Ketan Ahuja
Forthcoming in Elias Deutscher, Justin Lindeboom and Stavros Makris (eds.), Cambridge Handbook on Competition Law and Antitrust Theory (Cambridge University Press 2026)

Innovation Ecosystems in Antitrust

Bringing "Innovation Capabilities" Considerations Into Antitrust Law

Innovation is key to improving people's standard of living, and matters more for economic growth than prices or quality in the long-run.[1] A reasonable economic approach to antitrust would focus on innovation harms, prioritizing them above 'static' welfare measures like prices. And academics consider today's economics-informed consumer welfare standard to protect innovation appropriately, at least in theory.[2]

Yet innovation arguments are often peripheral in cases, and courts may be reluctant to intervene because of innovation harms. This is partly because innovation harms are hard to prove.[3] But more importantly, where innovation concerns do arise, antitrust courts have in practice found that innovation arguments support non-intervention, as judges emphasize the need to protect companies' rights to profit from their investments in innovation.[4] This is because these arguments focus on the incentives of innovators, guided by the assumption in neoclassical economics that innovation happens because innovators work hard at innovation problems. We'll call this understanding the 'Innovation-as-Incentives' paradigm. This paradigm biases antitrust's rules and enforcement philosophy against intervention and has given courts an 'immune response' against intervention on innovation grounds.

But the *ability* of innovators to innovate matters just as much as their *incentive* to innovate in determining whether innovations arise. Innovators' ability to innovate comes from a supportive ecosystem that gives them access to different capabilities and technologies that they can combine to make new products and services. Innovation is a 'team sport,' involving collaboration among organizations, sharing knowledge, and transmitting knowhow through open access to products and services and movement of employees. We'll call this understanding of innovation the 'Innovation-as-Capabilities' paradigm. In contrast with the Innovation-as-Incentives approach, Innovation-as-Capabilities concerns suggest a policy geared towards sharing knowledge and critical resources and enabling collaboration. These concerns are largely absent from antitrust law and debates on innovation.

Centering antitrust on innovation demands that it supports the *ability* to innovate, not just the *incentive*, by helping innovators access required capabilities to make new products and services. This paper outlines how to bring Innovation-as-Capabilities concerns into antitrust. Section 1 explores how an economic approach to antitrust questions would prioritize innovation. Section

[1] This clearly emerges from the literature on economic growth. See, for example, F. M. Scherer, *Innovation and Growth: Schumpeterian Perspectives* (Cambridge, Mass.: MIT Press, 1984); Rui Zhao, "Technology and Economic Growth: From Robert Solow to Paul Romer," *Human Behavior and Emerging Technologies* 1, no. 1 (2019): 62–65, https://doi.org/10.1002/hbe2.116.

[2] Leah Samuel, Fiona Scott Morton, "What Economists Mean When They Say 'Consumer Welfare Standard,'" *ProMarket* (blog), February 16, 2022, https://www.promarket.org/2022/02/16/consumer-welfare-standard-antitrust-economists/.

[3] Tim Wu, "TAKING INNOVATION SERIOUSLY: ANTITRUST ENFORCEMENT IF INNOVATION MATTERED MOST," *Antitrust Law Journal* 78, no. 2 (2012): 313–28.

[4] This paper explores these dynamics below through examining some of the major recent cases on innovation.

2 explores these two different paradigms on innovation. Section 3 addresses how antitrust law sees innovation primarily as a matter of incentives, and how this leads antitrust enforcement to bias against intervention. Section 4 outlines how to bring arguments related to the ability to innovate into antitrust analysis, and thereby to promote innovation better.

I. Proving Innovation Harms Is Hard, Which Side-lines Innovation In Antitrust Analysis.

Analysis of recent antitrust cases suggests that while litigants often mention innovation, they rarely assess it in detail. More often, they allude to harm to 'price, quality and innovation' because of a less competitive market environment, but without often homing in on innovation harms. Hillary Greene and Richard Gilbert find that around a third of the roughly 250 mergers that the DOJ and FTC challenged between 2004 and 2014 mentioned innovation harms, and allegations of innovation harm were much more common in mergers in R&D-intensive sectors (with innovation harms alleged in 82.5% of challenged mergers), than in mergers in low-R&D sectors (with innovation harms alleged in 9% of challenged mergers).[5] But in roughly half of these cases, innovation harms are merely mentioned or stated, without any elaboration or discussion; Greene and Gilbert accordingly conclude that the FTC and DOJ should 'describe their innovation concerns with greater specificity when merger challenges allege harm to innovation.'[6]

But innovation harms are hard to prove, which explains why plaintiffs see innovation arguments as 'nice-to-have', but rarely something to build a case around. Looking at how litigants reason in cases demonstrates how innovation concerns arise as a 'nice to have': in the DOJ's challenge to the merger of United Healthcare Group and Change Healthcare in 2022, the DOJ alleged broad harms to price, quality and innovation.[7] United, a conglomerate with leading health insurance and claims management software businesses, sought to buy Change, the main US provider of claims management software that was unaffiliated with a health insurer. Combining with Change, the DOJ alleged, would give United a dominant position in claims management software, and the ability and incentive to raise prices, reduce quality, reduce access to innovations in claims management for rival insurers, and copy rival insurers' innovations through surveillance of their data transmitted through Change.

As is typical in antitrust reasoning, the DOJ alleged harm to innovation arising alongside higher prices and lower quality, and because of reduced competition in some horizontal market. Innovation harms thereby complemented and reinforced arguments around harms to prices and quality arising from reduced competition, without adding a genuinely new chapter of argument to the debate. In the *United-Change* merger, the thrust of the DOJ's complaint was of

[5] Richard Gilbert and Hillary Greene, "Merging Innovation into Antitrust Agency Enforcement of the Clayton Act," SSRN Scholarly Paper (Rochester, NY, November 1, 2015), https://papers.ssrn.com/abstract=2716224.
[6] Gilbert and Greene.
[7] "Antitrust Division | U.S. and Plaintiff States v. UnitedHealth Group, Inc. and Change Healthcare Inc. | United States Department of Justice," February 24, 2022, https://www.justice.gov/atr/case/us-et-al-v-unitedhealth-group-inc-and-change-healthcare-inc.

consolidation in one part of the value chain (claims management software) giving the merged firm the ability and incentive to self-preference and copy rivals' innovations in another part of the value chain (health insurance).

The Court's treatment of these arguments about innovation demonstrates why litigators hesitate to make innovation-based arguments. The Court stated:[8]

> '[T]he central problem with this vertical claim is that it rests on **speculation rather than real-world evidence** that events are likely to unfold as the Government predicts. Governing law requires the Court to "mak[e] a prediction about the future," and that prediction must be informed by "record evidence" and a "fact-specific showing" as to the proposed merger's likely effect on competition. AT&T, 310 F. Supp. 3d at 190–92 (quotations omitted). Under this standard, "antitrust theory and speculation cannot trump facts." Id. at 190 (quotations omitted)… The Government has **failed to show that United's post-merger incentives will lead it to [substantially lessen competition].** Nor has the Government put forward real-world evidence that United's rivals are likely to innovate less out of fear that United will poach their data. No payer witness made that claim; in fact, all the payer witnesses testified to just the opposite." (emphasis added)

When called to give testimony, United's competitors testified that they would, of course, try to innovate and compete aggressively even after the merger. (What corporate executive makes a public statement that they won't try to innovate or compete aggressively?). The Court drew on this testimony to defeat the DOJ's argument that the merger would harm innovation, stating 'all the payer witnesses rejected the notion that the proposed merger would harm innovation. For example, a Cigna employee was asked, "You are not going to compete less aggressively after UnitedHealthcare acquires Change Healthcare?" Her answer: "So in my personal opinion, I don't think we ever compete less for any reason. We always go at it really hard. That's our job."' The DOJ failed to satisfy its burden of proof around its innovation claims because 'the Government provided zero real-world evidence that rival payers are likely to reduce innovation. The Government did not call a single rival payer to offer corporate testimony that it would innovate less or compete less aggressively if the proposed merger goes through.'[9]

The Court acknowledged that the DOJ 'presented evidence that United would have some incentive (and ability) to exploit competitors' competitively sensitive data for its own economic benefit following the acquisition.' But, quoting AT&T,[10] the Court found that 'evidence . . . that it could be possible to act in accordance with the Government's theories of harm is a far cry from evidence that the merged company is likely to do so.' In all, the DOJ's arguments on innovation

[8] *United States v. UnitedHealth Grp. Inc.,* 630 F. Supp. 3d 118. (United States District Court for the District of Columbia September 21, 2022)
[9] "United States v. UnitedHealth Grp. Inc., 630 F. Supp. 3d 118, (United States District Court for the District of Columbia September 21, 2022)."
[10] AT&T, 310 F. Supp. 3d at 210.

were too speculative for the Court's taste, with the Court noting that 'the Government does not explain how it can meet its burden of proof simply by asserting that "things may change."'[11]

Arguments about innovation are by their nature speculative: the innovation process is random and oriented towards a hard-to-predict future. Hard data often does not exist, and we lack econometric techniques to measure harm to innovation with the same firmness that we measure harm to prices. A court looking for specific evidence that a merger (or other antirust event) will harm innovation will be hard-pressed to find innovation harms on the balance of probabilities. A plaintiff will struggle to discharge this burden of proof. Where plaintiffs do make innovation arguments, courts can require an unrealistic amount of evidence. Plaintiffs and agencies therefore typically claim innovation harms as a 'nice-to-have', rather than a central feature of a case.

Despite these challenges, antitrust cases against tech companies increasingly force agencies and courts to grapple with innovation harms. Agencies in the US and EU that seek to develop a more assertive antitrust doctrine have demonstrated their ambition to bring new types of cases around innovation that challenge prevailing antitrust rules, even if these cases have a low probability of success. Over the last couple of years, we have therefore seen many new cases that raise innovation arguments, such as in challenges to Microsoft's acquisition of Activision,[12] Meta's acquisition of Within,[13] Illumina's acquisition of Grail,[14] and the various cases against Meta, Google and Amazon in the US and EU.[15]

Innovation arguments in these cases have generally unfolded as above—with enforcers alleging that a well-understood theory of competitive harm (such as vertical leveraging) will reduce competition and thereby harm prices, quality and innovation. In *Meta/Within*, for example, the FTC argued that Meta's acquisition of a popular Virtual Reality (VR) fitness app would lead Meta not to invest in developing its own VR fitness app offerings, or use Within's popular VR fitness app to steer users toward its VR platform.[16]

Courts have looked at innovation arguments in these cases with skepticism, generally requiring substantial evidence to prove innovation harms. For example, in *New York et al v Facebook*, the

[11] "United States v. UnitedHealth Grp. Inc., 630 F. Supp. 3d 118, (United States District Court for the District of Columbia September 21, 2022)."
[12] *FTC v. Microsoft Corp.*, 2023 __ F.Supp.3d __ (United States District Court for the Northern District of California, July 10, 2023).
[13] *FTC v. Meta Platforms Inc.*, 2023 U.S. Dist. LEXIS 29832; Case No. 5:22-Cv-04325-EJD.
[14] *Illumina, Inc. v. FTC*, 88 F.4th 1036.
[15] See eg "New York v. Meta Platforms, Inc., 66 F.4th 288," accessed November 19, 2023, https://advance-lexis-com.ezp-prod1.hul.harvard.edu/document/documentlink/?pdmfid=1516831&crid=93c83261-2f3c-400e-b32c-7a55b3285c05&pddocfullpath=%2Fshared%2Fdocument%2Fcases%2Furn%3AcontentItem%3A683S-64C1-F873-B128-00000-00&pdcontentcomponentid=6397&pddoctitle=New+York+v.+Meta+Platforms%2C+Inc.%2C+2023+U.S.+App.+LEXIS+10264+(D.C.+Cir.%2C+Apr.+27%2C+2023)&pdproductcontenttypeid=urn%3Apct%3A30&pdiskwicview=false&ecomp=kv88k&prid=9ed0cbc8-1a81-49fc-8f77-461bb8864d7c; Dave Michaels, "U.S. v. Google: What to Know About the Biggest Antitrust Trial in 20 Years," WSJ, accessed January 31, 2024, https://www.wsj.com/tech/google-antitrust-trial-doj-search-91d32f8f; David McCabe, Karen Weise, and Cecilia Kang, "D.C. Accuses Amazon of Controlling Online Prices," *The New York Times*, May 25, 2021, sec. Business, https://www.nytimes.com/2021/05/25/business/amazon-dc-lawsuit.html; "European Regulators Crack down on Big Tech," *Reuters*, March 5, 2024, sec. Technology, https://www.reuters.com/technology/european-regulators-crack-down-big-tech-2023-10-03/.
[16] FTC v. Meta Platforms Inc., 2023 U.S. Dist. LEXIS 29832.

Federal Court of Appeals for the DC Circuit dismissed the states' innovation arguments as '"Odd" because the States' suit concerns an industry that, even on the States' allegations, has had rapid growth and innovation with no end in sight.'[17] Similarly, a district judge in California allowed Meta to acquire Within, because the FTC could not satisfy the high evidentiary burden of proof to demonstrate innovation harms.[18]

So antitrust sidelines innovation arguments in part because innovation harms are hard to prove: litigators shy away from centering cases around innovation harms, and when they do argue for innovation harms, courts find that they struggle to discharge their burden of proof.

II. Two Paradigms on Innovation: Innovation-as-Incentives and Innovation-as-Capabilities.

Notice *what* enforcers were required to prove in *United Healthcare/Change Healthcare* and *Meta/Within*: that competitors' incentives to innovate were harmed because of a reduction in competition within a specific market. Not, notably, that a specific innovation did not emerge, nor that data demonstrated lower consumer welfare because of a missed innovation.

