# PERA Affirmative

## File Explanation

This is an affirmative about the patents part of the topic. Patents are grants of limited, exclusive property rights to inventors for a limited time (20 years). If you invent something, apply for and receive a patent for it, then you are the only party that can use or sell your invention. You can **license** it to others to use or sell if they pay you **royalty payments**. The purpose of patents is to reward inventors for the time and expense they invested in innovation, and to encourage others to continue to invent products.

**If the 1ac is too long** **to read in 8 minutes**, the cards that have asterisks in the tags can be cut without sacrificing anything crucial to the 1ac. They are nice to have, but not 100% necessary.

Eligibility (called “**subject matter eligibility**” in most evidence) for patents is determined by Congress in the **Patent Act**. Section 101 (abbreviated as **§ 101**) of the Patent Act has four criteria that an invention must meet to be eligible: the discovery must be a new and useful (1) process, (2) machine, (3) manufacture, or (4) composition of matter, or a new and useful improvement thereof.

If your invention falls into one of those categories, then it’s eligible. However, “eligible” doesn’t mean it gets a patent – instead, it just means you can apply for a patent. There are other criteria in the Patent Act that screen out bad patents. Three relevant sections are:

**§ 102** – it must be a new discovery. It can’t have been claimed on a prior patent

**§ 103** – it must be a ‘nonobvious’ discovery. If other people in the field are using it widely now, then it’s obvious.

**§ 112** – it must be disclosed so that a person of ordinary skill in the art can understand, make, and use the invention.

#### The problem with the status quo

Between 2010-2014, there were four Supreme Court decisions about patenting computer software and biotechnology innovations that made it much harder to get a patent. These decisions are referred to as the “***Mayo-Alice inquiry***”, or sometimes ***Alice-Mayo***, or sometimes just ***Alice***, since *Alice* was the last case. While you don’t need to know the names of each case, here is a list if you are curious:

*Bilski v. Kappos* (2010), *Mayo Collaborative Services v. Prometheus Laboratories* (2012), *Association for Molecular Pathology v. Myriad Genetics* (2013), and *Alice v. CLS Bank* (2014).

These decisions created three **judicial exceptions** to § 101. They don’t exist in a law passed by Congress, instead the Court just invented them. A patent is ineligible if it falls into one of these categories:

* + Abstract ideas
	+ Laws of nature
	+ Physical phenomenon

It might seem reasonable that an abstract idea can’t be patented. For example, most people would agree that nobody should be able to patent the Pythagorean Theorem and charge money to license its use. But § 101 already prevented that; patents must be ‘new and useful’ and fall directly in one of the four categories. The problem is courts have used the *Alice-Mayo* set of cases to deny patent eligibility to patents where part of the patent might involve one of those three things. For example, a court denied a patent application to a new kind of garage door opener because it relied on physical phenomenon. Given that every invention will in some way use an abstract idea, law of nature, or physical phenomena, courts have denied a wide range of patent applications.

#### What does the affirmative argue?

The affirmative advocates passing the Patent Eligibility Restoration Act (**PERA)**, a bill that has been proposed several times in Congress but never passed.

The two main things this law does are:

1. Eliminates the judicial exceptions, effectively having Congress overturn the four cases that are part of *Alice-Mayo*.
2. It legislatively codifies some exceptions to patent eligibility. These exceptions exist now in judicial doctrine – so no one can get a patent based on them now – but the affirmative makes it part of the Patent Act.

For example, PERA would mandate that mathematical formulas and unmodified human genes are not eligible for patents. They aren’t eligible now, but the law clarifies they won’t be even after the Alice-Mayo cases are overturned.

There are two advantages to passing PERA:

#### Advantage 1: Competitiveness

This advantage argues that the United States and China are in a high technology race to become the global leader. It assumes that technology is one of the most important elements of national power, and that innovation in emerging technologies like artificial intelligence, biotechnology, and quantum computing will provide tremendous power to the nation that develops them first. It also claims that if China leads instead of the United States, that will cause China to challenge the United States militarily and politically. Emerging technology provides China with military advantages that make them more confident in beating the United States in a conflict. It also argues that if China leads in emerging technology, that gives it the ability to threaten global democracy by increasing their political influence with other countries.

The affirmative says that the *Alice-Mayo* cases are undermining US innovation in emerging technology, because they are causing **uncertainty** for innovators about whether they will get patents. Patents are important to attract **investors** and funding for research and development. If investors think there is a good chance that a company’s patent will be denied, then they’re less likely to invest in that company.

#### Advantage 2: Innovation

This advantage argues that predictable patent protection is necessary to stimulate innovation in a wide range of technologies. The problem is that when the availability of patents is uncertain, companies will treat their discoveries as **trade secrets**. So they might develop technology, but they won’t share their discoveries, and they won’t be able to commercialize it effectively, and other companies won’t be able to license it, learn from it, or improve it.

This advantage claims that new technological innovation is especially important for the biotechnology sector, which has the capability to innovate in environmental remediation to help clean up pollution with new strains of bacteria (bacteria will literally eat the chemicals). But the lack of predictable patents will stall innovation in biotechnology as companies shift to trade secrets, and we won’t see the level of innovation or commercialization necessary for effective remediation.

#### Definitions

You don’t need to memorize these, but they will help you explain the affirmative.

**Subject matter eligibility** – the eligibility criteria governed by § 101 of the Patent Act, and the judicial exceptions created by the *Alice* line of Supreme Court cases.

**USPTO** – the US Patent and Trademark Office. They are in charge of patent applications.

**The Federal Circuit** – this is an appeals court in Washington DC that hears all patent appeals. Federal district courts can hear patent cases, but if they are appeals, they go to the Court of Appeals for the Federal Circuit, and to the Supreme Court after that. It’s not that important for this affirmative but a lot of evidence references this.

**Patent trolls** – sometimes referred to as Non Practicing Entities (NPEs) or Patent Assertion Entities (PAEs). These are companies that buy patents, but don’t use them other than to license the invention to others and sue in the case of infringement. They are criticized for undermining innovation by making it more expensive. They aggressively file lawsuits against other innovators that use inventions that are similar to, but not the same, as patented technology. Even if the lawsuit has little merit, innovators have incentives to settle due to the cost of lawsuits.

**Patent thickets -** refers to the fact that some sectors of the economy have so many patents that innovation is impossible. For example, the iPhone has 1298 patents, which makes it hard for a new market entrant to develop a competing product. The fragmentation of patents across different types of technology means someone trying invent something would have to license dozens or hundreds of patents first.

## 1ac

### 1AC - Plan

The United States federal government should strengthen its protection of patents by passing the Patent Eligibility Restoration Act.

### 1AC – Competitiveness Advantage

#### Advantage 1 is competitiveness

#### The US and China are competing for global technological leadership. However, four Supreme Court decisions called the “*Mayo-Alice* framework” created significant uncertainty over the whether high-tech innovation could receive patents. This will destroy US tech leadership

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Like it or not, the United States and China are locked in high-stakes global competition over trade, technology, and national security. Ironically, at this crucial time, China appears to have found an unwitting ally in the US Supreme Court.

The challenge couldn’t be more serious. But if Congress can move with bipartisan resolve, a legislative solution is at hand. Sen. Thom Tillis of North Carolina has a plan for that.

First, the context. The Patent Act, under Section 101, spells out the categories of inventions eligible for patenting; however, a series of Supreme Court decisions between 2010 and 2014 changed the test for what could be patented. It expanded the list of what would be ineligible, chiefly among abstract ideas, mathematical formulas, and products of nature. The tests involve highly subjective decisions for which the Supreme Court has provided no further guidance.

Together, the Supreme Court rulings have led to inconsistent case decisions. The resulting uncertainty has acted like kryptonite in innovation and investment communities. Patent rights across nearly all technologies have become much less reliable. Worse, inventors’ ability to obtain patents in sectors of crucial importance to the United States — including computer software, AI, and life sciences — has been virtually wiped out.

Not only are foreign governments well aware of America’s self-inflicted restrictions on patent eligibility, but they have seized upon the judicially created opportunity to their own competitive advantage. Many of the inventions the United States deemed ineligible are being patented in China and Europe.

Between 2014 and 2019, more than 17,000 US patent applications were rejected based on ineligibility, according to an analysis by George Mason University Law Professor Adam Mossoff. He found that 1,694 of those applications were subsequently granted patents in China or the EU.

China currently leads in 37 of 44 critical and emerging technologies, according to a study funded by the US State Department. There is no shortage of know-how or inventors in the United States, yet it’s stunning to think that the United States is ceding the global technology race because of dubious court decisions.

It doesn’t have to be that way. Current and retired judges on the US Court of Appeals for the Federal Circuit have expressed deep concerns over the patent eligibility chaos, as have the Solicitor General and Patent & Trademark Office directors. And in our deeply divided Congress, there’s a broad, bipartisan call for reforms to reestablish America’s global primacy in innovation and technology.

Tillis understands that if the United States is to beat China in emerging technologies — such as artificial intelligence, advanced computing, biotechnology, medical diagnostics, and 5G — we must make sure we aren’t depriving our top inventors of the free-market incentives and rewards that drive our competitive advantage.

That’s why he introduced S.2140, the Patent Eligibility Restoration Act, with Senate Judiciary IP Subcommittee Chairman Chris Coons of Delaware. Tillis’s bipartisan bill would resolve confusion by retaining Section 101’s existing statutory categories for patent-eligible subject matter (i.e., process, machine, manufacture, and composition of matter) and by replacing the ambiguous judicially created exceptions with more clearly defined exceptions.

Tillis’ PERA legislation provides specific exceptions to eligible subject matter and ensures that they will be the only exceptions. These exceptions include pure mathematical formulas, certain economic or social processes, processes that can be performed solely in the human mind, processes that occur in nature independent of human activity, unmodified genes, and unmodified natural material.

Tillis’s bill also clarifies the narrow conditions under which otherwise unpatentable processes, genes, and materials may be patentable. For example, under PERA, a process that cannot be practically performed without the use of a machine or computer may be patentable. The bill also clarifies that human genes and natural materials that are “isolated, purified, enriched, or otherwise altered by human activity” or “employed in a useful invention or discovery” are patent-eligible.

PERA would simplify eligibility determinations by requiring patent claims be read as a whole and prohibiting the consideration of other patentability factors (e.g., novelty and nonobviousness), ensuring Section 101 focuses solely on subject-matter eligibility. Under current law, patent examiners and courts determining whether a claimed invention is eligible for a patent under Section 101 must consider vague factors, including whether portions of a claim include elements that are “conventional” or “routine.”

Confusing, constricted and unclear patent eligibility court rulings have stymied the nation’s innovative progress. Tillis’s PERA bill lays down clear, consistent rules about what subject matter is eligible. Adding more certainty to the process ensures greater confidence in IP investments, which will grow America’s economic pie and raise the standard of living in our country. At a time of emerging challenges to US national security, Congress should make passage of PERA an urgent priority.

#### The *Mayo-Alice* framework generates investment-killing uncertainty about patent protection and drives investment overseas

Adam Mossoff, 24 - Professor of Law, Antonin Scalia Law School George Mason University. Answers from Adam Mossoff to Questions for the Record from Senator Thom Tillis, Senate Committee on the Judiciary, Subcommittee on Intellectual Property, United States Senate “The Patent Eligibility Restoration Act – Restoring Clarity, Certainty, and Predictability to the U.S. Patent System” 1/24, <https://www.judiciary.senate.gov/imo/media/doc/2024-01-23_-_qfr_responses_-_mossoff.pdf> //DH

**italics in original**

Beyond the blithe acceptance of a 90% invalidation rate for patent claims as representative of normal operating conditions in courts, there are several problems with the article by Professors Datzov and Rantanen. First, Professors Datzov and Rantanen conflate *legal* unpredictability and *commercial* unpredictability. As I have explained in numerous amicus briefs in patent eligibility cases over the past decade, the Mayo-Alice inquiry is indeterminate insofar as courts are using it to invalidate patents on inventions that have long been upheld by courts as patent eligible before the Mayo-Alice inquiry was created by the Supreme Court. I have also acknowledged in these amicus brief that the Mayo-Alice inquiry is predictable in a more narrow sense: courts almost always invalidate patents as ineligible when they apply this legal framework. This creates unpredictability for innovators in the biopharma and high-tech sectors who rely on the patent system to make long-term investments costing billions of dollars.25 Innovators cannot reasonably predict that they will receive reliable and effective property rights to secure a return on their investments in creating and commercializing new innovations; in fact, their only safe prediction is that there is a 90% chance their patent will be invalidated by a court. Thus, a reasonable businessperson concludes not to make the investment in the new technology or drug, or to shift the investment overseas to a country in which they can be certain they will receive legal protection for their fruits of their inventive labors.

This is what one scholar has identified as “investment-killing uncertainty,” which he rightly recognizes as the primary form of uncertainty in a legal system that “creates a problem that must be addressed by policy makers and suggests appropriate action” in enacting reform.26 Investment-killing uncertainty, which can be the result of a legal doctrine being applied consistently, is the unpredictability and indeterminacy that lawyers and economists speak about when they speak of the function of property rights in incentivizing investments and commercialization activities (as I explained above in my answer to Question 3(a)). Datzov and Rantanen agree with judges and others calling for reform when they find a 90% invalidation rate in the Federal Circuit’s application of the Mayo-Alice inquiry, and this agreement confirms there is an unbalanced, anti-patent bias inherent in the Mayo-Alice inquiry that must be reformed, just as nonobviousness doctrine required reform in the 1952 Patent Act given the high rates of invalidation of patents under the Supreme Court’s “flash of creative genius” test.

Datzov and Rantanen’s questionable decision to blithely accept massively lopsided decisions lacking dissents as evidence of investment-spurring predictability is further confirmed by their review of the Patent Trial and Appeal Board (PTAB) decisions. Datzov and Rantanen’s review of the Federal Circuit’s affirmance rate of the PTAB’s § 101 decisions is especially relevant given the PREVAIL Act, and the STRONGER Patents Act before this, introduced by members of this committee. The PREVAIL Act imposes important procedural and substantive reforms on an agency tribunal that many lawyers, judges, and stakeholders in the innovation economy have repeatedly identified as institutionally and legally unbalanced, and which the Federal Circuit has not reined in. Yet, Datzov and Rantanen find nothing wrong with a 100% affirmance by the Federal Circuit of PTAB decisions invaliding patents under § 101 in nine years over a span of ten years (2012-2022)—there was only one year the rate dropped to 93.3% (2020). Datzov and Rantanen conclude that “PTAB judges have been doing a good job of correctly and predictably determining when the patent claims are ineligible.”27 Given the extensive, necessary reforms of the PTAB in the PREVAIL Act, this is a surprising claim that further highlights the problematic nature of the study by these two academics.

There is much else that can be said about this study beyond its fundamental and improper equivocation between difference senses of predictability in the patent eligibility debates. For reform advocates supporting PERA, there is massive *commercial and investment unpredictability* created by a decade of decisions applying the Mayo-Alice inquiry to invalidate patents at rates of 90% or more. (Whether these inventions or discoveries would satisfy the patentability requirements for novelty, nonobviousness, and disclosure is a separate question, and one that the USPTO and a court would assess if they moved past the threshold legal inquiry of whether an invention is patent eligible.) For Datzov and Ratanen, a doctrine producing 90% patent invalidation rates—and 100% affirmance rates of § 101 invalidation decisions by the PTAB—are acceptable because they reflect legal predictability. But this is not predictable protection of property rights that secures investments and promotes the creation of new commercial business models in the innovation economy that drive economic growth.

#### \*Tech innovation drives national power and patents lock in tech leadership. Chinese leadership ends the liberal international order

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The world is on the brink of yet another industrial revolution, one that will be shaped by new and emerging technologies such as artificial intelligence, biotechnology, quantum computing, and other technologies which, analysts from the McKinsey Global Institute summarize, will “affect billions of consumers, hundreds of millions of workers, and trillions of dollars of economic activity across industries.” 5 That transition—a revolution in many ways—will be the fulcrum upon which global power and the world order will balance. As the National Intelligence Council summarized in its last Global Trends Report, “some technological areas appear to offer the potential for transformative change . . . advances in these areas will combine with other technologies, such as energy storage, to shape societies, economies and perhaps even the nature of power.” 6

Most simply, there are economic advantages that flow from leading the way. Leadership in those new and emerging technology sectors will yield revenues which facilitate a virtuous cycle of investment, research and development, securing dominance in this and future generations of technology. Leading promotes the creation of international standards which lock in that principal position; patent holders can generate substantial revenues from licensing—Qualcomm generated about €5.2 billion from licensing in 2017, more than 20 percent of its profit—and those royalty payments constitute a de facto tax on second-place competitors, providing an immediate advantage in subsequent research into next-generation technology. Standards also create dependencies, as they encourage the use of related technology throughout a network even as new generations of equipment develop. An integral part of China’s Belt and Road Initiative (BRI) is the proliferation of and reliance upon Chinese standards to encourage integration with and dependence on Chinese tech providers such as Huawei, the telecommunications giant. Tech supremacy confers legitimacy on that country’s innovation model, reinforcing its soft power.

The green technology industry provides insight into how this future could look. There is consensus that China is already pacing development of these vital technologies, holding “a commanding lead” in manufacturing most low-carbon technologies. China is responsible for the production of about 90 percent of the world’s rare earth elements critical to this transition. It is also responsible for at least 80 percent of all stages in making solar panels, and 60 percent of production of wind turbines and electric-vehicle (EV) batteries—and increasing capacity in both areas. In some niche components, its share is even higher. Economists applaud China’s efforts to lower costs and speed the green transition, but the massive subsidies afforded China’s solar panel producers have led European competitors to warn that they are being pushed to the brink of bankruptcy by these unfair practices.7

This “cornering of the clean tech supply chain” has been compared to Saudi Arabia’s power over the oil market and the geopolitical influence it created in the 20th century. 8 If China’s dominance continues and even extends into other new technologies, Beijing would accelerate its own growth and position in the global economy today, while also taking the lion’s share of revenues generated in multi-trillion-dollar industries and laying the foundations for future generations of China-created green tech. This would then endow China with enormous soft power as the leader of the energy transition critical to the planet’s survival.

What makes some new and emerging technologies different is that they not only generate wealth and prosperity, thereby validating the companies, countries and social systems that create them. That would be powerful enough. But some, such as AI and quantum computing, also provide insight into and potential control over the processes by which future decisions—no matter how distant—are made. Their effect is not just temporal, but enduring potentially for generations. Because they are capable of tipping the balance of power in a variety of ways, pre-eminence in these new technologies will determine who makes the rules and how the world works. Failure by the United States and its allies to lead in this competition will undercut their ability to construct or maintain a global order that favors their values and interests. That is what makes these technologies different.

Russian President Vladimir Putin gets it. As early as 2017, he argued that “Artificial intelligence is the future, not only for Russia, but for all humankind. … Whoever becomes the leader in this sphere will become the ruler of the world.” 9

China’s supreme leader Xi Jinping gets it. Xi has said that new technologies—artificial intelligence, big data, quantum information and biotechnology—will trigger “earth-shaking changes” that will give China an “important opportunity to promote leapfrog development,” and overtake competitors. 10 According to China technology scholar Tai Ming Cheung, Xi’s mindset is “a Hobbesian backdrop of a life or death struggle for the economic and strategic renaissance of China … an intensive zero-sum technological revolution … to effectively compete for the global commanding heights.” 11

China scholar Rush Doshi, now serving as deputy senior director for China and Taiwan at the National Security Council, has warned that “Beijing believes that the competition over technology is about more than whose companies will dominate particular markets. It is also about which country will be best positioned to lead the world.” While party officials are reticent to speak bluntly, Doshi pointed to “commentaries and think tank pieces [that] seem to suggest that surpassing the United States in high technology would end its era of global leadership, and presumably, usher in one of Chinese leadership.” 12

Consider one sobering scenario for 2033: a world in which China has surpassed the United States as the leading tech power and is typically first to announce breakthrough scientific discoveries and turn them into technologies. 13 Shenzhen has eclipsed Silicon Valley as the world’s leading source of innovation. China has closed the defense gap and can field weaponry as good as—if not better than—that of the US. Its technology is preferred across much of the developing world and has been eagerly adopted by autocrats and authoritarians who use it to impose China’s political model. The spread of “smart cities” that rely on its data, algorithms and technology provide Beijing with the ability to manipulate even mundane decisions on the platforms China provides. Imagine the mischief that can be done with—or the intelligence that could be gleaned from—control over computer systems that process visas, for example.

Moreover, the insights afforded by access to all those systems accelerates the development of artificial intelligence in China and extends its reach even further. Domination of China’s home market, combined with unfair trading practices abroad, ensures that Chinese companies maintain a competitive advantage over other businesses. This lead facilitates the spread of Chinese-supported international standards across multiple types of technology, favoring the power of the state over individual freedom globally and providing a technological underpinning to an increasingly illiberal international order.

#### Russia and China are revisionist powers. The mere perception of displacing US tech leadership could cause them to attack, risking nuclear war

Matthew Kroenig, 2021 – professor of government and foreign service at Georgetown University and the director of the Scowcroft Strategy Initiative at the Atlantic Council “Will Emerging Technology Cause Nuclear War?: Bringing Geopolitics Back In” Strategic Studies Quarterly, Winter, <https://www.airuniversity.af.edu/Portals/10/SSQ/documents/Volume-15_Issue-4/D-Kroenig.pdf> //DH

**4IR technologies = 4th Industrial Revolution**

New Tech Arms Race

Many analysts believe the emerging technology of the 4IR could profoundly affect military capabilities and operational concepts.35 New technology has had revolutionary effects on warfare and international politics throughout history from the Bronze Age to the gunpowder and nuclear revolutions.36

New technologies with direct military application are in development, including AI, quantum information technology, hypersonic missiles, directed energy, additive manufacturing, and biotechnology. How exactly these technologies will affect the future of warfare is still uncertain. The National Defense Strategy Commission report charges that the United States lacks clear operational concepts for combat with Russia and China.37 Still, there is reason to believe these new technologies could have meaningful military applications but perhaps not to the advantage of the United States and its Allies and partners. At present, Russia and especially China might transcend the United States and its Allies and partners in some key 4IR technologies.

Indeed, AI could transform the future of warfare, including through the development of lethal autonomous systems.38 These “killer robots” may lower the threshold of conflict by allowing political leaders to take a country to war without risking the lives of human soldiers. When produced in large numbers, these drones could operate in swarms that overwhelm enemy military platforms and targets.39

Artificial intelligence could also be employed to rapidly sort through vast quantities of data, improving intelligence, surveillance, and reconnaissance and making it easier to track and target enemy forces. The United States retains important advantages in AI, including through its world- leading university system. But China, with its large population and surveillance tactics, has access to more data to train its AI algorithms.40 Beijing is also less constrained by ethical and moral concerns and has the lead in some applications of AI, including facial- recognition technology.

Quantum computing promises information advantages including the ability to have secure, encrypted communications and to decode enemy communications. In its 2021 Military Balance report, the International Institute for Strategic Studies states, “the integration of quantum technologies currently represents one of the most anticipated advances for armed forces. . . . There is little doubt that they will have disruptive effect when they are employed at scale.”41 China may have the edge in this area, as it was the first country to conduct a successful test of a quantum satellite.42

Space and cyber are increasingly important military domains. Space- based weapons, sensors, defensive interceptors, and the diffusion of counterspace capabilities will make space an increasingly contested military environment.43 The United States is relatively more dependent on space- based assets and computers than its rivals, and the US Department of Defense warns Russia and China will likely employ cyber and counterspace attacks in the early stage of any conflict with the United States in a bid to disrupt US command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR).44

Hypersonic missiles, maneuverable and able to travel at over five times the speed of sound, could allow states to conduct low- or no- warning attacks and to evade missile defenses.45 These weapons could also execute large- scale, nonnuclear strategic attacks, the rate of speed compressing the decision- making time leaders have to respond to such attacks. Although the United States developed the initial concepts for these weapons, Russia and China have prioritized their production, testing, and deployment. China has conducted more hypersonic tests than any other nation, and Moscow and Beijing have deployed hypersonic weapons.46

Many other emerging technologies have military applications. Directed- energy microwaves and lasers could allow states to develop more effective integrated air and missile defense systems or to degrade an enemy’s command and control.47 Additive manufacturing could greatly reduce the cost of producing component parts of military platforms and creates the potential for large and rapid quantitative increases in weapons systems, from drones and tanks to submarines and nuclear weapons.48

Biotechnology could be exploited to produce “super soldiers.” China has genetically engineered beagles with three times the muscle mass of a typical canine, a technology that could possibly be applied to humans.49 Exoskeletons could provide soldiers with superhuman strength, and brain implants promise superior cognitive performance. China employed exoskeletons in combat in its 2020 border conflict with India.50

It is not yet clear how these new technologies, when combined with novel operational concepts, will affect the future of warfare, but it is likely they will. A future state may, for example, be able to use additive manufacturing to produce masses of inexpensive drones directed by new AI algorithms to swarm and overwhelm adversaries.51 The attack might be preceded by cyber and counterspace attacks that blind an adversary and disrupt its command and control.

