range of scenarios analyzed. But we don't mean to suggest that every scenario must be analyzed in any one study. In fact, conceiving of this kind of scenario analysis as the broad framework for research should enable individual analysts to focus self-consciously on particular scenarios and frame the findings in relation to other similar scenario analyses.

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30. *See, e.g.*, DAVID M. DRIESEN, THE ECONOMIC DYNAMICS OF LAW 210–11 (2012). There is a rich literature on the approach. In his book, *The Economic Dynamics of Law*, David Driesen argues for the use of scenario analysis in various contexts, with particular emphasis on environmental law where scenario analysis would supplement and/or replace cost-benefit analysis.

31. This is obviously akin to specifying social welfare functions. We recognize the similarity, but do not commit to employing those techniques. For our purposes, it is enough to recognize the apparatus that could be used and perhaps must be used in some contexts. The comparative analysis itself is not dependent on these techniques. They are likely complementary.

Another related approach would be to group the studied scenarios at different levels of micro-meso-macro context and specificity. Consider the possibilities detailed in the Sections below.

A. Micro, Small-Scale Contextual

These studies would begin with a clear, well-understood context within which a specific objective is well-defined and politically-acceptable. There might be some useful negotiation over how to articulate the objective, but this process should take place *ex ante*. For example, we might consider the context of drug development and articulate the objective in terms of supplying drugs to the public that deliver demonstrably large health-related benefits (perhaps measured in terms of quality-adjusted life years (QALYs)).[32] We could also narrow the agreed-upon objective, perhaps to lowering the cost of delivering existing drugs with substantial health benefits. Or we could narrow it even further to focus on specific health problems. Thus, Brett might conduct a comparative analysis of institutions aimed at delivering drugs (health care improvements) to deal with malaria; Mark might do the same with respect to AIDS; Kelly with respect to obesity; and Maria with respect to autism.

Whatever the level of specificity, it is important to first choose a defined, well-understood context within which we can identify a particular objective that is politically-acceptable and perhaps even politically-established. We can then engage in a comparative analysis of institutions within that context and make some headway in understanding how well different institutions serve the defined objective. If multiple objectives are unavoidable, then the scenario analysis suggested above might be necessary, but at least it would be more tractable in the more manageable micro-context.

There are, of course, limitations to this approach. Working at this level necessarily requires the analyst to bracket important questions: Why focus on this context rather than another? Why this objective? Why, to take our examples above, malaria rather than AIDS, obesity, or autism?

Regardless, there are genuine advantages to these types of studies. For one thing, they can at least be done in an open, transparent fashion such that assumptions and choices can be interrogated. When they are done well, these studies can provide useful information that might be sufficiently close to the real world

32. Sachs, *supra* note 10, at 186.

that it can be practically useful and perhaps even point to some politically feasible policy intervention. They might be particularly useful where it seems very likely that something in the relevant context will be done one way or another, such that the comparative analysis will be relevant. And, of course, if these kinds of studies are done as part of the kind of scenario analysis we described above, we might be able to aggregate the studies and draw some lessons at a higher level of generality.

B. Meso, Sector-Specific Context, with Somewhat More Generic Articulation of the Objective

This type of analysis would begin with a well-understood context that is defined in terms of a cognizable (industrial, economic, technological, cultural) sector within which the relevant set of intellectual activities, actors, relationships, and so on can be reasonably well-understood. The analyst would then attempt to articulate a well-defined and politically-acceptable objective for that sector. It is likely that such an objective will have to be stated at a rather high level of abstraction to accommodate the diversity of actors and beliefs about what "success" (progress) within that sector might entail.[33] In a sense, this is the sector's general purpose, and in at least some situations, that purpose might provide a satisfactory basis for evaluation. It might be necessary, once more, to look for more concrete objectives and employ scenario analyses. Or it might be useful to conduct a series of smaller-scale, micro comparative analyses within the sector.

Of course, there are obstacles and limitations to sector-specific comparative analysis. Some are the same as we discussed regarding micro-level analyses—for example, why this sector rather than another? Others concern line drawing and the definition or delineation of sectors themselves—this is done imperfectly already, however, and there would be no reason to reinvent the wheel. One analytical concern is the extent of spillovers across sectors, both in terms of the impact that institutions in one sector might have on others and in terms of the impact that R&D and other activities in one sector might have on others. Obviously, this can occur at the micro-level as well.

Sector-specific comparative analysis at least reduces the scope of the analysis and the corresponding range of objectives, and it also may be useful for analytical reasons. Specifically,

33. *See* JESSICA SILBEY, THE EUREKA MYTH: CREATORS, INNOVATORS, AND EVERYDAY INTELLECTUAL PROPERTY 271 (2015). Relatedly, we think it would be interesting to study the beliefs of actors within the identified sector. What counts as success within the sector? What is progress?

comparative institutional analysis is likely to be more tractable and manageable within sectors.

The pharmaceutical industry is a decent context for this type of comparative institutional analysis. In fact, recent surges in drug prices have driven scholars to evaluate how different institutional arrangements might bring prices down without undermining R&D, innovation, reliability, or other widely accepted industry objectives. Michael Carrier, among others, has analyzed how different combinations of patent, antitrust, and related regulation potentially would work.[34] His testimony to the Senate Judiciary Committee on "Intellectual Property and the Price of Prescription Drugs: Balancing Innovation and Competition" is representative. Though contested (for obvious reasons), his essential claim, based upon his comparative analysis of past, present, and his proposed regimes, is that a series of legislative reforms would bring prices down (the primary objective in his analysis), curb industry abuse of existing laws that were intended to benefit consumers, all with little impact on innovation or R&D investment. In other words, he claims to have identified a configuration of institutions that constitute a (second-best) win-win across objectives that should receive bipartisan support.[35] Other scholars, including Rachel Sachs, have made similar arguments about institutional arrangements for reducing drug costs and/or promoting wider access.[36]

C. Macro, Not Constrained by Context or Sector, Framed at the Broad Level of National Political and Economic Systems, with a Generic Articulation of Objective(s)

It is tempting to conduct comparative analysis at a macro-level and thus offer prescriptions with the broadest impact. But, as is the case for meso-level analyses, for such work to be credible, there must be a basis for evaluation, a broad but well-defined and

34. *See, e.g.*, Michael A. Carrier, *Sharing, Samples, and Generics: An Antitrust Framework*, 103 CORNELL L. REV. 1, 44–47 (2017); Michael A. Carrier et al., *Using Antitrust Law to Challenge Turing's Daraprim Price Increase*, 31 BERKELEY TECH. L.J. 1379, 1398–1400 (2016); Michael A. Carrier, *Unsettling Drug Patent Settlements: A Framework for Presumptive Illegality*, 108 MICH. L. REV. 37, 69 (2009).

