R Street Institute
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June 26, 2019

The Honorable Lindsey O. Graham
Chairman, Committee on the Judiciary
United States Senate
Washington, DC 20510-6275

Dear Mr. Chairman,

Thank you again for inviting me to testify at the Subcommittee on Intellectual Property hearing entitled "The State of Patent Eligibility in America: Part I." In response to your letter of June 12, 2019, below are my answers to the written questions of Senators Blumenthal and Hirono.

I. QUESTIONS FROM SENATOR BLUMENTHAL

1. Striking the appropriate balance between encouraging innovation and protecting consumers is a key goal of our patent system.

1a. What impact will broadening the subject matter that can be patented have on industry?

Historical and contemporary economic research suggest that the impact on industry will be mixed at best and likely detrimental to business and innovation.

Expanding the realm of patent eligibility will hinder downstream innovation, cutting off valuable lines of new business and research. As I discuss in section IV.A of my written testimony, the U.S. Patent and Trademark Office granted patents on human genes for years prior to *Ass'n for Molecular Pathology v. Myriad Genetics, Inc.*, 569 U.S. 576 (2013), a practice that was found to have led to numerous instances of researchers dropping projects or having their studies suppressed because of assertions of gene patents. Scientists and scientific organizations, from the National Research Council to the present director of the National Institutes of Health, have remarked on the harms to research and innovation that result from broad patents on natural phenomena like genes.

There is limited merit to the countervailing theory that broader patent eligibility will act as an incentive for firms to engage in research or innovation. As I explain in section IV.B of my written testimony, researchers are not motivated to do research because of the possibility of obtaining broad patent coverage on their discoveries. Among other harms, patents on natural phenomena such as genes led to harmful and costly "patent races" in which scientists were pressured to copy each other, wage denigratory press battles, and engage in other detrimental behavior.

Economic research further confirms that innovation is not increased by the sorts of patents the proposed legislation allows. Studies discussed in section V.B of my testimony show that the Supreme Court's recent decisions limiting patent eligibility have not noticeably affected investment or innovation in the medical diagnostics space. Similarly, the Federal Circuit's relaxing of restrictions on software-implemented business method patenting in the 1990s caused no change in the rate of growth in that industry, rebutting the assumption that increased patent eligibility drives growth. I have attached an appendix demonstrating this fact.

None of this is to say that patents as a general matter are contrary to the development of industries. Well-drawn patents on specific inventive creations of human genius have great value to both their owners and the public. But patents primarily covering abstract ideas, natural laws, and natural phenomena are categorically different. History has shown such patents to be unhelpful and harmful to industry.

1b. What impact will broadening the subject matter that can be patented have on consumers?

Broadening patent eligibility, as the draft legislation will do, will raise drug prices, delay the development of lifesaving treatments, prevent patients from obtaining vital second opinions, and subject Americans to subpar health care. My written testimony explains each of these points in detail in Section III.

1c. Could the proposed reforms increase consumer prices? If so, in what industries or on what products?

The proposed legislation could increase consumer prices in all fields, but most notably for medical treatments. As I discuss in section III.A of my written testimony, broad patents on natural discoveries or diagnostic correlations will likely become a primary strategy for "evergreening" or "patent thicketing," practices that artificially extend the effective length of patent protection. Although that strategy could be used in many industries including software and telecommunications, the pharmaceutical industry has exhibited the most willingness to use these patent strategies to prevent generic entry and price-saving competition. This is unsurprising given that a single day of patent term can be worth millions in that industry—$41 million per day for Lipitor for example, as I noted on page 8 of my written testimony.

II. QUESTIONS FROM SENATOR HIRONO

1. Last year, Judge Alan Lourie and Judge Pauline Newman of the Federal Circuit issued a concurring opinion to the court's denial of en banc rehearing in *Berkheimer v. HP Inc.*, in which they stated that "the law needs clarification by higher authority, perhaps by Congress, to work its way out of what so many in the innovation field consider are § 101 problems."

Do you agree with Judges Lourie and Newman? Does § 101 require a Congressional fix or should we let the courts continue to work things out?

I disagree that congressional intervention is absolutely necessary to clarify the law. For one thing, only two out of twelve voting Federal Circuit judges joined this remark calling for Congress to intervene, suggesting that ten judges of the Federal Circuit disagree. Furthermore, there is at least some reason to believe that specialized patent judges may "face unique bureaucratic pressures that incentivize lobbying by judges in ways that are harmful to the legal system," in particular a lack of incentive for generalist judges to push back. J. Jonas Anderson, *Judicial Lobbying*, 91 Wash. L. Rev. 401, 453 (2016) (citing Rochelle Cooper Dreyfuss, *The Federal Circuit: A Case Study in Specialized Courts*, 64 N.Y.U. L. Rev. 1, 5–7 (1989)); *see also Holmes Grp., Inc. v. Vornado Air Circulation Sys., Inc.*, 535 U.S. 826, 839 (2002) (Stevens, J., concurring) (expecting that generalist courts "will provide an antidote to the risk that the specialized court may develop an institutional bias."). Significant weight to this minority view of judges is unwarranted without further input from the judiciary.