Following a successful advance, the country could then employ directed- energy weapons, autonomous mines, and other advanced defenses to lock in territorial gains and thwart enemy attempts to roll back its aggression. It is possible that the first state to hone these technologies and devise effective operational concepts will have a military edge over its opponents.

Novel Applications

How will states use such a newfound advantage? Technology rarely fundamentally changes the nature or objectives of states. More often, states use technology to advance preexisting geopolitical aims. Moreover, enhanced power can result in greater ambition. Given the geopolitical landscape described, it is likely the United States and its Allies and partners at the core of the international system will behave differently with new military technologies than will revisionist powers, such as Russia and China.

The spread of new technology to the United States and its Allies and partners would likely serve, on balance, to reinforce the existing sources of stability in the prevailing international system. At the end of the Cold War, the United States and its Allies and partners achieved a technological- military advantage over its great power rivals, with the US using its unipolar position to deepen and expand a rules- based system. They also employed their military dominance to counter perceived threats from rogue states and terrorist networks. The United States, its Allies, and partners did not, however, engage in military aggression against great power, nuclear- armed rivals or their allies.

In the future, these status quo powers are apt to use military advantages to reinforce their position in the international system and to deter attacks against Allies and partners in Europe and the Indo- Pacific. These states might also employ military power to deal with threats posed by terrorist networks or by regional revisionist powers such as Iran and North Korea. But it is extremely difficult to imagine scenarios in which Washington or its Allies or partners would use newfound military advantages provided by emerging technology to conduct an armed attack against Russia or China.

Similarly, Moscow and Beijing would likely use any newfound military strength to advance their preexisting geopolitical aims. Given their very different positions in the international system, however, these states are likely to employ new military technologies in ways that are destabilizing. These states have made clear their dissatisfaction with the existing international system and their desire to revise it. Both countries have ongoing border disputes with multiple neighboring countries.

If Moscow developed new military technologies and operational concepts that shifted the balance of power in its favor, it would likely use this advantage to pursue revisionist aims. If Moscow acquired a newfound ability to more easily invade and occupy territory in Eastern Europe, for example (or if Putin believed Russia had such a capability), it is more likely Russia would be tempted to engage in aggression.

Likewise, if China acquired an enhanced ability through new technology to invade and occupy Taiwan or contested islands in the East or South China Seas, Beijing’s leaders might also find this opportunity tempting. If new technology enhances either power’s anti- access, area- denial network, then its leaders may be more confident in their ability to achieve a fait accompli attack against a neighbor and then block a US- led liberation.

These are precisely the types of shifts in the balance of power that can lead to war. As mentioned previously, the predominant scholarly theory on the causes of war—the bargaining model—maintains that imperfect information on the balance of power and the balance of resolve and credible commitment problems result in international conflict.52 New technology can exacerbate these causal mechanisms by increasing uncertainty about, or causing rapid shifts in, the balance of power. Indeed as noted above, new military technology and the development of new operational concepts have shifted the balance of power and resulted in military conflict throughout history.

Some may argue emerging military technology is more likely to result in a new tech arms race than in conflict. This is possible. But Moscow and Beijing may come to believe (correctly or not) that new technology provides them a usable military advantage over the United States and its Allies and partners. In so doing, they may underestimate Washington.

If Moscow or Beijing attacked a vulnerable US Ally or partner in their near abroad, therefore, there would be a risk of major war with the potential for nuclear escalation. The United States has formal treaty commitments with several frontline states as well as an ambiguous defense obligation to Taiwan. If Russia or China were to attack these states, it is likely, or at least possible, that the United States would come to the defense of the victims. While many question the wisdom or credibility of America’s global commitments, it would be difficult for the United States to simply back down. Abandoning a treaty ally could cause fears that America’s global commitments would unravel. Any US president, therefore, would feel great pressure to come to an Ally’s defense and expel Russian or Chinese forces.

Once the United States and Russia or China are at war, there would be a risk of nuclear escalation. As noted previously, experts assess the greatest risk of nuclear war today does not come from a bolt-out-of-the-blue strike but from nuclear escalation in a regional, conventional conflict.53 Russian leaders may believe it is in their interest to use nuclear weapons early in a conflict with the United States and NATO.54 Russia possesses a large and diverse arsenal, including thousands of nonstrategic nuclear weapons, to support this nuclear strategy.

In the 2018 Nuclear Posture Review, Washington indicates it could retaliate against any Russian nuclear “de- escalation” strikes with limited nuclear strikes of its own using low- yield nuclear weapons.55 The purpose of US strategy is to deter Russian strikes. If deterrence fails, however, there is a clear pathway to nuclear war between the United States and Russia. As Henry Kissinger pointed out decades ago, there is no guarantee that, once begun, a limited nuclear war stays limited.56

There are similar risks of nuclear escalation in the event of a US- China conflict. China has traditionally possessed a relaxed nuclear posture with a small “lean and effective” deterrent and a formal “no first use” policy. But China is relying more on its strategic forces. It is projected to double—if not triple or quadruple—the size of its nuclear arsenal in the coming decade.57

Chinese experts have acknowledged there is a narrow range of contingencies in which China might use nuclear weapons first.58 As in the case of Russia, the US Nuclear Posture Review recognizes the possibility of limited Chinese nuclear attacks and also holds out the potential of a limited US reprisal with low- yield nuclear weapons as a deterrent.59 If the nuclear threshold is breached in a conflict between the United States and China, the risk of nuclear exchange is real.

In short, if a coming revolution in military affairs provides a real or perceived battlefield advantage for Russia or China, such a development raises the likelihood of armed aggression against US regional allies, major power war, and an increased risk of nuclear escalation.

Implications

Future scholarship should incorporate geopolitical conditions and the related foreign policy goals of the states in question when theorizing the effects of technology on international politics. Often scholars attempt to conceptualize the effects of weapons systems in isolation from the political context in which they are embedded.

Studies treat technology as disembodied from geopolitics and as exerting independent effects on the international system. But technology does not float freely. Technology is a tool different actors can use in different ways. Bakers and arsonists employ fire in their crafts to strikingly different ends. In the current international environment, Russia and China would tend to employ technology toward advancing revisionist aims. Technological advances in these countries are therefore much more likely to disrupt the prevailing international order and nuclear strategic stability.

This approach also suggests the potential threat new technology poses to nuclear strategic stability is more pervasive than previously understood. To undermine strategic stability, new technology need not directly impact strategic capabilities. Rather, any technology that promises to shift the local balance of power in Eastern Europe or the Indo- Pacific has the potential to threaten nuclear strategic stability.

This understanding of this issue leads to different policy prescriptions. If the technology itself is the problem, then it must be controlled and should not be allowed to spread to any states. In contrast, the framework outlined here suggests a different recommendation: preserve the prevailing balance of power in Europe and Asia. Technological change that, on balance, reinforces the prevailing international system should strengthen stability.

Leading democracies, therefore, should increase investments in emerging technology to maintain a technological edge over their adversaries. Export control and nonproliferation measures should be designed to deny emerging military technology to Russia and China. Arms control should be negotiated with the primary objective of sustaining the current international distribution of power. Making progress in these areas will be difficult. But the consequences of failure could be shifts in the international balance of power, conflict among great powers, and an increased risk of nuclear war.

#### \*Chinese innovation leadership drives global totalitarianism

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Second, China’s illiberal campaign capitalizes on a disturbing global trend: As Freedom House reports, authoritarianism has spread during every year since 2006, while democracy has retreated. This “democratic recession” has given China a window of ideological opportunity to promote a vision of a hierarchical and harmonious society and a critique of a disorderly and decadent West. Around the world, public faith in democratic institutions has sunk to lows not seen since the 1930s. The political soil has grown ripe for authoritarianism to take root, and China, Russia, and other authoritarian states are fertilizing this antidemocratic plant with digital disinformation that their propagandists pump into the social-media feeds of billions worldwide.21

The third and most important factor supercharging China’s efforts is the ongoing digital revolution.22 The CCP possesses data-collection and messaging power to rival that of Apple, Amazon, Facebook, Google, and Twitter.23 By combining artificial intelligence (AI) and “big data” with cyber, biometric, and speech- and facial-recognition technologies, Beijing is pioneering a system that will allow dictators to know everything about their subjects—what people are saying and viewing, whom they hang out with, what they like and dislike, and where they are located at any given time—and to discipline citizens instantly by restricting their access to credit, education, employment, medical care, telecommunications, and travel if not to hunt them down for more medieval forms of punishment.

This technological revolution threatens to upend the global balance between democracy and authoritarianism by making repression more affordable and effective than ever.24 Instead of relying on expensive and potentially rebellious armies to brutalize a resentful population, an autocrat will now have more insidious means of control. Millions of spies can be replaced with hundreds of millions of unblinking cameras. Facial-recognition technologies can rapidly sort through video feeds and identify troublemakers. Bots can deliver propaganda tailored to specific groups. Malware can be installed on computers through seemingly innocuous apps or links, and then government hackers can crash the computer networks of dissidents or gather information on their operations. That information, in turn, can be used to coopt resistance movements by bribing their leaders or meeting their more innocuous demands. Alternatively, authorities can print out an AI-assembled list of alleged activists and kill everyone on it.

The evil genius of this “digital authoritarianism” is that most people will be seemingly free to go about their daily lives. In truth, however, the state will be constantly censoring everything they see and tracking everything they do. With old-school authoritarianism, one at least knew where the oppression was coming from. But now people can be nudged and cajoled by invisible algorithms delivering personalized content to their phones. In past eras, autocrats had to make tough choices between funding death squads or economic development. Today, however, repression is not only affordable, but also profitable, because “smart-city” technologies that enable tight social control can also be used to fight crime, diagnose diseases, and make the trains run on time.

These technologies are a tyrant’s dream. Recognizing this demand, Chinese companies were already selling and operating surveillance systems in more than eighty countries as of 2020.25 As the CCP feels increasingly threatened at home and abroad, there is every reason to expect Beijing to export digital authoritarianism farther and wider. Many countries already want it, and China has powerful tools to compel those that do not. Want access to the vast PRC market? Let Huawei install the core components of your 5G network. Want a Chinese loan? Accept PRC surveillance technology in your capital city.

As more governments partner with Beijing, the reach of China’s surveillance state will grow.26 Existing autocracies will become more totalitarian, and some democracies will drift into the authoritarian camp. International conflicts will likely proliferate—not merely those of ideas but those of arms, for as Putin’s invasion of Ukraine illustrates, dictatorship often turns to blood-and-soil nationalism and violent revanchism. The liberal belief that democracy and peace are destined to spread around the world will be upended. So will the comforting myth that humanity has evolved past the point of mass atrocities, because digital authoritarianism does not displace gulags and genocide; it enables them. When dictatorships ramp up digital repression, they also engage in more torture and murder.27 Computers and cameras handling everyday surveillance free the regime’s foot soldiers for tasks such as ethnic cleansing and beating dissidents into submission. Xinjiang, with its smart cities and concentration camps, offers a glimpse of this dire future.28

#### \*Global totalitarianism risks extinction

Haydn Belfield, 2023 – Research Associate and Academic Project Manager at the University of Cambridge's Centre for the Study of Existential Risk “Collapse, Recovery, and Existential Risk,” in *How Worlds Collapse: What History, Systems, and Complexity Can Teach Us About Our Modern World and Fragile Future*, p. 74-76. Accessed online via University of Michigan //DH

A world dominated by totalitarian states would be more incompetent, more war-prone, less cooperative, and more inhibitive of progress than one dominated by democratic states. Our current world is not particularly competent, peaceful, cooperative, or progressive—a totalitarian-dominated world would be worse. It would increase the risk of another collapse and extinction and could shape the future toward less desirable trajectories (Beckstead, 2013).

Totalitarian states are incompetent. They are bad at forecasting and dealing with disasters (Caplan, 2008).16 This can be seen most clearly in the great famines of Communist China and the USSR, in which millions died (Applebaum, 2017; Becker, 1996; Dikötter, 2010; Snyder, 2010). In comparison, functioning multiparty democracies rarely, if ever, experience famines (Sen, 2010). “Established autocracies” (or “personal”/“sultanist”) are particularly bad, as there are few checks or restraints on arbitrary rule and the whims and ideology of the single individual, even from other elites (Svolik, 2012). From the inside, the “inner circle” around Mao, Stalin, and Hitler seems incredibly chaotic, with elites strongly incentivized to conceal information and encouraged by the autocrat to squabble and feud—so they are divided (Conquest, 1992; Kershaw, 2008; Zhang & Halliday, 2006). If totalitarian states are worse at addressing social, environmental, and technological problems, then a world dominated by them would likely be worse at responding to risks of collapse and extinction.

A world dominated by totalitarian states is more likely to have major wars. States with near-universal adult suffrage rarely (if ever) go to war with one another (Barnhart et al., 2020), so a world dominated by democracies has fewer wars. Miscalculation might be a particular problem for totalitarian states due to personalization and disincentives for accurate information, leading to well-known strategic disasters such as Hitler and Stalin’s blunders in World War II (Bialer, 1970; Noakes & Pridham, 2001), or at a smaller level, Saddam Hussein’s rejection of diplomacy (Atkinson, 1993). War makes collapse and extinction more likely, by raising the chance of weapons of mass destruction being used.

Linked to this, totalitarian states are less cooperative than democratic states. While cooperation is possible (Ginsburg, 2020), their internal norms are characterized by paranoia and treachery, and their lack of transparency limits their ability to credibly commit to agreements. This is bad for all risks that require cooperation such as pandemics or climate change (Tomasik, 2015).

Finally, continued social and scientific progress is likely to reduce risks of collapse and extinction. Social progress could reduce global inequality and other risk factors. Scientific progress could help address natural risks and climate change (Sandberg, 2018), differentially increase defensive rather than offensive power (Garfinkel & Dafoe, 2019), and solve safety challenges in AI or biotechnology (Russell, 2019). However, as we will now discuss totalitarian states would likely inhibit social progress.

A central question from a longtermist perspective is: Which values should shape the future? I would argue that we should prefer it to be shaped by liberal democratic values. This is not to say that the current democracy-dominated world is perfect—far from it. The fate of billions of factory-farmed animals or hundreds of millions of people in extreme poverty makes that abundantly clear. However, democracies have two advantages. First, democracies have space for cosmopolitan values such as human rights, plurality, freedom, and equality. These are better than those that characterize life under totalitarianism: Fear, terror, subjection, and secrecy. Second, they have within themselves the mechanism to allow progress. In the last 100 (or even 50) years, the lives of women, LGBT people, religious minorities, and non-white people have dramatically improved. Our “moral circle” has expanded, and could continue to expand (Singer, 1981). The arc of the moral universe is long, but given the right conditions, it might just bend toward justice (King, 1968). A global society dominated by these values, and with the possibility of improving more, has a better longterm potential. A totalitarian-dominated world, on the other hand, would reduce the space for resistance and progress—distorting the human trajectory.

We should be particularly concerned about “bottlenecks” at which values are particularly important—where there is a risk of “locking-in” some particular set of (possibly far from optimal) values. While they are currently faroff, future technologies such as artificial general intelligence, space settlement, life extension (of autocrats), or much better surveillance could enable lock-in (Caplan, 2008).17

Conditional on them avoiding new catastrophes, world orders dominated by totalitarians could be quite long-lasting (Caplan, 2008). Democracies can undermine authoritarian and totalitarian regimes through the following ways: Control, including conquest; contagion through proximity; and consent, promoting receptivity toward democratization (Whitehead, 2001). Democracies can actively undermine these regimes through war, sanctions, hosting rebellious exiles, or sponsoring internal movements. Passively, through contagion, they offer a demonstration that a better, more prosperous life is possible. For example, in the final years of the USSR, ordinary Soviet citizens were able to see that the West had a higher standard of living—more innovation, more choice, and more consumer goods. The elites were able to read books from the outside, and travel—Gorbachev’s contacts and friendships with European politicians may have made him more favorable to social democracy (Brown, 1996). Democracies can undermine the will and capacity of the coercive apparatus (Bellin, 2004). However, in a world not dominated by democracies, all these pressures would be far less.

A world in which, say, totalitarian regimes emerged as dominant after World War II (for example if the USA was defeated) could be self-reinforcing and long-lasting, like the self-reinforcing relationship of Oceania, Eurasia, and Eastasia (Orwell, 1949). Orwell’s fictional world is characterized by constant low-grade warfare to justify emergency powers and secure elites, and with shifting alliances of convenience as states bandwagon and balance, thereby preventing any resolution. A totalitarian-dominated world order could be rather robust, perhaps for decades or even centuries.

A long-lasting totalitarian-dominated world would extend the period of time humanity would spend with a heightened risk of collapse or extinction, as well as increased potential for distortion of the human trajectory and the possibility that a “lock-in” event may occur. This example illustrates the possibility of a “negative recovery,” resulting in a trajectory with less or no scientific and social progress and a less favorable geopolitical situation, which would threaten the destruction of humanity’s longterm potential.

#### The plan solves. Passing the Patent Eligibility Restoration Act creates certainty and predictability by removing patent eligibility decisions from the courts.

Andrei Iancu, 24 – Partner, Sullivan & Cromwell; former Under Secretary of Commerce for Intellectual Property and Director of the United States Patent and Trademark Office. Testimony before the Subcommittee on Intellectual Property in the Senate Judiciary Committee, “The Patent Eligibility Restoration Act – Restoring Clarity, Certainty, and Predictability to the U.S. Patent System” 1/23, <https://www.judiciary.senate.gov/imo/media/doc/2024-01-23_-_testimony_-_iancu.pdf> //DH

As Chairman Coons and Ranking Member Tillis recognized in introducing PERA, “all 12 judges of the United States Court of Appeals for the Federal Circuit have lamented the state of the law” when it comes to patent eligibility under Section 101.1 The current state of the law is the result of many court decisions over the decades trying to determine whether modern technologies—such as computer software, DNA processing, and many others—fit into the categories for a patent defined in 1793, or whether they are subject to certain exceptions courts have imposed since then. The patchwork of decisions over time, struggling to keep up with fast-changing technologies, has created significant confusion and uncertainty as to what is in and what is outside the bounds of the statute. These court decisions also have resulted in certain *de facto* rules—such that diagnostic techniques, for example, are generally not eligible for a patent in the United States—that Congress has never considered, debated, or passed into law. If the United States Government is not to issue patents for certain categories of inventions that would otherwise be part of the categories outlined in Section 101, then it is up to Congress to make that rule. In other words, Congress defined the categories of patent subject matter; if there are to be exceptions to those categories, they must likewise come from Congress.

The current state of the law has caused profound uncertainty amongst inventors, investors, and patent-law practitioners alike. In turn, this uncertainty and confusion has hurt American innovation, competition, and the economy. It also has threatened the Constitutional right to patent protection—a right that James Madison and the Founders saw as vital to the economic strength and growth of our nation.

The current state of the law has even sown confusion amongst the expert ranks of the hardworking patent examiners at the United States Patent and Trademark Office (“USPTO”). To address this issue, the USPTO promulgated guidelines in 2019 that synthesized the relevant caselaw and provided examiners and applicants a significantly improved framework for analyzing eligibility under Section 101. This has dramatically improved the analysis at the USPTO. For example, a study by the USPTO’s Chief Economist has shown that “uncertainty about determinations of patent subject matter eligibility in the first action stage of patent examination for the relevant technologies decreased by 44% over the first year following publication of the 2019 [Revised Patent Subject Matter Eligibility Guidance] compared to the previous year.”2

Courts, however, are independent and not bound by administrative guidelines. As a result, Congressional action is needed to determine affirmatively which categories of inventions should be deemed as statutorily unpatentable. Otherwise, as Justice Clarence Thomas warned, “exclusionary principle[s]” espoused by the Judiciary about Section 101 risk “swallow[ing] all of patent law.”3

Fortunately, PERA provides the legislative vehicle for the United States to correct the state of the law. PERA expressly outlines certain categories that are not considered to be inventions eligible for a patent, and further indicates that courts are not to create any exceptions that are not in the statute. Once the categories—after debate and adjustment as appropriate—are settled on and passed into law, PERA will bring immediate certainty to Section 101. And it will prevent future uncertainty by “eliminat[ing]” “[a]ll judicial exceptions to patentability” and returning patent-eligibility decision making to Congress and legislative debate.

### 1AC – Innovation Advantage

#### Advantage 2 is innovation

#### Eligibility rejections on subject matter grounds creates a broad preemptive effect against entire industries. Uncertainty shifts industry to trade secrets protection, destroying innovation

Chad Rafetto, 2024 - Judicial Law Clerk for Chief Judge Colm F. Connolly of the United States District Court for the District of Delaware. J.D., May 2022, New York University School of Law “Fostering Innovation Through a Legislative Overhaul of Patentable Subject Matter”, 32 Fed. Cir. B.J. 93, Nexis Uni, accessed via University of Michigan //DH

B. Policy Issues

Mark Twain once wrote, "[A] country without a patent office and good patent laws was just a crab, and couldn't travel any way but sideways or backwards."172 The United States used to be the "gold standard" for patent [\*115] protection and was the world leader for promoting innovation.173 But the U.S. patent system is becoming a crab.

The purpose of the U.S. patent system is to incentivize innovation and the disclosure of new ideas.174 But currently § 101 jurisprudence is antithetical to the purpose of our patent system because it is stalling innovation in certain fields. Not only is this jurisprudence contrary to the purpose of patent law, but it is also causing America's patent system to fall behind that of other countries.

1. Our System Is Not Incentivizing Innovation in All Fields

Currently, there is a perception that certain kinds of inventions are precluded from receiving a patent because those inventions cannot pass the patentable subject matter requirement.175 This perception creates two issues. First, without certainty that downstream products in a field will be patentable, there is little incentive to invest in either the building blocks or the downstream products.176 So there are inadequate incentives to undergo the costs of innovation in certain fields. Second, when a company decides to invest in innovation, the uncertainty of whether its inventions are patentable incentivizes the hoarding of information in the form of trade secrets as opposed to the sharing of information that occurs in the patent system.177

Both of these issues are contrary to the core of patent law policy and are evidence that the system is not functioning optimally. The cause of these issues is that patentable subject matter functions best as a low bar, but the bar has been raised and now § 101 is doing exclusionary work that is best left to other doctrines. And the effect is that patents are now being granted or invalidated inconsistently across different fields.

a. Patentable Subject Matter Is No Longer a Coarse Filter

The idea of patentable subject matter serving as a coarse filter has been turned on its head. The coarse filter idea once meant that patentable subject matter was a low threshold to achieve.178 Thus, all inventions but the [\*116] bulky building blocks of science (i.e., laws of nature, physical phenomena, or abstract ideas) would pass through the filter. But now this coarse filter is being used more frequently. A lot more frequently. Since the Roberts Court's four cases on patentable subject matter from 2010 to 2014, the number of patent validity challenges on subject matter grounds has grown twentyfold.179 Further, one study found that out of a sample of 104 patent eligibility cases before the Federal Circuit post-Alice, the court determined that only 7.7% of those patents were valid.180 This has created a perception that certain types of inventions cannot receive patent protection, and this perception has stalled innovation in those fields.

Patent application rejections and patent invalidity rulings on subject matter grounds are more problematic for innovation than rejections and rulings based on other grounds because of the scope of the inquiry. Patentable subject matter asks whether inventions of this general kind are patent eligible; the other doctrines of patentability ask only whether a specific claim is patentable.181 So a rejection on subject matter grounds acts as a cudgel and sends a signal that all inventions of that "general kind" are not patentable, whereas a rejection on one of the other grounds acts as a scalpel and relates only to the specific claim at hand. Because patentable subject matter has been used too frequently to invalidate or reject a patent even though a rejection based on a different doctrine would suffice there is now a perception that patents are unavailable in certain fields.182

b. Technical Fields Are Being Treated Unequally Under Patent Law

The Supreme Court has refused to categorically ban certain fields of innovation from being patentable because inventions are often unforeseeable.183 As Judge Rader put it in his dissent in In re Bilski,184 "[W]hy should some [\*117] categories of invention deserve no protection?"185 The Supreme Court retained this policy by rejecting a categorical rule about the patentability of business methods because it would "frustrate the purposes of the patent law."186 Yet the current § 101 jurisprudence is foreclosing inventions in certain industries from the patent system.187

The current subject matter doctrine is preventing inventions in certain fields from being patented not because the advances in these fields are not valuable to our society, but rather because these inventions do not map well onto the subject matter requirements for patent law.188 Alice has had a particularly negative effect on software, business methods, and biotechnology patents.189 Post-Alice, the number of patent applications in each field decreased, yet even with fewer applications, the number of § 101 rejections increased.190 Another study looked at the invalidation rates under § 101 of over 800 patents before the Federal Circuit and found that 65% of software or IT patents were invalidated whereas only 50% of biotechnology or life science patents were invalidated.191 These studies exemplify just one of the discrepancies across fields.

