

Bowman's Beanstalk: Patent Exhaustion in Self-Replicating Technologies

ABSTRACT

The breakneck speed of innovation has once again brought uncertainty to the realm of patent law in the form of self-replicating technologies. Traditionally, the doctrine of patent exhaustion has provided a balance between the monopolistic powers of the patent holder and the consumer's freedom to utilize a purchased product without future interference. The rights holder receives compensation from the initial sale and retains the right to make and sell additional goods, while the consumer may use or resell their particular article without concern for additional fees or payments. Self-replicating technology blurs this line because a consumer's use inherently includes the making of additional identical products.

*This Note explores this issue against the backdrop of *Monsanto v. Bowman*, a genetically modified seed case that has reached the US Supreme Court. This Note argues that the Federal Circuit reached the correct conclusion; however, its reasoning relied overmuch on previous precedent and failed to adequately address the issues specific to this technology or those raised by recent Supreme Court decisions. This Note next explores the similarities between biotechnology and software systems—particularly the phenomenon of incidental copies—and the latter's protection under copyright in search of applying a similar solution in patent law. Unable to find such a solution, this Note concludes that requiring licenses for both the "right to use" and the "right to make" for self-replicating technologies ensures the best possible balance between the patentee and consumer and supports the underlying policies of promoting innovation and competition.*

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Once the subject of “grey goo,”¹ apocalyptic scenarios, and science-fiction theories, human-engineered self-replicating technologies have arrived.² Computer scientists and biotechnology engineers have created self-replicating nano-bots and bacteria specifically engineered to clean up oil spills.³ Seeds are perhaps the

1. See ERIC DREXLER, ENGINES OF CREATION: THE COMING ERA OF NANOTECHNOLOGY 172–73 (1987) (referencing a hypothetical apocalyptic scenario in which out-of-control molecular nanotechnology consumes all matter on Earth in the pursuit of continuous self-replication).

2. See, e.g., Kevin C. Tofel, *MIT: We're One Step Closer to Self-Replicating Objects*, GIGAOM (Apr. 3 2012, 7:47 AM), <http://gigaom.com/2012/04/03/mit-were-one-step-closer-to-self-replicating-objects>.

3. See *Diamond v. Chakrabarty*, 447 U.S. 303, 305 (1980); Andrew B. Cushing et al., *An Autonomous Self-Replicating Robotic System*, PROC. 2003 IEEE/ASME INT'L CONF. ADVANCED INTELLIGENT MECHANICS 137, 141 (2003); Sean Dodson, *The Machine That Copies Itself*, GUARDIAN (July 2, 2008), <http://www.guardian.co.uk/technology/2008/jul/03/copy.machine>.

most classic example of reproductive technology. They now incorporate genetic modifications designed to immunize the plants against herbicides and allow for greater yields in harsh climates.⁴

Development of reproductive technologies, such as seeds, has not come without cost; thus, the companies that invest in such technologies seek to protect the fruits of their efforts.⁵ For example, Monsanto, an international agribusiness, spends close to \$1 billion per year on research and development of genetically engineered crops.⁶ Specifically, Monsanto produces a variety of seeds imbued with genetic modifications targeted to resist damage from Monsanto's accompanying herbicides.⁷ Monsanto licenses its technology to intermediaries that manufacture and sell the patented seeds to farmers.⁸ In efforts to protect against widespread unauthorized dissemination of these seeds, Monsanto requires single-use licenses and restricts farmers from saving any seeds for replanting.⁹ The strategy has led to widespread litigation, particularly concerning patent exhaustion.¹⁰

reprint; Orion Jones, *MIT Builds Self-Replicating Machines*, BIG THINK (Apr. 5, 2012, 1:15 PM), <http://bigthink.com/ideafeed/mit-builds-self-replicating-machines>.

4. See *Focus on Yields Biotech Crops: Evidence, Outcomes and Impacts 1996–2007*, PG ECON., 2–4 (Oct. 2009), <http://www.pgeconomics.co.uk/pdf/focusonyieldeffects2009.pdf>; *More Beans Per Pod, More Bushels Per Acre*, MONSANTO (June 24, 2010), [http://rea-hybrids.com/assets/files/GEN_RR2Y_ProductFlier_062410\[1\].pdf](http://rea-hybrids.com/assets/files/GEN_RR2Y_ProductFlier_062410[1].pdf)

5. See *Why Does Monsanto Sue Farmers Who Save Seeds?*, MONSANTO, <http://www.monsanto.com/newsviews/Pages/why-does-monsanto-sue-farmers-who-save-seeds.aspx> (last visited Jan. 27, 2013) (“Monsanto invests more than \$2.6 million per day in research and development that ultimately benefits farmers and consumers. . . . [T]he loss of this revenue would hinder [the] ability to invest in research and development to create new products . . .”).

6. See *Corporate Profile*, MONSANTO, <http://www.monsanto.com/investors/pages/corporate-profile.aspx> (last visited Jan. 27, 2013).

7. See *U.S. Technology Use Guide*, MONSANTO, 17–25 (2013), <http://www.monsanto.com/SiteCollectionDocuments/Technology-Use-Guide.pdf> (explaining techniques for utilizing Roundup Ready technology in soybeans as well as alfalfa, canola, sugarbeets, and corn).

8. *Monsanto Co. v. Bowman*, 657 F.3d 1341, 1344 (Fed. Cir. 2011), *cert. granted*, 133 S. Ct. 420 (2012).

9. See *id.* at 1344–45. Farmer activist websites have begun posting these agreements on the Internet to inform others and stimulate discussion. See, e.g., *2011 Monsanto Technology/Stewardship Agreement (Limited Use License)*, THE FARMER'S LIFE, http://thefarmerslife.files.wordpress.com/2012/02/scan_doc0004.pdf (last visited Jan. 27, 2013); *2009 Monsanto Technology/Stewardship Agreement (Limited Use License)*, AGRIC. DEF. COALITION, http://www.agriculturedefensecoalition.org/sites/default/files/file/agriculture_57/57S%202011%20Monsanto%20Liability%20Agreement%20for%20Those%20Using%20GE%20Seeds+Crops.pdf (last visited Jan. 27, 2013).

10. See Kevin E. Noonan, *Patent Exhaustion Does Not Apply to Genetically Engineered Seed*, PATENT DOCS (Sept. 22, 2011, 11:59 PM), <http://www.patentdocs.org/2011/09/monsanto-co-v-bowman-fed-cir-2011.html> (“As it had in *Monsanto Co. v. McFarling*, *Monsanto Co. v. David*, and *Monsanto Co. v. Scruggs*, the Court in *Monsanto Co. v. Bowman* rejected defendant's argument, here that Monsanto's infringement action should be dismissed under the doctrine of patent exhaustion.”); see also Bernard Chao, *Non-Public Litigation: The Hidden Story of*

Established to serve as a limit on patent rights, the doctrine of patent exhaustion has caused confusion and debate when applied to self-replicating technologies.¹¹ The doctrine holds that the authorized sale of an article embodying the patent exhausts the patent holder's rights in that object.¹² In other words, the buyer has the freedom to use and resell the article as it chooses, but the patentee retains the right to restrict others from creating copies.¹³ With self-replicating technologies like seeds, however, using and making copies of the invention are the same. Farmers who have purchased the patented seeds contend that Monsanto has exhausted its patent rights and that those farmers are free to replant the second, third, or *n*th generation of crops.¹⁴ Monsanto, however, contends that its right to restrict reproduction extends independently to each generation of seeds, a position that has led to continuous litigation over the past decade.¹⁵ In each case regarding Monsanto's seeds, the US Court of Appeals for the Federal Circuit has rejected the farmers' arguments for patent exhaustion, and Monsanto has prevailed.¹⁶

Recent developments have further complicated the matter.¹⁷ The Supreme Court in *Quanta Computer, Inc. v. LG Electronics, Inc.* recently reaffirmed that the sale of an article that "substantially embodies" the patent at issue triggers the patent exhaustion doctrine.¹⁸ Specifically, the sale of an article whose only reasonable and expected use includes practicing the patent exhausts the patent

Monsanto v. DuPont, PATENTLY-O BLOG (Aug. 11, 2012, 7:57 AM), <http://www.patentlyo.com/patent/2012/08/non-public-litigation-the-hidden-story-of-monsanto-v-dupont.html> (describing a \$1 billion patent infringement judgment to Monsanto, despite not a single seed being sold).

11. See Douglas Fretty, Note, *Both a License and a Sale: How to Reconcile Self-Replicating Technology with Patent Exhaustion*, 5 J. BUS., ENTREPRENEURSHIP & L. 1, 2 (2011) ("Patent exhaustion, the rule that a patentee loses rights in a patent-practicing good upon its authorized sale to a consumer, is tormented by uncertainty when the good can self-replicate.").

12. See *United States v. Univis Lens Co.*, 316 U.S. 241, 250 (1942); *Adams v. Burke*, 84 U.S. 453, 455 (1873).

13. See *Univis*, 316 U.S. at 250; *Adams*, 84 U.S. at 455.

14. See *Monsanto Co. v. Scruggs*, 459 F.3d 1328, 1334 (Fed. Cir. 2006); *Monsanto Co. v. McFarling*, 302 F.3d 1291, 1298 (Fed. Cir. 2002); see also *Monsanto Co. v. David*, 516 F.3d 1009, 1014 (Fed. Cir. 2008) ("David's real complaint seems to be that he should be able to save seed from his harvest, regardless of Monsanto's patent.").

15. *Monsanto Co. v. Bowman*, 657 F.3d 1341, 1347 (Fed. Cir. 2011), cert. granted, 133 S. Ct. 420 (2012); see generally *supra* note 10 (listing several lawsuits involving Monsanto and seed patents).

16. See Noonan, *supra* note 10. **Error! Hyperlink reference not valid.**

17. See Tod Michael Leaven, Note, *The Misinterpretation of the Patent Exhaustion Doctrine and the Transgenic Seed Industry in Light of Quanta v. LG Electronics*, 10 N.C. J.L. & TECH. 119, 122 (2008) (suggesting that *Quanta's* ruling removes "uniform patent law remedies for enforcement of post-sale restrictions").