Rather than focusing on the substantive eligibility law itself, Congress could facilitate the development of that law by encouraging faster and more decisions on the issue, for example by altering the procedure of adjudication under 35 U.S.C. § 101. But the more deliberate development of the law through cases is preferable to the disruption of industries that could result from dramatic substantive changes to patent law by statute.

2. The Federal Circuit rejected a "technological arts test" in its en banc *Bilski* opinion. It explained that "the terms 'technological arts' and 'technology' are both ambiguous and ever-changing." The draft legislation includes the requirement that an invention be in a "field of technology."

2a. Do you consider this a clear, understood term? If so, what does it mean for an invention to be in a "field of technology"?

No. I am not aware of relevant U.S. patent law that determines whether an invention is in a "field of technology." While *Alice Corp. Pty. Ltd. v. CLS Bank International* referred to "improvement in any other technology or technical field," 134 S. Ct. 2347, 2359 (2014) (citing *Diamond v. Diehr*, 450 U.S. 175, 177–78 (1981)), the Supreme Court did not define the term, and in any event the proposed legislation would abrogate that decision. While Article 21 of the TRIPS Agreement refers to availability of patents "in all fields of technology," it is unclear whether this phrase has received substantial interpretation abroad, and in any event the TRIPS provision relates to non-

discrimination among technologies, so its value for determining what constitutes a technology in the first place is limited.

Furthermore, I do not believe that the term will be made clear any time soon if the proposed legislation were enacted. Only a court will be able to adjudicate the meaning of the phrase, and most likely the first cases to adjudicate that statutory provision will be infringement cases based on patents issued under the proposed legislation as enacted. That litigation may be years down the road. Until then, hundreds or thousands of patents may issue from the U.S. Patent and Trademark Office without adequate examination due to a lack of judicial interpretation of the term.

Finally, even if there were a clear definition of "field of technology," it is still unclear what nexus must exist between the technology and the rest of the claim. The proposed legislation broadly requires no more than "utility in a field of technology," which could enable the following patents on clearly non-technological subject matter:

- A patent claim recites a business method performed "to produce a perceptible marking of graphite on a cellulose substrate." That certainly falls within the field of chemical technology, even though the aforementioned recitation is nothing more performing the business method with pencil on paper.
- A patent claim is directed to a children's method of swinging sideways on a swing. Swings are mechanical artifacts that fall within a field of technology, so the claimed method arguably has utility in that field.
- A patent is drawn to a particular recipe. Cooking causes chemical reactions and is thus in the field of chemical technology.
- A book of bedtime songs for children is claimed in a patent. The act of inducing sleep is a psychological and physiological phenomenon, and instruments that induce sleep are thus in a field of technology.

Clarification of that nexus is thus necessary as well.

2b. The European Union, China, and many other countries include some sort of "technology" requirement in their patent eligibility statutes. What can we learn from their experiences?

Scholars have observed that all major national patent systems include a requirement that patentable inventions be technological, and more importantly have statutory definitions, legislative or administrative guidance, or extensive case law to provide interpretive backing for what constitutes a "technology." *See, e.g.,* Kelvin W. Willoughby, *How Much Does Technology Really Matter in Patent Law? A Comparative Analysis of Doctrines of Appropriate Patentable Subject Matter in American and European Patent Law*, 18 Fed. Cir. B.J. 63 (2008).

The United States has almost exclusively relied on case law to define subject matter eligibility and thus to differentiate technological and non-technological inventions; it generally lacks

statutory or administrative instruction on that question. The proposed legislation's abrogation of all case law on subject matter eligibility would thus leave the United States the sole major jurisdiction where patent eligibility is unmoored from interpretive guidance on technology, at least for the years before the courts have a chance to catch up.

The proposed legislation could potentially copy or incorporate another nation's interpretive law on what constitutes a technology. However, I would caution that the United States patent system is not the system of other nations. Importing concepts such as technology requirements from other nations can only be done with careful attention to other patenting requirements in those nations.

2c. Is a claim that describes a method for hedging against the financial risk of price fluctuations—like the one at issue in the *Bilski* case—in a "field of technology"? What if the claim requires performing the method on a computer?

It is unclear whether this hypothetical claim is in a "field of technology," because the term is undefined and has no certain meaning. As a matter of dictionary definitions, financial methods could be considered a technology; indeed "FinTech," or "financial technology," is a popular field of development today. On the other hand, business methods have traditionally been considered non-technological. This uncertainty highlights the ambiguity inherent in providing no definition for the term "field of technology."