 [\*118] That is not to say that all patents should be granted at an equal rate. But if no field is categorically banned from receiving a patent, then the subject matter rejection rates should be comparable. As explained previously, a rejection on subject matter grounds has a broader preemptive effect, so having higher subject matter rejection rates in certain fields forecloses a broader sphere of the field from patent protection than a rejection under any other doctrine.

One example of this inequality is in the field of diagnostics. In Athena Diagnostics, Inc. v. Mayo Collaborative Services, LLC,192Mayo v. Prometheus, and Association for Molecular Pathology v. Myriad, patents for diagnostic inventions were invalidated based on subject matter grounds.193 This trio of cases has signaled to inventors that applying for a diagnostic patent is a risky business. The patent may not be granted at all. Alternatively, even if the patent is granted, it can be invalidated when one attempts to enforce it.194 If the patent is invalidated, then the inventor disclosed his invention to the public but reaped none of the rewards of the patent. This uncertainty incentivizes inventors in the field of diagnostics to seek out other forms of protection or to abandon research in that field altogether in favor of a more patent-friendly field. For example, the Cleveland Clinic hospital system has shifted its research focus away from diagnostics because it thinks that inventions in this space will not be patentable under § 101.195

#### The shift to trade secrets protection weakens follow-on innovation

Courtenay C. Brinckerhoff, 24 – registered patent attorney and have been representing chemical, biotech, and pharmaceutical clients before the USPTO for over 30 years. Answers To Questions For The Record from Senator Tillis, before the U.S. Senate Committee on the Judiciary Subcommittee on Intellectual Property, “The Patent Eligibility Restoration Act”, 1/23, www.judiciary.senate.gov/imo/media/doc/2024-01-23\_-\_qfr\_responses\_-\_brinckerhoff.pdf //DH

While many U.S. companies continue to innovate in the diagnostic space, many doing so are maintaining their discoveries as trade secrets. This will not have the same impact on driving innovation as patent protection would, because the discoveries are not being made known to others who might improve upon them or build new innovations on them. In his written and live testimony, Mr. Blaylock argued that PERA would undesirably “permit the privatization of natural phenomena in the form of knowledge of new biomarkers and their clinical relevance,” but it is the current state of Section 101 that incentives innovators to keep their discoveries to themselves. Mr. Blaylock’s position forgets that patent rights come with the cost of public disclosure, and only last for a limited time. Without PERA, innovators have little reason to share what they learn about newly discovered disease biomarkers and personalized medicine, and more reason to develop their technologies in-house while keeping the underlying methodology a trade secret. It is the trade secret paradigm, not the patent system, that rewards “privatization” of knowledge.

I am aware of an empirical study reported in 2022 in the Washington and Lee Law Review2 that determined that, “in the four years following Mayo, investment in disease diagnostic technologies was nearly $9.3 billion dollars lower than it would have been absent Mayo.” The study focused on venture capital investment in the United States, in particular. While it did not consider whether money was invested in other countries instead, it at least indicates reduced investment in specific U.S. industries impacted by Mayo, which is of grave concern.

#### Trade secrets protection reduces microbial innovation necessary for environmental remediation

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Although the U.S. is considered a leader on the global stage, it is noteworthy that other countries have not followed the U.S. very far down this road of patent ineligibility. Isolated and purified forms of naturally-occurring products remain eligible for patenting everywhere else in the world, although some countries have specific exceptions for isolated genes.15 For example, the European Patent Office permits patenting of isolated genes and gene fragments as long as the patent’s description “indicate[s] the way in which the invention is capable of exploitation in industry.”16 Likewise, Australia, China, Japan, and Korea (for example) continue to grant patents on isolated natural products. Most countries permit patenting of diagnostic methods unless they are excepted on public policy grounds. For example, the European Patent Office permits patenting of diagnostic methods as long as they are not “practised on the human or animal body,”17 and so permits patenting of diagnostic methods conducted using saliva or blood samples (for example). Australia permits patenting of diagnostic methods without restriction (similar to the U.S. prior to Mayo), and methods of detecting specific markers of a disease or condition in a biological sample may be patented in China, Japan, and Korea (although methods of “diagnosing” a patient are excepted on public policy grounds).

This means that, since the changes in U.S. patent eligibility law flowing from Mayo, Myriad, and Alice,18 there are inventions that cannot be patented in the U.S. that can be patented in other countries. For example, as outlined above, isolated natural products that may be useful as medications, diagnostic agents, vaccines, antibiotics, or in industrial applications, can be patented around the world, except in the U.S. This leads to an imbalance in intellectual property rights that can be obtained in the U.S. versus elsewhere.

Regardless of where you seek to obtain a patent, you have to describe your invention in your patent application in a level of detail sufficient for others to practice the invention. This means that inventors who pursue patent protection have to disclose their inventions to the whole world, but cannot protect them to the same extent in the U.S. if they are caught in the § 101 snares of Mayo, Myriad, and Alice. This imbalance may cause innovators to think twice before pursuing a patent. If they do not expect to be able to adequately protect their investments, they may decide to maintain the technology as a trade secret, or shelve it altogether.

The imbalance in the “quid pro quo” of disclosure in return for patent rights19 is particularly acute for technologies related to isolated microorganisms, such as bacteria determined to have specific properties that make them particularly useful in commercial and industrial processes. (A few examples include bacteria used in brewing, baking, cheese- and yogurt-making, oil- and plastic-degrading bacteria used for environmental remediation, and carbon-fixing microbes used to address CO2 emissions.) In order to satisfy the 35 U.S.C. § 112 “written description” requirement for obtaining a patent relating to a newly discovered microorganism that is not readily available to the public, the patent applicant must “deposit” a sample of the bacteria with a qualified depository—such as the American Type Culture Collection (ATCC) in Gaithersburg, Maryland.20 The patent applicant also must assure that “all restrictions imposed by the depositor on the availability to the public of the deposited material will be irrevocably removed upon the granting of the patent.”21

Prior to Myriad, isolated bacteria were included in patent-eligible subject matter. Thus, even though members of the public could obtain a sample of the bacteria once a patent granted, the public’s freedom to use the bacteria often was limited by patent rights that covered any and all uses of the isolated bacteria. Under Myriad, however, it is no longer possible to obtain a patent on isolated bacteria per se. That means that a U.S. patent granted today might only cover a specific method of using the bacteria. Nevertheless, the patent owner still must irrevocably remove “all restrictions ... on the availability to the public of the deposited material” once the patent grants.22 This is another imbalance that has arisen in the wake of Mayo, Myriad, and Alice that may cause innovators to hesitate before pursuing a U.S. patent or developing technology for the U.S. market.

#### \*Microbial innovation reduces chemical pollution

Teklit Gebregiorgis Ambaye et al, 2024 – PhD. Postdoctoral researcher, Technical University of Denmark “Emerging technologies for the removal of pesticides from contaminated soils and their reuse in agriculture” Chemosphere, May, Science Direct, accessed via University of Michigan //DH

During biodegradation, organic substances are completely broken down into inorganic components by microorganisms. Microorganisms are the most abundant in nature. Their diversity, catalytic processes, and capacity to function without oxygen make them efficient and economically viable for the degradation of pesticides and other complex organic pollutants 93. Bacteria, fungi, and actinomycetes are the main pesticide degraders and transformants. They can make structural modifications to the pesticide molecule to reduce its toxicity. In addition, fungi typically biotransform insecticides and other xenobiotics, which bacteria can further degrade and make harmless before being released into the environment 186.

Fungi and bacteria produce several extracellular enzymes that act on various organic chemicals, making them ideal bioremediation agents. Microbial extracellular enzymes, particularly oxidases, laccases, and manganese peroxidases, play essential roles in the degradation process. Cytochrome P450, glutathione S-transferases (GSTs), and esterases have been reported as the primary enzyme families associated with pesticide degradation. Several pesticide-degrading microorganisms have been identified 187. For instance, recent studies by Ambreen and Yasmin 188 using Bacillus thuringiensis strain MB497 showed complete chlorpyrifos degradation (up to 99.9% in nine days). The results of this study also revealed the production of a novel metabolite, di-isopropyl methane phosphonate, which was obtained through alkylation/desulfurization reactions and then mineralized to produce carbon and phosphorus to support bacterial growth 188.

Enzyme-based pesticide degradation is a new treatment method for removing pesticides from polluted environments. Fungi and bacteria, particularly white rot fungi, are considered extracellular enzyme-producing microorganisms for this process. Environmental effects can produce and secrete these enzymes, which are involved in lignin degradation. Several microbial strains, including Transferases, isomerases, hydrolases, and ligases enzymes, are responsible for the biodegradation of pesticides, making them a promising bioremediation agent.189,190. In addition, enzymes are responsible for various metabolic reactions, such as hydrolysis, oxidation, oxygen addition, amino group oxidation, benzene ring hydroxyl group addition, dehalogenation, nitro group reduction, sulfur replacement, side chain metabolism, and ring cleavage, all of which are catalyzed by these enzymes. The metabolic ability of microbes to detoxify or modify pollutant molecules, which is based on accessibility and bioavailability, drives biodegradation191.

In general, three steps are involved in pesticide metabolism. Step I involves reduction, oxidation, or hydrolysis to create a more water-soluble and less poisonous compound. Step II involves the conjugation of a pesticide or pesticide metabolite to a sugar or amino acid, which boosts its water solubility and lowers its toxicity. Step III involves the conversion of step II metabolites into non-toxic secondary conjugates. Bacteria and fungi produce intracellular and extracellular enzymes 192. Although microbial biodegradation is an efficient, cost-effective, and environmentally beneficial method, some challenges remain. One of the biggest challenges is the inability to cultivate some microbial species, which makes it difficult to identify the environmental pollutants that cause the most damage. In addition, temperature, pH, and humidity influence the performance of microbes in the field, and rivalry between the target microorganism and other native microorganisms may restrict their growth.

Microbial consortiums can create an efficient system for pesticide bioremediation; however, selecting a partner bacterium that works well together is essential for constructing a strong system. Hence, to further evaluate this symbiotic association, a thorough investigation of the molecular dynamics, metabolic transitions and shifts, and small-molecule interactions between the microorganism and the surrounding conditions and environmental factors is required 193. Microbial catabolism is diverse and capable of breaking down a wide range of chemical substances; filling all the knowledge gaps is challenging. However, potential metabolic pathways and toxicity endpoints can be predicted using in silico investigations, system modeling, and molecular dynamics, as shown in Figure 11. The development of genetic bioaugmentation, which involves introducing donor bacteria into polluted soil to increase the capacity of native bacteria to break down pesticides, is a successful strategy 194. A general overview of the intricate biodegradation processes is provided by multi-OMICS techniques (genomics, transcriptome, and metabolomics), making it feasible to identify and characterize various molecular mechanisms, metabolic pathways, their control, and potential interconnections, as shown in Figure 11.

Currently, most research is focused on the application of molecular docking in environmental remediation for the intermolecular investigation of microbial biodegradation of pesticides, as shown in Figure 12, which has enabled the discovery of new genes and enzymes involved in remediation mechanisms, bridging research gaps and expanding our understanding of the remediation of xenobiotics 192.

#### The impact is agriculture and ecosystem collapse, and it risks extinction

Ravi Naidu, 2021 – Global Centre for Environmental Remediation (GCER), The University of Newcastle “Chemical pollution: A growing peril and potential catastrophic risk to humanity” Environment International

Volume 156, November 2021, Science Direct, <https://www.sciencedirect.com/science/article/pii/S0160412021002415> //DH

6. Contamination of the food chain

6.1. Food chain pollution

According to the American Academy of Paediatrics more than 10,000 chemicals are used or find their way into the modern food supply (Trasande et al. 2018). Food chain pollution poses direct risks to humans from ingestion of contaminated food (Fig. 3). The risk may be passed on to the next generation as pollutants were detected in human breast milk (van den Berg et al. 2017) and were associated with cognitive and other health disorders, or by epigenetic means (Baccarelli and Bollati 2009). The adverse effects of pollutants on the human gut microbiome are also a warning about potential long-term impacts on immunity and metabolism (Jin et al. 2017).

Food can be contaminated at several stages before consumption - during crop or forage or animal production and harvesting, or post-harvest during storage, processing, transport and processing. Heavy metal(loid)s, pesticides, dioxin, PCBs, antibiotics, growth-promoting substances, packaging residues, preservatives and excess nutrients (e.g. nitrate) have all been found to contaminate food at higher than acceptable levels (Awata et al., 2017, EFSA, 2018, Islam et al., 2017, Licata et al., 2004). This affects vegetables, grains, fish, and livestock via soil, surface water, groundwater or aerial deposition (Zhong et al. 2015) (Fig. 3). For example, Cd concentrations of various foodstuffs in China, including vegetables, rice, and seafood, were as high as 0.93 mg/kg and contributed 1.007 µg/kg bodyweight to the daily intake for children, which is 1.2 times higher than the acceptable limit recommended by WHO and the FAO (Zhong et al. 2015). Dioxin and PCB-like contaminants in food are also a concern to human health according to a report commissioned by the European Food Safety Authority (EFSA). Similarly, human exposure to pesticides can occur from residues in food or from legacy or inadvertent contamination during production and processing. Such contamination of food products can have chronic impacts on human health (The Gurdian 2004). A recent study of pesticide pollution at global scale reported that 64% of agricultural land was at risk of pollution caused by multiple active ingredients of pesticides. The risk includes adverse effects on food and water quality, biodiversity and human health (Tang et al. 2021).

Post-harvest protection of food can also result in contamination by fumigants, formalin and other insecticides and preservatives (e.g. calcium carbide, cyanide, sodium cyclamate, urea, melamine, aflatoxin and detergents), especially when they are used incorrectly, illegally or accidentally. Serious examples have been reported from numerous countries, including China, India, and Brazil (Handford et al. 2016). Even in countries with well-defined and established regulatory systems, such as those of the EU, chemical contamination in food and animal feed can occur to an extent sufficient to cause concern, due to intentional and unintentional use of post-harvest chemicals (Silano and Silano 2017).

6.2. Loss of soil productivity

Healthy soils are essential for safe, healthy food, ecosystem service delivery, climate change abatement, abundant food and fibre production, pollutant attenuation and freshwater storage, all of which are key to the sustainability of the world food supply. Reduced food availability and security in less-developed countries can occur when productive land is lost due to chemical contamination (Fig. 3). In the last 40 years nearly one-third of the Earth’s total arable land has been lost to soil erosion, desertification, urban expansion, and contamination (Cameron et al. 2015). Soils contaminated with heavy metals and pesticides cause loss of productive agricultural land and compromise food production and quality (Fig. 3). There is no global estimate of the areal losses of arable land attributed to chemical pollution, but regional reports indicate significant loss or potential loss. For example in Europe, 137,000 km2 of agricultural lands are at risk of being abandoned due to heavy metal(loid)s pollution (Tóth et al. 2016). This situation is exacerbated in developing countries by inadequate waste treatment and uncontrolled exploitation of natural resources (Lu et al., 2015, Tóth et al., 2016). China lost 0.13% of its total arable land due to chromium (Cr) pollution during 2005–2013 and 1.3% remains at risk (Lu et al., 2015, Tóth et al., 2016). Yet, key policy instruments and initiatives for sustainable development rarely recognise that contaminated soils compromise food and water security.

6.3. Biodiversity loss and damage to crops and livestock

Biodiversity in the Earth’s surface layer from bedrock to the vegetation canopy provides the primary source of services for the support of life on Earth (Banwart et al. 2019; Cardinale et al. 2012). The acute and chronic impact of excessive current and historical use of agrichemicals and other industrial pollutants is contributing to a substantial loss of Earth’s biodiversity. The global loss of honeybee communities due to neonicotinoid pesticides has caused an international crisis for crop pollination (Dave 2013), for example. There are reports of pesticide pollutants causing the loss of more than 40% of the total taxonomic pools of stream invertebrates in some regions (Beketov et al. 2013). Residues of more persistent chemicals, including many pesticides, may have long-term ecological impacts, especially in highly contaminated areas (Gevao et al. 2000) with significant threats of pollution of groundwater and marine water (Arias-Estévez et al., 2008, Jamieson et al., 2017). Losses of up to 78% of insect species have been reported from 290 sites in Germany (Seibold et al. 2019). Such ecological impacts and their persistence may profoundly alter biological processes such as decomposition and soil formation in natural environments, leading to unfavourable or challenging settings for human food production.

Reactive nitrogen pollution of the atmosphere and its deposition are responsible for declining biodiversity at regional (Hernández et al. 2016) and global scales (Condé et al. 2015). For example, assessing more than 15,000 sites, including forest, shrubland, woodland and grassland in the USA, Simkin et al. (2016) found that 24% of the sites had losses of vulnerability of species as a result of atmospheric nitrogen deposition, in particular when the disposition was above 8.7 kg N/ha/yr. A similar study in the UK also revealed that species richness had declined with increases of nitrogen deposition in the range of 5.9 to 32.4 kg N/ha/yr (Southon et al. 2013). Excess loading of nutrient pollutants by human activities affects hundreds of coastal and marine ecosystems and has been linked to a ‘missing’ biomass of flora and fauna (Diaz and Rosenberg 2008).

At a global scale there is also evidence that low crop yields may be caused by surface (tropospheric) ozone (O3) pollution (Tai et al. 2014); elevated O3 levels are also linked to chemical pollutants. It was projected that by 2030 that O3 precursors could cause crop yield losses for wheat (4–26%), soybeans (9.5–19%) and maize (2.5–8.7%) globally (Avnery et al. 2011). Reduction of crop yield due to the O3 exposure has also been reported by several regional experimental and model studies (Debaje, 2014, Hollaway et al., 2012, Kumari et al., 2020). The yield losses occur as a result of plant physiological interference with the O3 molecules such as the production of reactive oxygen species mainly through the diffusion of O3 into the intercellular air space of plant leaves (Ainsworth 2017).

7. The chemical pollutant challenge for humanity: Discussion and questions

From a toxicological point of view, exposure to the vast array of modern chemicals and their billions of mixtures might cause acute or chronic toxicity but also not pose any toxic risk to humans. This wide range of threats can be addressed using a risk-based approach (Siegrist and Bearth 2019). Due to methodological constraints and the varying susceptibility to toxins among humans, there are only a few reports showing direct quantitative, whole life-span analyses of fatalities attributed to environmental pollutants (section 2–6). Nevertheless, compilation of the substantial evidence of the health burden caused by chemical pollution both show and predict the impairment of normal human life expectancy by direct exposure to pollutants, food contamination and fertility decline (Fig. 4) (Aitken et al., 2004, Hou and Ok, 2019, Rabl, 2006).

Rockström et al. (2009) described nine planetary boundaries that humans ought not to breach for our own safety: climate change, ocean acidification, stratospheric ozone, global phosphorus and nitrogen cycles, atmospheric aerosol loading, freshwater use, land-use change, biodiversity loss, and chemical pollution. Later, ‘chemical pollution’ was not considered as a single entry (Condé et al. 2015) as they also cause climate change (e.g. emissions of CO2, methane and other greenhouse gases), ocean acidification due to elevated CO2, depletion of stratospheric ozone due to released halocarbons, and interruption of P and N cycles. As pointed out here, atmospheric aerosol loading is another aspect of anthropogenic chemical pollution (Singh et al. 2017), and ambient air pollutants are responsible for millions of premature deaths and cost many billions of dollars (West et al. 2016).

Every year thousands of new chemicals are produced and most of them remain beyond current risk assessment regulations (Sala and Goralczyk, 2013, Wang et al., 2020). The effects of mixed pollutants are especially unclear (Heys et al., 2016, Konkel, 2017). This due to inadequate methodology to assess the interaction of chemical mixtures and the risk factors for human health (Heys et al. 2016), although the effects of mixed pollutants on human health are probably physiologically more relevant than that of any single pollutant (Carpenter David et al. 2002). Global climate change, including warming and extreme climatic conditions, will exacerbate human exposure to chemical pollutants present in soil and water (Biswas et al. 2018). Erosion and aerial transport of polluted soil or acidification of soil and water causing mobilisation of toxic heavy metal(loid)s are two mechanisms by which this can occur. There is in general far too long a delay between scientific discovery of pollution problems and their effects, and regulations and actions to abate them.

It is likely humanity is approaching a dangerous tipping point due to our release of geogenic, anthropogenic synthetic chemicals (Table 1, Table 2 and SI Box S1). This raises the issue that, as yet, no scientifically credible estimate has been made of humanity’s combined chemical impact on the Earth and on human health. This gap was highlighted by Rockström et al. (2009) whose popular ‘global boundaries’ chart was unable to include a boundary for chemical emissions because of a lack of data and suitable methodology. Public awareness is constrained by several issues, including the fact that toxic chemicals are now so widely dispersed throughout the Earth’s biosphere that their origins are untraceable, that cases of poisoning may take decades to be officially noticed, researched and proven, that the polluters may not be aware of or well-equipped to curb the pollution, that consumers and many professionals may be insufficiently educated in the risks. There are several local incidents that the aftermath analysis could reveal the insufficiency of knowledge regarding the effect of synthetic chemicals. For instance, the Bhopal Union Carbide gas disaster of 1984 of such categories where gaseous contaminant levels were so high that people died immediately following exposure.

Consequently, humanity is unaware of how near or far it is from exceeding the Earth’s capacity to ‘absorb’ or safely process our total chemical releases, which grows by many billions of tonnes with each passing year. This represents a potential catastrophic risk to the human future and merits global scientific scrutiny on the same scale and urgency as the effort devoted to climate change.

#### The Patent Eligibility Restoration Act solves by creating a more predictable innovation environment. Limiting judicial discretion means innovators are less likely to rely on trade secrets and will disclose their inventions

Maxwell H. Terry, 2023 – Managing Editor, Minnesota Law Review, Vol. 108 J.D. Candidate 2024, University of Minnesota Law School. “Hello, World? Domestic Software Patent Protection Stands Alone Due to Uncertain Subject Matter Eligibility Jurisprudence” 108 Minn. L. Rev. 403, Nexis Uni, Accessed via University of Michigan //DH

C. Recalibrating the Domestic Jurisprudence Through Lessons Learned from Domestic Legislative Proposals and Global Trends

The United States has a patentable subject matter issue. Rather than base eligibility determinations along predictable lines, the United States instead utilizes ever-changing common law requirements that blur patentability requirements rather than clearly define them. Legislative proposals and global trends offer tremendous insight into how to better support American innovation. First, Congress should statutorily define categories of patent-ineligible subject matter such that judicial discretion is limited to not extend beyond explicit bounds. Second, due to software's importance and prevalence in today's economy,309 the Patent Act should specifically consider software and computer-implemented inventions. Finally, the Patent Act should clarify that patentable subject matter determinations are a distinct requirement apart from, and without consideration of, other patentability requirements. Such changes would align the United States' patent system with global standards while simultaneously increasing predictability before the USPTO and federal courts.

First, the Patent Act should specifically enumerate categories of ineligible subject matter and limit a court's discretion to make eligibility determinations beyond those defined. Judicially created categories are amorphous, unworkable, and ultimately not essential considering the remainder of the Patent Act.310 By moving away from common law development in this area, the standards for eligibility will be clearer and more easily applied.311 Such a change also aligns with other IP5 members, who explicitly enumerate ineligible subject matter categories.312 Additionally, by limiting court discretion to the mere application of the statute to the invention at hand, a prospective inventor can more easily discern whether their invention would be patentable.

Second, the Patent Act should specifically address software and computer-implemented inventions. One approach, as used by other IP5 members and proposed by PERA, is to eliminate patentability for software "as such," but to allow patents on discrete applications of software.313 PERA further divided this analysis depending on the type of process sought to be patented, as non-technological processes remain patent-eligible if they are solely capable of being performed through the use of a machine or manufacture, and a judge's evaluation of other processes is constrained by statutory considerations.314 As it stands, software is often patented as a "process" under §101. Specifically defining what types of software inventions are patentable, as Japan has done,315 would promote consistency, simplify the application process, and incentivize inventors in computer-related fields to publish their inventions through the USPTO rather than hold onto them as proprietary trade secrets.316 Defining software subject matter eligibility would also limit a court's ability to hold such patents invalid on patentable subject matter grounds, further promoting predictability, consistency, and uniformity.

Finally, the Patent Act should make it abundantly clear that the patentable subject matter analysis, along with its many considerations, is a doctrine distinct from other patentability requirements. One major complaint with the current Alice/Mayo framework is that it wrongfully conflates subject matter eligibility issues with requirements embodied by other portions of the Patent Act, leading to inconsistent applications of §101.317 A PERA approach would correct this by limiting a court's discretion to make considerations outside of §101.318 Alternatively, the Patent Act could follow Japan or Europe's approach, wherein the subject matter eligibility determination goes to whether the claimed subject matter constitutes a statutory "invention" at all, and a court only applies other patentability doctrines upon a finding that the claimed subject matter is, in fact, an invention.319 Either outcome would increase predictability as an inventor will know which metrics their patent will be evaluated by. While this may cause fewer infringement cases to be dismissed early in litigation, §101 eligibility should not draw from other portions of the Patent Act for the sake of judicial efficiency.