This assumes that innovation happens because innovators have incentives to work hard at a problem; that innovation is the product of incentive-oriented agents that try to stay ahead of their competitors; and that this same mechanism drives reductions in price and improvements in quality in competitive markets. This mental model about innovation is a paradigm—a belief about how the world works that antitrust then tries to make rules around. In other words, current law adopts the Innovation-as-Incentives paradigm.

An alternative paradigm focuses more on the ability to innovate—and understands innovation as "emerging" from a structure of social and technological relations that are conducive to innovation. This 'Innovation-as-Capabilities' approach focuses more on an innovation ecosystem—the relationships between firms, talent, customers, investors, research institutions, and partners, and understands innovation to come from sharing knowledge and resources.

These two paradigms come from different academic communities and suggest different policies: Innovation-as-Incentives is rooted in neoclassical economic traditions, and implies that innovation policy should maximize the incentives of firms to innovate.[19] Innovation-as-Capabilities approaches are rooted more broadly in the social sciences and suggest innovation

[17] *New York v. Meta Platforms, Inc.*, 66 F.4th 288

[18] Steven Salop, "An Excessive Evidentiary Burden Sunk the FTC's Case Against the Meta/Within Merger," *ProMarket* (blog), February 22, 2023, https://www.promarket.org/2023/02/22/an-excessive-evidentiary-burden-sunk-the-ftcs-case-against-the-meta-within-merger/.

[19] See, for example, Giulio Federico, Fiona Scott Morton, and Carl Shapiro, *Antitrust and Innovation: Welcoming and Protecting Disruption*, vol. no. 26005, no. 26005., NBER Working Paper Series (Cambridge, Mass: National Bureau of Economic Research, 2019); Giulio Federico, Gregor Langus, and Tommaso Valletti, "A Simple Model of Mergers and Innovation," *Economics Letters* 157 (2017): 136–40, https://doi.org/10.1016/j.econlet.2017.06.014. The sources of this paradigm and it's status in neoclassical economics are discussed below in detail.

policy should aim to promote collaboration, knowledge-sharing and transmission of knowhow.[20] These approaches to understanding innovation are not mutually exclusive—they explain different parts of the innovation puzzle.

This section elaborates on how paradigms shape antitrust, explains the Innovation-as-Incentives and Innovation-as-Capabilities paradigms, and examines how both these paradigms relate to each other.

a. Economic Paradigms Frame Antitrust Interpretation and Enforcement, Including Around Innovation.

Paradigms are beliefs that people or institutions hold that *structure* and *integrate* analytical solutions to narrow questions to solve complex problems. Paradigms represent assumptions about the way the world works: they shape what we decide to pay attention to when we model certain activities or attempt to explain certain phenomena. In short, paradigms are a form of worldview about a problem.

The French call paradigms 'déformation professionelle'—the habit of seeing things from the perspective of one's trade or profession. In English we say 'to a man with a hammer, everything looks like a nail'. The many idioms in different languages about how paradigms shape our worldview is a testament to their existence and universal reach.

Paradigms drive how we make sense of the world even in the 'hardest' areas of science.[21] Thomas Kuhn in The Structure of Scientific Revolutions described science as progressing through phases of theoretical stasis, crisis, revolution, and renewal.[22] 'Normal' stages of science involve broad consensus from the scientific community on problem statements, theories, methods and instruments (in other words, on paradigms). At these stages, paradigms suggest new problems for research to tackle, provide the tools and methods for solving problems, and provide standards by which solutions can be verified.

But problems appear which existing paradigms cannot explain very well. For a time, scientists tack these problems as coda or exceptions onto existing approaches, until a better paradigm or theory emerges that can explain these problems, at which time, paradigms go through periods of revolution and renewal. Paradigms and paradigm shifts do not, of course, result from the

[20] Innovation has been heavily studied in the social sciences over the last 50 years. Research has arisen from many different perspectives, and there may be other paradigms on innovation that are relevant to antitrust. The vast and diverse literature on innovation is difficult to summarize comprehensively, and this paper does not attempt to do so.

[21] 'Hard' science here refers to fields of science that are perceived to be the most methodologically rigorous, employing the use of formal mathematics to analyze natural phenomena, like the natural sciences.

[22] Thomas S. Kuhn, *The Structure of Scientific Revolutions*, Fourth edition. (Chicago ; London: The University of Chicago Press, 2012).

objects of scientific study—they instead result from how we try to make sense of natural phenomena. They are objects of our construction.

Paradigms *structure* modeling and analysis of specific questions. In economic modeling, we need to form hypotheses about problems to render them analytically tractable. These hypotheses, which we base on our chosen paradigms, influence which features of a problem we consider relevant to a model. A standard paradigm in neoclassical economics is that economic agents are rational profit-maximizers, which leads to a modeling approach of maximizing the financial incentives of economic agents. [23]

We also use paradigms to *integrate* narrow, technical analyses to build a broader understanding of a complex issue, using inductive reasoning. Integrating technical analyses into broader narratives requires us to fill in gaps, simplify, and generalize in a way that renders a complex problem tractable. Paradigms help us do this. For instance, we may develop a narrative around how innovation happens by combining different models or case studies about innovation in specific situations to infer a larger truth about innovation. Paradigms help us decide what aspects of models to pay attention to, and how to build an overall causal narrative.

Paradigms have more impact on an analysis when they *integrate* analyses into a broader narrative than when they *structure* a technical analysis on a narrow question. We can identify good answers to narrow questions, paying attention to case-specific nuances. But integrating technical analyses into broader narratives requires us to fill in gaps, simplify, and generalize, and we use paradigms extensively when doing so.

Of course, some paradigms are more accurate, and some less. Working with paradigms often means acknowledging that they represent only a part of the whole picture. Paradigms can be very hard to see from the inside of a coherent system because a paradigm shapes how we see the world—often, we need to step out of a particular worldview to understand its impact.

Paradigms about the economy affect many aspects of antitrust enforcement, with real implications for how firms compete. In some cases, antitrust enforcers use economic analysis to understand how the case might impact welfare, and paradigms structure these analyses. When creating general rules in antitrust, such as those prohibiting or allowing mergers under certain conditions, judges and policymakers rely on paradigms to integrate an understanding about how the economy works: They must do this to make decisions expediently, rather than exploring economic foundations in each case. For example, in antitrust we often design rules that are most

[23] 'Neoclassical' economics is a diverse field. Archetyping the field's central tenets can be challenging and nebulous, perhaps unjustly leaving out some stream of thought. At risk of oversimplification, neoclassical economics refers to an approach to analyzing economic behavior built around a few main tenets such as that economic agents are rational profit (or utility) maximizers, who make decisions on the margin, are motivated by incentives, and act to satisfy their preferences. Neoclassical economics is therefore a collection of paradigms that add up to make a shared understanding of a discipline. "Neoclassical Economics, by E. Roy Weintraub: The Concise Encyclopedia of Economics | Library of Economics and Liberty," accessed March 16, 2024, https://www.econlib.org/library/Enc1/NeoclassicalEconomics.html; Imre Lakatos, *The Methodology of Scientific Research Programmes*, Lakatos, Imre. Philosophical Papers ; v.1 (Cambridge ; New York: Cambridge University Press, 1978).

likely to maximize the incentive of an economic agent to innovate, adopting a paradigm that innovation happens when incentivized agents apply effort to a problem.

As a result, antitrust often decides whether to intervene to prevent harm to innovation according to general rules of law rather than case-specific economic analysis, which makes paradigms around innovation especially influential in deciding antitrust cases. Empirically evaluating the impact on economic welfare in all but the simplest cases is almost impossible.[24] This is particularly true in innovation cases, where evidence on new products is limited and often highly speculative, and it is often wiser to rely on general economic principles.[25]

Enforcers do, of course, pay close attention to case-specific features when applying antitrust rules to particular cases. Many theories of harm are decided under the rule of reason,[26] and enforcers conduct substantial analysis of economic effects in a given case. But even here, exactly what an enforcer must prove often depends more on general rules than specific contextual welfare evaluations. In innovation cases, proving empirically that firms reduced R&D on particular projects (thereby harming consumers) is generally impossible. Assertive antitrust enforcement only requires enforcers to show that firms would have less incentive to develop new products.[27]

The sections below contrast the incentive and capability-based approaches to understanding innovation.

b. Innovation-as-Incentives: Innovation Happens Because Actors Apply Effort to Problems.

Neoclassical economic approaches to analyzing innovation understand it to arise from the efforts of appropriately incentivized market actors—they adopt the Innovation-as-Incentives paradigm. These analyses try to balance the incentive created by letting innovators profit from their inventions with the pressure to innovate to stay ahead of competitors. Balancing these two sets of incentives will maximize the overall incentive to innovate.[28]

This Innovation-as-Incentives paradigm accordingly *structures* analyses of innovation in antitrust cases. For example, Federico, Langus, and Valletti detail a model in which all firms can eventually achieve a particular product innovation if they apply sufficient effort. This model helps identify

[24] Herbert Hovenkamp and Fiona Scott Morton, "FRAMING THE CHICAGO SCHOOL OF ANTITRUST ANALYSIS," *University of Pennsylvania Law Review* 168, no. 7 (2020): 1843-. See also Justin Lindeboom, "Formalism in Competition Law," *Journal of Competition Law & Economics* 18, no. 4 (December 1, 2022): 832–80 at 863=865, https://doi.org/10.1093/joclec/nhac003.

[25] Giulio Federico, Fiona Scott Morton, and Carl Shapiro, *Antitrust and Innovation: Welcoming and Protecting Disruption*, vol. no. 26005, no. 26005., NBER Working Paper Series (Cambridge, Mass: National Bureau of Economic Research, 2019).

[26] Under which antitrust litigators conduct a case-by-case analysis of the economic impacts of a specific practice to decide if it should be prohibited.

[27] Federico, Scott Morton, and Shapiro, *Antitrust and Innovation*. See also Fernando Castillo de la Torre, "Is the Effects-Based Approach Too Cumbersome?: Taking Stock of Recent Practice and Case Law on Article 102 TFEU," SSRN Scholarly Paper (Rochester, NY, March 21, 2023), https://doi.org/10.2139/ssrn.4395401, which makes a similar point regarding evidentiary standards in EU competition law.

[28] Federico, Scott Morton, and Shapiro.

circumstances in which a merger reduces a firm's incentive to innovate.[29] In this case, the paradigm that innovation arises from a firm's effort in response to incentives defines how Federico et al.'s model takes shape. The model works within this paradigm to structure an analysis of a narrow question on merger policy and innovation.

Policymakers and academics also use the Innovation-as-Incentives paradigm to *integrate* research to answer larger questions in antitrust. Shapiro demonstrates this as he tries to tie together existing research on innovation into three principles:[30]

- Contestability: Capturing profits from competitors spurs innovation.
- Appropriability: Being able to appropriate profits from an innovation spurs innovation activity.
- Synergy: Mergers of complementary assets can lead to innovation.

"Contestability" and "appropriability" are based on the incentives of innovators to innovate, and they predominate Shapiro's inquiry.

Shapiro's framework has been influential and is widely adopted by agencies and academics.[31] It has, for example, often been used to explain the European General Court's decision prohibiting the merger of Deutsche Börse and NYSE Euronext.[32] These competing stock exchanges pressured each other to innovate, and much of their innovation in trading technology came from their efforts to outdo each other to win business. While allowing them to combine would let the joint entity *appropriate* greater profits from each innovation (because the joint entity would apply innovations to more customers), on balance prohibiting their merger would maximize innovation incentives because the two stock exchanges were motivated to innovate to *contest* each other's business.

Exactly how this mode of economic research informs competition and antitrust inquiry is complex, and covered in substantial detail elsewhere.[33] For our purposes, it is enough to appreciate that a certain form of embedded paradigm shapes both the narrow analytical research that economists use to address scientific questions, as well as the broader conclusions that lawyers, economists, and policymakers draw around what promotes innovation in general. This paradigm embeds certain assumptions around how innovation takes place into antitrust that then determine the terrain of permissible policy interventions.

---

[29] Giulio Federico, Gregor Langus, and Tommaso Valletti, "A Simple Model of Mergers and Innovation," *Economics Letters* 157 (2017): 136–40, https://doi.org/10.1016/j.econlet.2017.06.014.

[30] Carl Shapiro, "Competition and Innovation: Did Arrow Hit the Bull's Eye?," in *The Rate and Direction of Inventive Activity Revisited* (Chicago: University of Chicago Press, 2019), 361–410, https://doi.org/10.7208/9780226473062-012.

[31] See, for example, Competition Directorate–General of the European Commission, Competition Policy Brief: EU Merger Control and Innovation 2 (April 2016) and (Directorate-General for Research and Innovation (European Commission), Ezrachia, and Stuckeb 2020)

[32] See Case T-175/12 *Deutsche Börse v European Commission* (2015).