Properly defined, the term should not encompass this claim. As explained in the attached appendix, business method patents did not contribute to growth in the software industry and arguably harmed such growth. Thus, as a policy matter, it would be better for "field of technology" to be defined to exclude financial transactions.

If the claim recited performance on a computer, it arguably would fall within the proposed legislation's "field of technology" requirement. As noted above, the technology could be a wholly insignificant part of the claimed invention. Indeed, if the hypothetical claim above were performed with pen and paper, it arguably would fall within a "field of technology" too since ink and paper are chemical technologies. The potential for such easy circumvention of the "field of technology" requirement is a serious flaw in the proposed legislation that needs to be corrected.

2d. What changes to the draft, if any, do you recommend to make the "field of technology" requirement more clear?

For the reasons I provided in my testimony and this letter, I do not believe that clarification of "field of technology" would make this bill workable; instead the Subcommittee should take a different approach altogether.

A good first step would be for the Subcommittee to call for a study of scientists on the subject of what should be patentable. The hearings featured very few representatives of this community, despite the fact that numerous scientists desire to weigh in on the subject, as the letter from

Prof. Harold Varmus and others indicated. Such a study would also be in line with historical precedent and congressional practice before making substantial changes to the patent laws.

3. Sen. Tillis and Sen. Coons have made clear that genes as they exist in the human body would not be patent eligible under their proposal.

Are there other things that Congress should make clear are not patent eligible? There are already statutes that prevent patents on tax strategies and human organisms. Are there other categories that should be excluded?

There are other categories that should be excluded, but it would be a bad approach to draft a statute that enumerates specific categories of ineligible subject matter.

As an initial matter, Senators Tillis and Coons have not made it clear that genes are ineligible under their proposal. Though they have stated that it is not their intent to enable patenting of genes, my testimony at section II explains why their intent is inconsistent with their text. I refer to the letter from Prof. Harold Varmus and other scientists to this Subcommittee for a further explanation of why the senators' claims are incorrect.

The fundamental aim of patent eligibility is to prevent floods of patents that harm innovation and the public welfare. When those limitations have failed, the consequences have been dramatic: A flood of software-based business method patents in the 1990s and onwards gave rise to masses of abusive litigation against small businesses; and a flood of human gene patents around the turn of the century that harmed and even killed patients, as I describe in my testimony.

Both of those patent floods were spawned by a breakthrough in science or technology—respectively, the rise of personal computing and advances in gene sequencing. It would be legislative hubris to imagine that a federal law could predict all future breakthroughs that might lead to the next patent flood. There are many mysteries of the human body, such as the composition of microflora in the gut or the physics of protein folding, that could lead to a patent landscape just as problematic as gene patents in the early 2000s. No statutory listing of specific categories could capture all those potential future discoveries.

The better approach would be to begin with the general premise that scientific discoveries of laws or products of nature, like abstract ideas, are not eligible for patenting, and then to bolster that premise to prevent clever draftsmanship in patent claims from overcoming the spirit of that premise. That approach would ensure that the law encompasses all present and future discoveries, rather than a closed list that quickly will go out of date.

4. I have heard complaints that courts do not consistently enforce Section 112 with respect to claims for inventions in the high tech space.

4a. Are these valid complaints?

These complaints are valid. The purpose of 35 U.S.C. § 112 is twofold: to ensure that patent claims are limited to inventions adequately disclosed as knowledge to the public, § 112(a), and to

guarantee that those claims clearly delineate the boundaries of the activity proscribed under the patent, § 112(b).

Yet experience in many fields of technology shows that the Federal Circuit's application of § 112 fails to live up to both aims. Multiple scholars find that patent disclosures do not provide useful scientific or technical knowledge. *See* W. Nicholson Price II, *Expired Patents, Trade Secrets, and Stymied Competition*, 92 Notre Dame L. Rev. 1611 (2017); Jeanne C. Fromer, *Patent Disclosure*, 94 Iowa L. Rev. 539 (2009); Lisa Larrimore Ouellette, *Do Patents Disclose Useful Information?*, 25 Harv. J.L. & Tech. 545 (2012). The Federal Circuit fails to police ambiguity in patent claims, despite a direct Supreme Court order to the contrary. *Compare Nautilus, Inc. v. Biosig Instruments, Inc.*, 134 S. Ct. 2120, 2130 (2014) (rejecting Federal Circuit's test for definiteness), *with* Jennifer Librach Nall, *New Test, Same Results: Indefiniteness After Biosig v. Nautilus*, Intell. Prop. & Tech. L.J., Sept. 2015, at 14, 16 (suggesting that the Federal Circuit "views the Supreme Court's new standard as not changing the Federal Circuit's law of indefiniteness considerably, if at all").