CONCLUSION

Software innovation is paramount to the development of modern society and will only continue to grow in importance as emerging technologies such as quantum computing, artificial intelligence, and automation become increasingly prevalent. The United States' patent system currently stands to hinder the innovation of software and computer-implemented inventions more than it stands to help it, as the common law development of the patentable subject matter doctrine has enshrouded the patent system in a cloud of unpredictability. To right the course, and better align the United States with global trends, Congress should take action to modify §101. Specifically, Congress should amend the Patent Act to explicitly define categories of ineligible subject matter, provide specific clauses directed to the patentability of software and computer-implemented inventions, and statutorily prevent courts from making eligibility determinations based on patentability requirements outside of the four corners of §101 itself. The Patent Eligibility Restoration Act accomplishes many of these goals and has already been introduced in the Senate.320 These changes would promote a more consistent approach and ensure that the United States retains its powerful position at the center of the global technology market.

#### \*Other doctrines of patentability will exclude bad patents. But a broad standard for subject matter eligibility prevents preempting entire fields of technology

Chad Rafetto, 2024 - Judicial Law Clerk for Chief Judge Colm F. Connolly of the United States District Court for the District of Delaware. J.D., May 2022, New York University School of Law “Fostering Innovation Through a Legislative Overhaul of Patentable Subject Matter”, 32 Fed. Cir. B.J. 93, Nexis Uni, accessed via University of Michigan //DH

D. Applying this Article's Proposal to Recent Supreme Court Cases to Demonstrate Its Practicality

One of the goals of this Article's proposal is to shift the work currently being done by the subject matter doctrine to the other doctrines of patentability. This shift requires that the other doctrines can perform that exclusionary work. In Mayo, the Supreme Court said:

We recognize that, in evaluating the significance of additional steps, the § 101 patent-eligibility inquiry and, say, the § 102 novelty inquiry might sometimes overlap. But that need not always be so. And to shift the patent-eligibility inquiry entirely to these later sections risks creating significantly greater legal uncertainty, while assuming that those sections can do work that they are not equipped to do.231

 [\*126] But the Supreme Court is wrong. The other doctrines are adequately equipped to prevent undesirable patents. To prove this theory, this section will analyze recent Supreme Court decisions and demonstrate how the same result could have been reached through rulings based on other doctrines of patentability besides § 101.

In reaching the same result as the Court did, the emphasis is not on whether the Court made the correct decision if such a thing could even be proven.232 The purpose of this exercise is to show that patent law can be effectuated in the same way without relying on § 101 as heavily as the Court currently does. This overuse is significant because § 101 acts as a coarse filter; when decisions are rendered on a § 101 basis, there is a larger preemptive effect than for rejections based on the other doctrines of patentability.233 Thus, invalidating a patent under the novelty, nonobviousness, written description, or enablement doctrines means that the specific claim was not patentable, but rejecting a patent on subject matter grounds means that inventions of this general kind are not eligible for patent protection.

Professor Michael Risch previously conducted this exercise in 2008 and discussed how the pre-2008 patentable subject matter case law could have been decided on different grounds.234 To avoid being duplicative, the current analysis will focus on the post-2008 Supreme Court cases Bilski, Mayo, Myriad, and Alice.

In Bilski, the patent dealt with the business method of hedging.235Bilski is a rare case because though the patent had been pending for eleven years, the USPTO had never examined the patent for any element of patentability except for subject matter.236 Because § 101 is a threshold inquiry, the USPTO, the parties litigating the issue, and each of the courts never even reached the [\*127] other doctrines nor presented arguments on these other doctrines.237 Despite this dearth of argumentation on the other aspects of patentability, both Judge Newman's dissent at the Federal Circuit and Justice Stevens's concurrence at the Supreme Court mentioned § 112 for the proposition that the claim language was too broad to be supported by the invention itself.238 Both Newman's dissent and Stevens's concurrence seem to suggest that the majority opinions' reasonings were wrongly conflating preemption with claim breadth. So Bilski most likely could have been decided as a § 112 case because the invention did not support the breadth of the patent's claims and thus the patent still would have been denied.

Mayo, a case about using thiopurines to treat autoimmune disease, was more straightforward than Bilski because the government argued in an amicus brief that the invention met the patentable subject matter bar, but that the patent is likely invalid under novelty or nonobviousness.239 The government argued this point because the only element that was distinct from the prior art was the last step of the process, the doctor's mental inference.240 Because of the similarity between the prior art and the invention, either novelty or nonobviousness could have been used to decide Mayo. It is also worth noting that the Supreme Court's only reasons for rejecting the government's position, besides their misguided belief that the other sections are not capable of performing this function, were because it was inconsistent with prior doctrine and because the Court did not wish to risk "creating significantly greater legal uncertainty."241 A legislative change would nullify the first concern because the prior doctrine would no longer be relevant. As to the second concern, [\*128] the Supreme Court has it backwards the prior inconsistent case law has created legal uncertainty.242

Myriad, a case about the patentability of isolated DNA and cDNA,243 can also be resolved based on novelty and nonobviousness grounds. First, the cDNA was deemed to be patentable, so a lower subject matter bar would not change that result.244 The isolated DNA segments, however, were deemed not patentable because the DNA segment was a product of nature and isolating it did not make it patent eligible.245 Both of these arguments are similar to the arguments that would be made for novelty and nonobviousness, respectively. The isolated DNA segments have occurred before and are anticipated. And the act of isolating the DNA is obvious because it is not distinct enough from the prior art. Thus, Myriad also could have been decided based on novelty or nonobviousness grounds.

Last, Alice was a case about a computer-implemented scheme for mitigating settlement risk.246 The patent was ruled ineligible on subject matter grounds because it did nothing more than "instruct the practitioner to implement the abstract idea of intermediated settlement on a generic computer."247 At the Federal Circuit, then Judge Moore's dissenting opinion specifically argued, "Section 102's novelty or § 103's nonobviousness requirements are the means to challenge a system claim that does no more than take a familiar, well known concept and put it on a computer."248 Thus, these doctrines could also have been used to rule this patent invalid.

Conclusion

Patent law's current § 101 jurisprudence is broken. The Federal Circuit and district courts cannot effectively apply it, its case law is inconsistent, and, most importantly, it is harming innovation. By harming innovation, § 101 is acting contrary to the goals of patent law. Accordingly, change is needed. Congress is best situated to right the doctrine because of the Supreme Court's reluctance to touch upon the topic, the innate difficulty of correcting the doctrine judicially, and the need for complex technical knowledge.

 [\*129] This Article proposes a legislative change to patentable subject matter that turns the inquiry into solely whether the invention fits within one of the inclusion categories, with no weight to be given to the current carve-outs. In doing so, more of the exclusionary work will be shifted to the other doctrines of patentability. This shift is preferred because of the smaller preemptive effect that a rejection under one of these doctrines has compared to the preemptive effect of a subject matter rejection. Thus, even if the rejection rates remain the same, fewer industries will think they are foreclosed from the patent system while the same "bad inventions" that patent policy would aim to exclude can still be rejected.

#### \*Patents are empirically central to innovation and have been responsible for prior tech revolutions

Adam Mossoff, 24 - Professor of Law, Antonin Scalia Law School George Mason University. Statement before the Committee on the Judiciary, Subcommittee on Intellectual Property, United States Senate “The Patent Eligibility Restoration Act – Restoring Clarity, Certainty, and Predictability to the U.S. Patent System” 1/24, <https://www.judiciary.senate.gov/imo/media/doc/2024-01-23_-_testimony_-_mossoff.pdf> //DH

Before addressing a specific legal or policy debate in the patent system, it is necessary to first review the legal and economic evidence that sets the framework for evaluating the current legal disputes and data. This is important, if only because there is widespread confusion today about the key role of a patent system in promoting innovation and driving economic growth. The patent system has been a key driver of the U.S. innovation economy for over 200 years, as economists, historians, and legal scholars have repeatedly demonstrated.16 The patent system was central to the successes of the Industrial Revolution in the nineteenth century, the pharmaceutical and computer revolutions in the twentieth century, and the biotech and mobile revolutions in the early twenty-first century. Studies have consistently shown that patent systems that secure reliable and effective property rights to inventors strongly correlate with successful innovation economies.17

Dr. Zorina Khan, an award-winning economist, has demonstrated that reliable and effective property rights in innovation—patents—were a key factor in thriving markets for technology in the United States in the nineteenth century.18 Other economists have also identified features of these robust nineteenth-century markets in new technologies—such as an increase in “venture capital” investment in patent owners, the rise of a secondary market in the sale of patents as assets, and the embrace of specialization via licensing business models—as indicators of value-maximizing economic activity that were made possible by reliable and effective patents.19 All of this remains true today: a twenty-first-century startup with a patent more than doubles its chances of securing venture capital financing compared to a startup without a patent, and this patent-based startup has statistically-significant increased chances of success in the marketplace as well.20 These are the academic and scholarly analysis that confirm the everyday experience of what most people have seen in Shark Tank, in which the venture capitalists always ask the entrepreneurs if they have patents for their inventions as a precondition to investing in their new products or services.

The real-world results of reliable and effective property rights—whether in land or in inventions— is extensive private investments, development of new products and services, and the creation and growth of new commercial markets in which consumers benefit from new products and services. These have been the consistent features of the U.S. innovation economy from the Industrial Revolution through today’s mobile revolution. They were made possible by a patent system that was as innovative itself as the inventions it promoted and secured in the marketplace.

# Case Extensions

## Competitiveness Advantage

### They Say: “US Winning Now”

#### China’s innovation is growing rapidly despite inefficiencies

The Economist, 2024 – the Economist is a British weekly news magazine founded in 1843 that focuses on international affairs. It rarely provides author information based on tradition “How worrying is the rapid rise of Chinese science?” June 13, Gale database, accessed via University of Michigan //DH

It is time to lay these old ideas to rest. China is now a leading scientific power . Its scientists produce some of the world's best research, particularly in chemistry, physics and materials science. They contribute to more papers in prestigious journals than their colleagues from America and the European Union and they produce more work that is highly cited. Tsinghua and Zhejiang universities each carry out as much cutting-edge research as the Massachusetts Institute of Technology.

Chinese laboratories contain some of the most advanced kit, from supercomputers and ultra-high-energy detectors to cryogenic electron microscopes. These do not yet match the crown jewels of Europe and America, but they are impressive. And China hosts a wealth of talent. Many researchers who studied or worked in the West have returned home. China is training scientists, too: more than twice as many of the world's top ai researchers got their first degree in China as in America.

In commercial innovation China is also overturning old assumptions. The batteries and electric vehicles it exports are not just cheap, but state-of-the-art. Huawei, a Chinese telecoms firm brought low after most American firms were barred from dealing with it by 2020, is resurgent today and has weaned itself off many foreign suppliers. Although it earns a third of the revenue of Apple or Microsoft, it spends nearly as much as they do on R&D.

China is not yet the world's dominant technological power. Huawei still has limited access to advanced chips; self-sufficiency is costly. The country's many state-owned firms are sclerotic. Much of the spending on research is guided by the state's heavy hand. And some mediocre universities still produce mediocre research. China's innovation, in other words, is inefficient. Yet it is an inefficiency that Mr Xi is willing to tolerate in order to produce a sheaf of world-class results.

#### China’s engaged in military-civil fusion to outcompete the US – only a robust, innovation oriented private sector can counter it

Bronte Munro, 24 – Analyst at the Australian Strategic Policy Institute in Washington, DC. “The Tech Industry is the New Defense Industrial Base” The National Interest, 4/21,

<https://nationalinterest.org/blog/techland/tech-industry-new-defense-industrial-base-210661> //DH

China has recognized the role of civilian research and commercial sectors in boosting military and defense capabilities. Through its strategy of military-civil fusion, China aims to ensure that it will have the most technologically advanced military in the world. The execution of this strategy includes China’s acquisition of, and heavy subsidies for, its own tech sector for state purposes. Critically for the United States, it also involves China attempting to harness global commercial capabilities through intellectual property (IP) theft and strategic adversarial investment in its private sector. This threatens the United States and allied leadership in bleeding-edge technologies.

The United States’ tech sector is feeling the effects of this. Discussion between industry and government at events held by the Australian Strategic Policy Institute at SXSW emphasized that national security-minded investors are unable to compete with the scale and speed of Chinese capital being thrown at early-stage dual-use start-ups in areas such as quantum computing, microelectronics, biotech, and AI.

The natural advantage the United States and its allies have over China’s military-civil fusion strategy is the private sector’s agility, innovation, and market viability compared to Chinese competitors. Silicon Valley’s success and the historically high fraction of global tech leadership in the United States are testaments to this. The United States must help nurture this advantage to accelerate commercial technology adoption to meet national security needs at speed and scale.

### They Say: “No Impact to Tech Leadership”

#### Tech is the most important factor in military power, and innovation is vital to being able to maintain military presence

Loren B. Thompson, 2020 - Ph.D., Chief Operating Officer of the non-profit Lexington Institute, former Deputy Director of the Security Studies Program at Georgetown University. “WHY U.S. NATIONAL SECURITY REQUIRES A ROBUST, INNOVATIVE TECHNOLOGY SECTOR” <https://www.lexingtoninstitute.org/wp-content/uploads/2020/10/100820-WHY-U.S.-NATIONAL-SECURITY-REQUIRES-A-ROBUST-INNOVATIVE-TECHNOLOGY-SECTOR-002.pdf> //DH

Technology is thus a critical driver of national security, because it is the variable that determines the significance of all the other factors. In the past, the United States was able to sustain a culture of innovation that permitted it to lead the world in advanced technologies. Now that may be changing as other nations pursue investment initiatives aimed at dominating the global information revolution. For example, the Chinese economy today generates as much manufactured output as Germany, Japan and America combined, and that output increasingly consists of advanced information technology.

This report is about the role that America’s own technology sector plays in bolstering national security. It is focused mainly on the defense dimensions of America’s strategic competition with China and other nations, illuminating how a robust and innovative domestic technology sector can contribute directly and indirectly to U.S. military dominance.

The United States has faced major challenges to its military security in every generation since the 20th century began, and in each case new technology was a key factor defining the danger. The threat posed by imperialism at the century’s beginning was closely associated with development of the dreadnaught. The threat posed by fascism a generation later was driven largely by the advent of air power. And the threat posed by communism in the century’s second half arose first and foremost from nuclear weapons.

Unlike those earlier dangers, the technological content of today’s threat from other nations is grounded largely in commercial innovations— innovations readily adapted to new concepts of warfare. If the United States is to emerge from this latest contest with its leadership position intact, as it did in earlier rivalries, it will have to compete successfully in commercial markets through commercial enterprises. This is not an “arms race” in the traditional sense, but its implications for America’s place in the world are every bit as serious as the danger posed by dreadnaughts and bombers in earlier generations.

What is the technology sector, and why will it be central to national security in the years ahead?

The domestic technology sector is that part of the national economy devoted to developing and exploiting new information technologies. During the 1960s and 1970s, it was defined by information hardware such as mainframe computers and semiconductors. The definition later expanded to include enterprises focused on the generation of software. More recently, it has come to encompass companies whose business lines are enabled by the internet, such as Google and Facebook.

It is not easy to define the boundaries of the technology sector, because every segment of the economy now relies on digital innovations and the internet to function. Hardware such as the smartphone is central to the emerging information economy, but many tech companies are engaged primarily in delivering services leveraged off of that hardware. For example, Amazon has transformed marketing and logistics using an internet-based business model, but it is mainly a provider of services rather than hardware. It is, nonetheless, a technology-driven change agent that is revolutionizing commerce.

The military’s interest in the technology sector arises from the fungibility of information innovations across all facets of human activity. The same processors and memory chips that enable iPhones can be applied to smart weapons, battlefield communications, and military training devices. The same algorithms that facilitate machine learning in commercial products can be used to operate unmanned attack drones and autonomous fighting vehicles. And the “internet of things” that links disparate appliances is a model for the joint connectivity the military seeks in wartime.

There is a broad consensus among military planners that the industrial model of warfare spawned by 20th century conflicts is giving way to an information-driven model enabled by new digital technologies. Collectively, these technologies allow warfighters to find, fix and defeat threats faster than adversaries can, while minimizing dangers arising from the fog of war such as fratricide. But the process of innovation is unfolding at a furious pace, and America’s military is hard-pressed to keep up. In August of 2020, the chief of staff of the Air Force released a strategy document aptly titled Accelerate Change Or Lose.

The fear among military planners is that a near-peer adversary might use new technologies to leapfrog beyond the warfighting capabilities of America’s joint force, exploiting technologies that barely existed when the current force was conceived. In June of 2020, the Pentagon’s director of research and engineering issued a list of the highest-priority technologies in which the military needed to invest. The top technologies, in descending order of importance, were (1) microelectronics, (2) 5G communications, (3) hypersonics, (4) biotechnology, (5) artificial intelligence, (6) autonomy, and (7) cyber technologies. Only one of these technologies is predominantly military in character; all the others are mainly the products of commercial innovation.

They are also all technologies that China and other nations have disclosed plans to invest in heavily as they strive to overtake the United States. So from a military perspective, the threat posed by new information technologies is twofold. On the one hand, the United States might be overtaken and surpassed in operationalizing the new technologies as tools for gaining military advantage in future conflicts. On the other hand, if America cannot keep up in the race to innovate, it might eventually lack the economic resources needed to sustain a global military posture.

#### Technological dominance deters war in the first place

JACOB HELBERG, 2024 – Co-chair of the US-China Economic and Security Review Commission, senior adviser at the Stanford University Center on Geopolitics and Technology and an adjunct fellow at the Center for Strategic and International Studies. HEARING ON CURRENT AND EMERGING TECHNOLOGIES IN U.S.CHINA ECONOMIC AND NATIONAL SECURITY COMPETITION, 2/1, <https://www.uscc.gov/sites/default/files/2024-02/February_1_2024_Hearing_Transcript.pdf> //DH

While much remains unconcern about the 2020s and the 2030s, recent events have made it unmistakably clear that technology will be the indispensable precondition for American propensity, security, and national sovereignty in the years ahead.

President Eisenhower once observed, “There is only one thing I can tell you about war, and almost one only, and it is this; no war ever shows the characteristics that were expected. It is always different.”

It has now been 79 years since the world last experienced a war between great powers. That’s the same amount of time that elapsed between the American Civil War and War World II. Just think of how different the world of the American Civil War was compared to the world on the eve of World War II.

Similarly, the world today bears little resemblance to the world of 79 years ago. If a great power war broke out tomorrow, we can’t know exactly what shape it would take, but we do know, as President Eisenhower wisely suggested, that it would bear little in common with the last great power war of the 1940s.

It is, therefore, essential for the future of American security and deterrence to fully understand the implications of recent breakthroughs and commercial and military technologies. America cannot remain capable of winning great power wars beyond any reasonable doubt if it does not remain superior technologically, and conversely America cannot deter great power wars from happening if the world doubts America’s capacity to win them.

Since the days of David and Goliath, or the Trojan Horse of Troy, the books of history are full of stories of smarter adversaries out maneuvering larger foes. The greatest risk to America is that we underestimate the importance that intelligence will play in reconfiguring military power in the decade ahead.

We can think of AI as a factory for intelligence, a system that can solve any puzzle, find a cyber exploit, predict the next chess move, locate tanks in a satellite image, anticipate an adversaries’ response options, and so forth.

I look forward to discussing at greater length the critical role of AI in the future of the U.S.-China rivalry, and diving deeper into China’s adoption of AI into its global military strategy.

Second, technology will be the sine qua non for the U.S. to remain the world’s preeminent economic power. In the U.S.-China rivalry, the nation with the most advanced technology will also be the nation with the larger economy.

Look no further than the difference between Israel and Nigeria today. Nigeria has more than 21 times the population of Israel and has 37 billion barrels in oil reserves. Yet, Israel has the larger economy and the stronger military. The reason is technology.

Contrary to popular belief, America can, in fact, stay ahead of China economically but to do so it must also stay ahead technologically. With four times our population, if China simply manages to converge with us technologically and to get to parity on productivity, it could have four times our GDP, and maybe four times our military making it the dominant power.

So parity means the West is losing. Parity cannot be the by-product of American technology policy. Technology dominance should be our north star and that will be my focus today.

### They Say: “No Uncertainty”

#### Data confirms uncertainty is driving investment to other countries

Chad Rafetto, 2024 - Judicial Law Clerk for Chief Judge Colm F. Connolly of the United States District Court for the District of Delaware. J.D., May 2022, New York University School of Law “Fostering Innovation Through a Legislative Overhaul of Patentable Subject Matter”, 32 Fed. Cir. B.J. 93, Nexis Uni, accessed via University of Michigan //DH

 [\*119] 2. A Comparison to Foreign Countries Demonstrates America Is Falling Behind in Terms of Patenting Inventions and Securing Investment for Innovation

Another indicator that the United States' approach to patent eligibility is not good policy can be seen by comparing our patent law to that of foreign countries. The United States used to be the "gold standard" for patent protection and "has led the world in securing stable and effective property rights in cutting-edge innovation."196 But this statement has become further and further from the truth each day. Currently, the United States is rejecting more patents than foreign countries and is ceding investment in innovative technologies to other countries.197

While the United States is dealing with its § 101 uncertainty, other countries are developing and, perhaps, surpassing the United States in being the world leader for patent protection.198 A recent study tracked over 17,000 U.S. patent applications that were rejected and then abandoned on eligibility grounds and found that nearly 10% of these applications were granted by the European Patent Office, China, or both.199 True, granting fewer patents does not necessarily mean that innovation is stalling. For example, if the patent system was only invalidating, rejecting, or preventing applications for undesirable patents, then our system would be functioning optimally. But that is not the case. Though it is difficult to determine whether the patent system is [\*120] promoting or preventing innovation,200 there are a couple of key indicators that innovation is being stalled.

First, other countries are now receiving more funding than the United States for innovation. For example, in 2013, the United States received 77% of capital investments for software driven industries but received only 50% four years later.201 Further, in 2017, 48% of the funding for artificial intelligence startup companies went to China, and the United States received only 38%.202 Because funding is crucial to developing certain technologies, decreased investment is likely to result in decreased innovation.

There is also evidence to suggest that this reduction in funding is caused by the change in our patent eligibility jurisprudence. In a recent survey of 475 venture capital and private equity investors, 74% said that patent eligibility is a key reason to invest or not invest in a company's developing technology.203 And in a different study, 33% of investors said that the patent eligibility laws caused their firms to shift their capital investment away from new software or new technology related to the biotechnology, medical device, and pharmaceutical industries.204

Second, anecdotally the United States is not allowing patents on some very desirable inventions. One example is the patent that the Federal Circuit invalidated on eligibility grounds in Ariosa Diagnostics, Inc. v. Sequenom, Inc.205 That patent was for a technology that utilized cffDNA to detect fetal abnormalities noninvasively206 a medical advancement that is unequivocally desirable. The United States invalidated this patent,207 but both the United Kingdom208 and Australia209 upheld the patentability of the very same technology.

To summarize, our current patentable subject matter doctrine has caused a trickledown effect in which: (1) section 101 has been used more frequently to invalidate patents, (2) different subject matter invalidity and rejection rates have led to inequality amongst fields, (3) there is a perception that patents [\*121] are unavailable in certain fields, (4) companies and investors fund and conduct less research in these fields that are perceived to be patent-ineligible, and (5) ultimately, there is less innovation in these fields. Though the Supreme Court warned that applying the Alice Two-Step too strictly could eviscerate patent law and cautioned against such an application,210 in practice that is precisely what happened. As a result, innovation in America is being curtailed and is lagging behind that of other countries.

#### Numerous studies show uncertainty and decreased investment as a result

David J. Kappos, 24 - attorney and former government official who served as Under Secretary of Commerce for Intellectual Property and Director of the United States Patent and Trademark Office from 2009 to 2013. Questions for the Record from Senator Tillis, Senate Judiciary Committee, “The Patent Eligibility Restoration Act – Restoring Clarity, Certainty, and Predictability to the U.S. Patent System” 1/23, <https://www.judiciary.senate.gov/imo/media/doc/2024-01-23_-_qfr_responses_-_kappos.pdf> //DH

d. In other words, how much is the current uncertainty costing our economy in terms of jobs, innovation, and development?

Answer: Numerous studies have shown that the Supreme Court’s changes to subject matter eligibility law through Myriad, Mayo and Alice have decreased confidence in the U.S. patent system, decreased private investment in key areas of technology that rely on patents, decreased commercialization of innovations in these areas, and created threats to America’s economic, social and national security interests. One 2022 empirical study concluded that in the four years following Mayo, venture capital investment in disease-diagnostic technologies was nearly $9.3 billion lower than it would have been without that verdict. A 2020 study similarly concluded that almost one-third of venture capital and private equity investors who knew about at least one of the Supreme Court’s eligibility decisions indicated that these cases caused their firms to either invest less in affected areas, or shift investments out of biotechnology, medical device, pharmaceutical and software and internet industries into other areas. Meanwhile, 62% of investors “agreed that their firms are less likely to invest” in companies developing patent-ineligible technologies “given the unavailability of patents.”