18. *Quanta Computer, Inc. v. LG Elecs., Inc.*, 553 U.S. 617, 638 (2008).

holder's rights to restrict that use.¹⁹ The Court's holding in *Quanta* notwithstanding, when faced with a similar seed case in *Monsanto Co. v. Bowman*, the Federal Circuit relied primarily on its pre-*Quanta* precedent and again found for the agribusiness.²⁰ The case now finds itself before the Supreme Court to reconcile the competing case law.²¹

Part I of this Note describes the nature of self-replicating technology and discusses the characteristics of Monsanto's seed patents that are relevant to patent exhaustion. Part II explains the doctrine of patent exhaustion and expounds upon Monsanto's pre-*Quanta* seed cases, which encourage a bright-line rule for *n*th-generation patent protection,²² and the *Quanta* case, which suggests a more robust patent exhaustion doctrine.²³ Part III discusses the *Bowman* case and examines the underlying facts and rationale for the Federal Circuit's ruling.²⁴ Part IV first analyzes the Federal Circuit's opinion and the separability of patent rights and then considers importing solutions and rationales from copyright law's more mature legal structures governing incidental copies and self-replication. Part V contends that relying on contract law in lieu of patent rights ultimately fails to address the issue and that only explicit licenses are capable of authorizing the reproduction of self-replicating technology. Part VI concludes that explicit licenses to make self-replicating technology provide the optimal balance of equities, and only the patent holders have the right to grant such a license.

I. SELF-REPLICATING TECHNOLOGY: THE NEW FRONTIER

Self-replicating technology—in the form of selective breeding and cross-pollination—has been part of agriculture for centuries.²⁵

19. *Id.* at 618, 631.

20. *Bowman*, 657 F.3d at 1349.

21. *Bowman v. Monsanto Co.*, 133 S. Ct. 420 (2012).

22. *See Bowman*, 657 F.3d at 1347 (“Monsanto argues that, even if there was exhaustion with respect to commodity seeds, *Bowman* is nevertheless liable for infringement by planting those seeds because patent protection ‘is independently applicable to *each* generation of soybeans (or other crops) that contains the patented trait.”); *see also Monsanto Co. v. Scruggs*, 459 F.3d 1328, 1336 (Fed. Cir. 2006); *Monsanto Co. v. McFarling*, 302 F.3d 1291, 1299 (Fed. Cir. 2002).

23. *See Bowman*, 657 F.3d at 1346 (“*Bowman* urges the court to hold, under *Quanta*, that each seed sold is a ‘substantial embodiment’ of all later generations, thus adopting a ‘robust’ exhaustion doctrine that encompasses the progeny of seeds and other self-replicating biotechnologies.” (citation omitted)).

24. *Id.* at 1348 (explaining that growing the next generation of seeds produces “newly infringing article[s]”).

25. *See Loren H. Rieseberg & Shanna E. Carney, Tansley Review No. 102 Plant Hybridization*, 140 NEW PHYTOLOGIST 599, 600 (1998) (“Hybridization has been important to

Yet only recently have scientists moved beyond products of nature and into the realm of man-made inventions.²⁶ Modern technology and advances in genetics have allowed scientists to create fusions not possible in the natural world, including plants and animals better tailored to the needs of our society.²⁷ Once established, these specially tailored beneficial traits will pass on and multiply with each successive generation.²⁸ The complications of such exponential dissemination have placed the simple seed, a self-replicating technology that is millennia old, at the forefront of the patent exhaustion debate.²⁹

A. Monsanto Roundup Ready Soy Beans

The introduction of sexually reproducing plants as patentable subject matter led to a flood of plant patents, including Monsanto's own Roundup Ready soybeans.³⁰ The seeds' development centered on a resistance to Roundup and other glyphosate-based herbicides.³¹ The seeds include two primary patents—the '605 Patent for "chimeric genes for transforming plant cells using viral promoters" and the '274E Patent that uses the viral promoters described in the '605 Patent to encode the gene sequence with a glyphosate-tolerant enzyme.³² These genetic traits allow farmers who use Monsanto's seeds to treat their fields with Monsanto's Roundup herbicide without

humans since the Neolithic era when the domestication and breeding of plants and animals began." (citing C. ZIRKLE, *THE BEGINNINGS OF PLANT HYBRIDIZATION* (1935)).

26. See, e.g., *Diamond v. Chakrabarty*, 447 U.S. 303, 303 (1980).

27. See PAUL F. LURQUIN, *THE GREEN PHOENIX: A HISTORY OF GENETICALLY MODIFIED PLANTS* 1 (2001) ("Transgenic plants have been a reality since 1983."); FELICIA WU & WILLIAM P. BUTZ, *THE FUTURE OF GENETICALLY MODIFIED CROPS: LESSONS FROM THE GREEN REVOLUTION* 41–42 (2004) (listing benefits such as herbicide and pesticide resistance, as well as "changing the [crop's] fat and acid composition . . . , conferring resistance to viral infection . . . , and delaying time to ripeness to allow for longer transportation time and shelf life").

28. See *Bowman*, 657 F.3d at 1345 ("[T]he patented Roundup Ready genetic trait carries forward into each successive seed generation.").

29. See *id.* at 1343 (stating plaintiff's argument "that Monsanto's patent rights are exhausted with respect to all Roundup Ready soybean seeds").

30. *Id.* at 1343 ("The '605 and '247E Patents cover different aspects of this Roundup Ready technology."); see *J.E.M. Ag Supply, Inc. v. Pioneer Hi-Bred Int'l, Inc.*, 534 U.S. 124, 138, 145 (2001) (holding sexually reproduced plants fall within the patentable subject matter of § 101); ETC Grp., *Surge in Corporate Patents on "Climate-Ready" Crops Threaten Biodiversity and Signal Grab on Land and Biomass*, ETC GROUP (Oct. 25, 2010), http://www.etcgroup.org/sites/www.etcgroup.org/files/publication/pdf_file/ETC_ClimatereadyNR251010final.pdf (identifying "over 262 patent families, subsuming 1663 patent documents published worldwide (both applications and issued patents) that make specific claims on environmental stress tolerance in plants").

31. *Bowman*, 657 F.3d at 1343.

32. *Id.* at 1343–44.

harming their crop.³³ Monsanto's genetically modified seeds now account for approximately 93 percent of soybeans sold in the United States.³⁴

Unlike other genetically modified crops, the traits in Monsanto's soybeans are "true to seed," meaning that the patented genetic material transfers to each successive generation of seeds.³⁵ A Monsanto soybean plant yields an average of 85.8 new seeds, each capable of creating another fertile plant with minimal effort.³⁶ To protect its technology, Monsanto requires farmers to sign a technology agreement upon each purchase of the soybeans.³⁷ The contract restricts the farmers from using the seeds for more than a single season and requires them to refrain both from selling leftovers from the first planting and saving the grown seeds either for replanting or for use in research.³⁸ Growers may sell their crops to local grain elevators without restriction as commodity seed.³⁹

B. Software, Quines, and Self-Replicating Programs

In addition to permitting advances in biotechnology, the advent of computers has allowed for virtual concepts and mathematical theories to become useful, functioning tools.⁴⁰ Self-replicating

33. *Id.* at 1344.

34. Peter Whoriskey, *Monsanto's Dominance Draws Antitrust Inquiry*, WASH. POST (Nov. 29, 2009), <http://www.washingtonpost.com/wp-dyn/content/article/2009/11/28/AR2009112802471.html>.

35. Tom Laskawy, *Seeding Justice: Monsanto vs. Soybean Farmer Case Hits the Supreme Court*, GRIST (Oct. 10, 2012, 7:22 AM), <http://grist.org/food/seeding-justice-monsanto-vs-soybean-farmer-case-hits-the-supreme-court>; Samantha M. Ohlgart, Note, *The Terminator Gene: Intellectual Property Rights vs. the Farmers' Common Law Right to Save Seed*, 7 DRAKE J. AGRIC. L. 473, 476 (2002) (discussing terminator genes in genetically modified plants, which produce "self-terminating offspring").

36. *See More Beans Per Pod*, *supra* note 4.

37. *Bowman*, 657 F.3d at 1344.

38. The Federal Circuit explained:

Under the Technology Agreement, the licensed grower agrees: (1) "to use the seed containing Monsanto gene technologies for planting a commercial crop only in a single season"; (2) "to not supply any of this seed to any other person or entity for planting"; (3) "to not save any crop produced from this seed for replanting, or supply saved seed to anyone for replanting"; and (4) "to not use this seed or provide it to anyone for crop breeding, research, generation of herbicide registration data, or seed production."

Id. at 1344–45 (citation omitted).

39. *Id.* at 1345. "Commodity seeds are a mixture of undifferentiated seeds harvested from various sources" that are sold for different uses, such as feed or planting, without restrictions. Deniza Gertsberg, *Monsanto Wins Against Indiana Farmer over Seed Saving*, GMO J. (Sept. 26, 2011), <http://gmo-journal.com/2011/09/26/monsanto-wins-against-indiana-farmer-over-seed-saving>.

40. *See, e.g.*, Michael S. Mahoney, *The Structures of Computation and the Mathematical Structure of Nature*, RUTHERFORD J., <http://www.rutherfordjournal.org/article030107.html> (last visited Jan. 30, 2013) ("[T]heoretical computer science gave meaning to the seemingly

programs, sometimes known as “quines,” are increasingly common. Their uses include network load balancing, dissemination of applications across enterprise networks, peer-to-peer networking tools, and even computer anti-virus tools.⁴¹ Each system faces unique issues regarding the self-replication process, such as how to set implementation boundaries without prior knowledge of the number of copies needed and the danger of any *n*th generation copy being removed from the network, carrying with it the entire patented technology.⁴²

Due to the ease of reproduction and inherent need for at least limited reproduction rights, software often finds protection under licensing agreements and contract law rather than outright sales.⁴³ A typical software license grants the licensee permission to place copies of the computer code on multiple machines and create the necessary copy for whichever machine the licensee is using.⁴⁴ Corporations with large numbers of employees often purchase bulk licenses.⁴⁵ The licenses are subject to contract law and may be revoked upon a breach,

paradoxical notion of ‘applied abstract algebra,’ as it brought the most advanced concepts of twentieth-century mathematics to bear on what has become the defining technology of our time.”).

41. A Honeypot Host, WO Patent No. 2010030169, EP Patent App. No. 2327014 (filed Sept. 11, 2009); Attenuated Computer Virus Vaccine, U.S. Patent No. 7,512,809 (filed Aug. 21, 2004) (issued Mar. 31, 2009); Automatic Network Load Balancing Using Self-Replicating Res., U.S. Patent App. No. 20030167295 (filed Mar. 1, 2002); Data Transfer to Nodes of a Commc'n Network Using Self-Replicating Code, U.S. Patent No. 7,474,656 (filed Feb. 25, 2004) (issued Jan. 6, 2009); *see* Self-Replicating and Self-Installing Software Apparatus, U.S. Patent App. No. 20030217171 (filed May 17, 2003); Self Replicating Installation Method for Operating Sys. Clusters, U.S. Patent No. 7,240,107 (filed Oct. 15, 2002) (issued July 3, 2007).