Furthermore, as I noted in my testimony, the Federal Circuit has observed that § 112(a) requires enablement of "the full scope of the claimed invention," but has failed to explain what "full scope" means outside the context of several idiosyncratic pharmaceutical patents. *See In re Wright*, 999 F.2d 1557, 1561 (Fed. Cir. 1993); *Ariad Pharm., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1350 (Fed. Cir. 2010). And, in the so-called "predictable arts" such as machines and software, the Federal Circuit has said that "a broad claim can be enabled by disclosure of a single embodiment," effectively discarding any "full scope" limitation in those fields. *Spectra-Physics, Inc. v. Coherent, Inc.*, 827 F.2d 1524, 1533 (Fed. Cir. 1987).

Thus, as I explained in Section VII of my written testimony, there are numerous improvements to § 112 that the Subcommittee ought to consider.

4b. Do the proposed changes to Section 112 adequately address those complaints and limit the scope of claims to what was actually invented?

No. The issues noted above relate to § 112(a) and § 112(b), but the proposed legislation only affects § 112(f), so it does nothing to address any of the above concerns.

4c. Are you concerned that the proposed changes will make it too easy for competitors to design around patent claims that use functional language?

I am not concerned, for at least the following reasons.

First, the proposed changes do not actually change the law, but rather merely codify the holding of *Williamson v. Citrix Online, LLC*, 792 F.3d 1339 (Fed. Cir. 2015). Hence, the proposed legislation makes design-arounds no easier for competitors than the current law does already.

Second, the proposed legislation on § 112(f) still guarantees reasonably broad scope for relevant patents. Under current law that the legislation would not change, an article may infringe a patent claim under § 112(f) if it is "an 'equivalent' under the doctrine of equivalents." *E.g., Kemco Sales, Inc. v. Control Papers Co., Inc.*, 208 F.3d 1352, 1364 (Fed. Cir. 2000).

Third, strategic patent practice already provides numerous ways for patent holders to mitigate competitor design-arounds, even with the proposed amendment in place. For one thing, an inventor wishing to avoid the limitations of an amended § 112(f) need only recite sufficient structure to avoid the amended section from taking effect. The inventor may also use continuation practice under 35 U.S.C. § 120 or reissue under 35 U.S.C. § 251 to obtain patents covering design-arounds after the fact. The inventor gets multiple bites at the apple under current law.

Having prosecuted patent applications for several years, I am confident that, for any competent patent lawyer, the proposed legislation would present no impediment to obtaining patents of appropriate breadth to stop competitors.

Finally, it should be noted that designing around a patent is often a desirable activity because the act of designing around a patent sparks new innovation. As the Federal Circuit has observed, designing around a patent "bring[s] a steady flow of innovations to the marketplace," which is "[o]ne of the benefits of a patent system" that "should not be discouraged." *State Indus., Inc. v. A.O. Smith Corp.*, 751 F.2d 1226, 1236 (Fed. Cir. 1985). "Designing around patents is, in fact, one of the ways in which the patent system works to the advantage of the public in promoting progress in the useful arts." *Slimfold Mfg. Co., Inc. v. Kinkead Indus., Inc.*, 932 F.2d 1453, 1457 (Fed. Cir. 1991). Thus, any fear that the proposed legislation will facilitate designing around patents ought to be mitigated by the fact that it can be good for innovation to encourage design-arounds.

5. There is an intense debate going on right now about what to do about the high cost of prescription drugs. One concern is that pharmaceutical companies are gaming the patent system by extending their patent terms through additional patents on minor changes to their drugs. My understanding is that the doctrine of obviousness-type double patenting is designed to prevent this very thing.

The Federal Circuit has explained that obviousness-type double patenting "is grounded in the text of the Patent Act" and specifically cited Section 101 for support.

Would the proposed changes to Section 101 and the additional provision abrogating cases establishing judicial exceptions to Section 101 do away with the doctrine of obviousness-type double patenting? If so, should the doctrine of obvious-type double patenting be codified?

As an initial matter, I would caution against the notion that obviousness-type double patenting "is designed to prevent" improper extension of patent exclusivity. The double patenting doctrine was developed in the 1960s to deal with a very different problem of patent law, and as such it complements, but does not supplant, other limitations of patentability, including 35 U.S.C. § 103 and § 101, to prevent gaming of the patent system.

That said, I agree that the obviousness-type double patenting doctrine should be codified, as I stated during the hearing. However, I would augment my answer to note that the double patenting doctrine is extraordinarily unsettled, so codifying it correctly would not be not a simple matter legislatively.