4. One of the key concerns from innovators is that, absent additional clarity in this space, we’re going to start seeing American companies start developing their inventions overseas in jurisdictions which have broader standards of patent eligibility.

Do you agree with that concern and, if you do, what evidence have you seen to suggest that technological inversion is already occurring?

Answer: I absolutely agree with that concern, and the data confirms it. For example, one study shows that from 2016 to 2020, the market capitalization of Chinese biopharma companies increased exponentially in value, from $1 billion to over $200 billion, and China saw over $28 billion invested in its life sciences sector in 2020, double the previous year’s amount. Another study states “it should be a warning to our law and policy makers that Chinese AI start-ups are now receiving more funding than American AI start-ups. According to a review published in 2018 by MIT Technology Review, of the $15.2 billion invested in AI startups globally in 2017, 48 percent went to China and just 38 percent to America. The U.S. is starting to lose out in capital investments in key industries, such as artificial intelligence which has interconnections to newly emerging medical diagnostic technologies, highlighted by the fact that while the U.S. accounted for 77 percent of such investment before the Alice decision, that investment fell to 50 percent three years after the Alice decision.”

### They Say: “Uncertainty Turn”

#### PERA just restores the pre-2012 status quo – that’s more predictable

Courtenay C. Brinckerhoff, 24 – registered patent attorney and have been representing chemical, biotech, and pharmaceutical clients before the USPTO for over 30 years. Answers To Questions For The Record from Senator Padilla, before the U.S. Senate Committee on the Judiciary Subcommittee on Intellectual Property, “The Patent Eligibility Restoration Act”, 1/23, www.judiciary.senate.gov/imo/media/doc/2024-01-23\_-\_qfr\_responses\_-\_brinckerhoff.pdf //DH

5. The Courts and the U.S. Patent Office have had 10 years to develop the Alice/Mayo caselaw and guidance for the innovation ecosystem. PERA introduces new terms and standards that would have to be newly interpreted by the Courts. How long do you think it would take the Courts and the Patent Office to bring certainty to the application of the new Section 101, should PERA become law? Can you explain why a potential new period of uncertainty would be more attractive than the current status quo?

As I noted above, for life sciences technologies such as diagnostics and isolated natural products, PERA would restore patent eligibility to what was eligible for patenting before the 2012-2014 Supreme Court decisions in Mayo, Myriad, and Alice. Thus, rather than signify a new paradigm, it would restore the status quo prior to Mayo. Additionally, the current draft of PERA itself provides specific examples that will inform its interpretation and application.

When considering this issue, I think it is important to keep in mind that even though Mayo, Myriad, and Alice were decided 10 years ago, still today there is no certainty or predictability in how a court will apply the “judicial exceptions” to Section 101. As one example, in my written testimony I discussed the Federal Circuit decisions in Yu v. Apple Inc.10 (invalidating claims to a digital camera) and Cardionet, LLC v. Infobionic, Inc.11 (upholding claims to a medical device) as emblematic of this unpredictability, which seems especially acute for applications of the “abstract idea” exception.12 Additionally, although the U.S. Patent Office has issued guidance for examiners, courts are not bound by that guidance, and have expressly declined to follow that guidance.13 This undermines confidence in the validity of patents granted today, since they still could be challenged under a new extrapolation of Mayo, Myriad, or Alice.

#### PERA’s improved language immediately ends uncertainty - even with litigation

Andrei Iancu, 24 – Partner, Sullivan & Cromwell; former Under Secretary of Commerce for Intellectual Property and Director of the United States Patent and Trademark Office. Responses to Questions from Senator Alex Padilla, before the Subcommittee on Intellectual Property in the Senate Judiciary Committee, “The Patent Eligibility Restoration Act – Restoring Clarity, Certainty, and Predictability to the U.S. Patent System” 1/23, <https://www.judiciary.senate.gov/imo/media/doc/2024-01-23_-_qfr_responses_-_iancu.pdf> //DH

RESPONSE TO QUESTION 5: Once Congress finalizes the contours of PERA and passes it into law, it will bring an immediate amount of certainty to Section 101. It will do this by eliminating the judicial exceptions, which have proven to be unworkable over the past decade, and replacing them with a clear articulation of what is a patent-eligible invention and what is not. This structure of defined matter that is not an invention, such as “mathematical formulas,” is much more amenable to judicial interpretation than amorphous terms like “abstract idea.” While there will always be litigation at the outer edge of any term’s meaning, the language of PERA starts off by being much more concrete. Importantly, this will not only help examiners and judges, but it will help inventors who do not have law degrees or experience in case law research understand whether they are operating within a patent-eligible field just by reading the statute. Any lay person now just reading the statute would probably not even realize that significant judicial exception exists to the plain text of Section 101.

### They Say: “IP Theft Prevents Solving”

#### Chinese IP theft is in trademarks not high tech

Richard Vigilante, 2024 – Vice President and Editorial Director at Gilder Publishing “The Mirage of China's I.P. Theft” Reason Magazine, July, https://reason.com/2024/06/02/the-mirage-of-chinas-i-p-theft //DH

We're Talking About Sneakers

But the plot thickens—or rather, the truth thins out. Though these two reports are wielded in accusations that China's tech ascendancy is owed to stolen I.P., neither has anything to do with high tech. The "I.P." allegedly stolen mostly consists of trademarks affixed to faux high-fashion sneakers (a perennial leader), watches, handbags, and other accessories, or copyrights on pirated music. Most shipments intercepted are in retail quantities, often fewer than 10 items. Most come by mail.

Somewhere in China, Mom and Pop are ripping off Rolex, Louis Vuitton, and probably Taylor Swift. They may have some bad karma coming their way, but they are not the reason China is rich.

Yet that is what we are meant to believe. Nearly every commentary on the subject promotes itself as evidence that China stole its way to technological prowess and then cites these irrelevant numbers as the sole quantitative evidence. Again and again, we are told "China steals hundreds of billions or trillions in intellectual property," with no mention that we're talking about sneakers.

Without these phony numbers, the China hawks' fearmongering campaign would lose its legs. No reporter would write this story without such eye-catching numbers to cite.

#### Chinese IP theft statistics are doctored

Richard Vigilante, 2024 – Vice President and Editorial Director at Gilder Publishing “The Mirage of China's I.P. Theft” Reason Magazine, July, https://reason.com/2024/06/02/the-mirage-of-chinas-i-p-theft //DH

Even with all of this guesswork at play in the OECD reports, the 2011 USITC report makes them look like high scholarship. Focusing on I.P.-intensive U.S. firms operating in China in 2009, the report claims these firms "reported losses of approximately $48.2 billion in sales, royalties, or license fees" due to I.P. infringement. Yet a closer look reveals the range of estimated losses, stretching from $14.2 billion to $90.5 billion, was based not on direct reports from companies but on third-party guesstimates from industry associations. Essentially, these firms were parroting back guesses fed to them by industry groups with a vested interest in painting the grimmest picture possible to grab government attention. The claim that the oft-cited USITC report was based on accounts by victim companies is a fraud.

### They Say: “Democracy is Resilient”

#### Democracy is declining rapidly

Larry Diamond, 2024 – senior fellow at the Hoover Institution and the Mosbacher Senior Fellow in Global Democracy at the Freeman Spogli Institute for International Studies at Stanford University“Power, Performance, And Legitimacy” Journal of Democracy, Volume 35, Number 2, April 2024, pp. 5-22, <https://muse.jhu.edu/pub/1/article/922830/pdf> //DH

Unfortunately, however, many efforts to subvert democracy have not been contained. And thus, we remain in a protracted democratic recession, embodied in the following four trends.

First, among countries with populations of more than a million, the share that are at least electoral democracies (a category that includes liberal democracies, but is wider) has declined from a peak of 57 percent in 2006 to around 43 percent today.11 In a pair of difficult judgments, I include India and Indonesia among the defectors from democracy.12 Yet even leaving them aside, the global trend is clearly negative. And if we can no longer count those two huge countries as democratic, then the share of humans who live under democracy has declined from 55 percent in 2006 to 25 percent today.

Second, every decade since the third wave began in 1974 has seen a rise in the rate of democratic breakdown. While it was 8 percent in the 1980s, it was 19 percent in the decade that ended in 2022.

Third, the rate of transition to democracy has been falling: While 36 percent of all autocracies became democracies during the 1983–92 period, that rate fell in the following three decades to 30 percent, 21 percent, and then 12 percent in the decade ending in 2022.

Among larger countries, virtually all mobilizations for democracy have failed in this century. So far in this century, there have been only two high-profile cases in which a mass movement for democracy has brought about a democratic transition. Both movements, moreover, started during the century’s first decade: Ukraine following the Orange Revolution (launched in late 2004) and Tunisia following the Arab Spring (launched in late 2010). Every other instance of mass popular mobilization (through elections, mass protests, or both) to achieve or restore democracy has fallen short. The failed cases include Burma, Iran, Sudan, Turkey, Venezuela, and Egypt plus a number of other Arab states. The rising pace of democratic breakdowns alongside the shrinking rate of transitions has meant fewer democracies in the world, indeed significantly fewer than in 2007.

Fourth, Freedom House data from 2007 through 2022 show a steady pattern of many more countries declining than gaining in freedom. The relative decline in 2022 was only very slight, but once again in 2023 Freedom House found that more than twice as many countries declined in freedom as the number that gained, and that the declines were bigger in scale than the improvements.

#### Growing authoritarian diplomatic influence is the reason – maintaining US hard power leadership is vital

Larry Diamond, 2024 – senior fellow at the Hoover Institution and the Mosbacher Senior Fellow in Global Democracy at the Freeman Spogli Institute for International Studies at Stanford University“Power, Performance, And Legitimacy” Journal of Democracy, Volume 35, Number 2, April 2024, pp. 5-22, <https://muse.jhu.edu/pub/1/article/922830/pdf> //DH

The world’s most potent autocracies, principally Xi Jinping’s China and Vladimir Putin’s Russia, have been increasingly deploying “sharp power” to undermine and subvert democracy. These covert, coercive, and corrupting initiatives are designed to penetrate, sway, and propagandize democratic societies and institutions.35 Democracies are taking steps to counter sharp power, but even the wealthiest democratic societies remain vulnerable to efforts by Beijing, Moscow, Tehran, and the Gulf monarchies to insinuate authoritarian influences into democratic civic life. We still have a huge amount of work ahead to defend the integrity and autonomy of our universities, research enterprises, and think tanks; our high-technology innovations; our private enterprises; our newspapers, broadcast, and other media; our subnational governments; our political parties; and our community organizations and other civic institutions from covert efforts to bend them to the purposes of powerful and determined authoritarian regimes.

The battle for independent, critical media and open flows of information is especially important, because authoritarian efforts to distort news and narratives and to pump false and democratically demoralizing content into social-media streams and public conversations can shift public opinion and sour public support for democracy promotion and indeed democracy itself. This has been the purpose of Russian and Chinese global propaganda, along with specific efforts to sway election outcomes.

Then there is the hard power of military might, which Putin’s Russia has used first to gobble up parts of Georgia and now to try to obliterate Ukraine’s democracy and sovereignty. A Russian victory in Ukraine would embolden Putin to attack other now-democratic parts of the former Soviet Union, and to cast a broader and darker shadow of tyranny over the entire region. Since the February 2022 start of this senseless war, Putin has morphed his country into a totalitarian state whose expansionist regime permits no dissent.36 Meanwhile Xi’s China, with the world’s most rapidly expanding military, is using its growing naval and air forces to dominate the South China Sea and pressure Taiwan into giving up its democracy in favor of “unifying” with Beijing. Should Xi’s plans succeed, the prospects for freedom in Asia would fall sharply, and in countries around the world power-grabbing autocrats, not constitutional democracies, would seem like the wave of the future.

## Innovation Advantage

### They Say: “Innovation High Now”

#### Current innovation is about legacy products monopolized by large companies. Disruptive innovation depends on small innovators to succeed

Mark Deem, 2024 – Operating Partner at Lightstone Ventures, a Menlo Park-based firm that invests in innovative biotech and medtech companies. Questions for the Record from Senator Thom Tillis, Senate Judiciary Committee “The Patent Eligibility Restoration Act – Restoring Clarity, Certainty, and Predictability to the U.S. Patent System” 1/23, <https://www.judiciary.senate.gov/imo/media/doc/2024-01-23_-_qfr_responses_-_deem.pdf> //DH

5. Some have claimed that even under current interpretation of Section 101 there is still a tremendous amount of innovation happening in the U.S. – that we aren’t really missing out on anything, and innovation will happen regardless of whether we pass legislation like the Patent Eligibility Restoration Act.

Would you agree with this assessment?

It is true that there is something called “innovation” found today in many products and services, but it is critically important to differentiate what Clayton Christensen calls “disruptive innovation” from the kind of innovation that simply maintains or improves on existing products or services in order to stay competitive and preserve market share. Many cutting-edge technologies require the kind of disruptive innovation that Professor Christensen describes and that are essential to this nation’s ability to maintain its leadership in science and technology. Examples abound – quantum computing, nuclear fusion, artificial intelligence, CRISPR, vaccines, etc. This type of disruptive innovation is far more the province of startups, entrepreneurs and high-risk investors than existing incumbents and large companies.

We should acknowledge that large companies are certainly important to our nation’s economy, and many large companies perform exceptionally well in terms of organizational efficiencies, cost control, manufacturing, distribution and developing worldwide markets. These organizations invest in R&D largely to improve their legacy products in order to compete with other companies and maintain their market share. What large companies do not do well is to create disruptive new technologies that amount to paradigm shifts. It is nimble entrepreneurs and inventors that are most likely to develop these new technologies that truly disrupt industries and markets and make old technologies obsolete. There are many reasons for this, starting with the level of passion in pursuit of a vision that leads startup founders and their employees to work hundreds of hours each week, sleep on the floor of an office or cubicle, and be single minded about their objectives for months or years. Ideas and dedication for creating genuinely new technologies characterize every startup I have ever worked with, and it is hard for any large company to replicate these qualities with its own employees.

#### Alice uncertainty impacts small innovators the most

Courtenay C. Brinckerhoff, 24 – registered patent attorney and have been representing chemical, biotech, and pharmaceutical clients before the USPTO for over 30 years. Answers To Questions For The Record from Senator Tillis, before the U.S. Senate Committee on the Judiciary Subcommittee on Intellectual Property, “The Patent Eligibility Restoration Act”, 1/23, www.judiciary.senate.gov/imo/media/doc/2024-01-23\_-\_qfr\_responses\_-\_brinckerhoff.pdf //DH

3. In your experience, does the state of Section 101 have a greater impact on smaller or larger companies and why?

In my experience, sole inventors and smaller companies are more impacted by the uncertainty, for several reasons. First, innovators may not realize the current state of the law, and may invest in their technologies before learning the technology cannot be patented. Many of the lines drawn are counter-intuitive, and do not make sense to scientists or engineers. Additionally, sole inventors and smaller companies do not have the resources to spread the risks or hedge their bets, and do not have the infrastructure or market position to commercialize their technologies without patent protection. While larger companies may be able to bring (non-pharmaceutical) products to market without a patent, smaller companies need patents to attract investors or for acquisition deals. Without patents, the technology may be shelved and companies shut down. Additionally, the expanding applications of the “judicial exceptions” can particularly impact sole inventors and small business, who may invest everything in technology protected by a patent, only to have it unexpectedly wiped out as a judicial exception.

### They Say: “Patent Trolls Turn”

#### Plan doesn’t cause patent trolls – other requirements for patentability block them

Maxwell H. Terry, 2023 – Managing Editor, Minnesota Law Review, Vol. 108 J.D. Candidate 2024, University of Minnesota Law School. “Hello, World? Domestic Software Patent Protection Stands Alone Due to Uncertain Subject Matter Eligibility Jurisprudence” 108 Minn. L. Rev. 403, Nexis Uni, Accessed via University of Michigan //DH

1. Legislative Proposals Prevent Amalgamating Patentability Requirements

Many of the proposals' discretionary limitations are focused on isolating patentable subject matter considerations from other patentability issues. For example, PERA, the AIPLA-IPO Proposal, and the ABA Proposal all explicitly prevent a court from considering any requirement which stems from another section of the Patent Act.207 Thus, proposals for a reformed §101 all focus on reestablishing §101 as a distinct requirement apart from novelty, nonobviousness, or other patentability requirements. This would allow inventions embodying practical applications of "abstract ideas" under the Alice/Mayo framework to proceed to the merits of other patentability considerations, rather than amalgamate all patentability requirements under §101 at the motion to dismiss stage.208

Note that restricting judicial discretion to make eligibility determinations would not open the floodgates to patent trolls and frivolous patents, as the Patent Act holds many other protective backstops.209 Rather, such a change would merely require a judge or patent examiner to make an eligibility decision based solely on §101 grounds before weeding out frivolous patents by applying the Patent Act's other statutory bars. Should a court's discretion be limited to require consideration of §101 subject matter eligibility in isolation, the immediate impact would be a heightened difficulty for alleged infringers in litigation proceedings to dismiss cases involving software or computer-implemented inventions on the pleadings.

**[goes to footnote 209]**

Just because a patent recites eligible subject matter does not necessarily mean the patent is valid. Other requirements of patentability must also be met. See, e.g., 35 U.S.C. §§102, 103, 112 (establishing patentability requirements outside of subject matter eligibility).

#### Trolls are rare and have no impact on innovation

Noel Maurer and Stephen Haber, 2018 - \*Associate Professor of International Affairs and International Business at the George Washington University and \*\*Peter and Helen Bing Senior Fellow of the Hoover Institution, A.A. and Jeanne Welch Milligan Professor in the School of Humanities and Sciences, Professor of Political Science, of History, and (by courtesy) of Economics, and Senior Fellow of the Stanford Institute for Economic Policy Research at Stanford University “An Empirical Analysis of the Patent Troll Hypothesis: Evidence from Publicly-Traded Firms” 10/29, <https://www.hoover.org/sites/default/files/research/docs/18114_maurer-haber.pdf> //DH

**PAE = Patent Assertion Entity** (a troll)

Let us be clear about our claims. We are not saying that there are no patent trolls. We are also not claiming that no firm that licenses patents, rather than produces a product, has ever frustrated the development of a downstream firm. The question is not, however, whether one can point to a firm that operates in the manner described by Executive Office of the President (2013), FTC (2011, 2016), and a related academic literature, but whether such firms are large and numerous enough to constitute a systemic problem.

What, then, are we claiming? The first takeaway of our study is that the magnitude of the transfers to the RPX-identified public PAEs plus the legal costs that might be associated with them are small compared to the size of the market in which they operate. This fact is not consistent with the hypothesis that they impose a significant “innovation tax” that causes a deadweight loss. The small size of these firms as a group is also inconsistent, however, with the hypothesis that they are important intermediaries in the market for innovation.

The second takeaway is that the RPX-identified public PAEs, as a group, do not seem to be earning economic rents. Most of them lose money, both on an accounting basis and as investments for their shareholders. It is hard to reconcile these findings with the claim that PAEs assert low value IP against defendants for nuisance-value settlements. This finding also explains why the revenues of these firms, as a group, are small compared to the market in which they operate: if there are no rents, there is little entry.

#### “Patent trolls” are just intermediaries who make it easier for innovators to reduce transaction costs and increase innovation

Daniel F. Spulber, 2021 - Elinor Hobbs Distinguished Professor of International Business and Professor of Strategy at the Kellogg School of Management at Northwestern. The Case For Patents, <https://www.worldscientific.com/doi/pdf/10.1142/9789811225666_0001> //DH

The market for innovative control also allows the entry of specialized intermediaries who can invest in commercialization, innovation, and complementary assets.99 The allocation of patents in the market for innovative control implies that there should not be regulatory restrictions on patent transactions and ownership that are based on the characteristics of companies acquiring patents. Various commentators critically refer to some types of firms that acquire patents as “patent trolls,” “patent monetizing entities” (PMEs), “non-practicing entities” (NPEs), or “patent assertion entities” (PAEs). Some types of firms that acquire patents have a particular expertise as market intermediaries.100 Market intermediaries perform many types of activities that reduce various types of transaction costs, including search costs, bargaining costs, moral hazard, adverse selection, and contracting costs.101 Intermediaries in the market for innovative control reduce transaction costs by evaluating patent quality, handling licensing transactions, or marketing and reselling patents. Intermediaries in the market for innovative control can act as market makers, bringing buyers and sellers together, clearing markets and adjusting prices.102 Andrei Hagiu and David Yoffie identify different types of patent intermediaries.103

The market for innovative control also promotes efficiencies in the organization of firms and industries. Weaker IP protections increase transaction costs for inventors and innovators. Inventors and innovators will have incentives to replace patent protections with other mechanisms including trade secrets, contracts, and vertical integration.104 With stronger IP protections, inventors and innovators can make decisions about transactions, outsourcing, and vertical integration based on other business considerations. The market for innovative control generates differences in patent transfers across industries depending on technologies. Carlos Serrano shows that there are surplus enhancing patent transfers and finds that higher rates of transfers occur in information and communications technology (ICT) and the pharmaceutical and medical industries.105 In some industries, consortia form to exercise innovative control. For example, in 2011, Nortel Networks sold about 6000 patents and patent applications for $4.5 billion to a consortium of companies that included Apple, EMC, Ericsson, Microsoft, RIM, and Sony.106

As with securities markets, the market for innovative control allows separation of ownership and control. The patent owner can obtain returns from the patented invention while delegating control over innovation to licensees who employ the technology. The patent owner does not need to undertake all the transactions needed to apply the invention, but instead can rely on others to manage the IP. Delegation of control to licensees also provides benefits from specialization and division of labor. The patent owner can obtain returns from licensing, and the licensees can apply their expertise to developing, commercializing and applying the invention.

### They Say: “Patent Thickets Turn”

#### Data disproves patent thickets – existing innovation is because of patents

Adam Mossoff, 24 - Professor of Law, Antonin Scalia Law School George Mason University. Answers from Adam Mossoff to Questions for the Record from Senator Alex Padilla Senate Committee on the Judiciary, Subcommittee on Intellectual Property, United States Senate “The Patent Eligibility Restoration Act – Restoring Clarity, Certainty, and Predictability to the U.S. Patent System” 1/24, https://www.judiciary.senate.gov/imo/media/doc/2024-01-23\_-\_qfr\_responses\_-\_mossoff.pdf //DH

Although conventional wisdom and classical economics define patents as monopolies by which the incentive to invent is balanced against restraints on access and higher short-term prices, this is a fundamental misunderstanding of the nature and function of patents. Patents and other intellectual property rights, such as copyright and trademark, are not merely incentives to create, but also incentives to commercialize innovation. They are property rights. Thus, they represent an equal opportunity for any person who creates a new invention to secure the fruits of their labors, just like any person who works as a farmer or worker should have secured to them the fruits of their productive labors. Thus, patents, like all property rights, are the basis for commercialization activities, such as obtaining venture capital financing, entering into license deals, and creating new commercial structures for efficiently placing new products and services into the hands of consumers, such as the franchise business model invented by U.S. patent owners in the nineteenth century.

In the healthcare market, for example, this has meant an ever-increasing supply of cuttingedge medical treatments and increasing availability of older medical treatments that are now “off patent.” Patents not only function for companies to recoup billions in investments and thousands of labor hours in creating new drugs and other healthcare innovations, they facilitate extensive licensing and information-sharing agreements that efficiently distribute these healthcare innovations to patients. These extensive manufacturing, commercial distribution, and information-sharing agreements were the launch pad for the unprecedented response by the biopharmaceutical sector in inventing, producing, and distributing billions of doses of the COVID-19 vaccines during the pandemic—an achievement never before accomplished by the biopharmaceutical sector since the invention and patent for Aspirin in 1900 and the invention of vaccines in the 18th century.1 Although drug prices are a subject of policy debate, it is important to recognize that 95% of the essential medicines identified by the World Health Organization are in the public domain; thus, these drugs are available for production by any generic company wishing to sell them in the healthcare market in any country in the world, subject to regulatory approval by health officials.2

In the high-tech sector, the patent system has driven an explosion in new products and services at a rate never before seen in any sector of the global innovation economy. “Several empirical studies demonstrate that the observed pattern in high-tech industries, especially in the smartphone industry, is one of constant lower quality-adjusted prices, increased entry and competition, and higher performance standards.”3 This has occurred in one of the most patent-intensive sectors of the economy.4 This empirical evidence contracted the predictions of academics and economists almost twenty years ago that “patent holdup” and “patent thickets” on smartphones and other high-tech devices would raise prices for consumers and stifle innovation.5

All of this economic and historical evidence creates a strong presumption that reforming patent eligibility doctrine by returning it back to its longstanding function within the U.S. patent system would benefit consumers. Consumers will benefit from the continued creation of new products and services and more jobs. Overall, the U.S. will continue to experience economic growth and a rising standard of living for all consumers.