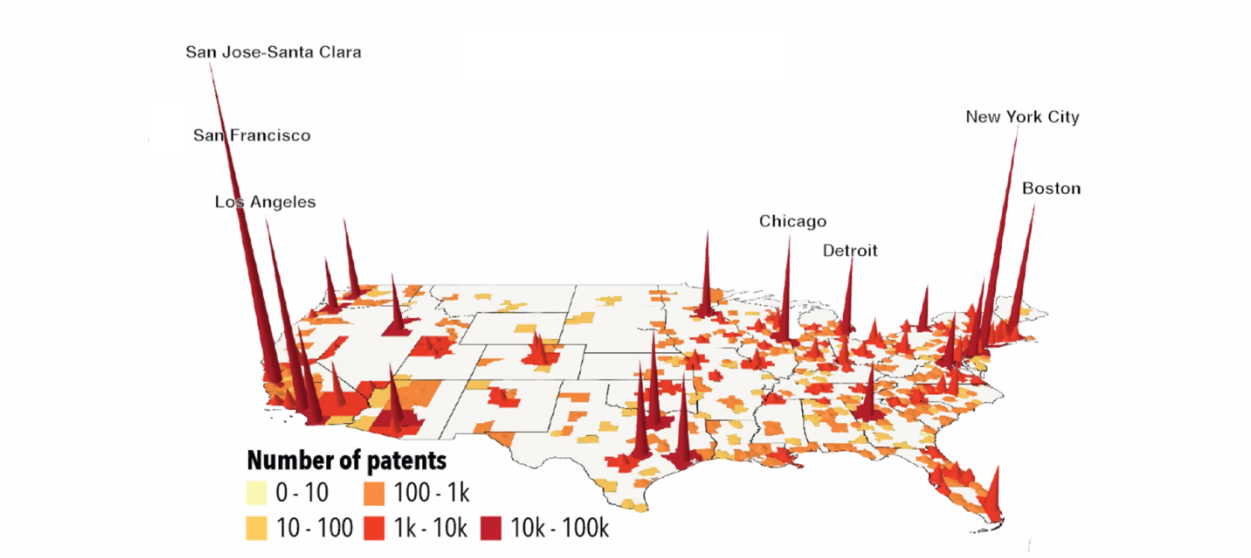
[33] Federico, Scott Morton, and Shapiro, *Antitrust and Innovation*. Ioannis Kokkoris and Tommaso Valletti, "Innovation Considerations in Horizontal Merger Control," *Journal of Competition Law & Economics* 16, no. 2 (June 2, 2020): 220–61, https://doi.org/10.1093/joclec/nhaa008.

c. Innovation-as-Capabilities: Innovation Arises from Combining Capabilities.

Where the Innovation-as-Incentives paradigm addresses how much effort market actors are likely to put into innovation in different circumstances, other research tries to understand the mechanics of how innovation actually happens. A standard paradigm within this line of research is that innovation takes place by combining pre-existing "ingredients" or capabilities in new ways. We'll call this the Innovation-as-Capabilities paradigm.

Under this paradigm, innovations emerge from environments where required capabilities are in close proximity to each other. Proximity here means relational proximity, or the ease with which market participants can access and combine different capabilities to come up with new products and services. This could include geographic proximity: for example, more patents are registered in Silicon Valley (where talent, funding, partners, universities, and customers exist in close proximity) than elsewhere in the US (Figure 1).[34] But 'relational proximity' will also include the strength of social or professional ties between workers and customers, knowledge sharing between firms, and ease of access to opportunities or commercial partners. Innovations "emerge" from combining capabilities in new ways because the new system becomes more than the sum of its parts, achieving things its component capabilities cannot do alone.[35]

Figure 1: Innovation Emerges From Conducive Environments[36]



[34] Patents may be considered an incomplete proxy for innovation activity.

[35] See W. Brian Arthur, *The Nature of Technology: What It Is and How It Evolves* (London ; New York: Allen Lane, 2009) for a discussion of emergence.

[36] Pierre-Alexandre Balland et al., "Complex Economic Activities Concentrate in Large Cities," *Nature Human Behaviour* 4, no. 3 (January 13, 2020): 248–54, https://doi.org/10.1038/s41562-019-0803-3.

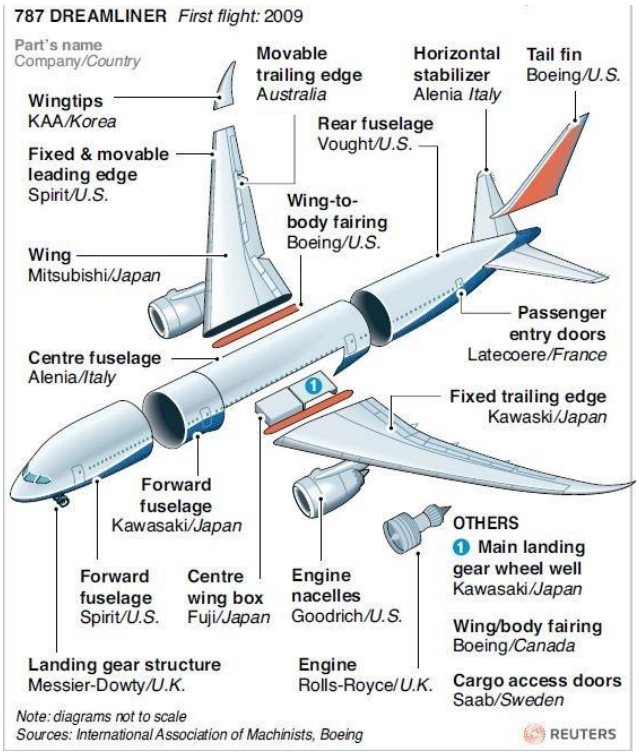
Capabilities under this paradigm consist of the knowledge to do or make something. This knowledge *can* be recorded and transmitted in codes, manuals, or books. But *most* useful knowledge in economic activity is tacit and is embedded in products, individuals, infrastructure, or organizations, particularly at a technological frontier. For example, to use a microwave, we do not have to understand the physics behind microwaves, or how they are designed, built, or powered. All this knowledge is embedded in the microwave and made available to us to use as a functioning product.

A capability can therefore be transferred by moving a product through trade, moving teams or people with particular know-how, or moving knowledge through discussion or publication of manuals. As useful knowledge for production is often tacit, moving products or people often transfers a capability more effectively than sharing information in written publications. In this case, the knowledge to make the product is 'embodied' in the product that is traded or licensed. Capabilities are embedded practical knowledge that is difficult to transfer.

For an example of this paradigm, airplanes are made from a vast number of specialized components, which are each produced by specialist manufacturers, often in different regions (Figure 2). The task of airplane manufacturers such as Boing or Airbus is to combine these parts in ways that make airplanes. An aircraft manufacturer such as Boeing does not need to know how to make jet engines: it can buy jet engines from Rolls Royce. Conversely, opening up these networks of capabilities or suppliers to new manufacturers can allow for new aerospace companies, manufacturers and technology architectures to emerge.

Figure 2: Components of an Airplane[37]

[37] Copyright The Boeing Company.



Research conducted under the Innovation-as-Capabilities paradigm is much more methodologically diverse than research conducted under the Innovation-as-Incentives paradigm. Research under the Innovation-as-Capabilities paradigm has touched disciplines as diverse as sociology, economic history, economic geography, complexity economics, and business strategy. These communities do not regularly engage with antitrust and competition practitioners and much of this research needs translating to apply it to competition policy. In some cases, these researchers specifically conceive of their work as falling within a Capabilities paradigm (for example, Brian Arthur, Hidalgo and Hausmann, and Baldwin and Clark); in other cases, the capabilities paradigm may be implicit.

Brian Arthur's foundational research elaborates how new technology emerges under the Innovation-as-Capabilities paradigm.[38] He argues that new technologies are almost always a combination of existing technologies, and existing technologies are made up of smaller technologies organized into systems. Technology "evolves" as new components are added and systems are reorganized to improve a particular technology until the technology becomes mature and progress slows. New technologies can also emerge where they satisfy a particular need

[38] Arthur, *The Nature of Technology*.

better than older ones. This paradigm informs a diverse collection of recent research from across the social sciences.[39]

Innovation-as-Capabilities paradigms have substantially impacted work in economic geography, which examines why economic activity happens in certain places. Hidalgo and Hausmann's economic complexity framework infers a region's capabilities from what it produces and demonstrates that places with more capabilities are able to produce radically more, and more complex, products. Under this model, economic development takes place when particular areas acquire new capabilities, which they can recombine with their existing capabilities to produce new products and services.

Other research in economic geography validates that movement of knowledge workers is key to innovation. Saxenian argues that unrestricted movement of workers across firms was a key enabler of Silicon Valley's innovative dynamism.[40] Hyde and Gilson argue that Silicon Valley as a whole outperformed Massachusetts so spectacularly in the 1980s and 1990s because California did not enforce employee non-competes, leading to much more circulation of employees, know-how, and ideas between firms in California than in Massachusetts.[41] In a related line of work, Crescenzi, Dyèvre & Neffke demonstrate that cross-border investments by foreign multinationals help create new innovation clusters by bringing knowhow to new geographies, and the value of foreign R&D investments to new innovation clusters depends on how much the foreign firms integrate with the local ecosystem through research collaborations and hiring local workers.[42]

The Innovation-as-Capabilities paradigm has also influenced business writing on competitive strategy. Baldwin and Clark's research at Harvard Business School demonstrates that the computer industry has achieved remarkable levels of growth by embracing modularity and subsystems that can be innovated independently and integrated in new ways.[43] In research conducted with the management consultancy BCG, Fink et al. model when companies should

[39] See, for example, James Mcnerney et al., "Role of Design Complexity in Technology Improvement," *Proceedings of the National Academy of Sciences of the United States of America* 108 (May 31, 2011): 9008–13, https://doi.org/10.1073/pnas.1017298108; Hyejin Youn et al., "Invention as a Combinatorial Process: Evidence from US Patents," *Journal of The Royal Society Interface* 12, no. 106 (May 6, 2015): 20150272, https://doi.org/10.1098/rsif.2015.0272; Anton Pichler, Francois Lafond, and J. Doyne Farmer, "Technological Interdependencies Predict Innovation Dynamics," *SSRN Electronic Journal*, 2020, https://doi.org/10.2139/ssrn.3547474; R. Cowan and N. Jonard, "The Dynamics of Collective Invention," *Journal of Economic Behavior & Organization*, Journal of Economic Behavior & Organization, 52, no. 4 (2003): 513–32, https://doi.org/10.1016/S0167-2681(03)00091-X.

[40] AnnaLee Saxenian, *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*, Acls Humanities E-Book (Cambridge, Mass: Harvard University Press, 1996), https://hdl.handle.net/2027/heb.00993.

[41] Alan Hyde, *Working in Silicon Valley: Economic and Legal Analysis of a High-Velocity Labor Market*, Issues in Work and Human Resources (Armonk, N.Y.: M.E. Sharpe, 2003); R. J. Gilson, "The Legal Infrastructure of High Technology Industrial Districts: Silicon Valley, Route 128, and Covenants Not to Compete," *New York University Law Review (1950)* 74, no. 3 (1999): 575–629; Yochai Benkler, "Law, Innovation, and Collaboration in Networked Economy and Society," *Annual Review of Law and Social Science* 13, no. 1 (2017): 231–50, https://doi.org/10.1146/annurev-lawsocsci-110316-113340.

[42] Riccardo Crescenzi, Arnaud Dyèvre, and Frank Neffke, "Innovation Catalysts: How Multinationals Reshape the Global Geography of Innovation," *Economic Geography* 98, no. 3 (May 27, 2022): 199–227, https://doi.org/10.1080/00130095.2022.2026766.

[43] Carliss Y. Baldwin and Kim B. Clark, *Design Rules: The Power of Modularity*, 2000, https://doi.org/10.7551/mitpress/2366.001.0001.

focus on acquiring more complex capabilities that would enable them to innovate in more complex ways, and when they should focus on exploiting their current capabilities.[44]

Some describe this work as having crystallized around a unifying 'ecosystem' lens on innovation. In innovation 'ecosystems', actors combine their complementary assets or capabilities to create new products and services. Important issues in analyzing innovation ecosystems involve defining actors, coordination mechanisms, how actors collaborate to create and capture value, modularization, complementarity and hierarchy of capabilities, and understanding the ecosystem as a unit of analysis.[45] One principle that emerges from this work is that economic and innovation activities thrive where they are related to existing activities within an ecosystem.[46]

Researchers have applied this lens on innovation to study the innovation implications of antitrust intervention following enforcement events. They have found in some instances that forced breakups and mandates sharing of patents can increase innovation activities, and that innovation increases because of technological spillovers rather than because the companies facing antitrust proceedings stopped exclusionary activities. Accordingly, Watzinger et al find that the 1956 Bell consent decree that required AT&T to make its patent portfolio public substantially boosted follow-on innovation.[47] Similarly, Felix Poege found that Allied forces breaking up the German chemical company IG Farben after the second world war led to increased innovation because it increased technology spillovers in various technology domains.[48]

Technology spillovers here are not some abstract concept: they refer to the strength of ties between participants within an ecosystem, which enables them to collaborate. The 'technology spillovers' concept encourages us to focus analysis on what happens either inside the firm in question or outside the firm's boundaries. But what we're really interested in is the network structure of the ecosystem: strong ties between participants (some of which will be firms or their employees) generate more innovation. This is the mechanism that generates technology spillovers.[49]

Ideas of 'ecosystems', 'technology spillovers', or 'positive externalities' may mislead us into thinking that capabilities are state-created public goods in some narrow sense. Private companies

[44] Thomas Fink, Pankaj Ghemawat, and Martin Reeves, "Searching for Great Strategies," *Strategy Science* 2, no. 4 (December 2017): 272–81, https://doi.org/10.1287/stsc.2017.0052; T. M. A. Fink and M. Reeves, "How Much Can We Influence the Rate of Innovation?," *Science Advances* 5, no. 1 (n.d.): eaat6107, https://doi.org/10.1126/sciadv.aat6107.

[45] Carliss Y. Baldwin et al., "Focusing the Ecosystem Lens on Innovation Studies," *Research Policy* 53, no. 3 (April 2024): 104949, https://doi.org/10.1016/j.respol.2023.104949; Neave O'Clery, Muhammed Ali Yıldırım, and Ricardo Hausmann, "Productive Ecosystems and the Arrow of Development," *Nature Communications* 12, no. 1 (March 5, 2021): 1479, https://doi.org/10.1038/s41467-021-21689-0.