Among other things, legislation to codify obviousness-type double patenting would need to address the following questions:

- Whether the standard for obviousness-type double patenting should mirror the obviousness standard under § 103. The Federal Circuit has treated the two standards as "analogous" in the past, and also has treated them as unrelated.
- Whether a showing of obviousness-type double patenting requires a showing of motivation to modify one patent claim to be another. The Federal Circuit has answered this question in both the affirmative and the negative.
- Whether the disclosure text of the patent is relevant to obviousness-type double patenting. The Federal Circuit has said that it is not, but also has relied upon the disclosure to support double patenting rejections.

A fuller treatment of these unanswered questions may be found in Brief of the R Street Institute and Public Knowledge as *Amici Curiae* in Support of the Petition at 5–8, *Mylan Pharm. v. UCB, Inc.*, No. 18-692 (U.S. Dec. 21, 2018), https://www.supremecourt.gov/DocketPDF/18/18-692/77397/20181221151024017_brief-mylan-ucb-petition.pdf.

Codification of the obviousness-type double patenting doctrine would also need to consider the correctness of the rule that a terminal disclaimer of certain characteristics may overcome obviousness-type double patenting. That rule is entirely a judicial manufacture of the Federal Circuit's predecessor court without basis in statute. *See In re Robeson*, 331 F.2d 610, 615 (C.C.P.A. 1964). It was developed prior to patent thicketing being common and arguably exacerbates this practice by allowing pharmaceutical firms to build up walls of patents that are exceptionally costly to litigate. It is thus unclear whether the terminal disclaimer doctrine is advisable today.

6. In its *Oil States* decision, the Supreme Court explicitly avoided answering the question of whether a patent is property for purposes of the Due Process Clause or the Takings Clause.

What are the Due Process and Takings implications of changing Section 101 and applying it retroactively to already-issued patents?

I will defer to the answers to this question provided by Profs. Sarnoff and Gugliuzza, with the following additional note.

In determining the takings or due process consequences of retroactively changing § 101, the question left open in *Oil States Energy Services, LLC v. Greene's Energy Group, LLC*, 138 S. Ct. 1365 (2018), is arguably irrelevant. The effect of retroactivity would be that numerous patents previously deemed invalid would return to force. But American businesses and innovators have reliance interests in the invalidations of those patents, having made investments and sunk business costs into enterprises on the assumption that they were free to do so without fear of those invalidated patents. Retroactivity of § 101 legislation would negate those reliance-based investments and devalue those business enterprises by reopening them to the risk of patent litigation.

It is best left to the constitutional law experts to determine whether the revival of patent rights after businesses have made investments in reliance on invalidity constitutes "interference with reasonable investment-backed expectations" of those businesses under the Takings Clause. *Ruckelshaus v. Monsanto Co.*, 467 U.S. 986, 1005 (1984) (citing *PruneYard Shopping Ctr. v. Robins*, 447 U.S. 74, 83 (1980)). But the larger and more important point is that the consequences of retroactivity on those other than patent holders are critical to evaluating the propriety of § 101 legislation.

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Thank you again for the opportunity to answer these questions and to testify at the hearing. If you have any further questions, please feel free to contact me.

Sincerely,

Charles Duan

APPENDIX: EFFECT OF BUSINESS METHOD PATENTS ON INDUSTRY[1]

The evidence shows that patents directed to software-implemented business methods, particularly the kind questionable under § 101, have "made little contribution to innovation." Cong. Budget Office, *Federal Policies and Innovation* 33 (2014), https://www.cbo.gov/publication/49487. First, the empirical evidence shows no correlation between the rise of software patenting and software industry growth. Second, many software companies are actually harmed by the proliferation of vague, overbroad software patents. Third, industry participants, particularly startup entrepreneurs and venture capitalists, do not rely on patents for competitive success.

This is not to say that software patents are categorically problematic; many advances in artificial intelligence, cryptography, and other highly technical fields of computer science are valuable for patenting and indeed are eligible for patenting under § 101. The focus of the following discussion is on patents primarily directed to software-implemented business methods or other non-technological uses of computers.

III. SOFTWARE PATENTS DO NOT CORRELATE WITH, MUCH LESS CAUSE, SOFTWARE INDUSTRY GROWTH

Empirical evidence shows that software patents did not accelerate the growth of the software industry.

Software has not been considered eligible for patenting from the inception of the software industry itself. Indeed, it was years after software had become a major phenomenon that the Federal Circuit declared software to be within the realm of patentable subject matter.

Early decisions of the Supreme Court from the 1970s suggested that software was not eligible for patenting under § 101. *See Gottschalk v. Benson*, 409 U.S. 63, 64, 72 (1972); *Parker v. Flook*, 437 U.S. 584, 586 (1978).[2] It was not until the 1990s that software was first recognized to be eligible subject matter. *See In re Alappat*, 33 F.3d 1526, 1545 (Fed. Cir. 1994); *State St. Bank & Trust Co. v. Signature Fin. Grp., Inc.*, 149 F.3d 1368, 1373 (Fed. Cir. 1998).