35. Professor Carrier does not claim he has identified the optimal first best solution for promoting the set of social values implicated by the legal regimes he has analyzed. Rather, he claims that specific legislation "on samples, settlements, citizen petitions, product hopping, and patent thickets would make patients' lives better without affecting innovation." *See Intellectual Property and the Price of Prescription Drugs: Balancing Innovation and Competition: Hearing Before the S. Comm. on the Judiciary*, 116th Cong. (2019) (statement of Michael A. Carrier, Professor, Rutgers Law School).

36. *See* Sachs, *supra* note 10, at 176–77; Rachel E. Sachs, *Delinking Reimbursement*, 102 MINN. L. REV. 2307, 2335–36 (2018).

politically-acceptable overall objective—one that is stated at a high enough level of abstraction to accommodate the diversity of actors and beliefs about what "success" (Progress) might entail. There are a few candidates, including objectives framed in terms of social welfare or economic growth.

These candidates have serious flaws. Most simply, in our current historical and political context, these objectives can only be presumed or argued for and justified. There is no basis for concluding that the people (through the political process) manifest a commitment to academics' construction of objectives (or social welfare functions, etc.) framed in these terms. Indeed, our list of understandings of the constitutional concept of Progress indicates significant disagreement about objectives even among academics focused on intellectual property and innovation. That such disagreement persists suggests that the evidence for any particular understanding is quite ambiguous and subject to contrary evidence.[37] And that is just among legal scholars. In our view, the way the political process manifests demand is simply too coarse and distorted to provide any meaningful support for a public commitment to economic growth or welfare maximization as objectives for IP policy.

Still, in theory, comparative analysis under various scenarios at the macro-level would be useful. That is, for the reasons explained above, it would be informative at least to know how different institutional regimes fared in various scenarios, where the scenarios involve different objectives or weighting of objectives. It might be the case that certain institutional designs are preferable regardless of the scenario—or perhaps for a wider range of scenarios than others. For example, a comparative evaluation of different institutions (patent, prize, tax, and so on) or even different designs for a particular institution (patent) as means for pursuing different visions of Progress (economic growth, social welfare, and so on) would be incredibly useful. It would, of course, be wonderful to identify potential win-win opportunities where a configuration of institutions fared well.

In *The Wealth of Networks* (2006), Yochai Benkler did something similar to what we have in mind. Benkler conducted comparative institutional analysis across a range of normative values. He carefully analyzed *commons-based peer production* as a provisioning system, in comparison with *market-organized* and *firm-organized proprietary-based provisioning*. These provisioning systems are, or at least can be understood as, macro-level *means*

37. Frischmann & McKenna, *supra* note 19, at 128.

that involve complex institutional structures. Accordingly, it seems to us that Benkler is engaged in comparative institutional analysis at the macro-level.

In a sense, Benkler "supplies" the ends because he chooses liberal political theory as the baseline. Some such choice must be made. What we find most important is that he is explicit, wide-ranging, and substantive in his engagement with the normative values. The normative values Benkler discusses include: autonomy (Chapter Five), democratic participation in both the political sphere (Chapter Seven) and the construction of culture (Chapter Eight), justice and human development (Chapter Nine), and community (Chapter Ten).

> The normative thrust of the book is that the emerging nonmarket production systems should be allowed, if not encouraged, to emerge within the core of the information economy rather than consigned to the periphery. The dynamic changes to the technological and economic conditions of the information environment enable nonmarket production to coexist and in some instances rival market production. Not surprisingly, dominant market players may resist the emergence of nonmarket production systems for a variety of reasons. Incumbents may see emergent systems as direct substitutes or as disruptive technologies that will enable new entrants to challenge the incumbents' market positions. In addition, incumbents may see emergent systems as "free-riders" that unfairly benefit from existing proprietary systems. Finally, incumbents may seek to control the development and emergence of these systems so as to ensure a "cut" of the eventual benefits. The critical prescriptive point . . . is that society should avoid optimizing legal, technological, economic, and other socially constructed conditions—the institutional ecology—for the industrial or proprietary modes of production.[38]

Although Benkler might not have viewed himself as engaging in comparative institutional analysis, the normative section of his book reflects his approach to the macro-level institutional design choice about which provisioning systems to rely on and support. He did not argue in favor of one provisioning system to the exclusion of others; to the contrary, he argued for design choices that would preserve freedom for all rather than giving in to persistent pressures to optimize the institutional ecology.[39] And this final point highlights, as Komesar emphasized in his seminal work on comparative institutional analysis, that the "who decides"

38. Frischmann, *supra* note 20, at 1117–18.

39. YOCHAI BENKLER, THE WEALTH OF NETWORKS 391–92 (2006).

question is perhaps the most important and hotly contested institutional choice.[40]

To conclude this Part, we think it is necessary to begin with the end(s) that serve as the underlying basis for comparative evaluation of failures and institutions in context. Without attention to the normative end(s), which we've described in terms of objectives, comparative analysis is limited to a descriptive comparison of the way various institutions function and the consequences of those institutional arrangements.[41] No comparative evaluation can be made because there is no basis for judgment.

In our view, comparative institutional analysis loses something as it moves from the micro- to meso- to macro-level of analysis. Specifically, it loses relevance and connectedness to real-world systems, and it dilutes empirical information about what actors need/want/demand. From a purely normative perspective—focusing on the well-defined and politically-acceptable objective that serves as the basis for comparing institutions and failures—the more micro the analysis, the more trustworthy it is. At the same time, the more micro the analysis, the more open the analyst is to being challenged on the limitations noted above: whether generalization is possible, and whether prescriptions for legal reform can be developed.[42] Those challenges, however, have more to do with the biases of legal scholarship, since the best approach may be to pursue a series of micro-level studies in order to develop the knowledge base for analysis at the meso- or macro-levels.[43]

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40. KOMESAR, IMPERFECT ALTERNATIVES, *supra* note 25, at 42; KOMESAR, LAW'S LIMITS, *supra* note 25, at 31–32.