[46] Yang Li and Frank Neffke, "Evaluating the Principle of Relatedness: Estimation, Drivers and Implications for Policy," 2023.

[47] Martin Watzinger et al., "How Antitrust Enforcement Can Spur Innovation: Bell Labs and the 1956 Consent Decree," *American Economic Journal: Economic Policy* 12, no. 4 (November 2020): 328–59, https://doi.org/10.1257/pol.20190086.

[48] Felix Poege, "Competition and Innovation: The Breakup of IG Farben," 2022. Also see Petra Moser and Alessandra Voena, "Compulsory Licensing: Evidence from the Trading with the Enemy Act," *The American Economic Review* 102, no. 1 (2012): 396–427, https://doi.org/10.1257/aer.102.1.396; Joerg Baten, Nicola Bianchi, and Petra Moser, "Compulsory Licensing and Innovation – Historical Evidence from German Patents after WWI," *Journal of Development Economics* 126 (2017): 231–42, https://doi.org/10.1016/j.jdeveco.2017.01.002.

[49] Xiaofan Liang et al., "Intercity Connectivity and Urban Innovation," *Computers, Environment and Urban Systems* 109 (April 1, 2024): 102092, https://doi.org/10.1016/j.compenvurbsys.2024.102092.

can create capabilities for their own commercial ends. For example, companies such as Intel and TSMC make and sell semiconductors. In developing these businesses, they benefited from state investment into research, training, procurement, etc, that gave them the capabilities they needed to commercialize semiconductors. But to many other manufacturers, semiconductors are necessary inputs into their products: having access to semiconductors they can buy represents a broad capability that allows them to innovate in many other domains of technology. This is the case even though semiconductors are made by private companies. Rather than state-created public goods, it is more helpful to think of a capability as applied knowhow used in economic activities (which may be embedded in networks of relationships in an ecosystem, or in products that companies make and sell, or in asset bases that companies control). Understood in this way, a 'capability' is a fairly general, amorphous concept.

d. Reconciling Innovation-as-Capabilities with Innovation-as-Incentives Frameworks

These approaches to understanding innovation are not mutually exclusive, and both make sense: from a venture capitalist's perspective, innovation happens because profit-motivated entrepreneurs take risks and work hard; from a bird's-eye-view economic perspective, the right circumstances draw innovation out of certain groups, firms, and places. Innovation requires both incentives to motivate individual effort and required capabilities or ingredients to exist in a way that makes them easy to combine. Put another way, the Innovation-as-Incentives paradigm and the Innovation-as-Capabilities paradigm can coexist—they explain different parts of the innovation puzzle (Figure 2 below).

Innovation-as-Incentives and Innovation-as-Capabilities arguments can both support antitrust intervention and non-intervention. Innovation-as-Incentives arguments suggest that antitrust should optimize incentives to innovate: this may mandate non-intervention to allow an innovator to profit from its innovation investments, or it may mandate intervention to increase competition in the market and thereby increase the pressure on firms to innovate to stay ahead of their rivals.

Similarly, Innovation-as-Capabilities arguments suggest that antitrust should promote the *ability* of innovators to innovate by giving them access to required capabilities. This can support antitrust intervention, as interventions to force firms to share capabilities through, for example, the essential facilities doctrine or compulsory licensing opens up access to capabilities to other innovators, enabling them to make new products and services. Sometimes, Innovation-as-Capabilities arguments can also support non-intervention, for example where letting a firm acquire another firm allows it to buy in new capabilities that it will need to make new products and services.

But in practice, Innovation-as-Incentives arguments typically support non-intervention and Innovation-as-Capabilities arguments more often support intervention. Innovation-as-Incentives arguments have led courts to focus on the need to protect innovators' ability to profit from their investments (explored below). By contrast, Innovation-as-Capabilities arguments generally promote modularizing knowhow into tradable products and services, sharing of capabilities, and

giving as many firms as possible access to needed capabilities. In most circumstances, opening up access to capabilities to more innovators will drive more innovation than trying to privatize a set of capabilities as the exclusive domain of one firm.[50]

Accordingly, suggesting (as Hovenkamp recently has)[51] that mergers of complementary capabilities within ecosystems are generally good for innovation demonstrates a serious misunderstanding of the economic literature around Innovation-as-Capabilities. The right unit of analysis for an Innovation-as-Capabilities lens is the *ecosystem*, not the *firm*. Buying a complementary capability will always benefit the acquirer, just as buying a horizontal competitor will always benefit the acquirer. What matters to antitrust is that nobody else now has access to that complementary capability—that the acquisition has weakened the strength of the ecosystem or network of knowledge-sharing. In a merger context, antitrust has to balance between innovation benefits to the acquirer and innovation harms to the ecosystem.

Although Capabilities and Incentive-based approaches to innovation focus on different aspects of innovation problems, they are related. Innovation-as-Incentives can support antitrust intervention where intervention subjects dominant firms to more competition (for example, by giving a firm's competitors access to its essential facilities), and thereby increases their incentives to invest in innovation. Incentive-based reasoning in favor of this sort of intervention contains a hidden step in the argument: intervention improves competition *[by giving third parties the capabilities needed to enter the market]* and thereby increases incentives of dominant players to continue to innovate. Focusing on the *ability* to innovate rather than the *incentive* lets us home in on what we really care about here: the capabilities and inputs that third parties need to enter a market or become competitive in a new domain. We might tentatively say that the ability to innovate is therefore, in some sense, prior to the incentive to innovate.

This discussion shows that Capabilities and Incentives-based approaches to innovation are mostly complementary, but occasionally their policy prescriptions can be in tension. Innovation-as-Incentives demands that innovators can profit from their innovations, and would therefore tend to privatize returns and allocate them to particular innovators.[52] By contrast, Innovation-as-Capabilities would promote sharing capabilities across networks and among both market and non-market participants.[53] Antitrust needs to strike a balance between these two approaches, but this should not deter policy from seriously adopting an Innovation-as-Capabilities approach alongside its existing incentive-oriented approach.

The government plays a different role under incentive-based and capabilities-based approaches to economic regulation: under an incentive-based understanding of innovation, policy should

[50] See the discussion above, and in particular Xiaofan Liang et al., "Intercity Connectivity and Urban Innovation," *Computers, Environment and Urban Systems* 109 (April 1, 2024): 102092, https://doi.org/10.1016/j.compenvurbsys.2024.102092.
[51] Herbert Hovenkamp, "Mergers of Complements," SSRN Scholarly Paper (Rochester, NY, March 15, 2024), https://papers.ssrn.com/abstract=4754466.
[52] In intellectual property law, this approach has led to a strengthening of intellectual property rights. Benkler, "Law, Innovation, and Collaboration in Networked Economy and Society."
[53] In intellectual property law it would therefore suggest more sharing and weaker intellectual property rights. Benkler.

maximize the incentives of innovators to "pull" innovation from ordinary market processes. By contrast, a capabilities-based approach calls for a much more active "push" role for the state, in which government aims to supply missing capabilities, coordinate strategic networking and sharing of capabilities, and shape not just the rate but also the direction of innovative activity.[54]

Moderna's recent patent dispute with the National Institutes of Health (NIH) demonstrates how this tension can be relevant to economic regulation. Moderna claims that its scientists deserve sole credit as inventors of a patent crucial to manufacturing its COVID-19 vaccine, whereas the NIH claims that this patent arose out of a multiyear collaboration during which the NIH and Moderna pooled their expertise, with many of the riskiest areas of research funded by the government.[55] An Innovation-as-Incentives approach may give Moderna the patent—doing so would maximize Moderna's ability to appropriate returns from its investments in innovation and thereby incentivize future innovators. By contrast, an Innovation-as-Capabilities approach would recognize the deep collaboration involved in producing the COVID-19 vaccine, and support policies that encourage this sort of sharing of information and collaboration, for which our current patent system may not be well-designed.[56]

Both Innovation-as-Incentives and Innovation-as-Capabilities approaches are required to understand Moderna's creation of an mRNA COVID-19 vaccine. Government-directed industrial policy, sharing of information within networks, and public-private collaboration was just as important in the creation of the vaccine as private investment in response to incentives. Patent law must balance these approaches as it seeks to create economic regulation that supports innovation, and the same is true of antitrust and competition policy.

Figure 3: Combining The Incentive and Ability Approaches To Innovation

	Approach to innovation focuses on:	**Innovation happens because:**	**Innovation policy should:**
Incentive to Innovate **("Innovation-as-Incentives")**	Agents or innovators (generally firms).	Innovators apply effort to a problem motivated by incentives.	Maximize innovators' incentives to innovate.

[54] Mariana Mazzucato, *The Entrepreneurial State: Debunking Public vs. Private Sector Myths*, 1st edition (London ; New York: Anthem Press, 2013); Ariel Ezrachi, *How Big-Tech Barons Smash Innovation and How to Strike Back*, First edition. (New York, NY: Harper Business, an imprint of HarperCollins Publishers, 2022).
[55] Rebecca Robbins and Sheryl Gay Stolberg, "Moderna Backs down in Its Vaccine Patent Fight with the N.I.H.," *The New York Times*, December 18, 2021, sec. U.S., https://www.nytimes.com/2021/12/17/us/moderna-patent-nih.html.
[56] Benkler, "Law, Innovation, and Collaboration in Networked Economy and Society."

Ability to Innovate **("Innovation-as-Capabilities")**	Relationships between agents; the ecosystem.	Innovators have access to all the capabilities or technologies they need to create new products and services.	Maximize innovators' access to necessary capabilities.

III. Antitrust Focuses On Innovation Incentives, Not Capabilities, Which In Practice Biases Against Intervention.

Competition policy primarily views innovation as a question of the incentives of market actors, and has neglected to consider how social and technological relationships affect the ability to innovate. This has, in practice, framed innovation questions in ways that bias competition policy against intervention on innovation grounds. This section demonstrates that innovation ecosystems (a capability-oriented concept) is a blind spot in antitrust and that reasoning in innovation cases in antitrust is squarely incentive-based, leading antitrust to adopt an 'immune system' for innovation arguments.

a) Innovation 'Ecosystems' Are A Blind Spot In Antitrust

It is increasingly recognized that the 'ecosystem' dimension of competition is a systemic blindspot for antitrust.[57] Antitrust's approach of defining narrow markets and evaluating horizontal competition in those markets according to well-understood measures of harm,[58] systematically overlooks assessments of firms' complementary capabilities, and the networks of relationships between firms. These dimensions are critical to understanding firms' opportunities and market positioning, particularly in relation to markets that touch on digital platforms.[59] They are also critical to understanding innovation prospects.[60]

[57] Cristina Caffarra, "Furthering Ecosystem Analysis in Antitrust," *ProMarket* (blog), December 14, 2023, https://www.promarket.org/2023/12/14/furthering-ecosystem-analysis-in-antitrust/; "'Ecosystem' Theories of Harm in Digital Mergers: New Insights from Network Economics, Part 2," CEPR, June 6, 2023, https://cepr.org/voxeu/columns/ecosystem-theories-harm-digital-mergers-new-insights-network-economics-part-2; Matthew Elliott and Andrea Galeotti, "The Role of Networks in Antitrust Investigations," *Oxford Review of Economic Policy* 35, no. 4 (December 4, 2019): 614–37, https://doi.org/10.1093/oxrep/grz022; I. Boa, M. Elliott, and D. Foster, "A Capability Approach to Merger Review," *IDEAS Working Paper Series from RePEc*, 2023.

[58] Michael G Jacobides and Ioannis Lianos, "Ecosystems and Competition Law in Theory and Practice," *Industrial and Corporate Change* 30, no. 5 (October 1, 2021): 1199–1229, https://doi.org/10.1093/icc/dtab061; Viktoria H. S. E. Robertson, "Antitrust Market Definition for Digital Ecosystems," SSRN Scholarly Paper (Rochester, NY, May 12, 2021), https://papers.ssrn.com/abstract=3844551; Nicolas Petit, "The Proposed Digital Markets Act (DMA): A Legal and Policy Review," *Journal of European Competition Law & Practice* 12, no. 7 (September 1, 2021): 529–41, https://doi.org/10.1093/jeclap/lpab062.

[59] Frederic Jenny, "Changing the Way We Think: Competition, Platforms and Ecosystems," *Journal of Antitrust Enforcement* 9, no. 1 (March 1, 2021): 1–18, https://doi.org/10.1093/jaenfo/jnab003.

[60] Melissa A. Schilling and Corey C. Phelps, "Interfirm Collaboration Networks: The Impact of Large-Scale Network Structure on Firm Innovation," *Management Science* 53, no. 7 (2007): 1113–26, https://doi.org/10.1287/mnsc.1060.0624.

Generally, antitrust inquiry focuses on *substitutes*—defining a set of substitutable products that constitutes a market and assessing conditions of competition for that set. A capabilities approach would focus instead on *complements*—sets of new or unique capabilities that are synergistic with what a firm already has and thereby add value. Capabilities matter to competition *in their diversity*, *not in their substitutability*. This approach understands that capabilities are highly heterogenous (rather than fungible), difficult to replicate, and that capabilities become more valuable the more you have as they allow you to make a wider variety of products and services.[61] Seen in this way, analysis should focus less on monopolizing a new static vertical, and more on efforts to control a new set of capabilities that can add value to a platform or ecosystem as a whole.