42. For example, a network load balancing system is installed only once, after which it creates, removes, and recreates multiple instances as the system demands require. *See infra* notes 50–51 and accompanying text. At the time of installation, the number of copies that will be in existence at any given time cannot be known. *See infra* note 50. Similarly, the honeypot system attracts hackers, then, once infiltrated, creates a new trap to lure its next victim. *See supra* note 41. The user cannot know how many people, if any, will fall prey to the system. *See id.*

43. *See* Julie E. Cohen & Mark A. Lemley, *Patent Scope and Innovation in the Software Industry*, 89 CALIF. L. REV. 1, 34 (2001) (“[S]oftware vendors have taken the position that all software is licensed rather than sold.”).

44. *See* Dena Chen et al., *Providing an Incidental Copies Exemption for Service Providers and End-Users*, PUBLIC KNOWLEDGE 3 (Mar. 31, 2011), <http://www.publicknowledge.org/files/docs/craincidentalcopies.pdf> (“Similarly, all software programs create incidental copies as a fundamental part of their RAM-based operations, and make other kinds of temporary files to maximize program efficiency, preserve RAM memory, and the like.”).

45. *See, e.g., End User License Agreement*, ADOBE, § 16.6.2, <http://www.adobe.com/products/eula/tools/captivate.html> (last visited Jan. 30, 2013) (stating one copy of the font software is allowed in the RAM of a machine per five machines).

such as exceeding the number of intended users.⁴⁶ Most importantly, neither the individual nor the corporate purchaser owns the software product.⁴⁷ This simple fact precludes the invocation of patent exhaustion for the vast majority of software scenarios, since the licensee lacks the authorization to sell the article as required by the doctrine.⁴⁸

Problems arise, however, when the software owner sells rather than licenses the software or when the specific origin of the article is unknown.⁴⁹ Running software often creates incidental copies of the software in a machine's random access memory (RAM).⁵⁰ Incidental copies are also necessary whenever software travels through a network and across intermediate servers.⁵¹ The software owner has the right to use the software, but it is unclear whether the temporary copies that are incidental to its use are also authorized.⁵² In other words, if the consumer has obtained those rights through a purchase from the patent holder, it remains uncertain if the consumer can then pass those rights to another when reselling the product.⁵³

46. See, e.g., *Adobe Volume Licensing/Business/Enterprise Agreement*, ADOBE, <http://www.adobe.com/volume-licensing/business/enterprise-agreement.html> (last visited Jan. 30, 2013) (requiring a minimum purchase of one hundred licenses and a three-year agreement).

47. See Chen et al., *supra* note 44, at 9 (“[S]oftware licenses . . . give consumers only possession, and not ‘ownership,’ of the software.”).

48. See *Microsoft Corp. v. Harmony Computers & Elecs., Inc.*, 846 F. Supp. 208, 213 (E.D.N.Y. 1994) (“Entering a license agreement is not a ‘sale’ for purposes of the first sale doctrine.” (citing *ISC–Bunker Ramo Corp. v. Altech, Inc.*, 765 F. Supp. 1310, 1331 (N.D. Ill. 1990))).

49. See, e.g., *Vernor v. Autodesk, Inc.*, 621 F.3d 1102, 1116 (9th Cir. 2010) (reversing the district court’s decision that Vernor, who had purchased software from a garage sale, was entitled to protection under the first sale doctrine).

50. This has been the subject of considerable copyright litigation. Most courts now hold that a temporary copy loaded in the RAM memory of a computer is “fixed” and therefore constitutes a new copy for copyright purposes. See, e.g., *MAI Sys. Corp. v. Peak Computer, Inc.*, 991 F.2d 511, 518 (9th Cir. 1993). Many critics, however, disagree with this view. See Mark A. Lemley, *Dealing with Overlapping Copyrights on the Internet*, 22 U. DAYTON L. REV. 547, 551–52 & n.25 (1997) (cataloguing the critiques of MAI). An analogous conclusion seems evident in patent law. Because patent law has no fixation requirement, any reproduction of a patented program, no matter how temporary, arguably constitutes a “making” within the meaning of the statute.

51. See Lemley, *supra* note 50, at 555–56 (comparing liability for RAM copies to copies created on network intermediaries).

52. See *id.*

53. See *id.* at 575 (explaining how overlapping copyrights in the digital world have “altered the balance of rights set by Congress”).

II. PERSPECTIVES ON PATENT EXHAUSTION

While the doctrine of patent exhaustion has existed since the early nineteenth century,⁵⁴ it has recently undergone a resurgence as an affirmative defense to patent infringement.⁵⁵ The doctrine, while initially considered a “straight-forward proposition,”⁵⁶ became muddled in the twentieth century with the introduction of new technologies.⁵⁷ A trio of cases over the previous decade seemed to narrow the doctrine to exclude self-replicating technology until the Supreme Court ruling in *Quanta* breathed new life into the rule.⁵⁸

A. Patent Exhaustion

The Federal Patent Act grants patent holders the “exclusive right to make, use, and vend [their] invention or discovery.”⁵⁹ These rights may be transferred in whole by the sale of the patent or in part by the sale of an article embodying the patent.⁶⁰ The patent exhaustion doctrine, which is based in common law,⁶¹ states that, after an authorized sale of a patented article, the purchaser is free to use or resell that article without restraint from patent law.⁶² The doctrine rests on two balancing rationales: the patent holder benefits from the right to the exclusive “first” distribution and its accompanying compensation, and the public benefits from avoiding hidden licensing fees on the later use or sale.⁶³ Additionally, the public benefits from a robust and open secondary market that is strengthened by consumer

54. Vincent Chiappetta, *Patent Exhaustion: What's It Good for?*, 51 SANTA CLARA L. REV. 1087, 1087–88 (2011) (“The Supreme Court created the patent exhaustion doctrine in the nineteenth century.”).

55. John W. Osborne, *A Coherent View of Patent Exhaustion: A Standard Based on Patentable Distinctiveness*, 20 SANTA CLARA COMPUTER & HIGH TECH. L.J. 643, 646 (2004).

56. See Chiappetta, *supra* note 54, at 1088.

57. See Osborne, *supra* note 55, at 646 (“As a result, patentees and would-be licensees/infringers must contend with strained interpretations of seemingly conflicting caselaw.”).

58. See Noonan, *supra* note 10 (referencing the *McFarling*, *Scruggs*, and *David* cases). Compare *supra* note 22 (explaining that past cases considered each subsequent generation of self-replicating technology to be a new article outside of the initial sale), with *Monsanto Co. v. Bowman*, 657 F.3d 1341, 1346 (Fed. Cir. 2011), *cert. granted*, 133 S. Ct. 420 (2012) (suggesting that *Quanta* supports a robust patent exhaustion doctrine that would include the progeny of self-replicating technologies).

59. *United States v. Univis Lens Co.*, 316 U.S. 241, 250 (1942); see also 35 U.S.C. § 271(a) (2006).

60. See Osborne, *supra* note 55, at 648.

61. See Chiappetta, *supra* note 54, at 1088 n.3 (noting that the exhaustion doctrine has never been codified in federal patent law).

62. *Adams v. Burke*, 84 U.S. 453, 455 (1873).

63. Osborne, *supra* note 55, at 658.

confidence in the ability to resell the used article.⁶⁴ Without the doctrine, a patent holder could control the disposition of the patented goods indefinitely and could collect multiple royalties for each subsequent resell.⁶⁵ Thus, the doctrine limits the patent holder to one “bite of the apple” per sale and provides incentive to price the initial sale accordingly.⁶⁶ But patent holders trying to control their inventions often undermine the doctrine by utilizing licenses to control or restrict the downstream use of their products.⁶⁷

B. Monsanto's Legal Victories

Monsanto's limitations on the future use of its patented soybeans quickly collided with the traditional agricultural practice of saving seed for next year's planting.⁶⁸ Time and again, those disagreeing with Monsanto's restrictions have tested the validity and reach of its patent rights.⁶⁹ Regardless of the angle of attack—whether it was deliberate breach of the agreement, purchasing without signing the agreement, or denying the act altogether—the court has steadfastly held for Monsanto.⁷⁰

1. *Monsanto Co. v. McFarling*

One of the first pre-*Quanta* seed cases involved a Mississippi farmer, Homan McFarling, who purchased Roundup Ready soybeans,

64. Chiappetta, *supra* note 54, at 1136 (arguing that patent exhaustion “improve[s] . . . the secondary aftermarket, reducing prices, increasing access, and limiting deadweight loss”).

65. William A. Birdwell, *Exhaustion of Rights and Patent Licensing Market Restrictions*, 60 J. PAT. & TRADEMARK OFF. SOC'Y 203, 216, 229 (1978).

66. See Chiappetta, *supra* note 54, at 1094 (“When a patent owner sells a patented article, reasonable parties will normally assume . . . that the owner has demanded and received full compensation under the patent.”). Presumably, the initial sale provides “adequate financial reward to stimulate invention.” Birdwell, *supra* note 65, at 216, 229.

67. See, e.g., *Monsanto Co. v. Bowman*, 657 F.3d 1341, 1344–45 (Fed. Cir. 2011), *cert. granted*, 133 S. Ct. 420 (2012).

68. See *Bowman*, 657 F.3d at 1344–45 (detailing the restrictions imposed by Monsanto's technology agreement); *WU & BUTZ*, *supra* note 27, at 52 (suggesting that industrial nations are more comfortable with buying seeds each season and are moving away from the more traditional methods of saving seeds).