41. The Governing Knowledge Commons framework and collaborative research agenda is, at this stage, primarily descriptive. Its primary aim is to systematically study a wide range of knowledge commons, including various dilemmas, community objectives, and institutions. The individual case studies tend to be at the micro-level, and some series of case studies provide insight at the meso-level. *See* Frischmann et al., *supra* note 14, at 1–2; Strandburg et al., *supra* note 14, at 9–10.

42. This triggers the various concerns over uniformity costs, which scholars who have advocated some form of tailoring have dealt with at length. *See generally* Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575 (2003) (discussing the failure of uniform technology patents and calling for tailoring of patent to specific industries); Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 BERKELEY TECH. L.J. 1155, 1158 (2002) (noting that patent law is one area of many in which there are "drawbacks" to "encompassing many types of subject matter within one broad system"); Michael W. Carroll, *One for All: The Problem of Uniformity Cost in Intellectual Property Law*, 55 AM. U. L. REV. 845 (2006) (discussing the problems of uniformity cost in patent law and copyright law and the adequacy of legal institutions to address them).

43. *Cf.* Rachel E. Sachs, *Innovation Law and Policy: Preserving the Future of Personalized Medicine*, 49 U.C. DAVIS L. REV. 1881 (2016) (discussing the importance of

Finally, as we explore in more detail below, the level of analysis might also affect the relevance of different (market, political, communal) system failures and institutions. There may be a question of fit. Failures and institutions may vary across levels, just as the objectives vary.

III. COMPARATIVE ANALYSIS OF FAILURES AND INSTITUTIONS IN CONTEXT

Comparative institutional analysis must consist in substantial part of comparative failure analysis, by which we mean rigorous and contextual comparative analysis of market, political/government, and community failures. In this Part, we first briefly explain *why* and then we explain *how*. The *why* section explains the ways in which distorting myopia creeps into analyses of institutions aimed at promoting innovation. The distortions dramatically limit what we can learn from the comparative studies. In the *how* section, we begin with a preliminary diagnosis of failures and, in particular, develop the distinction between system-independent and system-dependent failures. We then discuss the relationships between institutions and these various failures.

A. The Importance of Comparative Failure Analysis

Many different legal and non-legal institutions govern and therefore shape knowledge production. The variety of knowledge, knowledge producers, and systems with and within which knowledge and knowledge producers and users interact make it all too tempting to look for reductionist shortcuts. That is true in general, but it is especially tempting when one undertakes the task of comparative institutional analysis. The temptation should be resisted for it leads to either what Demsetz called the Nirvana Fallacy or what Ostrom critiqued as myopic allegories.[44] One easy reductionist step is to focus on a particular dilemma—identify a particular market failure, for example, ignoring or assuming away others—and then compare institutions in terms of effective resolution of the dilemma.

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diagnostic testing to individualized medicine and the interplay between patent law, FDA regulation, and health law to achieve broad results); Eisenberg, *supra* note 10, at 360, 363 (same).

44. *See generally* ELINOR OSTROM, GOVERNING THE COMMONS 13–15 (1990); Harold Demsetz, *Information and Efficiency: Another Viewpoint*, 12 J.L. & ECON. 1 (1969); Brett M. Frischmann, *Two Enduring Lessons from Elinor Ostrom*, 9 J. INST. ECON. 387 (2013); Elinor Ostrom, *A Diagnostic Approach for Going Beyond Panaceas*, 104 PROC. NAT'L ACAD. SCI. U.S. 15181 (2007).

At the macro-level, for example, scholars tend to frame the problem to be solved by intellectual property laws as a basic public goods problem, which is often described in terms of the free-rider allegory.[45] Simply put, because intellectual resources are public goods (nonrival and (non)excludable),[46] they may be undersupplied within markets. The inability to cheaply exclude competitors and nonpaying consumers (free-riders) presents a risk that investors perceive *ex ante* (prior to production of the good), and that may discourage optimal levels of investment in production of the good.

Many analysts assume: (1) that the free-rider allegory describes a normal rather than exceptional problem; and (2) that underproduction can be solved only by government subsidy or intellectual property-enabled markets.[47] Government subsidies deal with the underproduction problem directly rather than by constraining consumption. The government allocates funds to research activities that yield intellectual resources, making investment risks less important. The resulting intellectual resources can be shared openly and freely without concern, because the underproduction problem has been solved on the front end. By contrast, intellectual property rights lower the costs of exclusion, enable transactions, and mitigate the risk to investment posed by free-riders. Intellectual property rights thus enable markets to function more effectively in supplying intellectual resources.

Unfortunately, both of the assumptions we identify at least oversimplify reality. First, free-riding may describe a normal or an exceptional problem—we simply do not know for sure. There is insufficient empirical evidence to support a general macro-level claim either way. Overall, the empirical evidence is quite mixed and suggests the answer varies considerably by context. The relevance of the free-riding risk is best evaluated empirically in context. In some contexts, free-riding is not a problem to be solved

45. *See generally* Mark A. Lemley, *Property, Intellectual Property, and Free Riding*, 83 TEX. L. REV. 1031 (2005) (explaining the traditional free-rider problem as manifested in the IP context).

46. We use nonrivalry (without the parentheses) because this characteristic is inherent or fixed for intellectual resources, and we use (non)excludability because this characteristic is context-dependent, is variable with the costs of exclusion, and can be addressed through various institutional interventions. *See* BRETT M. FRISCHMANN, INFRASTRUCTURE: THE SOCIAL VALUE OF SHARED RESOURCES 254 n.1 (2012). For a thorough discussion of public goods, see *id.* at 24–57, and for a thorough discussion of intellectual public goods, see *id*. at 253–314.