Thus, though the software industry itself dates back to at least the time of *Benson*, the full eligibility of software went unrecognized until at least a quarter century later, in *State Street*. *See, e.g.,* U.S. Gov't Accountability Office, *GAO-13-465*, *Intellectual Property: Assessing Factors that Affect Patent Infringement Litigation Could Help Improve Patent Quality* 13 (2013), http://www.gao.gov/assets/660/657103.pdf. The late 1990s thus marked the growth of patenting of software. *See id.*

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[1] This appendix is adapted from Brief of Public Knowledge and the Electronic Frontier Foundation as *Amici Curiae* in Support of Defendants-Appellees, *McRO, Inc. v. Bandai Namco Games Am. Inc.*, 837 F.3d 1299 (Fed. Cir. June 19, 2015) (No. 15-1080), https://www.publicknowledge.org/documents/amicus-brief-mcro-v-bandai, which I co-authored with Vera Ranieri.

[2] *Cf. Diamond v. Diehr*, 450 U.S. 175, 184 (1981) (holding eligible a software process tied to "transformation of an article," namely curing rubber, rather than software purely run on a general purpose computer).

If software patents are a significant driver of innovation and growth in the software industry, then one would expect at least a correlation between this late-1990s rise in software patenting and metrics of industry growth. The facts reveal the opposite.

A comprehensive industry survey reviewed the growth of the software industry based on user expenditures on software. Martin Campbell-Kelly, *From Airline Reservations to Sonic the Hedgehog: A History of the Software Industry* 16 fig.1.2 (2003). The software market began its rapid increase in the early 1980s, doubling about every six years to being a $60 billion industry in 1994, when *Alappat* was decided. Subsequent to then, the software industry grew at exactly the same rate, doubling again in 2000—six years later.

Thus, software patenting was not necessary for the software industry to grow to enormous magnitude, and even after software was declared patentable, there was no increase in industry growth rate. *See also* Cong. Budget Office, *supra*, at 33–34 (finding that growth in economic productivity was unchanged even as software patenting activity grew dramatically). Simply put, the change in patentability of software had no effect on the industry.

Studies of the economics of software patents reveal their minimal value to industry. One study considered the relationship between software patent applications and investment funding to see if patents tended to facilitate investment. *See* Iain M. Cockburn & Megan MacGarvie, *Patents, Thickets, and the Financing of Early-Stage Firms: Evidence From the Software Industry* 42 (Nat'l Bureau of Econ. Research, Working Paper No. 13644, 2007), http://www.nber.org/papers/w13644.pdf. But the study actually found that "the causality between funding and patent applications runs in the opposite direction." *Id.* at 43. The authors specifically hypothesized that startups file for patent protection *after* receiving investments, either because the investors demand patents or because the influx of cash supports the costs of filing, *See id.* Another study trying to trace the relationship between software patenting and investment concludes that it is not possible to "distinguish between the possibility that patents facilitate progress through the investment cycle and the possibility that progress through the investment cycle facilitates the firms ability to acquire patents." Ronald J. Mann & Thomas W. Sager, *Patents, Venture Capital, and Software Start-Ups*, 36 Res. Pol'y 193, 199 (2007). The strongest conclusion the paper reaches is "an ambiguous link between patenting and investment progress." *Id.*

IV. EVIDENCE SHOWS THAT THE SOFTWARE INDUSTRY IS ACTUALLY HARMED BY THE GROWTH IN OVERBROAD SOFTWARE PATENTS

There is also substantial evidence that the rush to obtain software patents, and particularly overbroad, abstract software patents, has actually *hurt* the industry.

Software patent assertion particularly targets small companies. Small startups make up at least 55% of the lawsuit targets of patent assertion entities, and nearly 75% of venture capitalists have had their portfolios impacted by such litigation. Colleen Chien, *Startups and Patent Trolls*, 17 Stan. Tech. L. Rev. 461, 471 (2014), http://stlr.stanford.edu/pdf/startupsandpatenttrolls.pdf; *see also* James Bessen & Michael J. Meurer, Essay, *The Direct Costs from NPE Disputes*, 99 Cornell L. Rev. 387, 398 (2014), http://cornelllawreview.org/files/2014/01/99CLR387.pdf. Much of this

litigation, at least 60% by one count, involved software patents. Chien, *supra*, at 464 & n.6; U.S. Gov't Accountability Office, *supra*, at 21 & fig.5.

Disturbingly, this software patent assertion activity reduces productive innovation and development. One survey found that startups have been forced to exit business lines, drop products, or delay hiring. Chien, *supra*, at 474–75. The survey further found that investors saw patent demands as a "death knell" for startups and would refuse to invest in targeted companies, lest their investments be "bled to patent trolls." *Id.* at 474.