This focus on substitutes in narrowly-defined markets has led enforcers to approve deals that are clearly damaging (such as Facebook's acquisition of Instagram and WhatsApp, where market definition in particular misled the agencies),[62] and structurally inhibited enforcers from challenging concerning activities (such as Google's acquisition of Fitbit,[63] Microsoft's acquisition of Activition,[64] Meta's acquisition of Within,[65] and recent ineffective challenges in unilateral conduct cases such as *New York et al v Meta*).[66]

Antitrust's dominant 'incentive' frame does not entirely exclude capabilities concepts. Paradigms are not as cleanly executed in practice as they may appear in theory. Antitrust's paradigm that innovation happens because of incentives still admits ideas about innovation capabilities on the margin as exceptions or qualifications to its dominant incentive-oriented framework. The EU Commission has issued the Technology Transfer Block *Exemption*,[67] and US antitrust enforcers have issued Guidelines on Licensing of IP,[68] which both exempt legitimate research and development collaborations from antitrust intervention. Shapiro's synergy principle (above) is theoretically broad enough to incorporate an Innovation-as-Capabilities worldview into antitrust law, though in both Shapiro's assessment and antitrust law discussion of synergies tends to collapse into narrow efficiency arguments in merger review. The European Commission has started to consider R&D Capabilities in certain recent cases such as *Dow/Dupont*,[69] *Bayer/Monsanto*[70] and *Sika/MBCC*.[71]

---

[61] Ricardo Hausmann et al., *The Atlas of Economic Complexity: Mapping Paths to Prosperity* (MIT Press, 2014).

[62] See, eg EU merger approval in Case No COMP/M.7217 - *FACEBOOK/ WHATSAPP*.

[63] "Mergers: Commission Clears Acquisition of Fitbit by Google," Text, European Commission - European Commission, accessed July 6, 2022, https://ec.europa.eu/commission/presscorner/detail/en/IP_20_2484.

[64] *FTC v. Microsoft Corp.*, 2023 __ F.Supp.3d __ (United States District Court for the Northern District of California, July 10, 2023).

[65] *FTC v. Meta Platforms Inc.* Case No. 5:22-Cv-04325-EJD.

[66] *New York v. Meta Platforms, Inc.*, 66 F.4th 288.

[67] "Commission Regulation (EU) No 316/2014 of 21 March 2014 on the Application of Article 101(3) of the Treaty on the Functioning of the European Union to Categories of Technology Transfer Agreements Text with EEA Relevance," 093 OJ L § (2014), http://data.europa.eu/eli/reg/2014/316/oj/eng.

[68] "Antitrust Guidelines for the Licensing of Intellectual Property," accessed August 27, 2024, https://www.justice.gov/atr/IPguidelines/dl.

[69] "M.7932 - DOW / DUPONT," accessed August 27, 2024, https://competition-cases.ec.europa.eu/cases/M.7932.

[70] "M.8084 - BAYER / MONSANTO," accessed August 27, 2024, https://competition-cases.ec.europa.eu/cases/M.8084.

[71] "M.10560 - SIKA / MBCC GROUP," accessed August 27, 2024, https://competition-cases.ec.europa.eu/cases/M.10560.

Notwithstanding these exceptions, 'Innovation-as-Capabilities' arguments are structurally disadvantaged in antitrust assessment. The language, paradigms, legal tests, precedent and intellectual scaffolding we use in antitrust to debate and admit arguments around innovation systematically biases assessment in favor of Innovation-as-Incentives arguments. Innovation-as-Capabilities concepts sit perpendicular to this scaffolding making their uptake harder because they jar with the rest of antitrust's dominant intellectual architecture. Where precedent prescribes that we assess antitrust harms by defining substitutable products within markets, it becomes challenging then to adopt a parallel frame that looks at complementary products within ecosystems, leading courts and antitrust experts to mishandle capabilities concepts, for example.

Many commentators have noted that antitrust overlooks these 'ecosystem', 'capability', and 'network' concepts;[72] this article's contribution is to integrate these ideas into a common paradigm about how innovation happens and propose a tractable way for antitrust to uptake ideas around innovation capabilities, alongside its current dominant incentive-oriented framing.

b) US Antitrust Cases Focus On Innovation Incentives, Not Capabilities.

US Antitrust practitioners to date have largely adopted the Innovation-as-Incentives paradigm. The Innovation-as-Capabilities paradigm is missing almost entirely from US antitrust law—which suffers as a result.

We see this in US cases on the essential facilities doctrine, which obliges dominant companies to share essential infrastructure, facilities, or resources with smaller competitors. Where cornerstone essential facilities cases consider innovation, they adopt an Innovation-as-Incentives framing, which has shaped the parameters of legitimate debate around innovation and affected the development of the law. Analysis follows a similar pattern in other areas of antitrust, though it is beyond the scope of this report to address how innovation concerns arise in all areas of antitrust law.

An Innovation-as-Incentives approach was responsible for dramatically restricting the essential facilities doctrine in *Verizon v. Trinko* (2004), such that many practitioners consider it substantially impossible to bring a successful essential facilities claim against a dominant company.[73] *Verizon v. Trinko* held that Verizon, in insufficiently sharing its telecommunications infrastructure with rivals, did not violate antitrust doctrine on essential facilities. This decision was reached based on an incentive-oriented understanding of innovation: Not requiring

[72] Cristina Caffarra, "Furthering Ecosystem Analysis in Antitrust," *ProMarket* (blog), December 14, 2023, https://www.promarket.org/2023/12/14/furthering-ecosystem-analysis-in-antitrust/; "'Ecosystem' Theories of Harm in Digital Mergers: New Insights from Network Economics, Part 2," CEPR, June 6, 2023, https://cepr.org/voxeu/columns/ecosystem-theories-harm-digital-mergers-new-insights-network-economics-part-2; Matthew Elliott and Andrea Galeotti, "The Role of Networks in Antitrust Investigations," *Oxford Review of Economic Policy* 35, no. 4 (December 4, 2019): 614–37, https://doi.org/10.1093/oxrep/grz022; I. Boa, M. Elliott, and D. Foster, "A Capability Approach to Merger Review," *IDEAS Working Paper Series from RePEc*, 2023; Francisco Costa-Cabral, "Innovation in EU Competition Law: The Resource-Based View and Disruption," *Yearbook of European Law* 37 (2018): 305–43, https://doi.org/10.1093/yel/yey019.

[73] Nikolas Guggenberger, "Essential Platforms," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, September 30, 2020), https://doi.org/10.2139/ssrn.3703361.

companies to share innovations with their rivals would promote investment in innovation. Speaking for a majority on a unanimous Supreme Court, Justice Scalia stated:[74]

> The opportunity to charge monopoly prices—at least for a short period—is what attracts "business acumen" in the first place; it induces risk taking that produces innovation and economic growth. To safeguard the incentive to innovate, the possession of monopoly power will not be found unlawful unless it is accompanied by an element of anticompetitive conduct.

Note that this application of the Innovation-as-Incentives paradigm did not mandate the particular result in *Trinko*. Innovation incentives can arise both from appropriating profits and from a need to stay ahead of close competitors.[75] In *Trinko*, the Court could have obliged Verizon to share its network under the Innovation-as-Incentives paradigm if it thought that doing so would ensure that Verizon was subject to more acute competitive pressure.

And one could legitimately question whether US courts demonstrate bias in how they handle questions around innovation incentives—not requiring any context-specific proof or testimony when arguing that intervention will harm incentives to innovate (as in *Trinko*), but requiring an almost impossibly heavy burden of proof when arguing that a merger or competitor's conduct will harm innovation incentives (as in *United Healthcare/Change Healthcare*, and *Meta/Within*). Even though standard civil procedure rules suggest that the movant carries the burden of proof, arguments around innovation incentives can theoretically justify both intervention to protect competition and non-intervention to protect a competitor's ability to profit from its innovations, and courts may seem to be more receptive to arguments for non-intervention. Rebalancing this bias is probably a necessary part of refocusing antitrust on innovation as others have argued.[76]

But the Innovation-as-Incentives paradigm does structure how antitrust law frames the issue. This "framing" is not neutral: in *Trinko*, it led the Court to focus on a conception of innovation as a result of individual effort applied in response to incentives. Focusing on the individual firms in this way meant the court did not engage with questions around what social relations would best facilitate innovation. The Innovation-as-Incentives paradigm gave the Court a prism through which to view the case (adopted directly from neoclassical reasoning), which led the Court to focus on certain features at the expense of others. Legal commentary on the essential facilities doctrine and duties to deal has subsequently been dominated by the Innovation-as-Incentives paradigm, with similar results.[77]

---

[74] *Verizon Communications Inc. v. Law Offices of Curtis V. Trinko, LLP*, 540 U.S. 398 (2004)

[75] Federico, Scott Morton, and Shapiro, *Antitrust and Innovation*. Antitrust practitioners often refer to this tension as the Schumpeter/Arrow debate: Schumpeter argued that innovation incentives are often maximized when companies are allowed to exploit their innovations. Arrow, by contrast, argued that innovation incentives are often maximized where companies need to innovate to get ahead of close competitors.

[76] Salop, "An Excessive Evidentiary Burden Sunk the FTC's Case Against the Meta/Within Merger."

[77] See Hovenkamp and Bohannan 2012, Chapter 11.

The Federal Trade Commission's (FTC's) recent challenge to Facebook demonstrates just how much this incentive-oriented reasoning has scarred antitrust law. In its initial complaint, the FTC challenged Facebook's efforts to throttle access to its Application Programming Interfaces (APIs)—which determine how software applications can interoperate—and therefore degrade its competitors' ability to interoperate with its services. In dismissing the FTC's complaint, Judge Boasberg of the US District Court concluded that Facebook's refusal to interoperate with competitors could not violate US antitrust law. Consistent with previous decisions, Judge Boasberg relied on the Innovation-as-Incentives paradigm, stating:[78]

> [f]irms may acquire monopoly power by establishing an infrastructure that renders them uniquely suited to serve their customers. Compelling such firms to share the source of their advantage is in some tension with the underlying purpose of antitrust law, since it may lessen the incentive for the monopolist, the rival, or both to invest in those economically beneficial facilities.

The US Court of Appeals for the DC Circuit upheld Judge Boasberg's decision adopting similar reasoning and aligning with the *Trinko* line of precedent, stating that it considered the States' claims against Facebook '"Odd" because the States' suit concerns an industry that, even on the States' allegations, has had rapid growth and innovation with no end in sight.'[79]

Based on an incomplete understanding of how innovation works, Judge Boasberg insulated Facebook's most innovation-harming activities from antitrust challenge. He recused antitrust from taking a central role controlling key strategic interfaces for the recombination of technologies and components in the digital economy (APIs). Innovation-as-capabilities research demands exactly the opposite: that antitrust meticulously safeguards the ability of new technologies to interoperate along key platform interfaces and stands firm against companies' attempts to bend these interfaces to their advantage. Antitrust law's failure to do so harms innovation and leaves us all worse off.

So what would an alternative judgement look like? As a thought experiment, we might consider how future Supreme Court Justices would frame their reasoning in *Verizon v Trinko* in an alternate world where the Innovation-as-Capabilities paradigm is dominant, and the Innovation-as-Incentives paradigm was less gripping. Let's call our hypothetical Justice 'Capabilities'. Considering the facts of *Verizon v Trinko*, Justice Capabilities might have reasoned:

> "The opportunity to innovate within a specific technoeconomic domain requires that astute business people have access to that domain's essential capabilities, and that they can recombine these capabilities freely to create new products and services. Where unique capabilities are controlled by companies or their access is otherwise restricted, making these capabilities available for exchange as market commodities empowers

[78] Memorandum Opinion in *FTC v. Facebook* Case 1:20-cv-03590-JEB (D.D.C June 28, 2021) at page 35, quoting *Trinko*, 540 U.S. at 407–08.
[79] *New York v. Meta Platforms, Inc.*, 66 F.4th 288.

> entrepreneurs to experiment which produces innovation and economic growth. To safeguard the ability to innovate, restricting access to a capability will be considered unlawful if that capability is not reasonably available elsewhere and that capability is required as an ingredient in new products and services."

Again, this reasoning does not predetermine whether Verizon must share its network with competitors, but it frames the impact of the case on innovation in a wholly different way (one that is well supported by economic research). To oblige Verizon to share its network, litigators must still demonstrate on the facts of the case that the network was an essential ingredient for innovation, and that equivalent capabilities were not available elsewhere (alongside other tests a court may choose to impose, such as those related to innovation incentives, proportionality, or materiality). Of course, properly integrating the Innovation-as-Capabilities paradigm into competition policy will require much more work than this thought experiment. Optimally promoting innovation also requires taking both the Innovation-as-Capabilities and the Innovation-as-Incentives paradigms into account. But this example suggests one way to integrate Innovation-as-Capabilities reasoning in the context of the essential facilities doctrine.

c) European Competition Cases Also Focus On Innovation Incentives, Not Capabilities.

EU Competition law also largely adopts the Innovation-as-Incentives paradigm. Though EU competition law regarding essential facilities appears easier to reconcile with Innovation-as-Capabilities paradigms, it does not explicitly adopt capabilities paradigms.

EU Competition law offers a more permissive approach to essential facilities cases (though successful claims are still rare and bringing an essential facilities case is by no means easy). EU law generally obliges a company to share an essential facility where (1) the company's refusal to share its facility prevents a new product from arising, (2) the refusal was not justified, and (3) the refusal prevents competition on a distinct secondary market.[80]

These requirements are applied flexibly: for example, in the European Commission's case against Microsoft, the European General Court relaxed the requirement for a new product to allow the essential facilities doctrine to apply where there was mere technical progress along an existing product line, and it relaxed the third requirement to allow a claim where the distinct secondary market was merely hypothetical.[81] In recent case law, the 'new product' criterion seems most binding in cases involving intellectual property, and least binding in cases that involve access to physical infrastructure.[82]

[80] *IMS Health GmbH & Co OHG v NDC Health GmbH & Co KG*, Case C-418/01, Court of Justice, [2000] ECR I-5039.