47. *See* Frischmann, *supra* note 44, at 398; Brett M. Frischmann et al., *Retrospectives: Tragedy of the Commons After 50 Years*, 33 J. ECON. PERSPECTIVES (forthcoming Fall 2019).

at all; in fact, it may very well be beneficial for society.[48] Second, in theory and practice, the solution set is considerably more diverse and nuanced than most analyses assume. Note how the binary thinking frames the macro-institutional choice (market vs. government) and leaves alternative provisions systems (e.g., commons) out of view.[49] Moreover, while this framing leads to some convenient, compartmentalized divisions of labor between government and market, it (all too conveniently) ignores a host of complications internal to the market and government institutions, which we discuss below as system-dependent failures. The allegory blinds us to the various problems and solutions, and even when it doesn't, it too easily subordinates them.[50]

The concern about myopia is not limited to the macro-level. At the meso-level, we might, for example, want to use comparative institutional analysis to examine the pharmaceutical industry. If we focus on overcoming the potential undersupply of drugs—because drugs are expensive to develop but cheap to copy—and we attribute the undersupply problem to the risk of potential free-riders, we might choose one narrow set of institutions to compare. We might, for example, compare differently-designed patent regimes, prizes, and tax incentives. Our concern is not only with the free-rider problem, however. If we identify the FDA approval process (and specifically clinical trials) as the source of many of the costs associated with drug development, we might be inclined to compare a different set of institutions—for example, patents and other institutions like prizes, grants, and government-provided infrastructure for clinical trials.[51] With regard to the

48. *See* FRISCHMANN, *supra* note 46, at 261–62; Brett M. Frischmann, *Spillovers Theory and Its Conceptual Boundaries*, 51 WM. & MARY L. REV. 801, 807–13 (2009); Brett M. Frischmann & Mark A. Lemley, *Spillovers*, 107 COLUM. L. REV. 257, 258–60 (2007).

49. *See generally, e.g.*, BENKLER, *supra* note 39 (discussing the effect of such binary forces on the industrial information economy); Frischmann, *supra* note 44; Ostrom, *supra* note 44.

50. There is much more we can say about the distortions associated with this framing. For example, it happens to work very well with the *linear model of innovation*—another terribly flawed model that is nonetheless widely adopted because of its tractability. *See* FRISCHMANN, *supra* note 46, at 271–74.

51. This highlights another reason why a broader framework for comparative institutional analysis is important: most existing studies consider only a narrow range of alternatives. Sometimes the studies are constrained by existing alternatives. Other times the analysis is confined because it can only be tractable within defined limits, and particularly because alternatives are difficult to compare when there are few common dimensions along which to draw the comparisons. Hence, while we see comparisons of patents and prizes or tax incentives, we do not see (to our knowledge, at least) comparisons between intellectual property laws and investment in music and art education as means of producing greater or better creative output. We note this not to be critical, but to note that comparisons are only meaningful as between those things that are compared, and it is important to understand the limitations of any particular comparative analysis.

latter, we might then determine that government funding of clinical trials was best because it lowers the cost of bringing drugs to the market and lessens deadweight as compared to patents.

That analysis might be useful, as far as it goes, but it would ignore still other problems, such as the demand-side failure that leads to under-provisioning of drugs to smaller or nonexistent markets. This is not to say that there is anything wrong with comparing institutions as solutions to the free-rider or clinical-trial cost problem. But it is to emphasize that we can only design institutions to address problems we recognize, and the risk of myopia is strong in comparative institutional analysis because introducing multiple institutions to compare seems to demand of the analyst a corresponding reduction in the scope of problems to which the institutions might be addressed.

B. Comparing Institutional Failures

Recall that in the previous section, we suggested that one must start with a defined objective (end) and context (level of analysis). Here, we assume that this has been done. In other words, the relevant objectives (ends) are settled, even if only in functional terms or as part of a scenario, and we're ready to evaluate means.[52]

We might begin with the biggest institutional choice question: what provisioning system is the best means to that end? What are the options?—Markets? Governments? Communities? Comparing these systems requires recognition not just of the strengths of different institutions, but also of the ways those institutions fail. We use "fail" here capaciously—and particularly we mean it more broadly than the type of "market failure" at the center of the dominant framing of intellectual property. As we discussed above, intellectual property rights are often described as necessary to remedy a particular kind of market failure that arises because of the public goods nature of inventions and works of authorship.[53] Specifically, inventions and works of authorship are costly to create but, owing to their non-rivalry and non-excludability, easy to copy and distribute at a price that would prevent the developer from recapturing its investment. We certainly don't mean to argue that this kind of market failure is irrelevant, only to highlight that this is only one type of failure that needs to be considered.

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52. We understand that there are problems with neatly separating means and ends. For now, we leave that aside.

53. *See supra* text accompanying note 45; Lemley, *supra* note 45, at 1039–40.

As we discuss extensively below, some failures have to do with the nature of the institution under consideration. Certain failures, for example, will be common to government institutions; others will be common to market-based institutions. Some failures will relate to the nature of the task an institution will be expected to undertake and not to the type of institution. Administration of prizes, for example, depends on the administering entity's ability to gather information about the desired output and the structure and size of the prize necessary to induce that output. That is true regardless of the type of institution that administers the prize. Still other failures will result from the combination of the institution and the type of task.

It therefore might be necessary, or at least helpful, to identify preliminarily the *system-independent* failures (or dilemmas) that will need to be overcome to achieve the stated objective. These might influence the macro-level options and evaluation. Then we can proceed to consider and compare the *system-dependent* failures and institutional options.

1. System-Independent Failures. Some obstacles to achieving the stated objectives are a function of variables, characteristics, or circumstances that do not depend on the provisioning system. We call these *system-independent failures*. Usually these failures are a function of the *natural resource environment* or of *human nature*.[54] These obstacles might be seen as exogenous to any particular system, although as we will see that might go too far since the systems may mitigate or aggravate the obstacles in various ways.[55] Consider three examples: (non)rivalry as an example of a resource characteristic; shortsightedness as an example of a characteristic of human beings; and externalities that can be a combination of the two.