69. See Noonan, *supra* note 10 (discussing several suits involving farmers who saved seeds).

70. See *Monsanto Co. v. David*, 516 F.3d 1009, 1012–13 (Fed. Cir. 2008) (rejecting the farmer's arguments that no seeds were saved, in part due to the farmer's inability to explain his fully planted fields with the inadequate amount of seeds he purchased that year); *Monsanto Co. v. Scruggs*, 459 F.3d 1328, 1333 (Fed. Cir. 2006); *Monsanto Co. v. McFarling (McFarling I)*, 302 F.3d 1291, 1293 (Fed. Cir. 2002) (“McFarling does not dispute that he violated the terms of the Technology Agreement. He . . . stated that unless enjoined he intended to [continue saving seeds.]”); Noonan, *supra* note 10.

signed the Monsanto technology agreement, and then deliberately breached it by saving a portion of his harvest each year for planting during the next season.⁷¹ The parties argued the case before the Federal Circuit in 2002.⁷² McFarling conceded that he was in violation of the agreement but contended that the restriction violated the doctrine of patent exhaustion.⁷³ McFarling relied on the *Univis Lens* case, which held that an “authorized sale of an article which is capable of use only in practicing the patent is a relinquishment of the patent monopoly with respect to the article sold.”⁷⁴ But the Federal Circuit disagreed based on the contention that the *new* seeds were not the subject of a sale of any kind and so could not fit within the “first-sale” doctrine.⁷⁵ Furthermore, Monsanto sold the initial seeds only for a single use and did not confer a license to construct new seeds.⁷⁶ The Supreme Court denied the case’s subsequent petition for certiorari.⁷⁷

2. *Monsanto Co. v. Scruggs*

In 2006, a similar case again reached the Federal Circuit involving another Mississippi farmer by the name of Mitchell Scruggs.⁷⁸ Scruggs purchased both Roundup Ready soybeans and cotton seeds without ever signing a technology agreement.⁷⁹ The grower argued that he had purchased the articles in an unrestricted sale and should have the right to their use under the doctrine of patent exhaustion.⁸⁰ The court used the same reasoning as in *McFarling*, saying that the second-generation seeds had never been sold and could not trigger the “first sale” doctrine.⁸¹ The court also explained that a capability of replication did not include a right to use the replicated works and that to do so would “eviscerate the rights of the patent holder.”⁸² The Supreme Court denied Scruggs’s petition for certiorari.⁸³

71. See *McFarling I*, 302 F.3d at 1293.

72. *Id.* at 1291.

73. *Id.* at 1298–99.

74. *Id.* at 1291 (quoting *United States v. Univis Lens Co.*, 316 U.S. 241, 250 (1942)).

75. See *id.* at 1299.

76. See *id.*

77. *McFarling v. Monsanto Co. (McFarling II)*, 537 U.S. 1232 (2003).

78. *Monsanto Co. v. Scruggs*, 459 F.3d 1328, 1332 (Fed. Cir. 2006).

79. *Id.* at 1333.

80. *Id.* at 1335–36.

81. *Id.* at 1336.

82. *Id.* (“The fact that a patented technology can replicate itself does not give a purchaser the right to use replicated copies of the technology.”).

83. *Scruggs v. Monsanto Co.*, 549 U.S. 1342, 1342 (2007).

3. *Monsanto Co. v. David*

Two years after *Scruggs*, Loren David, a farmer operating in North and South Dakota, found himself before the Federal Circuit for improperly using Monsanto's soybeans.⁸⁴ Monsanto suspected David of saving seeds from previous plantings after it determined that his entire fields contained Roundup Ready soybeans, despite David not purchasing an adequate amount of new seed that season to plant on all of the plots.⁸⁵ The Federal Circuit followed its precedent in *McFarling* and reiterated that no right exists to save seeds under the patent system and that patent exhaustion is not implicated for articles that did not undergo an authorized sale.⁸⁶ The court ruled in favor of Monsanto, due in large part to the lack of credibility concerning David's inconsistent and continually changing testimony.⁸⁷

C. *Quanta Computer, Inc. v. LG Electronics, Inc.*

Just as the Federal Circuit was building a body of case law around the topic of patent exhaustion in self-replicating technologies, the Supreme Court reintroduced uncertainty with its ruling in *Quanta*.⁸⁸

The case began with LG licensing a number of patents to Intel that involved controlling memory and data between various components of a computer system.⁸⁹ One patent—the '641 Patent—addressed the issue of synchronizing data changes between the cache and main memory.⁹⁰ Another—the '379 Patent—coordinated read and write requests to the main memory.⁹¹ Finally, the '733 Patent managed the traffic on the computer bus to avoid over-monopolization.⁹² The licensing agreement allowed Intel to manufacture and sell chipsets that used these patents but restricted third parties from combining the licensed Intel product with any non-Intel product.⁹³

84. *Monsanto Co. v. David*, 516 F.3d 1009, 1012 (Fed. Cir. 2008).

85. *Id.*

86. *Id.* at 1014.

87. *Id.* at 1015.

88. *See Chiappetta, supra* note 54, at 1088.

89. *Quanta Computer, Inc. v. LG Elecs., Inc.*, 553 U.S. 617, 621, 623 (2008).

90. *Id.* at 622.

91. *Id.*

92. *Id.* at 621–22 (“A set of wires, or bus, connects the microprocessor to a chipset, which transfers data between the microprocessor and other devices, including the keyboard, mouse, monitor, hard drive, memory, and disk drives.”).

93. *Id.* at 623.

Quanta, while aware of the restrictions on the Intel chipsets, incorporated its own products with Intel's in ways that practiced LG's patents.⁹⁴ When LG sued to enjoin the activity, Quanta claimed that the sale of the patented chipsets exhausted any right LG maintained over their use.⁹⁵ LG argued patent exhaustion was inapplicable to method patents⁹⁶ since they must be practiced each time the article is used, even after a sale.⁹⁷ In contrast, Quanta contended that the Court should refrain from excluding method claims from patent exhaustion, as it would allow patentees to avoid exhaustion altogether by rewording their patent claims.⁹⁸ The Court agreed with Quanta.⁹⁹

The Court then turned to the precedent established in *Univis Lens* in determining whether selling an incomplete article that requires another act or combination may exhaust the patent.¹⁰⁰ *Univis Lens* involved the sale of unpatented, unfinished lens blanks to a third-party manufacturer.¹⁰¹ The manufacturer would then grind the lenses to create the patented, finished product and distribute them for sale.¹⁰² The Court in *Univis Lens* held that the sale of an *unfinished* article with a single reasonable and intended use—to be ground and finished—would exhaust the patent holder's right to control the use or sale of that particular article.¹⁰³

The Supreme Court found that Intel designed the chipsets to control data and memory between components and “substantially embodied” the patents at issue.¹⁰⁴ Attaching the chipset to the necessary parts was the only reasonable use for the product and did not add any inventive thought that would preclude exhaustion.¹⁰⁵ The ruling revived the “substantial embodiment” test and signaled the

94. *Id.* at 624.

95. *Id.*

96. Method patents, also known as process patents, claim a series of steps or actions that are used to produce a specific result, such as innovative methods for curing rubber or tempering steel. *E.g.*, *Gottschalk v. Benson*, 409 U.S. 63, 70 (1972) (“A process is a mode of treatment of certain materials to produce a given result. It is an act, or a series of acts, performed upon the subject-matter to be transformed and reduced to a different state or thing.” (internal quotation marks omitted) (quoting *Cochrane v. Deener*, 94 U.S. 780, 787–88 (1876))).

97. *Quanta*, 553 U.S. at 628.

98. *Id.*

99. *Id.* at 630.

100. *Id.* at 630–31.

101. *United States v. Univis Lens Co.*, 316 U.S. 241, 243–44 (1942).

102. *Id.* at 244.

103. *Id.* at 249.

104. *Quanta*, 553 U.S. at 633 (“[T]he incomplete article substantially embodies the patent because the only step necessary to practice the patent is the application of common processes or the addition of standard parts.”).

105. *Id.* at 633–34.

desire for a stronger exhaustion doctrine.¹⁰⁶ Many scholars immediately made the leap to the singular purpose of seeds and predicted the coming end of patent rights in second-generation seeds.¹⁰⁷

III. BOWMAN'S BEANSTALK

Despite the setbacks of earlier cases, the ruling in *Quanta* emboldened Vernon Bowman, an Indiana farmer, to challenge Monsanto's patent rights.¹⁰⁸ In an effort to circumvent the technology-licensing agreement and associated fees, Bowman chose to purchase seeds on the open market, test them for Monsanto's patented traits, and keep the valuable seeds for replanting.¹⁰⁹ Both the district court and the Federal Circuit rejected Bowman's argument that absent the express limitations imposed by the licensing agreement the owner of the seeds had the freedom to use them for their primary purpose—planting.¹¹⁰

A. Background

Bowman lost in both the district court and the Federal Circuit, but he now stands ready to plead his case before the Supreme Court.¹¹¹ Bowman's story arguably demands more sympathy than that of his predecessors.¹¹² Bowman purchased a fresh batch of Roundup Ready seed each year for the first planting of the season.¹¹³

106. *Id.* at 637 (“[N]o further ‘making’ results from the addition of standard parts . . . to a product that already substantially embodies the patent.”).

107. *See, e.g.*, Yuichi Watanabe, *The Doctrine of Patent Exhaustion: The Impact of Quanta Computer, Inc. v. LG Elecs., Inc.*, 14 VA. J.L. & TECH. 273 (2009); Jon Sievers, Note, *Not So Fast My Friend: What the Patent Exhaustion Doctrine Means to the Seed Industry After Quanta v. LG Electronics*, 14 DRAKE J. AGRIC. L. 355, 372 (2009).

108. *See Monsanto Co. v. Bowman*, 657 F.3d 1341, 1345–46 (Fed. Cir. 2011), *cert. granted*, 133 S. Ct. 420 (2012).

109. *See id.*

110. *See Bowman*, 657 F.3d at 1347–48; *Monsanto Co. v. Bowman*, 686 F. Supp. 2d 834, 839 (S.D. Ind. 2009), *aff'd*, 657 F.3d 1341 (Fed. Cir. 2011), *cert. granted*, 133 S. Ct. 420 (2012).

111. *Bowman*, 133 S. Ct. at 420.

112. Each of the three previous cases involved questionable acts on the part of the farmers: McFarling breached his contract in bad faith, *see supra* Part II.B.1; Scruggs did not sign the contract, *see supra* Part II.B.2; and David attempted to claim he planted his fields with seeds that were likely purchased a month after the fact, *see supra* Part II.B.3. Bowman, by comparison, signed the technology agreement and abided by it in full. *See Bowman*, 657 F.3d at 1345–46. He purchased seeds that Monsanto had explicitly allowed to be sold to the granary without further restrictions on future sales. *See id.* His hands are arguably cleaner than any of his predecessors.

113. *Bowman*, 657 F.3d at 1345.