[81] *Microsoft Corp v Commission*, Case T-201/04, General Court, [2007] ECR II-3601

[82] See, eg, C-165/19 *Slovak Telekom* (2021) and T-136/19 *Bulgarian Energy Holding (2022)*.

This approach appears easier to reconcile with a capabilities-based understanding of innovation: it explicitly frames a rule around using an existing facility to create a new product or service. This seems congruent with the Innovation-as-Capabilities paradigm in that it uses competition law to open up access to existing capabilities that are not traded on the market and are required to produce an innovation.

That said, European courts did not frame this rule based on an explicit understanding of economic innovation as a process of recombination of capabilities. The key European decisions that created the EU's essential facilities doctrine were short and legalistic, and these rules largely grew out of the facts presented to the European courts in quite a narrow way. The European Court of Justice's decision in *IMS Health*[83] is the primary authority for the three-part test above: in *IMS Health*, one company wanted to license a data structure that was protected under IP law from another company to produce a new product. The Court relied on this 'new product' element in the facts of the case to distinguish previous authority[84] and establish the test set out above, without reference to any economic understanding of innovation (whether incentive or capabilities-based).

Where reasoning based on economics does address innovation in European cases on essential facilities, the reasoning is squarely neoclassical and incentive-based. Advocate General Jacobs demonstrates this in his opinion in *Oscar Bronner v Mediaprint*:[85]

> "In the long term it is generally pro-competitive and in the interest of consumers to allow a company to retain for its own use facilities which it has developed for the purpose of its business... [T]he incentive for a dominant undertaking to invest in efficient facilities would be reduced if its competitors were, upon request, able to share the benefits... It is on the other hand clear that refusal of access may in some cases entail elimination or substantial reduction of competition to the detriment of consumers in both the short and the long term. ... In assessing such conflicting interests, particular care is required where the goods or services or facilities to which access is demanded represent the fruit of substantial investment."

In *Oscar Bronner* the European Court of Justice held that it was not obligatory for one news organization to share its paper distribution network with a smaller rival because the delivery network was not essential for the smaller rival to distribute its papers: the rival could distribute through other less advantageous means. Advocate General Jacobs's opinion suggests that the Court relied on the Innovation-as-Incentives paradigm in its reasoning.

Similarly, in *Purple Parking* the Court of Appeal for England and Wales (applying EU competition law in 2011) applied the essential facilities doctrine to oblige Heathrow airport to share access to the forecourt of an airport with valet parking services that competed with its own offering.

[83] *IMS Health GmbH & Co OHG v NDC Health GmbH & Co KG*, Case C-418/01, Court of Justice, [2000] ECR I-5039.

[84] Such as *Oscar Bronner GmbH Co KG v Mediaprint*, Case C-7/97 Court of Justice, [1998] ECR I-7791.

[85] *Oscar Bronner GmbH Co KG v Mediaprint*, Case C-7/97 Court of Justice, [1998] ECR I-7791, Opinion of AG Jacobs at Paras 57, 61 and 62.

Central to its reasoning was the fact that valet parking services at airports were ancillary to the main purpose of an airport. Obliging Heathrow to share its forecourt with competitive services therefore would not meaningfully change the incentives to invest in developing airports.

Academic commentary on European essential facilities cases also squarely adopts an incentive-based understanding of economic innovation: a common critique of *IMS Health's* criteria is that it may harm innovation by reducing incentives to innovate.[86] Adoption of the Innovation-as-Incentives paradigm therefore shapes what is seen as legitimate criticism from a law-and-economics perspective. This paradigm about how innovation works frames and limits the terms of debate in both judicial reasoning and academic commentary and exerts a gravitational force on how legal argument takes shape over time.

Some features of competition law that protect research and development agreements seem as though they took shape with an implicit 'nod' to a capabilities-based approach to innovation.[87] But where these solutions appear, they feel more like an afterthought—a specific exception for companies to collaborate without violating antitrust rules—carved out in marked contrast to antitrust's governing incentive-oriented economic reasoning, and without reference to economic research around Innovation-as-Capabilities.

So, while European Union competition law appears easier to reconcile with the Innovation-as-Capabilities paradigm, the dominant economic reasoning around innovation in European law remains squarely incentive-based. This shared mentality among competition practitioners, judges and academics constrains the terrain of legitimate argument around innovation and may shape how enforcers litigate cases. As in the US, the European competition community needs to invite a broader array of economic voices on innovation into its conversations: it ought to acknowledge that a capabilities-oriented approach to innovation is well-supported by economic research and merits importance at least on par with an incentive-based understanding of innovation.

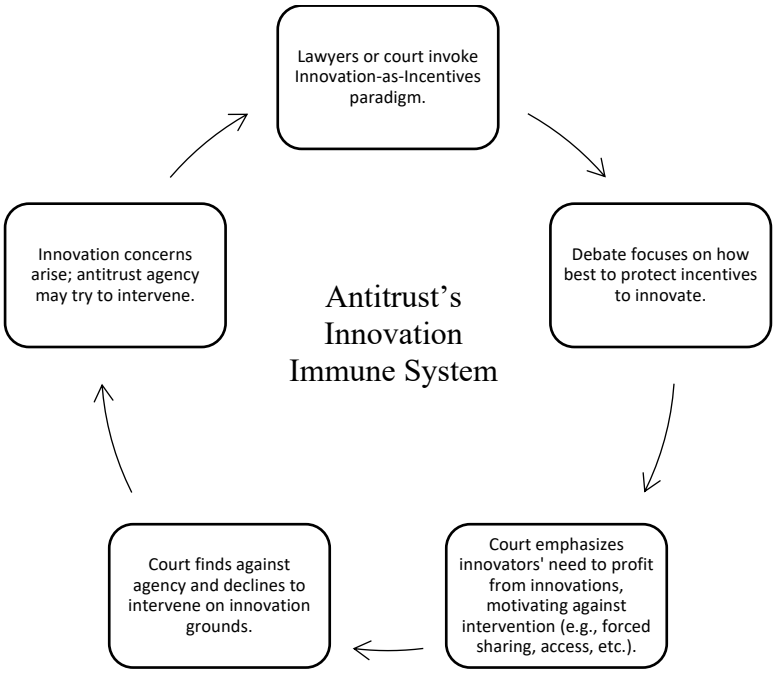
d) Antitrust's Innovation 'Immune System'

In practice, the Innovation-as-Incentives paradigm has led judges to avoid intervening in antitrust cases by focusing judicial attention on the need to preserve the incentives of innovators to invest in innovation. Innovation arguments thereby operate like an 'immune system' for innovation concerns in antitrust, with the pattern of reasoning set out in Figure 1, below.

[86] See the commentary on *IMS Health* in *EU Competition Law: An Analytical Guide to the Leading Cases* (Ezrachi 2014), Chapter 5.

[87] See the Research and Development Block Exemption under EU Competition law: Commission Regulation (EU) No 1217/2010 of 14 December 2010 on the application of Article 101(3) of the Treaty on the Functioning of the European Union to certain categories of research and development agreements.

Figure 4: Antitrust's Innovation Immune System



As agencies increasingly make innovation arguments (without also challenging the underlying incentive paradigm), this 'immune system' is increasingly triggered, and is reinforced as each case adds to the weight of legal precedent. This overactive immune response is damaging its host by preventing a more balanced approach to innovation within antitrust law that is better supported by economic research.

Reorienting antitrust to promote innovation demands that we prevent this 'innovation immune system' from misfiring, by complementing the underlying paradigms around Innovation-as-Incentives with an appreciation of how innovators also need required capabilities to innovate. The next section explores how to bring this perspective into antitrust law.

IV. Bringing Innovation-as-Capabilities into Antitrust Law

Operationalizing the Innovation-as-Capabilities approach requires a simple, tractable model of how innovation happens. This model is that innovation happens when people can combine capabilities in different ways to create new products and services.

An Innovation-as-Capabilities approach would focus on the following issues (which antitrust currently neglects):

- the assets and capabilities that firms have access to which define what firms can create;

- the relationships between agents who do or do not collaborate or share capabilities;
- the inputs and outputs to technical processes;
- tacit knowhow that is hard to transfer;
- the diverse motivations of innovators that may not be captured in a model of economic incentives; and
- the process of experimental recombination in search of a product that fills a need that is inherent to the innovation process.

To promote the ability to innovate, antitrust should make it easier for innovators to access important capabilities as inputs into the innovation process. It could do so by ensuring important capabilities are tradable as market commodities (for fair compensation), making technologies interoperable to create an open, modular innovation ecosystem, and helping workers move freely between firms, taking their knowhow with them. This parallels industrial policy, in which government coordinates innovation communities, facilitates clusters or ecosystems, and shapes the pace and direction of innovation.[88] In general, antitrust must acknowledge an active role for government in shaping technological development and should see itself as a part of this project.

Access to capabilities can be a remedy (mandating access to solve a competitive harm in a marketplace), or an abuse (where competitors prevent access to capabilities as a competitive harm). An open list of considerations involved in promoting access would include:

- *Geographic access to capabilities*. For example, ensuring mergers do not remove important capabilities from a region by closing an important R&D facility.
- *Prohibiting exclusivity relationships that reduce access to capabilities.* Exclusivity relationships can tie capabilities to particular companies or customers.
- *Access to components or modules*. Using antitrust to package components into modules tradable on an open market would enhance access to capabilities for innovators.
- *Interoperability*. Controlling key interfaces to make different technologies interoperable would promote innovation by helping innovators combine capabilities more easily.
- *Access to talent*. Freeing workers to move around, for example by banning worker noncompetes, would make it easier for firms to adopt new capabilities. The FTC has issued a rule to ban worker noncompetes, partly to promote innovation.[89]

This approach needs a limiting principle: Antitrust should open access to capabilities to as many potential innovators as possible, *without undermining incentives to innovate*. Policymakers should thereby balance between Innovation-as-Incentives and Innovation-as-Capabilities in determining antitrust's overall approach to innovation cases.

[88] Mariana Mazzucato, *The Entrepreneurial State: Debunking Public vs. Private Sector Myths*, 1st edition (London ; New York: Anthem Press, 2013).
[89] "FTC Announces Rule Banning Noncompetes," Federal Trade Commission, April 23, 2024, https://www.ftc.gov/news-events/news/press-releases/2024/04/ftc-announces-rule-banning-noncompetes.

By adopting an explicit 'capabilities' approach to innovation issues, antitrust agencies can signal to the research community a need for better quantitative tests on capabilities issues. These tests would use methods that aren't currently used often in neoclassical approaches to industrial organization, such as network science, and input-output modeling. In the meantime, we can attempt to develop legal tests and policy postures based on the Innovation-as-Capabilities paradigm, informed by the rich body of research that substantiates a 'capabilities' orientation to innovation questions. The rest of this paper aims to develop these policy approaches and legal tests.

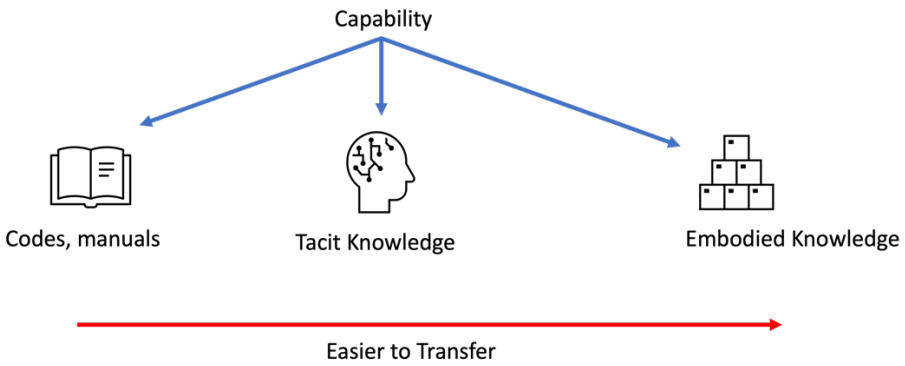
a) A New Lexicon For Innovation-as-Capabilities

The antitrust community needs a new lexicon to debate arguments based on the Innovation-as-Capabilities paradigm. Over decades of applying neoclassical economic arguments in antitrust, practitioners have developed a common language to speak about incentive-oriented topics, like market definition, market power, market failures, horizontal, vertical, and conglomerate markets, and competitive abuses like cross-market leveraging. This helps us debate harms and abuses. We need to develop a similar common language for Innovation-as-Capabilities debates. This lexicon should include the following concepts.

Capability

A capability is the ability to do or make something that is economically valuable (ie applied knowledge that a firm can trade). Capabilities are easily transferred as **embodied knowledge** in products (it is easier to buy a component, product or service than to learn how to produce it yourself) or by hiring workers and teams with **tacit knowledge** of a domain. A capability could be contained in a firm or product or team. Its importance arises because it is an ingredient, node or resource within an ecosystem or production network, rather than itself an actor. An Innovation-as-Incentives approach, by contrast, focuses on incentives of firms as actors, competing within product markets as its primary object of study.