The first example is the *rivalrousness of physical resources* and *nonrivalrousness of ideas*.[56] These resource characteristics

54. Bear in mind that market and political systems are social constructs.

55. We identify these as system-independent failures, using "independence" in a much weaker sense than is often used in social science and mathematical contexts. In those contexts, independence implies that the systems do not affect the problems. But, as we recognize in the text, the systems may feed into or reinforce the problems, in ways large and small.

56. We tend to emphasize failures associated with nonrivalrousness, but rivalrousness can be equally problematic. Whether the marginal cost of consuming something is zero or positive, different complications may arise for suppliers. In a sense, rivalrousness creates information problems—how much of a resource should be supplied? To determine provisioning, one needs to know who needs/wants/demands how much of what. Governments may struggle, and markets may thrive, in overcoming this problem by use of the price mechanism, but reliance on markets for rivalrous goods creates demand for

give rise to obstacles (even governance dilemmas)[57] that exist regardless of which systems society chooses to rely on as means for provisioning or governing the resources. Of course, the obstacles may vary in magnitude or form across systems, and again, the systems can be designed to exacerbate or lessen the dilemmas. But the point is that the resource characteristics that give rise to obstacles or dilemmas are not a function of provisioning systems.

Shortsightedness afflicts human beings, and it can be exacerbated, controlled, or adjusted within any of the systems.[58] Political systems may be designed to extend or shorten time horizons; the same is true of markets, of course. But the problem of shortsightedness originates with individual human beings and characteristics of human behavior and decision-making. We use shortsightedness to refer to decision-making that *irrationally* preferences the short-run over the long-run, or put another way, decision-making that *irrationally* discounts the future.[59] One could engage in shortsighted decision-making either by favoring short-run gains over significantly larger long-run gains, by choosing policies that generate short-run gains but larger long-term costs, or by avoiding short-run costs when the consequence is more significant longer-term costs. A variety of psychological biases contribute to the problem.[60] Shortsightedness constitutes a system-independent problem because of its origins in human behavior and because it distorts individual and collective decision-making regardless of the provisioning system.[61]

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a certain type of governance institution—exclusive rights to possession and use—without which markets may struggle. Nonrivalrousness doesn't eliminate the information problem—we still need to know what to supply and to whom, but it is different in certain respects. This is not the place to fully describe the obstacles. Frischmann has discussed them extensively elsewhere. *See generally* FRISCHMANN, *supra* note 46; Frischmann et al., *supra* note 14.

57. Another way to frame this would be to say that the resource characteristics themselves give rise to societal demand for governance.

58. For a short piece on shortsightedness that begins with an episode of South Park, see Brett M. Frischmann, *Some Thoughts on Shortsightedness and Intergenerational Equity*, 35 LOY. U. CHI. L.J. 457, 457–60 (2005).

59. We could discuss a host of behavioral economic concerns here. *See generally* DAN ARIELY, PREDICTABLY IRRATIONAL (First Harper Perennial 2010) (2008).

60. Shortsightedness is one of the examples/applications we will explore. *See infra* Section IV.A.

61. Here, again, we run into some confusion about our use of independence. Different provisioning systems can mitigate or exacerbate shortsightedness, and thus actual or observed shortsightedness is not independent of systems in the technical sense used in mathematics or the social sciences. *See supra* note 55. A similar point arose in the old debate about causation in which Ronald Coase observed that externalities arise from interdependence and are thus jointly produced. *See* Brett M. Frischmann & Alain Marciano, *Understanding the Problem of Social Cost*, 11 J. INSTITUTIONAL ECON. 329, 332–41 (2014). *See generally* R. H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1961).

A third example is *externalities*. Although often described as a type of market failure, this is a mistake. Externalities are system-independent, at least at a rather fundamental level where we examine what causes external effects to be external or outside of people's accounting or view or decision-making process. Externalities are, by definition, third-party effects; they exist when one person acts in a fashion (or even when two people jointly act in an interdependent manner) that leads to costs or benefits that are not factored into the actor's decision-making process.[62] In the context of markets, the idea is that an individual's willingness to pay doesn't account for the external benefits or costs realized by others. But of course, there is nothing inherent about externalities that makes them more susceptible to full accounting (internalization) within political systems. To the contrary, people cast votes and otherwise exercise political power in various ways that cause—or fail to account for—external effects. It may be the case the markets and political systems fail differently or more (less) frequently with respect to different types of externalities, or perhaps that institutions within those systems are better suited to dealing with externalities. And externality problems may be made worse within different systems—e.g., relying on markets to guide environmental resource allocation may systematically fail because of externalities. But our basic point holds. Externalities are not dependent on the provisioning system; rather, they are a product of interdependence among people and resources.

Another resource-related, system-independent failure is what Frischmann referred to as "innovative process market failure."[63] Though he erroneously framed the problem in terms of market failure, the problem he identified was not dependent on the choice of the market as the provisioning system. Rather, that problem concerned the innovative process itself.

> Innovative process market failure (IPMF) occurs when the dynamic nature of the innovative process and its uncertain progression press investors toward more applied research than is socially desirable. IPMF has two defining characteristics: (1) dynamic dependence, i.e., future innovative progress depends on the existing state, and (2) prospective uncertainty, i.e., risks, time horizons, expenditures, and spillovers are uncertain as estimated *ex ante*. Limited public and private investment resources require a careful balance between applied and basic innovation projects over time to ensure efficient progress.

62. *See* FRISCHMANN, *supra* note 46, at 37–40.

63. Frischmann, *supra* note 3, at 374.

> However, in the face of prospective uncertainty, investors skew innovation investment from the socially optimal distribution between applied and basic research, irrespective of public goods market failures . . . .
>
> . . . .
>
> The social costs of IPMF are an interesting brand of opportunity costs, ranging from slowed technological development within an industry to significant macroeconomic effects on competitiveness in emerging industries. As commentators have noted, under-investment in basic research will likely undercut the supply of new ideas and, equally important, the supply of future avenues of research. Moreover, innovative process market failures interact with public goods market failures and the corrective institutional mechanisms employed by the government.[64]

Our reason for identifying system-independent failures is, among other things, to prevent conflation with system-dependent failures. Importantly, identification and analysis of the system-independent obstacles will help frame the analysis of the provisioning system choice as well as the subsidiary comparative institutional analysis.