Upon harvest, he abided by the technology agreement and sold every seed, keeping none for future plantings.¹¹⁴

But Bowman wished to get the most from his land and wanted to cultivate a second crop at the tail end of the season.¹¹⁵ Because of the additional risk inherent in the shorter time frame coupled with declining growing conditions, Bowman sought to minimize potential losses.¹¹⁶ Instead of purchasing a second batch of Roundup Ready seed—which was prohibitively expensive—Bowman purchased unrestricted commodity seed from a local granary.¹¹⁷

During each planting, Bowman tested the crop for the same Roundup Ready properties as those purchased from Monsanto.¹¹⁸ Believing the unrestricted sale allowed him to utilize the seed as he saw fit, Bowman began saving the patented seed from this second crop for replanting each year.¹¹⁹ Bowman, confident that his use was noninfringing, notified Monsanto of his activities.¹²⁰ Monsanto sued.¹²¹

B. Federal Circuit Opinion

At the Federal Circuit, Bowman argued that the seeds substantially embodied the patents at issue and that limiting the singular use of the seed rendered the doctrine of patent exhaustion useless for self-replicating technologies.¹²² Bowman argued that the Supreme Court in *Quanta* had disapproved of unnecessarily limiting the exhaustion doctrine in regards to method patents and that the Federal Circuit should refrain from arbitrarily eliminating the doctrine for self-replicating technologies.¹²³

Monsanto countered, citing favorable rulings from the previous line of seed cases.¹²⁴ Monsanto argued that the progeny of the

114. *Id.*

115. *See id.*

116. *See id.* (explaining that the purchase was to reduce costs).

117. *Id.* Because of the restriction requiring the crop be used only for sale to local granaries and the pervasive use of Monsanto's seeds, the granaries' supply often consisted primarily of patented seeds. *See id.* (stating that 94 percent of soybeans grown in the area were herbicide resistant strains). The granaries have no duty to keep the patented seeds separate from the unpatented ones. Both types are sold as general-use commodity seeds without any licensing agreements. Without further testing (which Bowman performed), the two seeds would appear identical to the buyer. *See id.* at 1346.

118. *Id.* at 1346.

119. *Id.*

120. *Id.*

121. *Id.*

122. *See id.*

123. *See id.*

124. *See id.* at 1347.

patented seeds were *new* infringing articles and that the patent protection “is independently applicable to *each* generation of soybeans (or other crops) that contains that patented trait.”¹²⁵ Monsanto further contended that Bowman’s reading of the exhaustion doctrine would effectively eliminate patent protection for self-replicating technology.¹²⁶ Under Monsanto’s reasoning, a single seed could furnish a farmer (or farmers) with an inexhaustible supply of genetically altered products.¹²⁷

The Federal Circuit found that patent exhaustion did not prevent a finding of infringement in either *McFarling* or *Scruggs*, and it would not do so for Bowman.¹²⁸ The court in *Bowman* relied heavily on its pre-*Quanta* seed cases and failed to add a great deal of new analysis.¹²⁹ The court held the purchase of the commodity seed was valid, but the act of planting the seed and the resulting crop constituted infringement.¹³⁰ The right to use does not include the right to copy a protected article.¹³¹ The court’s view that “[a]pplying the first sale doctrine to subsequent generations . . . would eviscerate the rights of the patent holder,” while logical, was unsupported by analysis specific to self-replicating technologies.¹³²

In a nod to *Quanta*, the court also addressed the notion of a single use for the commodity seed, pointing out that the seed had other potential uses, such as feed.¹³³ Under *Quanta*, if the seed is “without utility” except in practicing the patent, then patent exhaustion applies.¹³⁴ The court found that alternative uses for the soybeans existed, but it implied that additional facts showing that planting was the “only reasonable and intended use” for the commodity seeds may have satisfied *Quanta*’s substantial embodiment test.¹³⁵ While this approach would continue to protect dual-purpose

125. *See id.* (citation omitted).

126. *See id.*

127. Without patent exhaustion, for the cost of a single seed, farmers can produce a never-ending supply of enhanced seeds. *See id.* at 1345.

128. *Id.* at 1347–48.

129. *See id.*

130. *See id.* at 1348.

131. *See id.*

132. *Id.* (citing *Monsanto Co. v. Scruggs*, 459 F.3d 1328, 1336 (Fed. Cir. 2006)). Patent rights are intended to encourage innovation and progress in the sciences. *See* U.S. CONST. art. I, § 8, cl. 8. The court did not analyze why upholding the exclusivity of the patent would align with this policy, implying that merely holding and exercising a patent right benefits progress. *See Bowman*, 657 F.3d at 1347–48.

133. *See Bowman*, 657 F.3d at 1348.

134. *United States v. Unis Lens Co.*, 316 U.S. 241, 249–50 (1942).

135. *Bowman*, 657 F.3d at 1348 (citing *Quanta Computer, Inc. v. LG Elecs., Inc.*, 553 U.S. 617, 631 (2008)).

crops, the fate of other crops with less versatile seeds—apples, for instance—remains less certain.¹³⁶ Synthetic alterations to DNA sequences and engineered organisms will rarely have secondary uses outside the problem that instigated their creation.¹³⁷ To require alternative uses in order to benefit fully from the patent system would seem to contradict or at least raise the minimal utility requirements prerequisite to obtaining a patent.¹³⁸

Bowman appealed the Federal Circuit's decision in favor of Monsanto. To the surprise of some and delight of others, the Supreme Court granted certiorari.¹³⁹

IV. THE RIGHT TO MAKE, INCIDENTAL COPYING, AND THE LIMITS OF PATENT LAW

At the heart of the confusion lies a scenario unique to self-replicating technology—when using the article also involves making the article.¹⁴⁰ The doctrine of patent exhaustion, which permits the unrestricted use but not the reproduction of the article, now finds itself in uncharted waters.¹⁴¹ Are the two rights so intertwined that the exhaustion of one automatically exhausts the other? Or if separable, do other considerations exist that would support the application of patent exhaustion when the use of a patented article creates copies of that article?

136. Soybeans are relatively versatile in that the seed may be used for planting, feed, or other uses. *See Bowman*, 657 F.3d at 1348. Other seeds (e.g., apple seeds) are not useful for feed and are useful only in planting. Under this logic, seeds that are useful for either planting or eating (e.g., soybeans, corn, wheat) are not exhausted while other equally useful genetic crops may find themselves without this protection. *See U.S. Technology Use Guide*, *supra* note 7, at 1 (listing a variety of Monsanto's genetically enhanced crops, including cotton, corn, and soybeans).

137. *See, e.g., Diamond v. Chakrabarty*, 447 U.S. 303, 305 (1980) (concerning an organism specifically created to aid in oil-spill cleanups by consuming the crude).

138. *See* Sean B. Seymore, *Patently Impossible*, 64 VAND. L. REV. 1491, 1502–03 & n.57 (2011) (explaining the PTO's difficulty in establishing unpatentability from lack of utility).

139. *Bowman v. Monsanto Co.*, 133 S. Ct. 420 (2012); Kevin E. Noonan, *Solicitor General Recommends the Supreme Court Deny Cert in Bowman v. Monsanto*, PATENT DOCS (Aug. 30, 2012, 11:59 PM), <http://www.patentdocs.org/2012/08/solicitor-general-recommends-the-supreme-court-deny-cert-in-bowman-v-monsanto.html>; Tanya Sitton, *Supreme Court to Hear Monsanto Patent Case: Can Farmers Reclaim Rights to Save Seed?*, EAT DRINK BETTER (Oct. 12, 2012), <http://eatdrinkbetter.com/2012/10/12/supreme-court-to-hear-monsanto-patent-case-can-farmers-reclaim-rights-to-save-seed>.

140. *See* Jeremy N. Sheff, *Self-Replicating Technologies*, 16 STAN. TECH. L. REV. 229, 238 (2013) (“[T]he only and intended ‘use’ of seeds or any other self-replicating technology necessarily ‘makes’ a newly infringing article.”).

141. *See* Chiappetta, *supra* note 54, at 1097 (suggesting that complications arise when it comes to “determining if and when . . . changes move beyond the ‘use’ authorized by exhaustion, and instead become an impermissible ‘making’ of a new article”).

Due to the similarities between seeds and software,¹⁴² and the latter's status as a relatively more mature field of study, an examination of the intellectual property laws governing computer code can provide guidelines for protecting rights holders while incentivizing innovation and protecting consumers.¹⁴³ Copyright law has wrangled with the wholesale copying of programs for decades.¹⁴⁴ Statutory permissions, explicit licenses, and the fair use doctrine serve as possible protective measures for the industry.¹⁴⁵ An analysis of the development and underlying rationales of these carve-outs can help inform analogous issues in patent law.

A. *The Right to Make*

The Federal Circuit's ruling in *Bowman* correctly emphasizes the separability of patent rights and the limited application of exhaustion.¹⁴⁶ The patent holder has a monopoly over the right to make, use, and sell his inventions and can assign or exhaust each right independently of the others.¹⁴⁷ While an unrestricted sale exhausts the patent holder's control over the use or resale of that particular article, it does not grant the purchaser the right to make the technology.¹⁴⁸ The right to make and exclude others from making rests with the patent owner and is only exhausted upon the sale of the *patent* itself.¹⁴⁹ The right to exclude others from recreating the

142. See *supra* Part I.A–B (explaining the self-replicating nature of seeds and software and the tendency for incidental copies to be created). Plants cannot help but produce more seeds, and computer programs cannot function without RAM copies. See *supra* Part I.A–B.

143. Compare Cohen & Lemley, *supra* note 43, at 3 (claiming that “eighty thousand software patents [have] already issued” in the United States), with ETC Grp., *supra* note 30 (identifying “1663 patent documents published *worldwide*” relating to “stress tolerance in plants” (emphasis added)).

144. See H.R. REP. No. 94-1476, at 54 (1976), *reprinted in* 1976 U.S.C.C.A.N. 5659, 5667 (illustrating that Congress intended the amendments in the 1976 Copyright Act to expand “[t]he term ‘literary works’” so that “[i]t also includes computer data bases, and computer programs”).

145. See 17 U.S.C. § 117 (2006) (listing specific acts of copying by the owner of a computer program that do not constitute infringement); 17 U.S.C. § 107 (fair use); *supra* Part I.B (discussing explicit licenses).

146. See *Monsanto Co. v. Bowman*, 657 F.3d 1341, 1348 (Fed. Cir. 2011) (“The right to use ‘do[es] not include the right to [make]” (quoting *Jazz Photo Corp. v. Int’l Trade Comm’n*, 264 F.3d 1094, 1102 (Fed. Cir. 2001))), *cert. granted*, 133 S. Ct. 420 (2012).