Even more troublingly, the patents that are decimating these companies represent no real innovation that is being copied; the asserted patents frequently are overbroad attempts to cover basic ideas. Modern patent cases rarely involve copying. *See* Christopher A. Cotropia & Mark A. Lemley, *Copying in Patent Law*, 87 N.C. L. Rev. 1421, 1423 (2009). Instead, the patents being asserted increasingly involve basic technologies or simple ideas, as demonstrated by the recent spate of invalidations under § 101. *See, e.g., Eclipse IP LLC v. McKinley Equip. Corp.*, No. 14-154, 2014 WL 4407592, at *8–9 (C.D. Cal. Sept. 4, 2014) (invalidating patent directed to asking multiple people to complete a task). Even if only a small fraction of the patents asserted against startups were improperly granted, each assertion of those invalid patents is a harm to industry and a loss to society.

V. SOFTWARE INDUSTRY MEMBERS, PARTICULARLY STARTUPS AND VENTURE CAPITALISTS, DO NOT FIND THAT PATENTS DRIVE INNOVATION

Software patenting by technologists is actually fairly rare outside of a few firms. Numerous empirical surveys report that only a small minority of software firms seek patent protection.[3] Researchers acknowledge that, in the information sector, only 10% of companies found utility patents important, and only 16% of new technology firms file for patents. John E. Jankowski, Nat'l Sci. Found., *InfoBrief No. 12-307*, *Business Use of Intellectual Property Protection Documented in NSF Survey* 3–4 (2012), http://nsf.gov/statistics/infbrief/nsf12307/; Cockburn & MacGarvie, *supra*, at 43.

Small startup companies are particularly unlikely to obtain patents, because software venture capitalists find patenting to be not a valuable use of resources, as myriad thought leaders in the industry agree.[4] As one survey of "lawyers, investors, and startups" found, "almost every-

[3] *See* James Bessen, *A Generation of Software Patents*, 18 B.U. J. Sci. & Tech. L. 241, 257 (2009) (finding that "most software firms still do not patent"); Robert M. Hunt & James Bessen, *The Software Patent Experiment*, Bus. Rev. (Fed. Reserve Bank of Phila.), Q3 2004, at 22, 25, https://www.philadelphiafed.org/research-and-data/publications/business-review/2004/q3/brq304rh.pdf; Ronald J. Mann, *Do Patents Facilitate Financing in the Software Industry?*, 83 Tex. L. Rev. 961, 980–85 (2005); Stuart J.H. Graham et al., *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey*, 24 Berkeley Tech. L.J. 1255, 1277 (2009).

[4] *See* Elon Musk, *All Our Patent Are Belong To You*, Tesla Motors Blog (June 12, 2014), http://www.teslamotors.com/blog/all-our-patent-are-belong-you ("Technology leadership is not defined by patents, which history has repeatedly shown to be small protection indeed against a determined competitor, but rather by the ability of a company to attract and motivate the world's most talented engineers."); Brad Burnham & Jason Mendelson, *Need Patent Reform to Drive Innovation Again*, The Hill (Apr. 7, 2015), http://thehill.com/blogs/congress-blog/

one agreed that while patents are relevant, they are not the top priorities for startup growth"; the survey concluded that "patents are more of a luxury (but not a necessity) in this industry." Celia Lerman, Patent Strategies of Technology Startups: An Empirical Study 34, 21 (May 25, 2015) (unpublished manuscript), http://ssrn.com/abstract=2610433.

To those familiar with the industry, it is not actually surprising that such an innovative community has so little need for patents. Software entrepreneurs have other, stronger, incentives for innovation. In a survey of software entrepreneurs on what factors were important to a company's "ability to capture competitive advantage," patents ranked *dead last*, with other incentives such as those described below taking the lead. *See* Stuart J.H. Graham et al., *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey*, 24 Berkeley Tech. L.J. 1255, 1290 fig.1 (2009).

Among the strongest non-patent incentives for rapid innovation are the first mover advantage and network effects, by which initial traction in market share can draw in further customers by virtue of the value of the existing customer base. *See, e.g.,* Michael Katz & Carl Shapiro, *Antitrust in Software Markets*, *in Competition, Innovation and the Microsoft Monopoly* 29, 32–34 (Jeffrey A. Eisenach & Thomas M. Lenard eds., 1999); Mark A. Lemley & David McGowan, *Legal Implications of Network Economic Effects*, 86 Cal. L. Rev. 479 (1998). Indeed, network effects can create such a lock-in for consumers that Microsoft was actually prosecuted for antitrust violations due to the power of those network effects. *See United States v. Microsoft Corp.*, 84 F. Supp. 2d 9, 27 (D.D.C. 1999); *see also* Lemley & McGowan, *supra*, at 500–05. The artificial monopoly of a patent pales in comparison to the natural monopoly of an early customer base.