We need to emphasize again here that identifying a particular failure or obstacle as system-independent does not imply that its significance or magnitude is entirely independent of institutional design. To the contrary, many system-independent failures can be mitigated or exacerbated by certain institutional design choices. The point is that doing *comparative* institutional analysis requires recognition that these failures will be relevant across different institutions, which should draw more attention to the ways institutional design can affect them.

2. *System-Dependent Failures.* Markets, political systems, and communities serve as means. These systems comprise the rules of the game and structure the opportunities that people have to act in pursuit of their interests. The systems don't exist independently—they are socially constructed, whether designed or emergent. [65] They are provisioning systems—systems through

64. *Id.* at 374–76.

65. *See* BRETT FRISCHMANN & EVAN SELINGER, RE-ENGINEERING HUMANITY 45–50 (2018) (discussing how systems depend on societies to construct their meaning). Consider antitrust law as an institution. Its primary (perhaps only) objective is maximizing [consumer welfare] [economic welfare] [social welfare]. To accomplish this objective, the institution is designed to achieve an intermediate objective, the preservation of [the competitive process] [competition] [the underlying operating system of the market]. In fact,

which we are provided with the outputs we desire. But for these systems to function as such, actors within the systems must also be able to figure out what to provide—to assess social demand. Markets determine how to match supply and demand through the price mechanism; political systems achieve this matching through elections and governance; communities through (generally more informal) social interactions.

Market systems fail in certain ways, political systems in other ways, and non-governmental community systems in still others. Of course, there is overlap. But in terms of identifying the demanded outputs, the systems rely on different signals, information, processes, and so on. And in satisfying that demand, the systems rely on different actors, distribution methods, and relationships. We think comparative institutional analysis should account for characteristics that vary at the system level and shape both failures and institutions—characteristics such as demand-signaling processes, evaluative criteria (for projects or investments or innovation), and basic capabilities operative within different settings or systems. Failures and institutions obviously do not correspond exactly, and we suspect that comparative analysis of these and other characteristics will provide guidance for continued analysis. Solid comparative analysis will require theory and empiricism in tandem rather than in isolation from each other. Comparative (failure and institutional) analysis is necessarily contextual.

System failures—market failures, political system failures, and community system failures—occur within each system and are a product of the particular system. In essence, the failures derive from societal use of the system as a means. For example, markets as means depend on a particular architecture, basic operating system, set of operating procedures, and so on. Perhaps the most basic defining feature of the operating system of a market is reliance on the price mechanism. This reliance has consequences, and it causes certain failures, particularly as compared to alternative systems. Demand-side market failures can be understood as situations in which markets allocate resources, structure relationships, and shape activities based on consumers' willingness to pay.[66] Because willingness to pay is

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antitrust law is tied directly to the provisioning system itself. The "who decides" question at the macro-level is determined. Congress then specified the law in very generic terms, in effect delegating to courts the responsibility for working out the institutional details. This is another macro-level "who decides" determination. Within antitrust law, the comparative institutional analysis focuses on doctrinal rules, presumptions, burdens of proof, and so on.

66. This includes allocating resources, structuring relationships, and shaping activities based on demand derived from consumers' willingness to pay—that is, upstream.

sometimes not a good proxy for actual demand,[67] the market system can underperform in achieving some specified objective relative to another system. In prior work, Frischmann discussed this in terms of social demand exceeding private demand, usually because of external effects from public and social goods that are not reflected in private willingness to pay, but this may be an incomplete description. As Demsetz implied by the Nirvana Fallacy, the analysis should be comparative; failure of one system should be described and evaluated relative to an alternative system.

Just as we emphasized above that characterizing a certain failure or obstacle as system-independent does not mean that institutional design is irrelevant, we need to emphasize here that the consequences of system-dependent failures may frequently be felt outside of that system. To take one basic example, failures in the government's provisioning of basic infrastructure are likely to affect market-based systems for providing other goods or services. Thus, analysts focused on system-dependent failures need to be attentive to extra-system effects.

IV. APPLICATIONS AND EXAMPLES

In this Part, we discuss some examples that we would like to explore as this project develops. For the most part, we have focused on potential applications of our approach, in part by highlighting some contexts in which others have already done work that is consistent with what we have described. Here we try to fit these applications within the typology we developed above, and we highlight strengths of the existing work while identifying issues for future elaboration.

A. Shortsightedness

In previous work, we attempted to lay the groundwork for a broader understanding of the goals of intellectual property law in the United States, particularly by arguing that there is room for a normative commitment to intergenerational justice, which we referred to generically as "intergenerational progress."[68] We suggested that intellectual property law as an institution was not as future-regarding as it could be, primarily because it relies so heavily on the market, and the market is systematically shortsighted. We regarded this as a missed opportunity because

67. For example, "willingness" to pay may reflect ability to pay.

68. *See* Frischmann & McKenna, *supra* note 19, at 123–25.

the subject matter of intellectual property makes it particularly susceptible to the promotion of intergenerational progress.

We began this project where that previous work left off, intending to focus on the ways we could promote intergenerational progress by altering some rules within the intellectual property system and by increasing our focus on other institutions that might be used to supplement intellectual property rules and partially offset their shortsightedness. To accomplish this, we first identified a particular problem—the failure of the intellectual property system to adequately provision goods and services with long-range or broader social value. We took for granted a normative commitment to intergenerational equity, or at least left a complete defense of that commitment to a later date. We then identified a cause of that failure, specifically the delegation to "the market" of decisions about what types of cultural, scientific, and intellectual progress we want.[69] We therefore argued that nonmarket institutions—including various government, nonprofit, and other social institutions—should supplement intellectual property rules in order to provide the kinds of goods and services we had in mind.

We anticipated building on that work and engaging in a comparative analysis of institutions for solving the shortsightedness problem, and we still hope to carry out that project. However, as we considered how to structure such an analysis, we realized that we needed a broader framework within which to conceive of our work. We recognized that shortsightedness is neither caused by nor unique to, the market as an institution. It is rather a consequence of a number of human behavioral characteristics—hyperbolic discounting among them. These behavioral characteristics afflict decision-makers in a variety of institutional settings. They are system-independent obstacles, to use our previous terminology. Nevertheless, we think shortsightedness is exacerbated by the market, relative to other mechanisms.