147. See *Adams v. Burke*, 84 U.S. 453, 454 (1873) (showing that the patent owner may not only assign the specific rights to make and sell the patented item, the owner may also limit those rights to a geographic area); Osborne, *supra* note 55, at 648 (“The patentee may surrender his monopoly in whole by the sale of his patent or *in part* by the sale of an article embodying the invention.” (emphasis added)).

148. See Chiappetta, *supra* note 54, at 1097 (“When exhaustion applies, it only extinguishes [the rights in] . . . the particular article. It does not ‘exhaust’ the patent right in its entirety.”).

149. See Osborne, *supra* note 55, at 648.

technology supersedes the exhaustion of the other rights, and patent holders may still sue the creators of infringing copies.¹⁵⁰ The *Bowman* court found that purchasing an article with the ability to self-replicate did not grant the purchaser that right by default,¹⁵¹ particularly when alternative uses were available.¹⁵²

The substantial embodiment rationale in *Univis Lens* and *Quanta* is insufficient to support exhaustion of the right to make.¹⁵³ The rule balances the restrictions placed on patent holders' downstream rights by limiting the exemption to the use and resale of the specific item sold.¹⁵⁴ Self-replicating technologies incorporate every aspect of the patented technology,¹⁵⁵ and their main, if not only, purpose is to reproduce.¹⁵⁶ Often, using these technologies creates incidental copies.¹⁵⁷ Exhausting the right to make along with the right to use would remove the limit on the consumer's right to produce *new* articles without a reciprocal grant to the patent holder.¹⁵⁸ The

150. See Chiappetta, *supra* note 54, at 1095 (stating that enforcing the right to make regarding manufacturing licenses raises "policy concerns antecedent to the application of exhaustion"); Cohen & Lemley, *supra* note 43, at 31 ("It is not the patent right itself that is exhausted, of course. The patentee retains the rights to prevent anyone else, including the buyer, from making, using, or selling additional copies of the patented item."); see also *Jazz Photo Corp.*, 264 F.3d at 1102 ("[R]ights of ownership do not include the right to construct [a] . . . new article . . .").

151. See *Monsanto Co. v. Bowman*, 657 F.3d 1341, 1348 (Fed. Cir. 2011), *cert. granted*, 133 S. Ct. 420 (2012).

152. See *id.* (suggesting that the seeds could be used as feed).

153. *Univis* and *Quanta* did not involve self-replicating technologies; they addressed the *unfinished* lenses for bifocals and method claims for controlling the flow of computer data, respectively. See *Quanta Computer, Inc. v. LG Elecs., Inc.*, 553 U.S. 617, 622–23 (2008); *United States v. Univis Lens Co.*, 316 U.S. 241, 246–47 (1942). Any actions allowed to complete the unfinished lens blank were limited to the particular item. See *Univis*, 316 U.S. at 249. Likewise, although the method claims were practiced each time the computers were used, the scope of the use remained limited to the particular item sold. See *Quanta*, 553 U.S. at 628–29. Neither situation accounts for a scenario in which using the product at issue creates additional articles outside of the scope of the product sold.

154. See Cohen & Lemley, *supra* note 43, at 31.

155. See, e.g., Laskawy, *supra* note 35.

156. See Sheff, *supra* note 140, at 238 ("[T]he only and intended 'use' of seeds or any other self-replicating technology necessarily 'makes' a newly infringing article.").

157. See generally Part I.A–B (explaining that computer systems create copies of code in RAM each time the software is loaded for use).

158. The price paid for a patented article is compensation for the unfettered right to use and resell that article. See Chiappetta, *supra* note 54, at 1094. Presumably, the price demanded for the sale of a single item does not include compensation for an unlimited right to make new articles. See *id.* If such were the case, a single seed would cost the equivalent of a hundred bushels since both are capable of creating an unlimited supply of future seeds. See *id.*

consumer would unfairly profit simply because of the technology's unique nature.¹⁵⁹ Such an inequitable grant is unnecessary.¹⁶⁰

B. Incidental Copying, Software, and Copyright Law

When reproduction and replication inherently occur with each use of the invention, the situation requires clear delineations of ownership and authorization.¹⁶¹ The emergence of self-replicating biotech and software patents are relatively new to patent law, and only a handful of precedents are available to navigate the issues.¹⁶² Copyright, on the other hand, has developed robust and mature case law and legal structures to address the issue of wholesale copying.¹⁶³ In particular, technology-specific statutory exemptions, contracts and licenses, and fair use exemptions address the incidental and self-replicating nature of software.¹⁶⁴ Each area shares overlapping policy considerations and all strive to strike the best balance between protecting creativity and benefitting the consumer.

1. The Essential-Step Exemption

As early as 1980, Congress saw the need to address copyright issues surrounding the incidental copies created when using software programs.¹⁶⁵ Known colloquially as the “essential-step defense,” the statute allows the *owner* of a copy of software to create copies without infringing so long as the copy acts as an essential step in the use of the program, such as a RAM copy.¹⁶⁶ The right to utilize the work is protected insofar as it does not infringe the copyright holder's right to

159. Since the actual price of the article does not include adequate compensation for the right to make unlimited replicas, it is questionable if the sale will provide “adequate financial reward” for the inventor. See Birdwell, *supra* note 65, at 216, 229.

160. See *infra* Part V (suggesting that maintaining strong patent protections offers the best results).

161. See *Monsanto Co. v. Bowman*, 657 F.3d 1341, 1348 (Fed. Cir. 2011) (explaining that applying patent exhaustion to self-replicating technologies would “eviscerate” patent protection for the industry (quoting *Monsanto Co. v. Scruggs*, 459 F.3d 1328, 1336 (Fed. Cir. 2006)), *cert. granted*, 133 S. Ct. 420 (2012)).

162. See, e.g., *Scruggs*, 459 F.3d at 1335–36 (using the limited number of available precedents from previous seed cases to support the court's ruling).

163. See *generally supra* Part IV.B (detailing how the essential step defense, licenses, and the fair use doctrine have developed in the copyright context).

164. See 17 U.S.C. § 117(c) (2006) (technology-specific statutory exemptions); 17 U.S.C. § 107 (fair use); *supra* Part I.B (contracts and licenses).

165. An Act to Amend the Patent and Trademark Laws, Pub. L. No. 96–517, 94 Stat. 3015 (1980) (amending 17 U.S.C. § 117 to allow for noninfringing incidental computer copies).

166. 17 U.S.C. § 117(a)(1).

distribute the work.¹⁶⁷ Similar to the first sale doctrine, the essential-step defense seeks to restrict the author's commercial influence after the sale.¹⁶⁸ Unnecessary copies lie outside the protection of the statute and still constitute infringing articles.¹⁶⁹

Courts apply the defense narrowly due largely to the pervasive nature of licensing rather than selling in the software industry,¹⁷⁰ which prevents most possessors of software from establishing actual ownership.¹⁷¹ Consequently, most users' rights to install and use software derive from specific terms in their licenses rather than from the exceptions laid out in the federal statute.¹⁷²

2. Licenses

Software licenses limit propagation and allow the inventor-owner to impose specific restrictions on the licensees.¹⁷³ As noted above, the majority of software sales are actually licenses.¹⁷⁴ The scope of the license limits the ability to create copies, even those necessary to utilize the product.¹⁷⁵ Unless otherwise stated in the license, the licensee has no authority to resell, replicate, or use the product in violation of the license's terms.¹⁷⁶

This demarcation establishes clear rules when operating with self-replicating software.¹⁷⁷ The buyer has notice that the

167. *Rudolph Leska, Vernor v. Autodesk, Inc.*, 621 F.3d 1102 (9th Cir. 2010), 15 INTELL. PROP. L. BULL. 99, 100 (2011), available at http://www.iplb.org/assets/pdfs/Volume15/Surveys/USF_IPLB_15-1_Leska_Survey.pdf (“[T]he ‘owner of a particular copy’ enjoys the right to sell that copy without infringing the distribution right of the copyright holder.”).

168. *See* 17 U.S.C. § 107 (first sale doctrine); Leska, *supra* note 167, at 100 (drawing similarities between the essential-step defense and the first sale doctrine because both require an authorized sale).

169. The essential-step defense only allows copies “created as an essential step in the use of the program on a machine, and for no other purpose.” Leska, *supra* note 167, at 100.

170. Cohen & Lemley, *supra* note 43, at 34 (“[S]oftware vendors have taken the position that all software is licensed rather than sold.”).

171. *Vernor v. Autodesk, Inc.*, 621 F.3d 1102, 1111 (9th Cir. 2010) (“[A] software user is a licensee rather than an owner of a copy where the copyright owner: (1) specifies that the user is granted a license; (2) significantly restricts the user’s ability to transfer the software; and (3) imposes notable use restrictions.”).

172. *See Autodesk*, 621 F.3d at 1112 n.13.

173. *See, e.g., End User License Agreement*, *supra* note 45, § 4.

174. *See Autodesk*, 621 F.3d at 1111.

175. *See, e.g., End User License Agreement*, *supra* note 45, § 16.6.2.

176. *See, e.g., id.* § 4.61.

177. The malleability of licenses allows for a plethora of variations to accommodate the unique characteristics of self-replicating technology. *See supra* note 38 (detailing the restrictions in Monsanto’s technology agreement). Monsanto’s attempt to permit only the first planting of its seeds serves as a prime example. *See id.* That limited license to create replicas remains with the first purchaser, even after the first purchaser has sold their seeds, similar to the end user license in *Vernor v. Autodesk*. *See Autodesk*, 621 F.3d at 1112.

inventor-owner maintains the rights in the product.¹⁷⁸ Unsurprisingly, reproduction without use—such as copying the product onto an independent disk—typically conflicts with the license.¹⁷⁹ Replication through use, however, has defined boundaries authorizing the program to promulgate only so far as the license permits.¹⁸⁰ Anything more is both a breach of the license and a violation of the patent owner's right to exclude others from copying and distributing the software.¹⁸¹

3. Fair Use

Fair use, a common-law principle that Congress codified in § 107 of the Copyright Act, rests on the belief that the public has a right to use copyrighted materials in certain ways without infringing.¹⁸² Criticism, commentary, transformative adaptations, and even reverse engineering are among the excepted uses.¹⁸³ Fair use serves as a “traditional safety [valve to] balance the public's interest” in using limited amounts of the protected works and the copyright owners' property interests.¹⁸⁴ A fair use analysis considers four primary factors: (1) the purpose and character of the use, (2) the nature of the work being copied, (3) the amount taken, and (4) its effect on the original work's potential market.¹⁸⁵ Private, noncommercial uses generally have a greater likelihood of escaping liability.¹⁸⁶

178. See Michael L. Rustad & Diane D'Angelo, *The Path of Internet Law: An Annotated Guide to Legal Landmarks*, 2011 DUKE L. & TECH. REV. 12, 39 n.161; see e.g., *End User License Agreement*, *supra* note 45, § 3.