Figure 5: Capabilities And Their Transmission



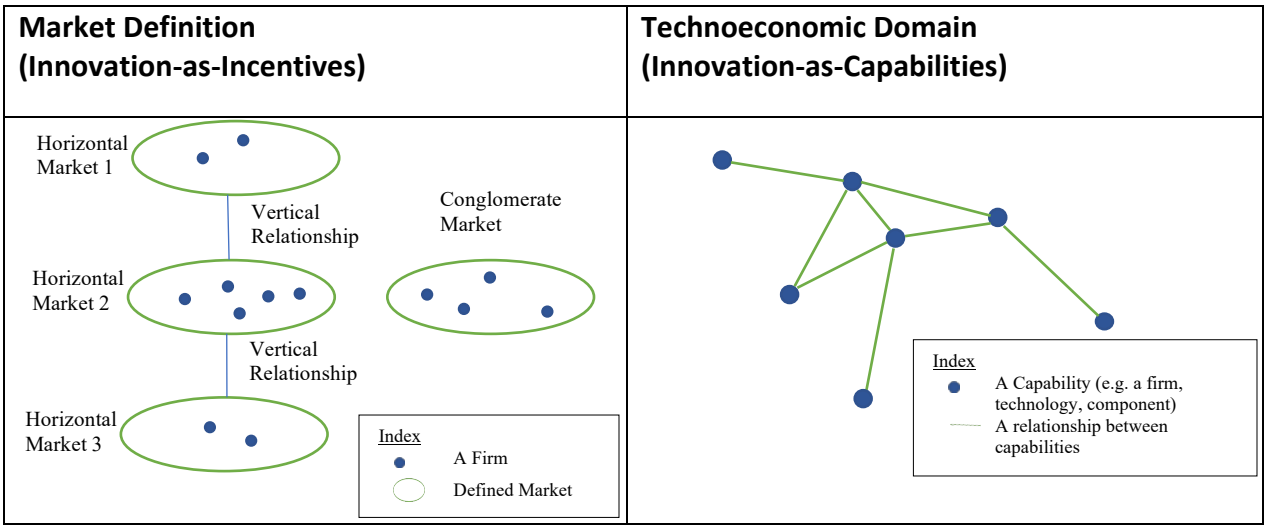
Technoeconomic Domain

A technoeconomic domain is the collection of capabilities that define a specific technology or product category or region for innovation. For example, innovating in AI foundation models requires a technology stack including cloud computing, GPU chips, AI engineers and researchers, and very large corpus of data on a topic.

Incentive-oriented antitrust rules start with market definition, which implicitly adopts neoclassical paradigms and overlooks ecosystem relationships (above). Vertical and conglomerate market relationships are only considered important to the extent that they affect competition in a defined horizontal market.

Capabilities-oriented rules need to start at a different point: Focusing on the inputs and outputs to the innovation process that collectively form an ecosystem that can enable collaboration. The policy goal is to make inputs to the innovation process accessible to innovators so that innovators can combine them to make new products and services.

Figure 6: Contrasting Market Definition (Based on Incentives) and Technoeconomic Domain (Based on Capabilities)



Systems, Subsystems, Hierarchy and Economic Structure

Capabilities are nested within each other, forming components and subsystems that go all the way down to the smallest building blocks of production. To an airline, an airplane is a capability it can purchase from airplane manufacturers to run its services. To an airplane manufacturer, a

jet engine is a capability it can purchase to make its products. To a jet engine manufacturer, aluminum and steel are capabilities it can purchase to make its engines.

Subsystems manage this complexity. Systems theorists define a subsystem as a set of elements (or nodes) within a system that have strong relationships with each other, but relatively weak relationships with other parts of the system.[90] For example, in an aircraft manufacturing firm, the team that procures and integrates jet engines into an airplane will collaborate closely with the team that designs the aircraft wings than with the firm's legal department. Relationships of **hierarchy** organize subsystems within systems, by controlling how different subsystems interact, communicate and take instruction from each other. For our purposes, **economic structure** refers to how capabilities are organized into systems and subsystems of varying hierarchy and proximity.

Module

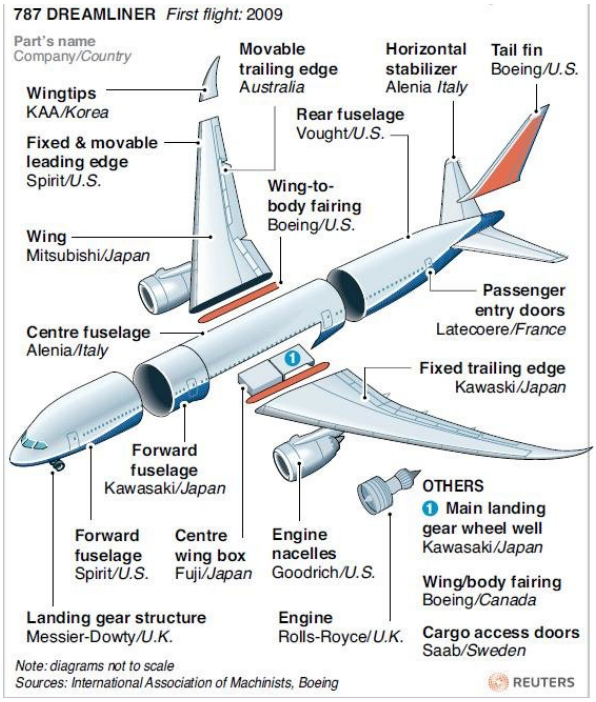
Modules are collections of capabilities that are organized into tradable products, services, or units of production. A module can operate as a going concern on a standalone basis: A company built around commercializing one module could in principle be successful—a module is not merely a feature that can only exist as part of a wider product. Modules empower innovators to create new products and services. Creating something new involves developing the ability to do many new things all at once. Being able to 'import' components by purchasing them on the open market makes it easier to develop new products and services. A module is best thought of as a firm or independent business unit built around one product or service; its corollary under the Innovation-as-Incentives paradigm might be a firm, product or business unit that may compete with others in a product market.

Modularization

The process of ensuring that modules of production are tradable as commodities on the open market on a non-exclusive basis.

[90] Donella H. Meadows, *Thinking in Systems: A Primer* (White River Junction, Vt.: Chelsea Green Pub., 2008).

Figure 7: Modules in a Boeing Plane



Applying this Lexicon to Antitrust

The lexicon outlined here gives us a vocabulary to discuss features of markets that are new to antitrust analysis. Markets have **economic structure**: they package **capabilities** into **modules** that form **subsystems** and **systems** with relationships of **hierarchy**. Innovators that have **access** to lots of related capabilities can create new products and services within a specific **technoeconomic domain**.

Antitrust should aim to shape **economic structure** to make it easier for innovators to access important capabilities within a **technoeconomic domain** and combine them in new ways to make new products and services. As capabilities are most easily transferred as **embodied knowledge**, capabilities will be easier for innovators to access where they are traded as products, services or components on a non-exclusive basis in the open market. Antitrust can improve **access to capabilities** by **modularizing** 'building blocks' of production, perhaps using structural remedies to package **capabilities** into distinct **modules**.

Framing antitrust tools through this paradigm represents a genuinely new way of understanding antitrust. It gives antitrust institutions the vocabulary to promote the ability of economic actors to innovate using antitrust's tools.

b) Application in Antitrust Law: Abuses (Protecting Innovation) and Remedies (Promoting Innovation)

Innovation-as-Capabilities arguments address the ability to innovate rather than the incentive; in each case, litigators should ask whether the harm addresses the ability or the incentive to innovate. Innovation-as-Capabilities arguments apply both to efforts to protect innovation (through findings of abuse), and to promote innovation (through application of appropriate remedies).

Because Innovation-as-Capabilities reasoning targets different issues from Innovation-as-Incentives reasoning, agencies should therefore apply legal tests based on Innovation-as-Capabilities in addition to existing analyses. For the most part, these tests add to but do not change existing tests, allowing us to target newly recognized competitive harms in addition to the ones we already understand well.

Some cases may raise issues about both the ability and incentives of innovators to innovate. Agencies should bear in mind our limiting principle: Antitrust law should promote the ability to innovate, so long as it does not undermine the incentive to innovate. This demands that assessing in each case whether innovation incentives are meaningfully reduced for real world actors. Innovation payoffs are highly uncertain with a high luck factor. Practical judgement is required; complex, theoretical modelling exercises may be less useful.

c) Protecting Innovation: Abuses

Abuses that could harm innovation involve denying access to important capabilities. This can happen across the three pillars of antitrust: Anticompetitive agreements, mergers, and unilateral conduct.

Abusive Agreements

Standard antitrust analysis of agreements suggests that they are abusive where they try to limit competition or inflate prices, such as with price fixing or market sharing arrangements. By contrast, agreements between companies can harm innovation (under a capabilities lens) where they attempt to control or prevent others from accessing a certain set of capabilities. The harm lies in using agreements to cultivate preferential access to a set of capabilities needed for innovation in a technoeconomic domain.

Agreements which may harm innovation include:

- Exclusivity agreements that tie up important technologies or capabilities through exclusive partnerships. Agreements that *non-exclusively* license capabilities can improve access to those capabilities for the parties to the agreement, without reducing access to those capabilities for other members of the ecosystem as a whole. *Exclusivity*

agreements, however, erode access to a set of capabilities for third parties who are not part of the agreement. Agreements to non-exclusively license capabilities generally promote innovation, whereas exclusivity agreements may undermine innovation where they remove a set of capabilities from open access within an ecosystem. Sometimes there may be good reasons for exclusive licensing—for example where both parties need to make commitments to each other to co-develop technology. But for some exclusivity agreements, the commercial purpose is to deprive third parties of access to the capabilities. Courts will have to make these tricky determinations carefully.

- Employee noncompetes that prevent employees from changing jobs. This affects the transmission of capabilities, particularly where employees have particularly specialized knowhow, as one of the fastest ways to transfer capabilities is through the movement of people who understand a topic. Encouraging employees to move between firms can promote innovation: for example, many leading AI startups[91] have emerged from AI researchers breaking away from other organizations, and some suggest that California's non-enforcement of non-competes has promoted its startup ecosystem.[92] The FTC has banned employee noncompetes in a rulemaking, in part to protect innovation.[93]

Mergers

Merger policy should keep important capabilities independent and make them available to many innovators, not just aggressive and well-funded acquirers. It would prefer licensing capabilities to different market actors on a non-exclusive basis than consolidation within a single firm through a merger.

Established thinking in US antitrust law suggests vertical and conglomerate mergers only matter when they might affect horizontal competition within a market. An Innovation-as-Capabilities perspective would take vertical and conglomerate mergers much more seriously. Its focus would be on vertical and conglomerate relationships of *complementary* products, rather than horizontal competition between *substitutable* products.

Mergers may have innovation benefits in that they give the acquirer greater access to the target's technology than an arms-length open-market agreement can ever achieve. These arguments are discussed under 'balancing efficiencies' below.

[91] Anthropic's founders broke away from Open AI, for example.

[92] AnnaLee Saxenian, *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*, Acls Humanities E-Book (Cambridge, Mass: Harvard University Press, 1996), https://hdl.handle.net/2027/heb.00993.

[93] "FTC Announces Rule Banning Noncompetes," Federal Trade Commission, April 23, 2024, https://www.ftc.gov/news-events/news/press-releases/2024/04/ftc-announces-rule-banning-noncompetes.

Unilateral Conduct

Innovation-as-Capabilities perspectives would support a strong essential facilities doctrine in innovation cases, alongside other vertical theories of harm like margin squeezing. US courts today are largely reluctant to intervene in these cases to protect innovation incentives. Focusing instead on the ability of innovators to innovate suggests antitrust should adopt a much more assertive essential facilities doctrine.

The current focus of essential facilities and other vertical harms is to demonstrate an abuse by showing a dominant company uses market power in one market to leverage its position in another market. These arguments trigger antitrust's innovation immune system: Courts then defend firms' right to profit from their innovations. Capabilities oriented reasoning allows us to focus on what we really care about in these situations: whether innovators have sufficiently open and non-discriminatory access to important capabilities to be able to create new products and services.

Balancing Efficiencies

Transactions such as mergers and exclusive licensing agreements can bring two sets of complementary capabilities together, facilitating innovation between the transacting parties, at the same time as reducing access to the merger or licensing target's capabilities for third parties. Antitrust may need to balance these innovation benefits and harms. We shall call these 'efficiency' arguments.

In practice, Innovation-as-Capabilities arguments will likely often support intervention. Innovation-as-Capabilities arguments generally promote modularizing knowhow into tradable products and services, sharing of capabilities, and giving as many firms as possible access to needed capabilities. In most circumstances, opening up access to capabilities to more innovators will drive more innovation than trying to privatize a set of capabilities as the exclusive domain of one firm.[94]

Accordingly, suggesting, as Hovenkamp recently has,[95] that mergers of complementary capabilities within ecosystems are generally good for innovation demonstrates a serious misunderstanding of the economic literature around Innovation-as-Capabilities. The right unit of analysis for an Innovation-as-Capabilities lens is the *ecosystem*, not the *firm*. Buying a complementary capability will always benefit the acquirer, just as buying a horizontal competitor will always benefit the acquirer. What matters to antitrust is that nobody else now has access to

[94] See the discussion above, and in particular (Liang et al. 2024)

[95] Herbert Hovenkamp, "Mergers of Complements," SSRN Scholarly Paper (Rochester, NY, March 15, 2024), https://papers.ssrn.com/abstract=4754466.

that complementary capability—that the acquisition has weakened the strength of the ecosystem or network of knowledge-sharing. In a merger context, antitrust has to balance between innovation benefits to the acquirer and innovation harms to the ecosystem.

Non-exclusive licensing or modularizing capabilities will promote innovation in most cases more than exclusive licensing or merging capabilities into an acquiring firm. Non-exclusive licensing and modularizing capabilities preserve access for everyone; exclusive licensing and mergers keep capabilities in the hands of only a few, reducing access to capabilities for other innovators. Antitrust should prefer these approaches to exclusive licensing or mergers.

In some cases, exclusive licensing or mergers may promote innovation, for example where the target doesn't produce a product that is well connected within an ecosystem, or where the acquirer and target need to codevelop products together. Courts and enforcers must weigh these benefits against the harm of restricting access to the target's capabilities by others in the marketplace.