#### No evidence of patent thickets exists – the more likely effect is greater competition

Randall Rader, 2024 – Former Chief Judge (ret.) U.S. Court of Appeals for the Federal Circuit, and as Professor, Chief Judge Rader has taught courses on patent law and other advanced intellectual property courses at George Washington University Law School, University of Virginia School of Law, Georgetown University Law Center, the Munich Intellectual Property Law Center “Rader’s Ruminations – Patent Eligibility III: Seven Times the Federal Circuit Has Struck Out” IP Watchdog, 3/31, [https://ipwatchdog.com/2024/03/31/raders-ruminations-patent-eligibility-iii-seven-times-federal-circuit-struck/id=174751/](https://ipwatchdog.com/2024/03/31/raders-ruminations-patent-eligibility-iii-seven-times-federal-circuit-struck/id%3D174751/) //DH

The main point for this softball pitch is the justification that follows: “[M]onopolization of those tools through the grant of a patent might tend to impede innovation more than it would tend to promote it.” Mayo, 132 S.Ct. at 1923. This theory (and the Court senses the weakness of its sole justification by using the words “might tend to”) is akin to a theory known in academic circles as the “tragedy of the anti-commons.” The “tragedy” in a few words is that “too many” patents give too many owners the right to inhibit all future research and progress. This hypothesis sprang from the 1998 writings of Professors Heller and Eisenberg. Heller; Eisenberg; Can Patents Deter Innovation? The Anti-commons in Biomedical Research; SCIENCE Mag. (May 1998). In truth, this so-called tragedy has been fully rejected by academic and empirical studies. See, e.g., Teece, David; The “Tragedy of the Anticommons” Fallacy: A Law and Economics Analysis of Patent Thickets and FRAND Licensing; Berkeley Tech.L.J. Vol 32:1489 (2017) (“The systematic problem identified here is undercompensation, and possibly overuse, not underuse.”). Upon reflection, the Supreme Court’s “tragedy” reasoning becomes a floating softball pitch that the Federal Circuit should hit to knock the entire eligibility doctrine back to statutory sanity.

Now, the Supreme Court often advises the use of “common sense” in patent law settings. See, e.g., KSR v. Teleflex, 550 U.S. 398 (2007). Let’s apply “common sense” to the Court’s “too many” patents justification. If the United States has “too many” patents endangering technological progress, where is the empirical evidence to prove that hypothesis? See, e.g., John P. Walsh, Ashish Arora & Wesley M. Cohen; “Effects of Research Tool Patents and Licensing on Biomedical Innovation”; PATENTS IN THE KNOWLEDGE-BASED ECONOMY 285, 285 (2003) (“[Despite] an increase in patents on . . . ‘research tools,’ . . . we find that drug discovery has not been substantially impeded.”). Where have fields of research been shut down by “too many” patents? Where have prices soared in technologies captured by overbearing exclusive rights? Where have groups of companies abandoned technology because it is too expensive or already locked up? Where is the evidence? The empirical evidence suggests that technology availability has soared and prices have declined as innovation creates intense cycles of research competition. Indeed, the semiconductor chips that run most high-tech phones cost less than a cup of designer coffee.

Actually, the reason patents do not deter, but spur scientific development, is embedded in the disclosure doctrines of the Patent Act. By statutory design, each patent on a new, non-obvious invention opens more doors to future research than it could ever close. Yet, where has the Federal Circuit undertaken to explain that the “too many patents” theory has no empirical or theoretical foundation?

The Supreme Court has served up a pitch that begs to be hit: After all, the Court’s justification for its new “exceptions” claim-by-claim validity doctrine does not pass the “common sense” test. No empirical data shows declining patent filing rates; no empirical data shows patents closing down technology markets; no empirical data shows patents causing research to dry up or grind to a halt. This softball pitch begs the Federal Circuit to show that the Court’s reasoning has no basis. Instead, the Circuit has yet to swing its bat at this softball pitch, instead swinging only its sledgehammer. Strike four!

### They Say: “No Chemical Pollution Impact”

#### Chemical pollution is ongoing – it kills 9 million a year and outweighs war

Ravi Naidu, 2021 – Global Centre for Environmental Remediation (GCER), The University of Newcastle “Chemical pollution: A growing peril and potential catastrophic risk to humanity” Environment International Volume 156, November 2021, Science Direct, <https://www.sciencedirect.com/science/article/pii/S0160412021002415> //DH

Rockström et al. (2009) warned that chemical pollution is one of the planetary boundaries that ought not to be crossed to safeguard humanity. Altogether more than nine million humans are dying prematurely each year – one in six deaths – due to contamination of their air, water, food, homes, workplaces, or consumer goods (Landrigan et al. 2018). To place this in perspective, the chemical-related annual death toll is significantly greater than that of World War II and today constitutes the greatest preventable form of mortality. Furthermore, it inflicts catastrophic losses on wildlife, notably insects and animals that depend on them, ecosystems and their services, such as pollination or clean water, on which humans depend for our own existence. This underlines the role of chemical pollution in potential planet-wide ecological breakdown (Dave 2013). There is increasing evidence in recent decades of cognitive, reproductive and developmental disorders and premature deaths caused by chemical contamination of the human living environment (Diamanti-Kandarakis et al. 2009).

A thorough and state-of-the-art literature and global database search was made to support the perspective developed here. We present a global picture of chemical pollutants from many sources affecting human wellbeing in general, and humanity’s long-term survival prospects in particular. This analysis is in addition to the effects of greenhouse gases and their effects on climate and humanity, which are considered elsewhere (Cavicchioli et al. 2019). Emphasis is given to chronic toxicity from exposure to low levels of pollutants on human reproductive capability, cognitive and foetal health, and food security. We identify priority issues and propose potential solutions to reduce impacts on human civilisation.

2. Production and consumption of chemicals

In Man in a Chemical World Abraham Cressy Morrison outlined the importance of chemistry, not only in contemporary post-industrial times, but also during earlier periods of traditional lifestyles (Morrison 1937). Chemical processes and innovations have been a cornerstone of civilisation, which probably started ca. 17,000 years during the transition of humans from hunters to civil societies, and will continue to be so for the foreseeable future (Rasmussen 2015). In 2017, approximately 2.3 billion tonnes of synthetic chemicals were produced globally – double the amount produced in 2000 (Cayuela and Hagan 2019). The majority of the chemicals were petroleum compounds (expressed as 25.7% of sales), speciality chemicals (26.2% of sales) and polymers (19.2% of sales) (CEFIC 2021). The use of chemicals other than pharmaceuticals is projected to increase by 70% by 2030, with China and the European Union (EU) remaining the largest consumers (see such projections in Supplementary Information, Fig. S1a,b). In 2019, world sales of chemicals were estimated at $4,363 billion, equivalent to the production of more than 2.3 billion tonnes of chemicals (excluding pharmaceuticals), which is approximately 300 kg per year for every man, woman, and child in the world (CEFIC, 2021, UNEP, 2019).

Since the 1970s there has been strong growth in the development and production of industrial chemicals that has introduced thousands of novel substances to daily use. According to the European Chemical Industry Council, the major sectors other than pharmaceuticals that utilise synthetic chemicals are agriculture, health, mining, services, rubber and plastic manufacturing, construction, and other industrial production (CEFIC 2021). New chemicals are often released with insufficient risk assessment (Sala and Goralczyk, 2013, Wang et al., 2020), and their mixtures are creating new chemical environments with very uncertain toxicity. Chemical intensification is a feature of almost all major industries: in modern agriculture, for example, the intensive production of crops and livestock to feed much of the world now relies on the annual application of some 5 million tonnes of pesticides and 200 million tonnes of concentrated nitrogen, phosphorus and potassium (NPK) fertilisers. According to the Food and Agriculture Organization of the United Nations (FAO) database, the total volume of pesticides was 3,835,826 tonnes in 2008, which increased by ca. 7% in the next decade (See comparative statistics in Supplementary Information, Fig. S1c) (FAOSTAT 2019). In the USA alone, the number of active chemical components in various pesticides stands at more than 400 (USGS 2017). Agrichemical use is also increasing in newly industrialising countries, such as China, which is now the world’s largest producer and user of industrial chemicals, itself accounting for 36% and 25% of world demand for chemical fertilisers and pesticides, respectively (Guo et al. 2010).

3. Chemicals as global pollutants

Although anthropogenic and synthetic chemicals have delivered enormous benefits to human civilisation, including disease control and food productivity, their benefits are now being offset by equally large-scale negative impacts resulting from unintentional human and environmental exposure, and insidious toxicity (Fig. 1) (ECHA, 2018, NPI, 2017, US-EPA., 2017).

Well-known harmful pollutants such as arsenic (As), lead (Pb), cadmium (Cd) and mercury (Hg), as well as smog and air-borne particulate pollutant in large cities, have been documented since ancient Rome and Athens, whose citizens suffered from contaminated water supplies, air, cooking and eating utensils, and food (Patterson et al. 1987). The Agency for Toxic Substances and Disease Registry (ATSDR) lists 275 priority chemicals as pollutants, based on their frequency, toxicity and potential for human exposure. However, this is likely to be a significant underestimate given the difficulties in tracking novel or ‘unknown’ chemicals in the environment after they have been released (Anna et al. 2016). To overcome this uncertainty, science is attempting to define ‘emerging contaminants’ that are yet to be regulated, in order to anticipate future problems (Richardson and Kimura 2017).

Many chemicals now considered pollutants were beneficial at the time of their discovery (Kerr 2017). For example, when organochlorine insecticides were developed in the 1950s their main application was to control agricultural and disease-carrying insect pests, and they were successful in the short term. However, with the publication of Rachel Carson’s Silent Spring in 1962 (Carson 1962), the world began to recognise it was facing severe problems due to the persistence of organic pesticides in the environment and the resulting cumulative exposure of wildlife and humans. Although some persistent organic pesticides have since been banned, humanity is still dealing with their legacy. Dichloro-diphenyl-trichloroethane (DDT), which was used widely in the 1950s, is a well-known example. Continuing illicit pesticide manufacture and use, and lasting residues, remain a problem in some countries.

The lag between discovering a chemical’s benefits and understanding its potential harms has resulted in a pattern of new chemical synthesis, licensing, production and use, followed by concerns over potential effects, bans and restrictions, followed by an urgent search for replacement chemicals – frequently with other negative effects. This has led to ‘pulses’ of new chemicals being released into the environment and food chain in recent decades, followed by frequent detection of negative side-effects.

So, while chemical toxicity is not new, it is the phenomenal 40-fold increase in the production of chemicals and resource extraction during the last 100 years that now poses a serious risk to humanity (see Table 1 for an estimate of combined anthropogenic chemical emissions) (Cribb, 2014, Cribb, 2017, Cribb, 2021). Emissions of pollutants can be continuous but they are often under-reported and there is great variability in reported values (Supplementary Information, S2).

### They Say: “SynBio Innovation Fails”

#### Patents are the vital component to commercialize synbio innovation

David Cain, 2024 - Patent Attorney, former cryptography primary examiner for USPTO. “Strategic Patenting: The Role of Patents in Sustaining Biotechnological Innovation” 5/9,

https://www.linkedin.com/pulse/strategic-patenting-role-patents-sustaining-innovation-david-cain-zcrqf //DH

In the verdant frontier of the biotechnology industry, innovation is not just a pathway to scientific discovery; it is the very foundation upon which the sector's growth is built. Over the past few decades, this dynamic field has expanded dramatically, evolving from a niche area of scientific exploration into a robust industry that spans health, agriculture, and environmental sciences. The driving force behind this expansion is a relentless pursuit of breakthroughs—new ways to edit genes, reprogram cells, and redesign biological systems—which promise to revolutionize how we treat diseases, cultivate crops, and mitigate ecological impacts.

However, the path from laboratory insight to marketable product is fraught with complexity and competition, where ideas alone do not suffice for success. Here, patents emerge as critical instruments of protection, serving not only as legal shields against infringement but also as vital assets in the biotech company’s arsenal. Patents protect the substantial investments made in research and development, ensuring that innovators can reap the financial benefits of their discoveries. This protection, in turn, fuels further innovation, creating a cycle of funding and discovery that drives the industry forward.

The importance of patents in the biotech industry cannot be overstated. They provide the necessary security for investors to allocate capital towards risky biotech ventures, knowing that intellectual property laws safeguard their investments. Moreover, patents facilitate an environment where shared knowledge leads to new innovations—through licensing agreements or research collaborations—thus broadening the scope of scientific exploration and application.

In sum, as biotechnology continues to advance by leaps and bounds, the strategic use of patents is indispensable in nurturing the ecosystem of innovation. They are not merely legal formalities but the lifeblood of progress in a realm where the next great discovery is always just over the horizon.

#### Patents are vital to commercialization and global tech transfer through licensing deals

Daniel F. Spulber, 2021 - Elinor Hobbs Distinguished Professor of International Business and Professor of Strategy at the Kellogg School of Management at Northwestern. The Case For Patents, <https://www.worldscientific.com/doi/pdf/10.1142/9789811225666_0001> //DH

Patents are important for commercializing inventions through licensing. Using data from the Securities Data Corporation (SDC), Bharat Anand and Tarun Khanna find significant licensing activity in the chemicals, computers, and electronics industries.95 Ashish Arora, Marco Ceccagnoli, and Wesley Cohen apply extensive survey data on research labs in the U.S. manufacturing sector and show that patent protection of IP supports the market for technology licensing and the provision of specialized technology services.96 The market for inventions includes not only domestic markets but also international transactions related to IP; royalty and licensing fees in international transactions grew faster than global GDP, reaching $2.8 billion in 1970, $27 billion in 1990, and $180 billion in 2009.97

# Pathogen Patents DA Answers

### 2AC – Pathogen Patents DA

#### 1. Nonunique - Global cooperation for pandemic response is collapsing now

Chloe Searchinger, 2024 – research associate for global health at the Council on Foreign Relations. “Why Pandemic Agreement Negotiations Failed to Land” ThinkGlobalHealth, 5/24, <https://www.thinkglobalhealth.org/article/why-pandemic-agreement-negotiations-failed-land> //DH

After more than two years of discussion and negotiations, the representatives for 194 nations failed to finalize a draft of the Pandemic Agreement, an international accord meant to fix the weaknesses and global inequities in pandemic preparedness that COVID-19 revealed.

The chairs of the World Health Organization's Intergovernmental Negotiation Body (WHO INB), which convened the deliberations, conceded on May 24 that negotiators would be unable to deliver a draft accord in time for the seventy-seventh World Health Assembly (WHA), which begins on May 27 and would have been responsible for approving the treaty.

"Every one of you tried to make this work," Precious Matsoso, INB co-chair, said at the final session. "Everyone was given a huge opportunity to make a difference in people's lives. That's something that none of us can take for granted."

After missing its initial deadline to finalize the pandemic agreement on May 10, the WHO INB carried negotiations into this week in a race against the clock.

Those who followed the process have been largely underwhelmed by the negotiated drafts of the accord relative to its initial ambitions, and the divisive nature of the talks leave questions about what legally binding terms for international cooperation on pandemic preparedness are achievable in the future.

Several domestic political battles had already emerged well before a decision could be made.

In countries including the United States and the United Kingdom (UK), far-right antipathy for international legal agreements and their purported threat to national sovereignty have rendered ratification of the agreement politically divisive. In the United States, all 49 Senate Republicans signed a letter to President Joe Biden demanding that his administration "withdraw support" for the pandemic agreement and IHR amendment at the World Health Assembly given that they "constitute intolerable infringements upon U.S. sovereignty"—"shredding intellectual property rights" and "free speech." They warned that they would consider the two international agreements to be "a treaty requiring the concurrence of two-thirds of the Senate under Article II Section 2 of the Constitution."

Misinformation on social media about the agreement has also bred increasing public resistance against it.

The Accord's Inception

The road formally began in December 2021 when the WHA held its second-ever special session to initiate the process for a "WHO convention, agreement, or other international instrument on pandemic prevention, preparedness and response," establishing the INB as its formal negotiating body. After the catastrophic loss of life and absence of international coordination seen during the COVID-19 pandemic, the agreement's aims, according to WHO Director-General Tedros Adhanom Ghebreyesus, would be to ensure more equitable access to medical countermeasures, safeguard health systems through improved sharing of information about emerging pathogens, and enhance cooperation between member states on confronting health crises.

If ever adopted by the WHA, the pandemic agreement would become only the third legally binding health accord that WHO member states have successfully negotiated, joining the International Health Regulations (IHR), first adopted in 1969, and the Framework Convention on Tobacco Control, adopted in 2005.

The IHR, which defines "countries' rights and obligations in handling public health events and emergencies that have the potential to cross borders," including the mandate to report such events, was largely observed to be both insufficient and ignored during the COVID-19 response. Complementing their call for a new pandemic instrument, WHO member states also launched a parallel negotiating process in 2022 to amend the IHR to strengthen its implementation and compliance. That negotiation has reportedly made more progress but whether the WHA will approve IHR revisions next week or wait to do in tandem with the pandemic accord is still uncertain.

"Let's take the Assembly as an opportunity to reenergize, to be inspired, and to have even more commitment and prepare us to address the problems to get us where we need to be," Adhanom Ghebreyesus told Friday's INB session. "Inshallah, we will conquer this."

Watered Down by Negotiations

Although the WHA's decision to establish the INB was based on broad recognition that countries were not adequately or equitably prepared for COVID-19, two and a half years of unrelenting divisions between member states over the policy's details produced an agreement criticized by many as largely watered down from its initial intent.

Long-standing disputes between high- and middle- to low-income countries over issues of intellectual property protection and resource-sharing persisted throughout the nine INB negotiating sessions and saw little compromise. The sessions were underpinned by a lack of trust on both ends from unsuccessful past international negotiations to the historical trauma of COVID-19 vaccine distribution and legacies of colonialism.

#### 2. Nonunique and turn – patent eligibility boosts research and innovation – and foreign patents make the link inevitable

Emily Michiko Morris, 2022 - is David L. Brennan Endowed Chair, Associate Professor, and Associate Director of the Center for Intellectual Property Law & Technology at the University of Akron School of Law. “A Response to ‘Another Legislative Attempt to Revive Gene Patenting’” 8/26, <https://blog.petrieflom.law.harvard.edu/2022/08/26/a-response-to-another-legislative-attempt-to-revive-gene-patenting/> //DH

Professor Jorge Contreras’ commentary on the Patent Eligibility Restoration Act of 2022 objects to Senator Thom Tillis’ recently introduced bill. Specifically, he argues that proposed inclusion of isolated and purified human genes and other naturally occurring substances as patent eligible subject matter is unnecessary and would both stymie research and obstruct access to medicine. But the truth is these criticisms rely mostly on narrative and anecdote rather than rigorous empirical evidence. (Professor Contreras has written an article acknowledging the many narratives behind the gene patenting debate: see Narratives of Gene Patenting, 43 Fla. St. U. L. Rev. 1133 (2016)).

A different narrative – and one that better reflects both technological and economic reality – is that including purified and isolated materials as eligible subject matter under 35 U.S.C. § 101 can benefit patients, researchers, and innovation. Legislatively overruling the Supreme Court’s 2013 decision in AMP v. Myriad Genetics could boost investment in biotechnology R&D. Identifying the existence, location, and sequence of the BRCA1 and BRCA2 gene variants at issue in Myriad, for example, took decades. New biologic therapeutics can require over $1 billion to develop. Without patents these innovations might never see the light of day.

Although genetic and other biotechnological research often begins in universities under federal funding, patents were clearly the focus of the university scientists racing to identify BRCA1 and BRCA2, as well as a gene relevant to Alzheimer’s. Biotechnological innovations also face resource-intensive and risky development cycles. Patent protections even for early-stage research by universities have become important in attracting private funding for both research and later commercialization.

This is why the U.S. passed the Bayh-Dole Act: so that federal funding recipients can patent and commercialize research that would otherwise be underutilized. Indeed, a study by David Taylor has shown that Supreme Court limitations on patentable subject matter, including Myriad, have decreased investment in R&D, particularly in biotechnology.

And there is concern that, if the U.S. does not broaden eligible subject matter, many innovators will ship their work abroad. The European Union, Australia, and Japan hold purified genomic DNA and proteins to be eligible subject matter (albeit with possible differences in their utility and inventive step requirements, as well as experimental-use exceptions). The European Union’s Biotechnology Directive, for example, specifies that “[b]iological material which is isolated from its natural environment or produced by means of a technical process may be the subject of an invention even if it previously occurred in nature.” In this light, Senator Tillis’ bill should be seen as an effort to support the U.S.’s role as a leading biotech innovator.

#### 3. No link – vaccine patents won’t be enforced, exemptions exist and licensing allows cooperation

Philip Johnson, 2024 - Chair of the Steering Committee of the Coalition for 21st Century Patent Reform, JD from Harvard. Patent and Trademark Office Senate Judiciary Subcommittee on Intellectual Property Holds Hearing on Patent Eligibility Restoration Act, Hearing Transcript, 1/24, proquest Congressional, accessed via University of Michigan //DH

PHILIP JOHNSON: OK, well, first, as to retarding research, I couldn't disagree more. The fact of the matter is we -- first, we have the Hatch-Waxman 271 (e) (1) exemption, which allows for free research, as long as it's related to developing information for the eventual submission to the FDA. But the experience has shown that people who discover and have these inventions don't privatize them.

They naturally would like to commercialize them or at least get them spread out and used, widely. And in fact the -- when there have been very dramatic advances done in the biotechnology area, licenses have been made available because it takes a village to do all of the research that's needed in different applications.

And these are widely -- they're widely licensed on a non-exclusive or product specific basis and those -- that ability to become licensed. I want to develop product X, using this, then you're willing to invest that money because you know you have the protection of the patent that's behind the license.

#### 4. Turn – Genetic patents boost vaccine research and distribution

Amy Q. Nguyen, 2022 - Juris Doctor candidate from Southern Methodist University Dedman School of Law and is the Associate Managing Editor of SMU's Science and Technology Law Review. “In the Midst of a Global Pandemic: Benefits of a Biomedical Patenting Regime,” 25 SMU SCI. & TECH. L. REV. 63 (2022). Hein Online. Accessed via University of Michigan //DH

There has long existed a debate on the patenting of genomic and biomedical data.10 Since the beginning of the COVID-19 global pandemic, healthcare advocates, governments, and scholars worldwide have expressed concern that patents would slow the manufacturing of medical supplies, vaccines, equipment, and therapies as well as distribution of supplies to those who really need them.11 On the other hand, countless scientists and researchers have called for patent protection for genomic and biomedical discoveries because patents allow pharmaceutical companies to recoup the massive investments they put into researching and developing.12 The potential patent protections of genomic and biomedical data act as incentives to spur the development of methodologies and technologies that can prevent future pandemics and foster innovation.13 In combating modern pandemics, patent law and protections for genomic and biomedical data have played a significant role in incentivizing vaccine innovation and cures related to viral infections. 14 While many assume that limiting patent protection allows for more vaccines to be produced, this assumption fails to recognize that being allowed to produce vaccines is starkly different from having the ability to produce vaccines to the same degree of effectiveness and safety.15 Creating clean and safe vaccines requires a high degree of knowledge, experience, and technological infrastructure.16 Having this knowledge, experience, and technological capability is especially important when producing vaccines based on the new mRNA technology, such as those produced by Pfizer, Moderna, and others.17 The new mRNA-based vaccines are significantly more expensive and complex to manufacture than the established vector vaccine. 18 For example, the vaccines are extremely sensitive to variations in temperatures and mostly require a constant set temperature. 19 Due to the unique challenges of manufacturing a COVID-19 vaccine, simply releasing patents will not guarantee that previously inexperienced pharmaceutical manufacturers worldwide will be suddenly able to produce clean and safe vaccines.20

Additionally, a single drug costs about $1.3 billion to $2.8 billion to produce.21 The government-initiated restriction on patent protections does not consider the complicated and cost-intensive development of drugs.22 It also fails to consider that the research and development of a medicine do not guarantee success.23 In the worst-case scenario, pharmaceutical manufacturers are expending billions of dollars to gain nothing in return.24 In the face of these multibillion-dollar R&D costs, pharmaceutical companies rely on patents to incentivize them to embark on costly and time-consuming research and development of new, breakthrough drugs.25

#### 5. No impact – disease won’t cause extinction and engineered pathogens can’t change that

David Thorstad, 2023 – professor of philosophy at Vanderbilt University. Before that, I was a research fellow at the Global Priorities Institute and Kellogg College, Oxford. “Exaggerating the risks (Part 9: Biorisk – Grounds for doubt)” 7/8 <https://reflectivealtruism.com/2023/07/08/exaggerating-the-risks-part-9-biorisk-grounds-for-doubt/> //DH

The main reason why scientists and policymakers are skeptical of existential biorisk is that it is terribly hard to engineer a pandemic that kills everyone.