The challenge of a well-executed comparative institutional analysis relating to the problem of shortsightedness will be to define with greater particularity the kinds of outputs we want

69. *See id.* at 124–25, 127–28. To be clear, we recognized that there is obviously some logic to such an approach, and we do not deny that IP systems optimally designed to facilitate markets would lead to progress and improve the welfare of future generations at least in some respects. Our argument was instead that progress need not, and indeed should not, be conceived of in linear, binary terms (more progress or less). Progress instead should be seen as contextual, in the sense that progress takes place within a particular information ecosystem, and the defining characteristics of that ecosystem shape the path along which we progress.

some provisioning system to provide, to evaluate who is in the best position to make particularized judgments about those outputs (and what signals they will use to decide), and to consider how other institutions can be structured to ameliorate the shortsightedness problem and the potential effects of such institutional arrangements on the market actors in the intellectual property context. Also, we think it will be important to be sensitive to context here, for the shortsightedness problem (and the problems attendant to its solution) will vary considerably by industry or setting.

B. Neglected Diseases

Terry Fisher and Talha Syed are working on a book that engages in a rigorous comparative analysis of failures and institutions in the neglected disease context. Though we have not obtained access to the full book (yet), some of the chapters are available online.[70] The book builds from their published article, *Global Justice in Healthcare: Developing Drugs for the Developing World*.[71]

In that article, Fisher and Syed accomplished three things. First, they identified a social crisis: "Each year, roughly nine million people in the developing world die from infectious diseases." Second, they developed a rigorous analysis of the normative arguments in favor of a social and political commitment to overcoming the crisis. And finally, Fisher and Syed identified two "obstacles" to achieving this objective.

> First, the majority of the most effective drugs are covered by patents, and the patentees typically pursue pricing strategies designed to maximize their profits. Second, pharmaceutical firms concentrate their research and development ("R & D") resources on diseases prevalent in Europe, the United States, and Japan—areas from which they receive 90-95% of their revenues—and most of the diseases that afflict developing countries are uncommon in those regions.[72]

The first two accomplishments together are quite useful in developing a normative baseline for evaluation and articulation of a well-specified, politically-acceptable (though still contestable)

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70. *See* WILLIAM W. FISHER III & TALHA SYED, INFECTION: THE HEALTH CRISIS IN THE DEVELOPING WORLD AND WHAT WE SHOULD DO ABOUT IT 22–23, https://cyber.harvard.edu/people/tfisher/Infection.htm [https://perma.cc/4ES8-P65X] (last visited Aug. 29, 2019).

71. William W. Fisher & Talha Syed, *Global Justice in Healthcare: Developing Drugs for the Developing World*, 40 U.C. DAVIS L. REV. 581 (2007).

72. *Id.* at 583.

objective. With respect to the normative baseline, it still might be useful to engage in scenario analysis where different normative baselines serve to differentiate the scenarios. But they have identified an objective.

The two obstacles are interesting in the sense that they are system-dependent and, to some degree, institution-dependent. That is, both "obstacles" really seem to be a function of having chosen the market as the macro-level provisioning system and further the choice of patents as the market-modifying institution to determine or drive progress.

It is not clear whether the authors engage in a comparative analysis of institutional options. Rather, it appears that they examine different institutions almost independently, motivated in part by the fit between the institution and a perceived problem. In a sense, they explain the gains that society might achieve through the use of particular institutional arrangements or reforms. But it is not clear that this is done in a comparative fashion.

We look forward to the publication of their book and the opportunity to further explore comparative research in this important context.

C. Climate Change

Climate change is one of the most pressing dilemmas society will face in our lifetime. There is widespread agreement that we will need to innovate to deal with some of the many consequences. Thus, we believe it is fair to say that there is a reasonably well-specified and accepted political commitment to support R&D investments in this context. We might state the objectives as promoting the development and widespread deployment of (1) innovation to reduce GHG emissions; and (2) innovation to mitigate the economic and social effects of climate change. We might articulate others, and we might articulate more specific subsidiary objectives already encompassed by (1) and (2). Moreover, social and political commitments or normative objectives will depend substantially on the scale and community chosen.

A comparative analysis would need to address a wide range of failures and institutions. There are a host of system-independent obstacles to confront, including several that we mentioned in the previous Part: shortsightedness, the nonrivalrousness of various environmental and knowledge resources, externalities of various types, and innovative process failures.

We suspect that the choice of provisioning system may not be resolvable; all available provisioning systems may need to be

harnessed in certain situations. That is, there are likely to be complementary roles for government provisioning, market provisioning, and community-based or commons-based provisioning of innovation that meets societal needs. It might not be terribly useful to do a comparative analysis at the macro-level because of the difficulty in choosing a provisioning system. But such a choice might be more easily made in more specific contexts with more concrete objectives in mind.

Josh Sarnoff recently published an exemplary starting point for this kind of analysis.[73] Here is the abstract for his paper:

> Huge amounts of money will soon be spent by governments and private entities to develop technology to reduce the costs of climate change mitigation and adaptation, and to deploy new energy and transportation infrastructures. Incredibly, we still lack any good idea of the best means of providing massive amounts of government or private money so as to promote the most innovation and technology diffusion at the lowest cost. This Article seeks to support better analyses of, and decision making regarding, the choices of government innovation-funding mechanisms by discussing the limits of current analyses and providing a taxonomy of such measures. It also proposes future work to better analyze what we know about these choices and their relative effectiveness, and it discusses new measures to expand our knowledge base, which include: (1) better tracking of government innovation-funding inputs and outputs; (2) better documentation of and self-conscious decision making regarding funding choices; and (3) creating experiments that go beyond existing natural experiments.

Sarnoff analyzes the comparative institutional analysis literature that focuses on innovation and concludes:

> [W]e do not know very much yet about important issues that should inform our decisions. We do not know: what government innovation choices have actually been made, their results, and their effectiveness across a number of dimensions; why we have made those choices; how those choices might compare to alternatives; what factors influence the comparative effectiveness of those choices; and the extent to which those factors are driven by particular cultural considerations that may be subject to manipulation.[74]

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73. Joshua D. Sarnoff, *Government Choices in Innovation Funding (with Reference to Climate Change)*, 62 EMORY L.J. 1087, 1087 (2013).