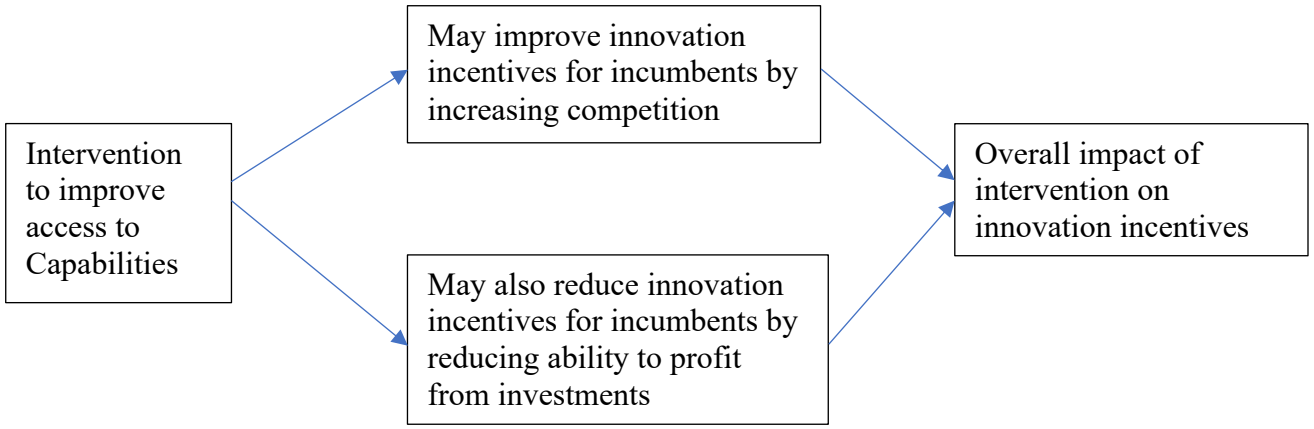
Applying the Limiting Principle

The Innovation-as-Capabilities and Innovation-as-Incentives approaches to understanding innovation are not mutually exclusive—they explain different parts of the innovation puzzle. They are mostly complementary but antitrust needs to balance between them when they are in tension: occasionally they conflict when providing an innovator with access to another's capability reduces the ability to earn a return from an innovation and thereby reduces the incentive to innovate in the first place. We shall call these 'limiting principle' arguments.

Improving access to capabilities can have ambiguous effects on the incentive to innovate: Antitrust intervention to strengthen an innovation ecosystem can increase competition (for example through an essential facilities designation) *by giving third parties the capabilities needed to enter the market* (Figure 8 below). It would be wrong to say that intervention to promote access to capabilities would generally undermine innovation incentives.

Antitrust should scrutinize 'limiting principle' arguments very closely. The payoff to innovation is very uncertain. Innovation is synonymous with risk and luck. Most startups fail; put another way, in most cases, an entrepreneur's median payoff in the value of their equity from starting a business is low to zero. Any precise calculation of innovation incentives falling because of antitrust intervention is voodoo econometrics: an effort to calculate an unknowable quantity in conditions of fundamental uncertainty. So long as innovators can still earn a fair return from their successful innovation, antitrust intervention will not discourage other innovators. In other words, this limiting principle should not deter policy from seriously adopting an Innovation-as-Capabilities approach alongside its existing incentive-oriented approach.

Figure 8: Ambiguous Impacts of Capabilities-Based Intervention on Innovation Incentives



Legal Tests to Protect Innovation

Current effects-based analysis[96] in antitrust generally adopts the following process: 1) defining the market; 2) assessing market power of various market players; and 3) assessing whether the conduct or transaction in question harms competition (balancing any efficiencies).

Legal tests around Innovation-as-Capabilities arguments would instead focus on whether innovators can access the capabilities they need to innovate in a technoeconomic domain. Legal tests would:

1. Assess the technoeconomic domain.

   What inputs and outputs are needed for innovators to innovate in a specific class of technologies? Where do the capabilities in question relate to this input-output network? Are there technological adjacencies between fields that the capabilities in question might bridge, leading to mixing of capabilities in different ways?

2. Assess whether the capabilities are particularly important.

   Are the capabilities in question packaging general purpose technologies that are applicable to many different functions or industries? Do the capabilities in question embody (or 'productize') a particularly complex set of knowledge, or perform a particularly difficult or novel task that incorporates knowhow at the leading edge of a discipline? Are there many alternatives to this specific set of capabilities that are broadly accessible to other innovators?

[96] Analysis of activities that are 'per se' illegal or anticompetitive 'by object' (such as naked cartels) proceeds differently—often focusing on establishing the facts of the illegal conduct.

3. Assess whether a wide variety of market participants can access the capabilities in question.

   Do the capabilities constitute a 'module' of production that many participants can buy or sell on a non-exclusive basis? Are they tradable on the open market? Do market participants have easy access to the technologies through APIs or licensing?

4. Assess whether the transaction or activity subject to scrutiny will increase or reduce access to the capabilities in question.

   Will the merger reduce access to the merger target's capabilities or technologies by third parties? Is the unilateral conduct of a particular company designed to throttle or condition access to technologies over time? Is an exclusivity agreement designed to gatekeep or otherwise limit access to a set of capabilities?

5. Balance efficiencies or trade-offs related to access to technologies.

   Does the acquirer's innovation objective mean that it needs greater access to the target's capabilities? Would the merger bring new capabilities into a pre-existing technoeconomic domain? Would the merger cut off access to the target's capabilities by third party innovators? Should the target capabilities remain modularized (ie accessible to all innovators in a predefined package), or would it enable innovation better to integrate them more closely with one or a number of use cases?

6. Apply our limiting principle.

   Intervention should ensure innovators can still make a reasonable profit from their successful innovations, so as not to undermine innovation incentives.

In essential facilities cases, the EU's approach to essential facilities questions is a good starting point for a legal test that incorporates Innovation-as-Capabilities arguments (see above for discussion of EU rules). In the EU, a company with market power[97] will be obliged to share an essential facility where:

(1) the company's refusal to share its facility prevents a new product from arising (particularly in cases involving intellectual property),
(2) the refusal was not justified, and

[97] In European framing, a position of dominance.

(3) the refusal prevents competition on a distinct secondary market (applied flexibly).[98]

This approach frames a rule around using an existing facility to create a new product or service. This seems congruent with the Innovation-as-Capabilities paradigm in that it uses antitrust to open up access to existing capabilities that are not traded on the market and are required to produce an innovation.[99]

d) Promoting Innovation: Remedies

Agencies and courts could also apply Innovation-as-Capabilities reasoning to structure remedies that promote the ability of innovators to innovate. Efforts here would involve designing remedies that improve access to capabilities by modularizing capabilities, technologies, or business units into standalone entities that many market participants can access on a nonexclusive basis (while ensuring the entity that developed the capability earns a fair rate of return to protect its incentive to innovate). Remedies target similar issues in a market's economic structure: Exclusivity arrangements, essential facilities that only a restricted set of market participants can use, mergers that aim to remove 'modules' of production from open market access, etc.

These remedies may look similar to certain remedies that are currently widely debated in antitrust communities, like interoperability, structural separations, and divestitures. But basing them on economic reasoning around the ability to innovate rather than the incentive to innovate allows for agencies and courts to reach these remedies on clearer economic reasoning and to design them more appropriately. Reasoning that structural separations, divestitures and interoperability improve innovation incentives by making leaders in a market work harder to stay ahead of their competitors always feels a little convoluted, and it is no wonder that an incentive-oriented mindset biases courts and agencies towards nonintervention (as argued above).

As discussed above, interoperability remedies improve competition [*by giving third parties the capabilities needed to enter the market]* and thereby increase incentives of dominant players to continue to innovate. Focusing on the ability to innovate rather than the incentive lets us home in on what we really care about: the capabilities that third parties need to enter a market or

[98] *IMS Health GmbH & Co OHG v NDC Health GmbH & Co KG*, Case C-418/01, Court of Justice, [2000] ECR I-5039. Regarding the third leg of this test, see also Oscar Bronner v Mediaprint Case C-7/97 [1998] at [41] which similarly stated that the an essential facility must be necessary for competition on a secondary market for EU competition law to oblige the facility's owner to share it.

[99] Note that European courts did not frame this rule based on an explicit understanding of economic innovation as a process of recombination of capabilities. The key European decisions that created the EU's essential facilities doctrine were short and legalistic, and these rules largely grew out of the facts presented to the European courts in quite a narrow way. The European Court of Justice's decision in *IMS Health GmbH & Co OHG v NDC Health GmbH & Co KG*, Case C-418/01, Court of Justice, [2000] ECR I-5039 is the primary authority for the three-part test above: in *IMS Health*, one company wanted to license a data structure that was protected under IP law from another company to produce a new product. The Court relied on this 'new product' element in the facts of the case to distinguish previous authority (Such as *Oscar Bronner GmbH Co KG v Mediaprint*, Case C-7/97 Court of Justice, [1998] ECR I-7791) and establish the test set out above, without reference to any economic understanding of innovation (whether incentive- or capabilities-based).

become competitive in a new domain. Focusing on the ability to innovate stops incentive-oriented reasoning from getting in the way in this sense.

Applying antitrust remedies to open up access to capabilities to more innovators may bring antitrust closer to industrial policy. The US government's efforts to open up Tesla's supercharger network to many different EV companies is a good example of this: It represents an attempt to open up access to capabilities by many different market players, and thereby make it easier for new competitors to emerge that seek to challenge Tesla's dominance.[100] Similar efforts by European regulators have helped Europe develop a more dynamic and mature EV market faster than the US.[101]

V. Concluding Remarks

Focusing on the ability to innovate rather than just the incentive promises to change the way we see innovation questions in antitrust. Research in economics and from across the social sciences supports a tractable model of innovation, understanding it as a process of combining existing technologies and capabilities in new ways to make new products and services. Adopting this lens on innovation in antitrust law allows us create rules that give innovators access to the critical inputs they need to create new products or services, with policy prescriptions ranging from banning employee non-competes to modularizing technologies to making products and services interoperable.

It's worth reflecting on what really changes by adopting a 'capabilities' approach to innovation in antitrust analysis. An incentive-oriented approach to innovation questions suggests that we should balance between letting companies profit from their innovations and ensuring that they face sufficient competitive pressure from rivals to keep innovating and stay ahead of their competition. In principle, this perspective supports a balanced approach to intervention on innovation grounds; in certain circumstances intervening to preserve competitive market structures, mandate access to essential facilities, ban mergers, et cetera. These arguments implicitly assume that when we do intervene, we give upstart competitors a better shot at competing in the market, thereby improving their ability to innovate.

More generally, Innovation-as-Capabilities arguments don't change the fundamental tradeoffs that antitrust action involves. Intervention still encroaches on property rights, limits commercial freedom, intermediates private power relationships, mandates sharing, can involve tricky-to-manage government oversight of private affairs, and overrides investors' abilities to maximize the value of their property. Intervention still enmeshes government regulators in context-specific questions around how to manage the economy. Antitrust remedies also offer a limited menu of

[100] "More Automakers Are Adopting Tesla's EV Charger. But the Competition Won't Go Quietly," CNET, accessed September 14, 2023, https://www.cnet.com/roadshow/news/teslas-ev-charger-is-on-track-to-be-the-industry-standard-but-the-road-ahead-is-bumpy/.
[101] "Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the Deployment of Alternative Fuels Infrastructure Text with EEA Relevance," 307 OJ L § (2014), http://data.europa.eu/eli/dir/2014/94/oj/eng.

options to choose from, including structural separations, interoperability, prohibiting mergers or requiring divestments: a capabilities-based approach to innovation questions still must apply remedies from this same possible universe of antitrust authority.

But approaching innovation issues solely as questions of maximizing incentives shapes the questions we ask, what we focus on, and ultimately the way we craft and apply antitrust remedies. Innovation is about incentives, but it is also about creating supportive ecosystems. In focusing only on incentives to innovate, courts, agencies and antitrust economists adopt an orientation towards allowing innovators to profit from their innovations, and biases against intervention. This becomes the easiest story to tell. Overall, exclusively focusing on innovation incentives gives antitrust its innovation 'immune system' which leads courts and agencies to pull back from interventions that look appealing out of a theoretically motivated fear of chilling innovation.

Innovation-as-Capabilities arguments rebalance our mental models, focusing not just on the incentive to innovate, but also on an approach to understanding the ability to innovate that is well-grounded in economic research. This makes for better economic reasoning in antitrust cases. It allows us to understand more clearly how and why intervention can promote innovation. Most importantly, it dampens antitrust's innovation 'immune system.' It counterbalances our impulse to let innovators exploit their innovations with an understanding that today's innovators had access to all the capabilities they needed to innovate in their technoeconomic domain, and that we should empower tomorrow's innovators similar with access to needed capabilities.

We should bring this 'capabilities' approach to innovation into antitrust today, even though we don't currently have good empirical tools to analyze Innovation-as-Capabilities arguments in antitrust situations. Making progress in the short term relies on adopting robust research-backed paradigms and mental models on Innovation-as-Capabilities to integrate an understanding of innovation dynamics in specific cases. Given appropriate signals from policymakers, researchers can develop richer and more empirical tools that structure assessments of the ability to innovate in particular contexts (adapted from disciplines such as network science, input-output analysis, and economic geography).

Innovation is the key to long-run advances in human wellbeing and economic growth. Adopting the Innovation-as-Capabilities paradigm with vigor would help us center antitrust analysis around innovation and move beyond a myopic focus on measurable prices or product quality. Focusing our assessment on what promotes the ability to innovate, alongside questions related to innovation incentives, is key to making this progress.