First, you would need to reach everyone. The virus would have to be transmitted to the most rural and isolated corners of the earth; to antarctic research stations; to ships at sea, including nuclear submarines on uncharted, long-term and isolated paths; to doomsday preppers in their bunkers; to hermits and uncontacted tribes; to astronauts in space; to each new child born every second; to island nations; and so on. And you would need a transmission mechanism that could spread the virus this far without being detected: otherwise, those with the means would be whisked away to safety and might well survive.

Second, you would need a virus that was virtually undetectable until all, or nearly all humans had been infected. That conflicts in a stark way with the goal of producing a virus that is 100% lethal, since lethal viruses tend to leave a trace as they spread through a population.

Third, you would need a virus that is unprecedentedly infectious. The virus would need to be capable of being transmitted, without fail, to every human being on the planet, in sufficient quantities to actually make them sick. It would need to avoid respirators and other forms of protective equipment. And it would have to maintain its transmissibility throughout many generations of mutation.

Fourth, you would need a virus that is unprecedentedly lethal, killing not 90%, 99%, or 99.999% but effectively all of those infected by it, no matter their age, health, or genetic makeup. This lethality would need to be preserved even against the best medical treatments, including quite possibly vaccines or synthesized antibodies. And it would have to be maintained throughout many generations of mutation despite selective pressures towards less lethal variants.

Fifth, you would need to find a way to evade basic public health measures such as masking and social distancing. This isn’t as easy as it sounds. How do you transmit a virus to someone who doesn’t leave their house?

Sixth, you would need the technological capability and equipment to synthesize the hypothesized biological agent, something it is widely agreed that humanity currently lacks.

Finally, you would need to find someone crazy enough to manufacture and deploy this biological agent, yet also competent enough to pull it off, which we have seen is no easy feat.

I am not sure if I would go so far as to say that the above is physically impossible. But without a very good argument, we should regard it as highly implausible that all of the above will come to pass by the end of the century.

### 1AR – Nonunique – Disease Cooperation Decreasing

#### Lack of governmental capacity means botching the next pandemic response is inevitable

Kelly McKinney, 2024 - former deputy commissioner at the New York City Office of Emergency Management and chief disaster officer at the American Red Cross in Greater New York “We could be ready for the next pandemic” Pittsburgh Post-Gazette, 5/19 <https://www.post-gazette.com/opinion/insight/2024/05/19/mckinney-pandemic-covid-response-disaster-relief-coordination/stories/202405190018> //DH

COVID-19 was a catastrophe and, throughout history, humanity’s responses to catastrophes have been a nearly unbroken series of abject failures. And now, as avian influenza spreads through dairy cattle herds in multiple states, many healthcare leaders say they would not be ready if it spreads widely among humans.

Meanwhile, the Centers for Disease Control is being hamstrung by state agriculture departments and dairy farmers, as it struggles to track the virus. Politico describes this gap as “emblematic of the trust gap between key agriculture players in both red and blue states and federal health officials.”

This version of the avian flu virus, H5N1, probably won’t spread among humans, but it might. But some day, perhaps soon, some virulent virus will hit us as hard as the coronavirus did, or even harder.

And we won’t be prepared. The whole government, federal, state and local, remains at a high-risk to botch the next crisis.

It’s hard to understand how we got here. In the four years since the start of the pandemic, there has never been a proper accounting of what actually happened and why.

How could we have gotten here?

That our COVID-19 response was a failure seems a foregone conclusion. Excess deaths, for instance, were up to 83% worse in the US than in Western Europe through the end of 2021. Contrary to conventional wisdom, though, the causes of our failure were not political.

Although it’s true that containment failed, the differences between the choices made by most Republican and Democratic governors have been greatly exaggerated. It is also true that federal crisis management collapsed and that this occurred during the Trump administration, but systemic problems existed long before 2020 and continue to exist today.

#### Pandemic preparedness is fracturing now

Annalies Winny, 2023 – Interview with Yanzhong Huang, a senior fellow for global health at the Council on Foreign Relations “We Know How to Prevent the Next Pandemic—But It’s Easier Said Than Done” Global Health Now, 10/27, <https://globalhealthnow.org/2023-10/we-know-how-prevent-next-pandemic-its-easier-said-done> //DH

Where does the world currently stand in terms of achieving pandemic preparedness?

Yanzhong Huang: There have been important strides. There’s the pandemic preparedness treaty currently in the works, the building of a pandemic intelligence hub in Berlin, a new pandemic fund at the World Bank, and the 100 Days Mission to come up with a vaccine within 100 days of discovering a novel pathogen.

But at the same time, international society seems to have become even less cooperative than before the COVID-19 pandemic, in preparing for the next one.

Why is that?

Yanzhong Huang: With the acute phase of COVID-19 over, psychologically people just want to end this traumatic chapter.

And in the meantime, we have all the other things that need to be prioritized: The crisis in Ukraine, inflation, recession, climate issues, and now, of course, the conflict the Middle East. All of this makes talking about preparing for next pandemic so unpopular—even though we are desperately not ready for the next pandemic. We could repeat the same experience we had with COVID-19.

### 1AR – Nonunique – Overseas Patents

#### The EU allows gene patenting now

Josh Saul, 2024 - J.D. Candidate, 2025, Fordham University School of Law; Ph.D., 2021, Massachusetts Institute of Technology; B.A., 2014, University of California, Berkeley. “GENE PATENTS: STRIKING THE RIGHT BALANCE BETWEEN INCENTIVE AND INNOVATION” FORDHAM LAW REVIEW, Vol. 92: 2765, May, <https://fordhamlawreview.org/wp-content/uploads/2024/05/Vol.-92_29_Saul-2765-2804.pdf> //DH

Unlike the United States, some other countries continue to permit the patenting of human genes. The EU, for example, explicitly allows for the patenting of genes.

In the EU, patents are processed by the European Patent Office (EPO) in compliance with the European Patent Convention (EPC).95 The EPC dictates that “any invention” may be patented,96 but it restricts this broad grant with specific limitations—for example, by indicating that “discoveries, scientific theories and mathematical methods” do not qualify as inventions.97 However, directives passed by the EU create carveouts to these restrictions. A 1998 directive of the European Parliament, for example, clarifies that DNA sequences are to be considered inventions—and not unpatentable discoveries—so long as the claimed sequence has an industrial application, such as use in the diagnosis of disease.98 Thus, in the EU, genes qualify as valid patentable subject matter through a narrowly tailored exception to a more general bar on patenting abstract scientific principles.99

With the above backdrop of what gene patents are and how they fit into the broader field of patent law, this part next turns to the legal history of gene patents in the United States that led courts to initially permit and subsequently invalidate the patenting of genes.

### 1AR – No link – Exemptions and Nonenforcement

#### Courts can force licensing if patents block cooperation

David Spetzler, 2019 - President and Chief Scientific Officer, Caris Life Sciences. Senate Judiciary Subcommittee Hearing, State of Patent Eligibility in America, 6/11, Proquest Congressional, accessed via University of Michigan //DH

 ADDRESSING THE CONCERN OF "GENE PATENTING"

 We well understand the concern with "gene patents" and the Myriad decision. However, there are better ways to deal with one company's unpopular business practices than imposing limitations on patentable subject matter--ways that will not stifle investment in life-saving innovations.

 It is important to understand what "gene patenting" means and what it does not mean. First, we do not believe that a product of nature per se, such as a gene as it exists in nature, should be patentable as it is not a man-made innovation. And we do not believe that it would be patentable under the proposed legislation. However, the knowledge gained from a product of nature or uses thereof that are novel and non-obvious may very well deserve patent protection. Second, if Myriad's patents had survived and competitors had been found to infringe, the Courts could have imposed a licensing regime upon Myriad that aligned with the public's interest in having access to the patented technology. Thus, the U.S. patent system already has built-in mechanisms to deal with so-called "blocking" patents. Finally, the human genome is known today. The isolated BRCA1 gene would not be patentable today because it either lacks novelty or is obvious given what is presently known.

 Indeed, we believe that other requirements of the patent laws are better equipped to deal with technological changes over time. For example, it goes without saying that what is considered new will change over time. But what is considered to be obvious also changes over time: at the time of Myriad's patent filings, genes were new and difficult to discover and isolate, but this is not the case today. In contrast, subject matter eligibility should not depend on the current state of the art and should remain anything under the sun that is made by man. Patentable subject matter should remain constant.

### 1AR: Innovation Turn

#### Patents made COVID vaccines possible – no evidence shows they hinder cooperation

Adam Mossoff and Amesh Adalja, 2022 – \*professor of law at George Mason. \*\*clinical assistant professor at the University of Pittsburgh School of Medicine “Patents as a Driver of the Unprecedented Biomedical Response to COVID-19” INQUIRY: The Journal of Health Care Organization, Provision, and Financing, 9/21, <https://journals.sagepub.com/doi/10.1177/00469580221124819> //DH

The invention, development, testing, and rollout of vaccines in response to the COVID-19 pandemic was the fastest in global history. The delivery of vaccine doses to patients in the developing world has lagged behind the developed world, but this was not caused by patents or other IP rights. There is no evidence that patents have blocked the research, development, or distribution of any vaccines for the treatment of COVID-19. The evidence is to the contrary: patents prompted the investment of billions of dollars over several decades in research and development efforts, as well as in creating a manufacturing and commercial infrastructure in the biopharmaceutical sector, that made possible the COVID-19 vaccines.

These investments were made possible given the reliable and effective patents rights secured in biotech innovations in the U.S. since the early 1980s.8 The result was the biotech revolution, driven by an explosion in biotech startups from Genentech in the early 1980s to Moderna today. The U.S. accounts for approximately 5% of the world’s total population and roughly 25% of global economic output, but over 50% of all new biotech innovations are created in the U.S.9

This technological and commercial foundation was key to the biopharmaceutical sector’s response to COVID-19. There was some work by government scientists on the basic research, but it was patent-based venture capital investments and licensing that were the foundation of new biotech companies, like BioNTech and Moderna, that developed the mRNA platform to create the first COVID-19 vaccines in early 2020. Two decades earlier, many in the scientific community believed mRNA-based vaccines were an impossible pipedream.6 After Chinese researchers published the genome of SARS-CoV2 on January 11, 2020, Moderna created its vaccine using its mRNA technology in 2 days.10 BioNTech was even faster: researchers created its COVID-19 vaccine in several hours.11

#### Gene patenting is essential to innovation – industry won’t invest in vaccines without it

Amy Q. Nguyen, 2022 - Juris Doctor candidate from Southern Methodist University Dedman School of Law and is the Associate Managing Editor of SMU's Science and Technology Law Review. “In the Midst of a Global Pandemic: Benefits of a Biomedical Patenting Regime,” 25 SMU SCI. & TECH. L. REV. 63 (2022). Hein Online. Accessed via University of Michigan //DH

The current state of the U.S. patent regime regarding patenting biomedical data and genomic processes and the announcement from the Biden Administration to waive patent protection for COVID-19 vaccines is a problem according to many in the pharmaceutical industry and other patent advocates. 66 It is especially harmful with the current global pandemic.67 First, genomic and biomedical data patents encourage innovation and provide inventive protection to researchers and inventors who seek to introduce new methods of identifying and curing viral infections.68 The pharmaceutical industry needs to be motivated by making profits when they make huge investments upfront and it can take many years to continue creating effective vaccines that combat the COVID-19 virus and its variants.69 The pharmaceutical industry needs to have sufficient guidance and a more substantial grasp on what is considered patent-eligible and broaden the scope of medical patents in times of increased technology and biomedical innovation and experimentation. 70 Such changes are essential to encouraging these companies to realize some gain that incentivizes the continuation of such innovation for researching the COVID-19 vaccines and other viruses for future pandemics.71 The policy decision to waive patent protections on the COVID-19 vaccines raises fear of a dangerous, unwanted precedent.72 There is difficulty in providing incentives for the future because patent protections were created to incentivize via short-term monopoly profits so that firms and individuals can invest in innovation.73 In the face of a public emergency, this temporary waiver sets a scary precedent that makes firms and individuals doubt whether they will want to invest next time there's an emergency. 74

#### Patents are vital to manufacturing and distribution agreements for vaccines

Adam Mossoff and Amesh Adalja, 2022 – \*professor of law at George Mason. \*\*clinical assistant professor at the University of Pittsburgh School of Medicine “Patents as a Driver of the Unprecedented Biomedical Response to COVID-19” INQUIRY: The Journal of Health Care Organization, Provision, and Financing, 9/21, <https://journals.sagepub.com/doi/10.1177/00469580221124819> //DH

Thus, patents have been the basis of innumerable commercial agreements for decades in the biopharmaceutical sector. These economic activities created efficiency-maximizing supply chains, licensing of products and services to manufacture and distribute new therapeutic treatments, and ultimately formed a knowledge infrastructure in the growing biopharmaceutical sector. This preexisting commercial foundation served as the basis for the many cross-industry and cross-sector agreements that made possible the unprecedented response to the COVID-19 pandemic.17

By May 2020, less than half a year after the emergence of a previously unknown novel coronavirus eventually classified by the WHO as SARS-CoV2, the biopharmaceutical sector was researching and developing 430 unique active compounds to treat the COVID-19 illness.18 This number has almost doubled in 2 years. As of June 2022, there are now 854 unique active compounds under development, including 240 vaccines, 261 antivirals, and 353 therapeutic treatments. Almost half of these compounds under development (415) are by companies based in the U.S. (Figure 1).19

The patents (and other IP rights) that have served as the basis for creating the complex global commercial and information-sharing infrastructure in the modern biopharmaceutical sector did more than incentivize research and development in vaccines. They also served as the basis for many commercial agreements to expand manufacturing capacity of vaccines (Figure 2).

One of the more well-known examples includes the license agreement BioNTech and Pfizer, which efficiently combined BioNTech’s innovation with Pfizer’s existing capital capabilities to quickly scale final development and manufacturing of vaccine doses. Other lesser-known licensing agreements entered into in 2020—the first year of the global pandemic—include AstraZeneca licensing the Serum Institute of India to manufacture its vaccine, Johnson & Johnson licensing Merck to manufacture its vaccine, and BioNTech-Pfizer licensing Novartis and Sanofi to manufacture its mRNA vaccine doses, among others. In total, there have been approximately 379 production and manufacturing agreements entered into between private and public entities for COVID-19 vaccines with over 50 of these agreements in the developing world.

### 1AR – Disease Won’t Cause Extinction

#### The risk of natural pandemics threatening civilization is at most .1%

Anjali Gopal, et al, 2023 – Research Scientist at MIT, where her work spans technical and policy research at the intersection of biosecurity, pandemic preparedness, and emerging technology. “Securing Civilisation Against Catastrophic Pandemics” October, <https://dam.gcsp.ch/files/doc/securing-civilisation-against-catastrophic-pandemics-gp-31> //DH

The Wildfire scenario requires the introduction of a lethal pandemic agent capable of spreading through populations of essential workers in every nation, even after they adjust their workflows to minimise human contact. The Omicron variant of SARS-CoV-2 plausibly sufficed. Drawing from data on its spread in previously naive Chinese populations in the months before and just after the relaxation of that country's zero-COVID policy, Omicron likely exhibits an R0 between 4.0 and 5.5 with an upper bound of 6.8 (see Appendix 1). We therefore define a Wildfire pathogen as one exhibiting a case fatality rate above 20% and a basic reproduction number exceeding 5.5. Only one pandemic pathogen in the four thousand years in which densely populated cities and frequently used trade routes have been key features of civilisation,22 i.e. the variola major virus that causes smallpox, has been both highly lethal (~30% case fatality rate) and could be sufficiently contagious (R0=3.5-6.0).23 Therefore, historical inference suggests that the annual chance of a natural Wildfire pandemic is somewhere between negligible and a theoretical maximum of 0.1% (see Appendix 1).

#### Pandemics don’t cause extinction – humans are resilient, adapt and recover

David Thorstad, 2023 – professor of philosophy at Vanderbilt University. Before that, I was a research fellow at the Global Priorities Institute and Kellogg College, Oxford. “Exaggerating the risks (Part 9: Biorisk – Grounds for doubt)” 7/8 <https://reflectivealtruism.com/2023/07/08/exaggerating-the-risks-part-9-biorisk-grounds-for-doubt/> //DH

4. Human history

We have experienced a great number of catastrophic pandemics throughout human history. These pandemics have all fallen far short of existential catastrophe: indeed, they have often failed to cause even local forms of societal collapse, and only extremely rarely if ever caused a region to become uninhabited for any significant amount of time.

One of the best known pandemics is the `Black Death’ which swept Europe from 1346 to 1352. Though the pandemic led to massive loss of life, there was little evidence of societal collapse or even breakdown of large-scale social institutions. The historian John Haldon and colleagues write:

Claims of mortality rates of as much as 50% give the impression that this event must have been devastating for the societies affected. Yet when we examine how different states and societies responded, we find that—without minimizing the terrible impact on people and communities—the medieval world did not grind to a halt, still less did a series of revolutionary transformations occur. Indeed, the Black Death struck at the beginning of the Hundred Years’ War, and in spite of its demographic impact both the kingdoms of England and France continued to field effective armies, even if there was a brief pause in hostilities (similar to contemporary calls for ceasefires in ongoing international conflicts in the context of COVID-19). Instead, some societal developments that were already under way accelerated while various groups within society responded by exploiting their situation and attempting to slow down, stop or otherwise control changes which they perceived as disadvantageous.

Still more devastating pandemics, combined with other risk hazards such as brutal colonial expansion, have still been frequently unable to produce even regional societal collapse. For example, the political scientist Alberto Diaz-Cayeros and colleagues study the combined effect of pandemic, violence and other colonialist disasters on Mexico from the mid-1500s onwards. Despite dramatic loss of life (average settlement population fell 95% by 1646), most settlements survived, and 13% even grew by the end of the colonial period. They write:

We develop a new disaggregated dataset on pre-Conquest economic, epidemiological and political conditions both in 11,888 potential settlement locations in the historic core of Mexico and in 1,093 actual Conquest-era city-settlements. Of these 1,093 settlements, we show that 36% had disappeared entirely by 1790. Yet, despite being subject to Conquest-era violence, subsequent coercion and multiple pandemics that led average populations in those settlements to fall from 2,377 to 128 by 1646, 13% would still end the colonial era larger than they started.

Human history is replete with such examples of resilience not only to pandemics, but also to the combination of pandemics with numerous other catastrophes. If our ancestors could survive and flourish with little in the way of modern medical knowledge or technology, then we should become relatively more confident in our own ability to survive future pandemics.

#### Engineering viruses fails – changing one trait will undermine other mutations – it’s impossible to create an existential virus

David Thorstad, 2023 – professor of philosophy at Vanderbilt University. Before that, I was a research fellow at the Global Priorities Institute and Kellogg College, Oxford. “Exaggerating the risks (Part 9: Biorisk – Grounds for doubt)” 7/8 <https://reflectivealtruism.com/2023/07/08/exaggerating-the-risks-part-9-biorisk-grounds-for-doubt/> //DH

Effective altruists often draw attention to experiments in which a single feature of a virus was manipulated: for example, the virus was made more virulent or more transmissible. But that is not what omnicidal actors need. They need a virus which is improved on a great number of dimensions at once: it must be quite virulent; highly transmissible; have the desired incubation time; resist likely treatments and antibodies; survive storage and transportation across the globe; and so on.

The problem is that we do not know how to induce all of these many mutations at once, and indeed there is a good chance that work done to produce one mutation may cut against other desired mutations. A bioweapons expert interviewed by Filippa Lentzos explains:

I do not think that it’s very easy to create weapons of mass destruction with biological weapons.

Ray Zilinskas’ book on the Soviet programmes, for example, points out how very, very hard it is to engineer something which is usable in that context. He lists 12 criteria that you want in your pathogen for it to be a useful biological warfare agent, and they include things like survivability in the air, survivability through whatever mechanical forces are brought to bear during dispersion, resistance to common antibiotics or anti-viral agents so that the enemy can’t simply treat the disease, high transmissibility etc. In evolutionary terms, normally as transmissibility increases, pathogenicity decreases; so you’re having to fight nature in trying to create a perfect biological weapon.

Some of the key lessons that came out of the Soviet programme go to this issue of pleiotropy, where a single gene affects more than one characteristic. And if you change that gene to improve one of the characteristics you’re going for in that list of 12, the chances are you’re going to diminish one or more of the other characteristics that are desirable. So getting something that works is extraordinarily difficult.

(Let me add for legal reasons that the existence of a Soviet bioweapons program is contested. So is the fact that someone cracked Kasparov over the head with a chessboard when he spoke out about certain issues. Make of that comparison what you will.)

How bad is the problem? Bad enough that an extremely well-funded, decades-long Soviet bioweapons program was likely unable to come close to overcoming it. The biosecurity expert continues:

In the 20 years of the Soviet programme, with all the caveats that we don’t fully know what the programme was, but from the best reading of what we know from the civil side of that programme, they really didn’t get that far in creating agents that actually meet all of those criteria. They got somewhere, but they didn’t get to the stage where they had a weapon that changed their overall battlefield capabilities; that would change the outcome of a war, or even a battle, over the existing weapon systems available to them.

Of course, we can insist that designer viruses with all of the characteristics an omnicidal agent would like them to have are just around the corner. But we should not pretend that manufacturing such viruses is an easy task, or that historical programs and experiments provide any significant evidence in favor of the possibility of manufacturing such viruses.

# Prizes Counterplan Answers

### 2AC – Prizes Counterplan

#### 1. No net benefit – patents increase competition and don’t create monopoly pricing

Daniel F. Spulber, 2021 - Elinor Hobbs Distinguished Professor of International Business and Professor of Strategy at the Kellogg School of Management at Northwestern. The Case For Patents, <https://www.worldscientific.com/doi/pdf/10.1142/9789811225666_0001> //DH

There is no empirical evidence for the assertion that patent owners systematically earn “excessive” rewards. In any case, there is no intrinsic value of an invention that departs from its market value. Economic analysis has long identified the value of goods and services as being given by market prices. Competition in the market for inventions strongly suggests that patent owners earn market rewards. A patent does not confer an economic monopoly because access to the market for inventions, markets for products, or financial markets remains unimpeded.

The standard Nordhaus argument is incorrect because it assumes that a patent confers an economic monopoly on their owners.168 This now standard assumption in the economics and law literature is inconsistent with reality. Competition in the market for inventions and in the product market that applies inventions means that a patent owner does not receive monopoly rents. This invalidates the standard analysis of patent policy that is based on the economic monopoly assumption.

The standard Nordhaus-style conclusion is that the duration of a patent should be just sufficient for a period of monopoly rents to cover the costs of invention. Even within this overly simplistic framework, it should be noted that more intense competition would dissipate economic rents and therefore would extend the optimal duration of a patent. The duration of a patent is not simply adding up monopoly rewards such that they exactly equal the cost of an invention.

The Nordhaus-style analysis is incorrect for more fundamental reasons. The inventor’s incentives depend on anticipation of the market value of the invention. Patents serve to promote competition among inventors. Greater patent duration increases incentives to enter the market, all other things being equal, which increases competition among inventors. By reducing transaction costs in the market for inventions, patents reduce the costs of entry and operation in that market, also increasing incentives to enter the market and increasing competition among inventors.

Competition in the market for inventions *limits* inventors’ rewards. Entry of inventors and competition in the market for inventions improves the quality of the best inventions. Entry of inventors also increases competition among inventors, which dissipates economic returns to inventors. This suggests that policymakers may wish to strengthen patent protections and increase their duration to increase competition in the market for inventions. A Nordhaus-style analysis will miss the beneficial effects of inventor entry because it assumes that all patents are economic monopolies.

A patent faces competition from past, present, and future inventions. For example, the USPTO issued 276,788 patents in 2012. Patents filed on or after June 8, 1995 have a term of 20 years from the time of filing, so the stock exceeds two million patents. Table 1.1 shows the number of patents issued in the US from 1963 to 2012.

#### 2. Looting deficit - prizes are corrupted by rent-seeking behavior – that reduces innovation

Daniel Spulber, 2021 – Elinor Hobbs Distinguished Professor of International Business and professor of strategy at the Kellogg School of Management at Northwestern. The Case for Patents, p. 68 //DH

Problems with central planning extend beyond asymmetry of knowledge. Prize advocates assume that governments maximize social welfare. Even if they could be fully informed, central planners need not act in the public interest. Central planners can be expected to suffer from corruption, abuse of power, discrimination, bureaucratic inefficiency, and other forms of government failure. Government agencies are likely to provide rewards to cronies of politicians, lobbying organizations, incumbent firms, political donors, voting blocs, or ideological allies. A government prize system would encourage rent-seeking to obtain prizes, diverting resources away from invention and innovation and toward political influence. Government agencies also are likely to pursue objectives other than allocative efficiency, such as subsidies for groups of voters, increases in employment, income redistribution, regional economic growth, industrial policy, and support for political causes.