74. *Id.* at 1106.

Sarnoff then makes three proposals, which he suggests "would help improve evaluations of such choices and consequently help government decision[-]making in the first stance."[75]

> These proposals are: (1) better tracking of government-innovation expenditure decisions and their outcomes; (2) self-conscious and documented legislative and agency decision[-]making regarding expenditure form choices; and (3) controlled experiments that go beyond existing natural experiments.[76]

Sarnoff then develops a useful taxonomy of government institutions: "(a) subsidization; (b) procurement; (c) direct development; (d) constructed commons; and (e) product, process, and market regulation."[77]

Even though he does not engage in the comparative analysis of failures and institutions in context, his proposals and taxonomy would be useful in framing such an analysis.[78]

In a series of reports, the Organization for Economic Co-operation and Development (OECD) has undertaken sophisticated analyses of the relationships between technological innovation and climate change. Some of these reports have adopted a comparative institutional approach. In one such report, the OECD examined, through a variety of metrics and models, the potential impacts that different policies might have on innovation. The OECD assumed that the policy instrument utilized would have a different effect on innovation depending on the type of renewable energy source. For example, feed-in tariffs might affect innovation in solar PV differently than it would affect wind energy.[79]

In 2011, the OECD published an extensive report analyzing a variety of "policy levers" that would encourage innovation in the

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75. *Id.* at 1116.

76. *Id.* at 1107–08.

77. *Id.* at 1116.

78. *Compare* Organisation for Economic Co-operation and Development [OECD], *Taxation, Innovation, and the Environment*, at 13–16 (Oct. 13, 2010), https://read.oecd-ilibrary.org/environment/taxation-innovation-and-the-environment_9789264087637-en#page1 (a comparative analysis of failures and institutions in context), *with* Sarnoff, *supra* note 73, at 1116 (Sarnoff's three proposals to help improve evaluations of government choices to fund innovations and Sarnoff's taxonomy of government institutions grouped into five categories).

79. Ovan Hašcic et al., *Recent Trends in Innovation in Climate Change Mitigation Technologies*, *in* ENERGY AND CLIMATE POLICY: BENDING THE TECHNOLOGICAL TRAJECTORY 17, 37 (2012), https://read.oecd-ilibrary.org/environment/energy-and-climate-policy_9789264174573-en#page7.

energy and environmental sector.[80] The normative goal was clear, and the report engaged in a comparative analysis at the meso-level of national policy instruments.[81] The report distilled potential policy instruments into five different "vectors"—different components of existing policy instruments that could be used to encourage innovation—and measured the correlation between each policy vector on innovation. The five vectors included stringency, predictability, flexibility, depth, and incidence. Stringency referred to the ambitiousness of the environmental policy target relative to the baseline emissions trajectory; predictability to the effect a policy had on investor uncertainty; flexibility to the extent to which the innovator was able to identify the best way to meet the objective; depth to the incentives to innovate throughout the range of potential objectives; and incidence to whether the policy targeted the externality directly or whether the point of incidence was a proxy for the pollutant.[82]

Note that the vectors related obstacles to objectives, and the comparative analysis evaluated policy instruments in terms of innovation, which in turn was measured according to the number of patent applications in selected environmental technology categories across OECD countries.[83] The report indicated that policy stringency was correlated with innovation and this correlation was statistically significant.[84] Additionally, the flexibility vector was important because the results of the study indicated that governments should give firms stronger incentives to look for optimal technological means. The authors concluded that monetary taxes and tradable permit systems scored well on most of the criteria. Nonetheless, the authors concluded that they could divine no hard and fast rules and that much comparative and contextual work remained to be done: "[A]ssessment of the effects of environmental policy on technological innovation requires a close analysis of both the characteristics of the environmental policy framework and the technology areas which it is likely to affect."[85]

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80. ORG. FOR ECON. CO-OPERATION & DEV., INVENTION AND TRANSFER OF ENVIRONMENTAL TECHNOLOGIES 14 (2011), https://read.oecd-ilibrary.org/environment/invention-and-transfer-of-environmental-technologies_9789264115620-en#page1.

81. *See id.* Notably, the book also includes three sectoral studies of innovation in alternative fuel vehicles, solid waste management and recycling, and green (sustainable) chemistry. *Id.* at 13.

82. *Id.* at 22.

83. *See id.* at 27–32. While there may be some problems with the methodology—for example, some would criticize using patent counts as a measure of innovation—our point here is not to criticize or defend the book on those terms.

84. *See id.* at 33–35.

85. *Id.* at 14.

The OECD has continued to engage in comparative work, and it has emphasized a greater need for research linking policy regimes to target innovation that achieves a particular environmental outcome.[86]

> Further work on the identification of the innovation impacts of alternative policies is required. This will necessarily involve modeling the links between policy regimes, knowledge stocks, capital investment and specific environmental outcomes (e.g., emissions) in a comprehensive manner. The development of commensurable indicators of policy regimes across a variety of emitting sources is perhaps the greatest challenge.[87]

Given the scale and scope of the climate change dilemma and the potential role that innovation can play in addressing some of the challenges facing society, the time is ripe for sustained comparative analysis of innovation failures and institutions. As we suggested in the Introduction, this is where we suspect the action will and should be.

V. CONCLUSION

Scholars engaged in comparative institutional analysis are poised to make significant contributions in the field of intellectual property, or more broadly, in information law and policy. This Article aims to help guide that analysis, so that the work of different scholars can be aggregated and learned from.

We have argued that to do comparative analysis well, analysts need to articulate and defend their normative baselines. Comparison can proceed at different levels (micro, meso, and macro), but there is important value in staying closer to the ground. Comparative institutional analysis is necessarily contextual.

We have also argued that comparative institutional analysis must be accompanied by comparative failure analysis, by which we mean rigorous and contextual comparative analysis of the ways different institutional responses tend to fail. Engaging in that analysis requires distinguishing between system-dependent and system-independent failures, even recognizing that institutional design can exacerbate or ameliorate these failures.

86. *See id.* at 15.
87. *Id.*