Complementary assets, the ancillary products and services that software developers can provide, are a further driver of industry growth. Such complementary assets include integration, customization, and other types of services. And they are valuable: for example, 57% of IBM's $99.87 billion in revenues in 2010 came from such services, more than double the revenue of its

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technology/237997-need-patent-reform-to-drive-innovation-again (two venture capitalists, one the co-chair of the National Venture Captial Association's general counsels group, asserting that "despite all of the patent assertions we have seen, we have yet to see a single instance of a legitimate company using the patent system to protect a novel invention"); Greg Blonder, *Cutting Through the Patent Thicket*, Bloomberg Bus. (Dec. 19, 2005), http://www.bloomberg.com/bw/stories/2005-12-19/cutting-through-the-patent-thicket ("[A]s a venture capitalist, I have come to the conclusion that protecting intellectual property (IP) with today's patents is virtually worthless . . . ."); Letter from Donald E. Knuth, Professor, Stanford Univ., to Comm'r of Patents & Trademarks (Feb. 23, 1994), https://archive.org/details/DonaldKnuthLetterAgainstSoftwarePatents (renowned computer science professor describing "considerable anxiety throughout the community of practicing computer scientists" that issuance of software patents is "making life much more difficult for programmers"); Paul Graham, *Are Software Patents Evil?* (Mar. 2006), http://www.paulgraham.com/softwarepatents.html (founder of startup incubator Y Combinator observing that "when one looks closely at the software business, the most striking thing is how little patents seem to matter"); Ben Klemens, *Math You Can't Use* 159 (2006) ("There is also abundant evidence that the software market would not collapse or stagnate without software patents."); Rob Pegoraro, *Ask A Startup About Patents. You Might Get An Interesting Answer*, Disruptive Competition Project (May 31, 2013), http://www.project-disco.org/intellectual-property/053113-ask-a-startup-about-patents-you-might-get-an-interesting-answer/ ("When [startups are] raising $50,000 to pay for ramen and hosting services and their desks, $15,000 doesn't have to go to intellectual property." (quoting Jonathon Perrelli, managing director of Fortify Ventures)).

software sales and more than triple that of its computer system sales. Int'l Bus. Machs. Corp., Annual Report (Form 10-K), at 25–26 (Feb. 22, 2011), http://www.ibm.com/investor/att/pdf/2010_10-K.pdf. *See generally* Michael Cusumano, *The Business of Software: What Every Manager, Programmer, and Entrepreneur Must Know to Thrive in Good Times and Bad* 273–74 (2004) (emphasizing the importance of services as a supplement to software sales).

Other factors are also relevant. Agile software startups value their ability to "pivot" quickly into new fields to meet unexpected customer demand; such agility is in principle contrary to the long application and assertion cycle of patents. *See* Eric Ries, *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses* 149 (2011). Rewards, both monetary and reputational, drive further innovation. *See* Daniel J. Hemel & Lisa Larrimore Ouellette, *Beyond the Patents—Prizes Debate*, 92 Tex. L. Rev. 303 (2013), http://www.texaslrev.com/wp-content/uploads/HemelOuellette.pdf; Joseph Stiglitz, *Give Prizes Not Patents*, New Scientist, Sept. 16, 2006, at 21, http://www2.gsb.columbia.edu/faculty/jstiglitz/download/2006_New_Scientist.pdf; Eric S. Raymond, *The Cathedral and the Bazaar: Musings on Linux and Open Source by an Accidental Revolutionary* 43 (rev. ed. 2001). *See generally* Charles Duan, *A Five Part Plan for Patent Reform* ch. 3 (2014), https://www.publicknowledge.org/documents/a-five-part-plan-for-patent-reform.

"Innovation is such a vastly different endeavour—in terms of investment, time and the human resources required—as to be virtually unrelated" to patenting.[5] As a former director of the U.S. Patent and Trademark Office similarly said, "Patents are not the only drivers of innovation."[6] The foregoing evidence shows that expanding patent eligibility to reach broad, abstract software concepts would not help, and would likely harm, the software industry.

[5] *Obituary for Software Patents*, The Economist, Dec. 13, 2013, http://www.economist.com/blogs/babbage/2013/12/difference-engine-0.

[6] Michelle K. Lee, Deputy Under Sec'y of Commerce for Intellectual Prop., *Speaking Truth to Patents: The Case for a Better Patent System, Remarks at Stanford Law School* (June 26, 2014), http://www.uspto.gov/about-us/news-updates/speaking-truth-patents-case-better-patent-system.