179. See, e.g., *End User License Agreement*, *supra* note 45, § 4.6.1.

180. See, e.g., *id.* § 16.6.2.

181. See *Autodesk*, 621 F.3d at 1112 (“Vernor's sales infringed Autodesk's exclusive right to distribute copies of its work.” (citing 17 U.S.C. § 106(3) (2006))).

182. H.R. REP. NO. 94-1476, at 65 (1976), *reprinted in* 1976 U.S.C.C.A.N. 5659, 5678 (giving “express statutory recognition [to fair use] for the first time” and noting that “there is ample case law recognizing the existence of the doctrine and applying it”).

183. See 17 U.S.C. § 107 (commentary); *Campbell v. Acuff-Rose Music, Inc.*, 510 U.S. 569, 569 (1994) (“The more transformative the new work, the less will be the significance of other factors, like commercialism, that may weigh against a finding of fair use.”); *Atari Games Corp. v. Nintendo of Am. Inc.*, 975 F.2d 832, 843 (Fed. Cir. 1992) (“[R]everse engineering object code to discern the unprotectable ideas in a computer program is a fair use.” (citing *Feist Publ'ns, Inc. v. Rural Tel. Serv. Co.*, 499 U.S. 340, 350 (1991))).

184. NANCY KRANICH, BRENNAN CTR. FOR JUSTICE, *THE INFORMATION COMMONS: A PUBLIC POLICY REPORT 7* (2004), *available at* <http://www.fepproject.org/policyreports/InformationCommons.pdf>.

185. *Acuff-Rose*, 510 U.S. at 576–77.

186. See *id.* at 585 (“[T]he fact that a publication was commercial as opposed to nonprofit is a separate factor that tends to weigh against a finding of fair use.” (quoting *Harper & Row, Publishers, Inc. v. Nation Enters.*, 471 U.S. 539, 562 (1985))).

Software rarely finds protection under this defense.¹⁸⁷ The complexity of code coupled with the desire to preserve utilitarian aspects of the product typically results in exact copies.¹⁸⁸ Additionally, the readily available market allows an unauthorized copy to amount to a lost sale.¹⁸⁹ Despite the limitations of the defense, the ease of copying and ready market for the illicit copies lead software manufacturers to avoid the application of fair use entirely if possible. Hence, licenses—which are not authorized sales—continue to be copyright’s most useful paradigm for protecting self-replicating software.

C. *The Limits of Patent Law*

Both patent and copyright exist in the same legal realm, but the rationales underpinning each framework differ, leading to overlapping but not congruent protections. Because patent rights and copyright rights may exist simultaneously in the same software, the policy governing such technology should consider both sets of rights.¹⁹⁰ Unlike copyright, patent law does not distinguish among technologies.¹⁹¹ If the doctrine of patent exhaustion is insufficient to permit the free use of incidental software copies, it should also not apply to self-replicating seeds.¹⁹²

The potential solutions to this problem—congressional action, licenses, or the creation of a fair use doctrine—either conflict with traditional patent law theory or suffer from limitations of scope and effectiveness. A technology-specific statutory exemption in patent law, like those found in § 117 of the Copyright Act, would likely

187. There are some scenarios where software has found a haven under the fair use doctrine. In *Lewis Galoob Toys, Inc. v. Nintendo of America, Inc.*, for example, the Ninth Circuit held that modification of copyright software for personal use was fair. See 964 F.2d 965, 970 (9th Cir. 1992) (agreeing with the lower court “that ‘a family’s use of a Game Genie for private home enjoyment must be characterized as a non-commercial, nonprofit activity’”). Similarly, in *Sega Enterprises Ltd. v. Accolade, Inc.*, the Ninth Circuit held that making copies in the course of reverse engineering is a fair use when it is the only way to get access to the “ideas and functional elements” in the copyrighted code and when “there is a legitimate reason for seeking such access.” *Sega Enters. Ltd. v. Accolade, Inc.*, 977 F.2d 1510, 1527–28 (9th Cir. 1992).

188. See, e.g., *Sega*, 977 F.2d at 1525 (“The record makes clear that disassembly is wholesale copying.”).

189. See *id.* at 1517.

190. Cohen & Lemley, *supra* note 43, at 27.

191. Arthur J. Gajarsa, Judge, U.S. Court of Appeals for the Fed. Circuit, Lecture at the Fifth Annual Honorable Helen Wilson Nies Memorial Lecture in Intellectual Property: Quo Vadis? (Apr. 22, 2002), in 6 MARQ. INTELL. PROP. L. REV. 1, 6–7 (2002) (“[The courts] also need to determine whether or not we should have a different standard of patentability for biotech cases and also for software. Should there be a different patentability standard that is established by decision of our court or by statute?”).

192. See *supra* Part IV.A.

conflict with the policies underlying the patent system.¹⁹³ Licenses are readily available in patent law but limit the use of the technology through privity of contract, excluding Bowman's particular use (that is, where allowing the use of the article also allows unlimited reproduction).¹⁹⁴ Lastly, as discussed below, the introduction of a fair use doctrine in patent law has multiple supporters, but to apply it, self-replicating technologies would create a self-serving, narrow doctrine that does not find support in the rationales underpinning the patent system.¹⁹⁵

1. Congressional Action

While parties have litigated the question of patent exhaustion for over a decade, Congress has not resolved the question for the courts.¹⁹⁶ Agribusiness ranks as one of the most influential lobbying sectors, spending over \$1.5 billion on lobbying from 1998–2012.¹⁹⁷ Monsanto's lobbying arm alone has averaged over \$7 million each year for the past five years, including attempts to influence the America Invents Act and the Patent Reform Act of 2009.¹⁹⁸ Yet Congress remains silent.

Even if Congress passed a statutory exception for self-replicating biotechnology, it would fail to provide the same balance of equities found in the copyright code.¹⁹⁹ The essential-step

193. See *supra* Part IV.B.1 (explaining that the essential-step defense in copyright relies on the premise that the use of the article does not affect the other party's distribution right).

194. *Monsanto Co. v. Bowman*, 657 F.3d 1341, 1346 (Fed. Cir. 2011) ("The Technology Agreement signed by Bowman extended only to seeds purchased from Monsanto or a licensed dealer; thus, Bowman's use of the commodity seeds was not within the scope of the agreement."), *cert. granted*, 133 S. Ct. 420 (2012).

195. See Maureen A. O'Rourke, *Toward A Doctrine of Fair Use in Patent Law*, 100 COLUM. L. REV. 1177, 1180 (2000); S. Carran Daughtrey, Note, *Reverse Engineering of Software for Interoperability and Analysis*, 47 VAND. L. REV. 145, 183–84 (1994); *infra* Part IV.C.3 (explaining why self-replicating technologies are too narrow to justify a fair use doctrine in patent law).

196. The Federal Circuit decided the first of the three existing seed cases in 2002. See *McFarling I*, 302 F.3d 1291 (Fed. Cir. 2002).

197. *Influence & Lobbying: Ranked Sectors (1998–2012)*, OPENSECRETS.ORG, <http://www.opensecrets.org/lobby/top.php?indexType=c> (last visited Jan. 20, 2013).

198. *Influence & Lobbying: Lobbying—Monsanto Co. (2012)*, OPENSECRETS.ORG, <http://www.opensecrets.org/lobby/search.php> (search "Search by name" for "Monsanto"; then follow "Monsanto Co" hyperlink) (last visited Jan. 20, 2013); *Influence & Lobbying: Monsanto Co. Bills Lobbied (2011)*, OPENSECRETS.ORG, <http://www.opensecrets.org/lobby/search.php> (search "Search by name" for "Monsanto"; then follow "Monsanto Co" hyperlink; then select "Bills" tab; then select "2011" under "Year") (last visited Jan. 20, 2013); *Influence & Lobbying: Monsanto Co.—Bills Lobbied (2010)*, OPENSECRETS.ORG, <http://www.opensecrets.org/lobby/search.php> (search "Search by name" for "Monsanto"; then follow "Monsanto Co" hyperlink; then select "Bills" tab; then select "2010" under "Year") (last visited Jan. 20, 2013).

199. See *supra* Part IV.B.1.

defense weighs the value of the consumer's right to use the work against the right holder's ability to control the distribution of his work.²⁰⁰ It strikes this balance by allowing only essential or incidental copies.²⁰¹ The scope of the reproduction is extremely limited, the reproduction is difficult to copy to another medium, and it presents little danger of misappropriation.²⁰² Seeds hold no such limitations.²⁰³ Each Monsanto soybean plant yields an average of 85.8 new seeds, enabling farmers to pluck them from the stem and replant them without any additional effort. Further, while the license typically permits the use of the RAM copy, the software user does not own it.²⁰⁴ The same cannot readily be said for the seeds produced from the farmer's plants.²⁰⁵ The ease of misappropriation and distribution and the questionable ownership of the incidental seed copies upset the balance needed for an equitable statutory amendment.²⁰⁶

2. Licenses

Similar to copyright, licenses prove to be the most easily adapted and versatile solution; however, the need for privity of contract to grant the right to make precludes Bowman's use. Monsanto's technology agreements are similar to software licenses, allowing limited replications in pursuit of utilizing the good.²⁰⁷ Unlike software, though, the process will consume the patented article that provides the input and blueprint for reproduction.²⁰⁸ This inherently

200. See Leska, *supra* note 167, at 100.

201. See 17 U.S.C. § 117(a)(1) (2006) (“[A] new copy or adaptation [that] is created as an essential step in the utilization of the computer program . . . and . . . used in no other manner [is not an infringement].”).

202. *Apple Computer, Inc. v. Formula Int'l, Inc.*, 594 F. Supp. 617, 622 (C.D. Cal. 1984) (“[T]he type of copying authorized by the statute must be no more permanent than is reasonably necessary.”), *aff'd*, 725 F.2d 521 (9th Cir. 1984).

203. Incidental software copies are typically limited to only a few per machine, are erased from RAM on each shutdown, and require additional effort to extract the copy from the RAM for use elsewhere. See *Apple Computer*, 594 F. Supp. at 622 (finding that RAM copies are created only when the software is being used, are temporary, and are erased when the computer is shut down). Conversely, seeds reproduce exponentially, will remain in existence indefinitely, and can create replicas simply from being dropped on the ground. See *More Beans Per Pod*, *supra* note 4 (explaining that seeds replicate at rates of eighty-to-one without loss of genetic material).