Although necessarily imperfect, the patent system is less subject to corruption than a public prize system. With patents, the government establishes general rules of the game through a system of private property rights. The patent system involves the legislature, the courts, and the USPTO, which is part of the executive branch. The market for inventions determines prices for inventions and selects the best inventions and innovations. In contrast, with a system of prizes, the government micromanages innovation: it designs the contests, chooses prizes, selects inventions, and allocates technology.

#### 3. Central planning deficit – prize committees have less information than the market – it makes it impossible to choose the best technology

Daniel Spulber, 2021 – Elinor Hobbs Distinguished Professor of International Business and professor of strategy at the Kellogg School of Management at Northwestern. The Case for Patents, p.67-68

Markets for invention depend on the knowledge and opinions of consumers, producers, investors, inventors, and innovators. In contrast to broad participation in the market for inventions, the awarding of prizes depends on the opinions of very few decision makers. For example, a committee of 12 scientists and engineers appointed by the President evaluates nominees for the National Medal of Science.103

Beginning in the late 1950s, the Soviet Union instituted a system of "inventors' certificates" that involved transfer of the invention to state ownership and some limited monetary and non-monetary rewards for the inventor based on usage.104 Compared to patent systems in market economies during the same time period, it is apparent that this approach was not successful in generating innovation.105 In addition, the Soviet Union offered a limited honorary "prize" system. During its entire existence, the Soviet Union awarded its "Honoured Inventor of the USSR" medal only sixteen times.106

Prize advocates assume that central planners are fully informed about market demand and producer costs. Central planners would need to have sufficient knowledge about science and technology to design contests and to choose the best inventions. Central planners must be sufficiently informed to allocate inventions efficiently to producers. The complexities of invention and innovation create significant information challenges for market participants; such challenges are likely to be insurmountable for central planners. The dramatic differences in the historical performance of market economies and centrally-planned economies are even more pronounced in innovative industries.

#### 4. Expropriation deficit - Prizes create fears of expropriation – that deters investment in R&D

Benjamin N. Roin, 2014 – Hieken Assistant Professor of Patent Law, Harvard Law School. “Intellectual Property versus Prizes: Reframing the Debate” The University of Chicago Law Review [81:999, <https://lawreview.uchicago.edu/sites/default/files/Roin_ART.pdf> //DH

The most pressing political economy concern with the prize system is the risk of inadequate prize payouts and expropriation. When innovators earn their profits through a government-funded prize system, they are competing against other interest groups over scarce taxpayer dollars. Innovators are likely to be at a disadvantage in these types of political battles for three reasons. First, by nature, innovators often threaten established interests and therefore create opposition from more powerful interest groups.286 Second, because innovators capture an unusually small portion of the social surplus generated by their activities,287 they have proportionally fewer resources to devote to rent seeking in support of their R & D investments. Third, and most importantly, innovators are particularly vulnerable to expropriation under a prize system because the government determines their prize payout after innovators have invested in R & D and disclosed their inventions to the government. Since innovators’ R & D investments are sunk at this stage, the government can take advantage of its position to grossly underpay innovators,288 who may have little choice but to accept the insufficient reward.289 Legislators could then redirect funds that would otherwise incentivize innovation toward lower taxes or other government spending programs, many of which would offer more immediate political gains than payments to innovators meant to encourage R & D spending.290 Eventually, the public would suffer from the reduced output of socially valuable innovation. However, this malfeasance would be largely hidden from voters, since it is nearly impossible to observe the relative absence of new innovations.291 Consequently, the risk of expropriation in a prize system could be a significant deterrent to private-sector investment in R & D unless there are political checks to prevent underpayment.

#### 5. Permute do both - it solves better

Keith N. Hylton, 2023 – Professor of Law, Boston University School of Law “A Patent and a Prize” Research Paper Series No. 23-7, 2/8, <https://scholarship.law.bu.edu/cgi/viewcontent.cgi?article=4398&context=faculty_scholarship> //DH

There are significant “public choice costs” under either of the optional prize plans. By this I mean there are risks of inappropriate transfers to patentees2 – that is, looting – and of confiscation of patentees, through the conduct of or through the omissions of government agents, sometimes working at the behest of private agents. I will argue that the confiscation risk appears to dominate.

The public choice costs point to a broader set of constraints that should be incorporated into any analysis of the patent system. There are rational actors operating at all levels, from patentees to licensees, and government actors. A discretionary prize system, where the government awards prizes and no enforceable patents, would invite lobbying and third-party interference in the determination of the award. Even in a prize process effectively shielded from third-party interference, government would confiscate patents on a regular basis.

The innovation regime I propose is a patent-plus-prize scheme. The patentee would receive the patent and a prize that approximates consumer surplus. Public choice costs are considerably lower than under optional or mandatory prize schemes: there would be no looting and no risk of confiscation under patent-plus-prize. In addition, private and social incentives to innovate are aligned. Private and social incentives align under the Kremer proposal too, but only if one ignores the risks of looting and of confiscation. Under the patent-plus-prize scheme, by contrast, private and social incentives align without requiring people to behave as angels.

#### 6. Costs deficit - Astronomical costs greatly limit the total number of prizes

Daniel Spulber, 2021 – Elinor Hobbs Distinguished Professor of International Business and professor of strategy at the Kellogg School of Management at Northwestern. The Case for Patents, p.58-59 //DH

Prize advocates generally assume that the government prize system would operate without costs. However, in addition to the economic distortions resulting from taxes, a system of government prizes would incur both transaction costs and administrative costs.62 The government would expend considerable resources designing and managing contests, selecting winners, and diffusing inventions to producers.

The administrative costs of a prize system would be many times the administrative costs of the current patent system. The costs of administering the US Patent and Trademark Office (USPTO) are approximately $3.5 billion per year.63 There are over a quarter of a million patents granted per year for highly diverse inventions.64 The USPTO covers a very wide range of scientific and technological subjects. No government agency could replace the entire patent system with contests and awards in every area of science and technology covered by the patent system without incurring astronomical administrative costs. Because of the complexities and broad range of the market for inventions, prizes could only replace a few market prices. The administrative costs of operating a public prize system suggest that the government would only offer a handful of prizes.

### 1AR – Patents Cause Competition

#### Patents spur market competition, prizes undermine it

Daniel Spulber, 2021 – Elinor Hobbs Distinguished Professor of International Business and professor of strategy at the Kellogg School of Management at Northwestern. The Case for Patents, p. 47-50 //DH

Calls to replace the patent system with public contests are misguided. With public contests, government agencies would design games, choose prizes, select winning inventions, take ownership of technologies, and allocate technologies to producers. Reliance on such public contests would significantly decrease incentives for invention and innovation. Replacing the patent system with public contests would damage the market for inventions and harm economic efficiency.

The America COMPETES Reauthorization Act of 2010 (the Act) establishes a legal framework for replacing some types of patents with prizes and government control of technology.1 The Act specifies the elements of prize contests: "the subject of the competition;" "the rules for being eligible to participate in the competition;" "the process for participants to register for the competition;" "the amount of the prize;" and "the basis on which a winner will be selected."2 The Act also allows the government to license intellectual property (IP) from inventors: "The Federal Government may negotiate a license for the use of intellectual property developed by a participant for a competition."3 The Act specifies that transfers of technology and licensing of IP to the government are voluntary.4 However, the government can apply various mechanisms to induce participation in contests, such as antitrust, regulation, subsidies, or procurement. The Act empowers the heads of all federal agencies in the Executive branch to create prize competitions.5 The Act authorizes the use of both tax revenues and private funds to pay cash prizes.

Some provisions of the Act have been put into practice: The Administration will continue to focus on using prizes to encourage new ways to speed commercialization."7 For example, the U.S. government is applying prizes such as "Challenge Grants" competitions to promote commercialization of new technologies.8 In addition, prizes are part of various public-private partnerships, including partnerships with universities.9 According to the Department of Commerce, "To support these communities [of innovators], the Administration has partnered with organizations to inspire participation in innovative activities through the use of challenges and prizes."10

In this chapter, I explain why arguments for replacing market prices with public prizes are incorrect. First, I show that the standard deadweight welfare loss argument is a fallacy because it assumes government prizes create no economic distortions — a classic case of a "free lunch." Yet, the government must collect taxes to pay for the prizes and such taxes create substantial deadweight welfare losses.11 The bureaucratic and compliance costs of the taxation system are substantial as well. The standard argument for public prizes assumes that the government would incur no costs of administering the prize system or managing subsequent technology diffusion and commercialization — another free lunch. Yet, the administrative costs of operating a government prize system and commercializing technologies are significant.

The standard argument for public prizes further assumes that market prices create monopoly deadweight welfare losses. This assumption is inaccurate because extensive competition in the markets for inventions and products reduces prices and mitigates deadweight welfare loss. Also, market competition promotes efficiency because firms have incentives to reduce the transaction costs of commercialization and innovation. I conclude that the deadweight welfare losses resulting from a government prize system are likely to substantially exceed any such losses from competitive markets — replacing prices with prizes would lower social welfare.

Second, I emphasize that government prizes, in contrast to the market for inventions, cannot achieve an efficient allocation of technology. A public prize system with government diffusion of technology can do little to promote efficient commercialization and innovation. Public prizes require planners to choose the best technology in advance, and government diffusion of technology eliminates many of the benefits of competition. Government contests and the selection of winners reflect the specific priorities of public policymakers rather than economic benefits of invention and innovation. In contrast, prices in the market for inventions are generated by competition and coordination that selects the best inventions and innovations. Patents, along with copyrights, trademarks, trade secrets, and other IP, support invention, commercialization, and innovation by providing the foundation of the market for inventions.12 Competitive pressures among inventors and among producers increase incentives to invent.13 Inventions and innovations are not exogenous forces but instead are the results of economic decisions and transactions among many participants in the market for inventions. As Friedrich Hayek points out, competition is a discovery procedure because it helps inventors and producers discover the best inventions and innovations.14

### 1AR – Looting Deficit

#### Looting is historically correct, and generates uncertainty about the prize system

Daniel F. Spulber, 2014 - Elinor Hobbs Distinguished Professor of International Business and Professor of Strategy at the Kellogg School of Management at Northwestern. “Prices versus Prizes: Patents, Public Policy,

and the Market for Inventions” <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2488095> //DH

Historical evidence casts doubt on prizes systems as sources of invention and innovation. According to Khan (2014a) “the historical record shows that administered prize systems tend to be associated with the potential for bias or corruption, unpredictable methods of allocation and outcomes, as well as other deficiencies attendant on a nonmarket orientation.” Khan (2011) studies inventors in Britain and the U.S. during the transition from the First to the Second Industrial Revolutions and finds that because prizes are less systematic than patents, they offer lower expected benefits for inventors. Khan (2013a) considers a sample of exhibits and premiums at U.S. industrial fairs between 1837 and 1874 and finds that prize winners tended to belong to privileged social groups, with prizes awarded less systematically than patents and unrelated to various proxies for the productivity of the innovation.37

Khan (2014c) provides a critically important historical comparison of the effects of patents and prizes on technology diffusion. She compares patented inventions with inventions that were submitted for prizes at annual industrial fairs of the American Institute of New York in the 19th century. Khan finds that patents promote much greater spatial diffusion of innovations than prizes. Additionally, Khan’s research shows that patents had large and significant effects on unpatented innovations in contiguous and adjacent counties, in contrast to limited geographic effects of prize-winning inventions.

#### Studies confirm rent-seeking behavior – government-directed innovation is corrupted by political influence

Olof Hallonsten, 2023 - Department of Business Administration, Lund University, Lund, Sweden. Empty Innovation: Causes and Consequences of Society’s Obsession with Entrepreneurship and Growth. <https://library.oapen.org/bitstream/handle/20.500.12657/63577/1/978-3-031-31479-7.pdf> //DH

The knowledge problem is but one exponent of what could very well be called “government failure” to counterbalance the hypothesis of “market failure”. Politics is, in and of itself, a struggle between different special interests. These special interests will take every opportunity to benefit from policies that they can have influence over (Niskanen 1975). On a general level, any policy measure will therefore run the risk of being captured by special interests, which means that rather than aiming for utility maximization on overall societal level, it will aim for utility maximization on individual or group level.

Purposive social action always has unintended consequences, changing the behavior of those it is aimed at (Merton 1936) and incentivizing beneficiaries of rewards or subsidies to adapt to terms and conditions rather than aspiring to quality or competitiveness in a broader or general sense (e.g. Muller 2018: 19–20). Direct and indirect subsidies handed out by public sector organizations tend to lead both public and private actors and entities in innovation systems to reorganize their efforts so as to maximize their eligibility for funding, and realign their activities to fit specific aims and purposes. Studies have shown that government subsidies tend to go to those who are good at applying for them, or lobbying for them, rather than those who need them (Karlson et al. 2021: 85). Programs are, allegedly, routinely “hijacked” by special interests so that resources are diverted away from intended goals and to “boosting cronies of the nation’s rulers or legislators” (Lerner 2009: 11). Other studies have demonstrated that entrepreneurs who are productive enough on their own are not only in no need for these types of grants, but indeed abstain from applying at all, and instead use their effort on increasing their productivity (Gustafsson et al. 2020). This seems to imply an inverse correlation between productivity and effort put into acquiring grants.

### 1AR – Central Planning Deficit

#### Prizes require the government to pick winners rather than the market – that reduces innovation and commercialization

Daniel F. Spulber, 2015 - Elinor Hobbs Distinguished Professor of International Business and Professor of Strategy at the Kellogg School of Management at Northwestern. “Public Prizes versus Market Prices: Should Contents Replace Patents,” 97 J. PAT. & TRADEMARK OFF. SOC'y 690 (2015). Hein Online, Accessed via University of Michigan //DH

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#### Government central planning is historically far worse than market competition – the government lacks sufficient knowledge for innovation

Olof Hallonsten, 2023 - Department of Business Administration, Lund University, Lund, Sweden. Empty Innovation: Causes and Consequences of Society’s Obsession with Entrepreneurship and Growth. <https://library.oapen.org/bitstream/handle/20.500.12657/63577/1/978-3-031-31479-7.pdf> //DH

But the real question is whether governmental innovation policy aimed at subsidizing innovation, and balancing market failure, really works. In a fundamental sense, the “knowledge problem” famously identified by Austrian economist Friedrich Hayek (1945) makes the endeavor very challenging, as it puts into doubt whether any uniform policy or intervention, in any society with some level of complexity, can be efficient. The knowledge deficit of any centrally placed actor, in relation to the actors on the field, makes prioritizing difficult. Also a state with the greatest corporativist integration of varieties of special interests will have a disadvantage compared to more dynamic systems (like scientific fields and markets) when it comes to problem choice, problem formulation, and evaluation of possible solutions. Put differently, and somewhat exaggeratedly (in order to clarify the basic argument), no state actor can have an overview of all ideas being pursued by innovators out there that is sufficient to make the choices that are necessary to pick the winners (Sandström and Alm 2022). It has been tried, not without (some partial) success, but with disastrous consequences in broader and long-term perspective. The huge investments in R&D in the Soviet Union were, for the most part, centrally planned and were ultimately motivated by military aims. They produced scientific research of high quality—for one thing, quite a few Nobel Prizes were awarded to Soviet researchers, well into the 1970s—and also some innovation, but in both respects this system was clearly inferior to any country in the West that had a more pluralist and dynamic system. As we will return to in the final chapter of this book, innovation is unpredictable and rather disorganized, and can really only be achieved by fostering pluralism and variation. As summarized by Matt Ridley (2020: 280), “to pretend that government is the main actor in this process, let alone one with directed intentionality, is an essentially creationist approach to an essentially evolutionary phenomenon.”

Lavish arguments aside, the problem of choosing what areas to bet on, and what firms and innovation projects should receive subsidies, is a practical problem for any aspiring entrepreneurial state. Corporate R&D suffers from similar challenges when sizing up and reaching higher levels of complexity, but the limited “ownership competence” (Murtinu et al. 2022) of the state is more problematic given that it operates with resources that are the results of the hard labor of others, which makes wasteful spending particularly wasteful.

### 1AR – Expropriation Deficit

#### Prize disbursement will undervalue innovation – reducing investment

Philip Stevens and Stephen Ezell, 2020 - “Delinkage Debunked: Why Replacing Patents With Prizes for Drug Development Won’t Work” (ITIF, February 2020), <https://itif.org/publications/2020/02/03/delinkage-debunked-why-replacing-patents-prizes-drug-development-wont-work/>. //DH

A major—and as yet unresolved—problem with delinkage in general, and prizes in particular, is governments find it very hard to determine accurately the true economic and social value of an invention. In the past, this failure has resulted in government prize committees undervaluing inventions. "There is an inherent conservative bias in the prizes granted by administrative and quasi-judicial bodies. Munificence is a rare committee virtue," wrote Harvard economist FM Scherer.54 For instance, under the U.S. Atomic Energy Act of 1946, military uses of atomic energy were made ineligible for patent protection. Instead, monetary awards were disbursed to inventors by a specialist government committee. Professor Scherer has observed that atomic-energy innovators—including inventors of early methods of producing Plutonium and basic liquid rocket engines—were awarded sums far below what they could have earned had their inventions been patented.

Undervaluing a new medicine in a prize system matters for future innovation. In a situation wherein innovators know their inventions are unlikely to be properly rewarded, they are less likely to invest in R&D and compete for the prize. With the cost of drug development approaching $3 billion, innovators—and the venture capitalists on which many biopharmaceutical start-ups rely—need to be certain the potential rewards are worth the risk of this capital.55 If there is a real prospect of under-reward, innovators could direct their capital away from medicines and toward sectors in which the expected rate of return would be higher.

Some prize advocates have suggested the problems of under-valuation and expropriation could be avoided by allocating a fixed amount to prize agencies and legally requiring them to disburse all their monies according to pre-set rules and criteria.56 But this would not prevent governments from underfunding the prize committee in the first place. Another challenge is that even for a prize winner, there would still be no guarantee the prize amount would sufficiently cover costs of development. Moreover, the prize would have to be large enough to account for the expected value of winning, which would be low given not only the technical challenges of successfully developing a drug that could be approved by governments, but that is ahead of all other competitors globally that would also hope to win the prize. The problem of under- rewarding invention is likely to be a fatal flaw in a prize system that could seriously disrupt innovation. In turn, that would harm society, as fewer new medicines would be developed.

#### The fear that the prize won’t cover the costs of innovation deters participation in a prize system

Keith N. Hylton, 2023 – Professor of Law, Boston University School of Law “A Patent and a Prize” Research Paper Series No. 23-7, 2/8, <https://scholarship.law.bu.edu/cgi/viewcontent.cgi?article=4398&context=faculty_scholarship> //DH

There are two prize levels to consider. One is the minimum necessary prize, which is the breakeven level of profit. The other is the optimal prize, which is equal to the entire surplus (Shavell and Ypersele). The optimal prize ensures that entry occurs whenever the cost of development is less than the benefit to society.

The minimum prize is sufficient to induce entry by the patentee. However, the original problem in the patent setting is that the patent authority does not know the development cost of the patentee; that is private information. Given this, if the patent authority were to choose a prize of a given amount, there would be some innovators who would refuse to enter. Because of the information problem, the minimum or break-even prize is not a workable solution to the entry problem.

The optimal prize, equal to the entire surplus, effectively replicates perfect price discrimination. It would require the patent authority to gain knowledge on the market demand for the patentee’s product. This is implausible as a general matter. Patent authorities do not gather information on the market demand for a patented product. Perhaps in the case of a proposed drug that has gone through the Food and Drug Administration (FDA) testing process, it may be possible for the patent authority to gain enough information to determine the market demand for the product, but even this seems unlikely. The FDA determines safety and efficacy for drugs, and makes no attempt to determine market demand. Drug companies, by contrast, surely attempt to determine market demand. A prize system that requires the patent authority to gather information on market demand would leave the patent authority in the hands of the drug companies.

#### Basing the prize value on sales incentivizes the government to suppress sales of the innovation

Benjamin N. Roin, 2014 – Hieken Assistant Professor of Patent Law, Harvard Law School. “Intellectual Property versus Prizes: Reframing the Debate” The University of Chicago Law Review [81:999, <https://lawreview.uchicago.edu/sites/default/files/Roin_ART.pdf> //DH

When the government calculates prize payouts based on sales volume, it faces an incentive to save money by imposing a sales tax on innovations, with the effect of reintroducing deadweight loss. Most proposals for prize systems rely on observing sales volume to calculate prizes.253 Given the close connection between the utilization of an innovation and its social value, it is hard to imagine a comprehensive prize system that does anything else.254 Unfortunately, basing rewards on sales volume gives the government a perverse incentive to suppress utilization as a way to reduce its own liabilities.255 The government could use a variety of means to limit the public’s access at marginal cost,256 but the most direct is to impose user fees on innovations to inflate their price, thereby suppressing sales volume while also raising money to help finance the prize system.257 From the public’s perspective, these user fees are harmful to the extent that they undermine some (or all) of the efficiency gains from the prize system. Nevertheless, so long as the government is operating under budget constraints and calculates prizes based on sales volume, it will have a strong incentive to suppress the utilization of innovations though a sales tax or similar user fee.

### 1AR – Permutation

#### Doing both solves better – it reduces looting and expropriation from a prize system alone

Keith N. Hylton, 2023 – Professor of Law, Boston University School of Law “A Patent and a Prize” Research Paper Series No. 23-7, 2/8, <https://scholarship.law.bu.edu/cgi/viewcontent.cgi?article=4398&context=faculty_scholarship> //DH

I propose an alternative that does not introduce a risk of either patentee confiscation or government looting. In my proposal, the innovator receives both a patent and a prize. Under this scheme, the patentee receives the patent profit and a prize that approximates the consumer surplus. The amount of the prize would be limited, as in the Kremer proposal, to some fixed percentage (or multiple) of patentee profit. Thus, the patentee receives the patent profit multiplied by a markup factor M2, where ideally



For example, if the demand schedule is linear, the ratio of the residual consumer surplus to the monopoly profit is ½. Thus, the patentee would be given a prize equal to 50 percent of profit. In this system, the patentee cannot have his profits confiscated because he has the usual patent; the patentee can only do better than under the current system. Since there is no auction of the patent, and the government does not propose to take patents and put them into the public domain, there is absolutely no risk of confiscation.

This stands in contrast to the Shavell and Ypersele plan. Under their plan, it seems at first glance that the patentee can only do better than under the current system. However, because the government takes patents and puts them into the public domain, there is a substantial risk that the patentee will suffer confiscation. Recall, the way confiscation can occur under the Shavell and Ypersele plan is that government approaches the patentee with a confiscatory prize offer, and the patentee comes under political pressure to accept the government’s offer.

Consider the problem of looting. In setting the prize amount, there is obviously a risk that an agent could arrange for the government to be looted by setting the prize well above the amount of consumer surplus. There are several reasons this risk is minimal or nonexistent under the patent-plus-prize scheme.

First, like the Kremer proposal, the amount of the prize is limited to a fixed percentage of patentee profit. In the proposed scheme here, the percentage is designed to measure the amount of consumer surplus from the patent. In the case of linear demand, the percentage is exactly 50 percent. However, more sophisticated methods of determining the precise percentage can be used.

Second, the approximation of consumer surplus is a conservative measure of the additional social value, beyond profit, created by the patent. There are additional components of social value not captured by this approach. For example, after the patent expires, society gets the entire surplus – the increment being the so-called deadweight loss – and this is clearly attributable to the innovation. Second, during the life of the patent, rivals attempt to introduce competing products to eat into the patentee’s profits and create substitutes. This process of creating substitutes reduces the market power of the patentee and therefore increases the surplus going to consumers. Third, the patent has spillover benefits to other firms (follow-on innovators) who attempt to build on the innovations revealed by the patent. The consumer surplus approximation, in the form of a prize, fails to incorporate these additional sources of social value. Because it fails to do so, it is quite unlikely to result in a transfer to the patentee that exceeds the additional social value, beyond the profit, created by the patent.

Under the patent-plus-prize scheme, there would be no effort to capture the unattained surplus (ASX in Figure 1) in the prize portion. Note that I do not refer to this as deadweight loss in this scenario. The reason is that the relevant choice is between the patent, with its accompanying monopoly price, and no production at all. The patent does not fall into the public domain, except upon expiration, under the patent-plus-prize scheme. Hence, the option of production and selling at marginal cost during the term of the patent does not exist. No deadweight loss arises.

For this reason (that is, because there is no deadweight loss), the patent-plus-prize scheme does a better job of aligning private and social incentives to innovate than the optional prize schemes that assign patents to the public domain upon award of the prize. Under the patent-plus-prize scheme, the innovator captures the social value of the innovation, or nearly so. The major portions of social surplus that are not captured in the patent-plus-prize scheme are the spillover benefits (e.g., to follow-on innovators) and the post-expiration social surplus. The spillover benefits are not central to the other prize schemes, and in any event those benefits can be incorporated easily into the markup as suggested by Kremer. The post-expiration surplus is not incorporated into the prize estimation in the optional prize schemes as well. One could attempt to incorporate the post-expiration surplus, but it would be difficult to estimate with any reasonable degree of accuracy. A great deal changes in the market during the course of a twenty year patent term.