204. See, e.g., *MAI Sys. Corp. v. Peak Computer, Inc.*, 991 F.2d 511, 519 (9th Cir. 1993).

205. The farmer-to-granary sale and the granary-to-Bowman sale are both valid and without the licensing restrictions from Monsanto's technology agreement. See *Monsanto Co. v. Bowman*, 657 F.3d 1341, 1346 (Fed. Cir. 2011), *cert. granted*, 133 S. Ct. 420 (2012).

206. See *supra* Part IV.B.1.

207. See *Bowman*, 657 F.3d at 1344–45 (restricting the use to a single crop that then must be sold as commodity seed and not replanted).

208. See Jeff Schalaus, *How Seeds Work*, THE BACKYARD GARDENER (Feb. 1, 2007), <http://cals.arizona.edu/yavapai/anr/hort/byg/archive/howseedswork.html> (explaining germination and the self-contained reproductive system of a seed). Seeds naturally cannibalize themselves in

limited duration and purpose restrict the licensing option.²⁰⁹ The need for economic feasibility requires Monsanto to allow the farmers at least one use for the resulting seeds, and Monsanto chose to allow the sale of commodity seeds as that one use.²¹⁰ Because the second farmer is the owner of the seeds pursuant to an authorized sale and not a licensee, the patent holder does not receive the same benefits as a copyright holder in a similar position.²¹¹

For the patent holder of self-replicating technology, contractually restricted sales, like those involving Monsanto's technology agreements, may provide the only protection available.²¹² Utilizing contract law allows each separate technology to find its own balance, a considerable value given the variety of crops Monsanto alone markets—from soybeans to cotton to sugar beets.²¹³ As the patent holder, Monsanto has the authority to grant both the right to use and to make the self-replicating technology.²¹⁴ This contract-law solution, however, fails to settle the question of patent exhaustion and Bowman's predicament.²¹⁵

the pursuit of creating replicas. *See id.* Questions arise on how to compensate the rights holder: Should the license be revoked after planting? Are they entitled to the planted seeds, the progeny of those seeds once grown, or simply monetary compensation? Compare this situation to a violation of the incidental copy of a software program where a single CD may be returned or the program remotely deactivated and locked.

209. Both the seeds purchased from Monsanto and their progeny have utility only if sold or planted, and once planted, the original seeds cannot then be sold, creating a zero-sum game that Monsanto built its licensing around. *See supra* note 38 (listing the restrictions placed on Monsanto seeds). The first generation of purchased seeds must be planted, while the second-generation progeny must be sold. *See Yee Wah Chin, Inexhaustible: Patents on Self-Replicating Technologies*, 3 LANDSLIDE 12, 16 (2011).

210. It makes sense that for farmers to have an incentive to purchase Monsanto seeds, the agribusiness must allow at least one permissible use for the resulting second-generation seeds. Farmers already have the option to purchase soybeans from the local granary. *See Bowman*, 657 F.3d at 1345. Monsanto offers an improved version of soybeans, but their benefits, such as higher yields, cannot be realized without planting them. *See More Beans Per Pod, supra* note 4. Even after harvesting, the crop is just a hill of beans unless they can be sold or used in some other fashion.

211. *Vernor v. Autodesk, Inc.*, 621 F.3d 1102, 1112 (9th Cir. 2010) (showing that a copyright owner can avoid the application of the first sale doctrine, even with regards to incidental copies, by merely licensing its product instead of selling it). While Autodesk could prevent Vernor from selling his second-hand CDs for lack of an authorized sale, Monsanto has no such hook with Bowman. *See id.* at 1115.

212. *See, e.g., 2011 Monsanto Technology/Stewardship Agreement (Limited Use License)*, *supra* note 9.

213. *U.S. Technology Use Guide, supra* note 7, at 1, 17.

214. *See supra* note 147 and accompanying text.

215. *See Monsanto Co. v. Bowman*, 657 F.3d 1341, 1346–48 (Fed. Cir. 2011) (explaining that regardless of the fact that “Bowman’s use of the commodity seeds was not within the scope of the [Technology] agreement,” when the commodity seeds are planted and “the next generation of seed develops, the grower has created a newly infringing article”), *cert. granted*, 133 S. Ct. 420 (2012).

3. Fair Use

In the absence of a statutory exception or specific contract, perhaps Bowman's actions deserve a fair use exemption. Multiple scholars have suggested a fair use standard in patent law over the years to address issues ranging from failures in the licensing market to enabling quicker adaptation of patent scope to keep pace with the speed of technological evolution.²¹⁶ While some call for a universal doctrine, others suggest only applying it to those industries showing a net need.²¹⁷ The suggested tests often mirror those codified in the Copyright Act, which instructs the courts to analyze the commercial nature of the infringement, its effect on the market, the nature of the work infringed, and any transformative or innovative additions to the infringing article.²¹⁸

While the fair use doctrine may effectively balance equities in copyright, self-replicating technology does not justify extending fair use to patents. First, where its copyright equivalent acts as a buffer for First Amendment rights, the First Amendment is irrelevant in patent law, which addresses only market issues and economic rights.²¹⁹ Second, the technology lacks the criteria necessary to garner protection under the fair use test. The technology itself is highly commercial in nature, and its use creates exact replicas containing no

216. See, e.g., O'Rourke, *supra* note 195, at 1180.

217. See Joshua I. Miller, *Towards a Doctrine of Fair Use in Some of Patent Law*, 2 INTELL. PROP. BRIEF 56, 57 (2011) ("[F]air use . . . should instead only apply to industries and technologies that raise network effect concerns."); O'Rourke, *supra* note 195, at 1205 ("The lack of any universal principle accounting for differences between the copyright and patent incentive schemes suggests that there may be such cases in patent law as well.")

218. O'Rourke presents one variation of the relevant factors:

[F]ive factors relevant to a fair use finding: (i) the nature of the advance represented by the infringement; (ii) the purpose of the infringing use; (iii) the nature and strength of the market failure that prevents a license from being concluded; (iv) the impact of the use on the patentee's incentives and overall social welfare; and (v) the nature of the patented work.

O'Rourke, *supra* note 195, at 1205. The US Code, by comparison, lists the following as the relevant fair use factors:

[F]actors to be considered shall include—(1) the purpose and character of the use, including whether such use is of a commercial nature or is for nonprofit educational purposes; (2) the nature of the copyrighted work; (3) the amount and substantiality of the portion used in relation to the copyrighted work as a whole; and (4) the effect of the use upon the potential market for or value of the copyrighted work.

17 U.S.C. § 107 (2006).

219. Patent law does not have the accompanying First Amendment considerations that spurred the need for a fair use doctrine in copyright. See KRANICH, *supra* note 184, at 7 (discussing fair use and the first sale rule as "traditional safety valves [that] balance the public's interest in open access with the property interests of copyright owners"). Instead, it would serve primarily as a market adjustment, transferring economic rights and benefits (the right to make) from the patent holder to the consumer.

more (or less) innovation than the original. Likewise, the activity would effectively cannibalize the market for the existing product until no market remained.²²⁰ While one can imagine noncommercial uses, a doctrine of fair use should require more than very rare scenarios for support.²²¹

V. DUAL EXPLICIT LICENSES BEST PROTECT SELF-REPLICATING TECHNOLOGIES

The best option for controlling patent rights in self-replicating products lies in the courts refusing to apply patent exhaustion and allowing the industry to rely on explicit licenses to use and to reproduce patented technology. The rights held by a patentee are best viewed as a bundle—distinct and divisible.²²² The patent exhaustion doctrine removes a single particular article from patent protection, to be *used* and *resold* at the whim of its new owner.²²³ Purchasing the good does not grant the right to reproduce it.²²⁴ The right to reproduce—and the ability to assign that right—rests with the patent holder.²²⁵

Quanta's patent exhaustion test attempts to grant the right to use an article that embodies the patent.²²⁶ With self-replicating technology, however, using and making the invention are one and the same.²²⁷ Where the act of using and making are so inescapably intertwined, the purchaser must obtain authorization to perform both actions.²²⁸

220. See *supra* note 127 and accompanying text.

221. It is possible to construct a hypothetical, noncommercial technology that is both innovative in its own right and is capable of increasing in innovation when replicated without affecting the market for the original. See Jeremy Sheff, *Self-Replicating Technologies*, PATENTLY-O (Apr. 30, 2012, 2:27 PM), <http://www.patentlyo.com/patent/2012/04/self-replicating-technologies.html> (citing nanomedicine as a self-replicating technology that is so personalized that reproduction would not be marketable). Given the examples from past and present (seeds, biotechnology, software, etc.), this would be an oddity without comparison. See *supra* Part I.A–B (describing seeds and software as innovative self-replicating technologies that reduce the market for the original when copied illicitly).

222. See *supra* note 147 and accompanying text.

223. See *supra* note 62 and accompanying text.

224. See *supra* note 148 and accompanying text.

225. See *supra* note 149 and accompanying text.

226. See *supra* Part II.C.

227. See *supra* notes 11–14 and accompanying text.

228. See *Monsanto Co. v. Bowman*, 657 F.3d 1341, 1344–45 (Fed. Cir. 2011) (requiring that a license be signed to obtain the right to both use the seed and make copies), *cert. granted*, 133 S. Ct. 420 (2012). The technology agreement extends beyond the dichotomy of planting versus selling—it includes provisions for not supplying the seed to others for crop breeding, research, or herbicide-registration data collection. *Id.* at 1346.

The joint-permission requirements for self-replicating technologies create two possible types of sales. The first sale from Monsanto to the farmer includes full authorization both to use and to make the seeds.²²⁹ Monsanto limits this authorization—which is within its power—to a single generation of crops.²³⁰ The authorization does not extend to the second-, third-, or *n*th-generation seeds.²³¹ Whether or not the patent exhaustion doctrine extends to the subsequent generations of seeds remains irrelevant because farmers cannot replant the seeds without the authorization to “make” as well.²³²

The second type of sale relates both to when the farmer sells his crop to the granary and to when the granary sells commodity seed to another farmer. Monsanto sanctions the former as far as it comports with the technology agreement signed by the farmer.²³³ The latter transaction from granary to farmer is one step removed from the initial Monsanto technology agreement and suffers none of the accompanying restrictions.²³⁴ While these transactions could arguably trigger the patent exhaustion doctrine under *Quanta*,²³⁵ they lack Monsanto’s authorization to “make” the invention that would allow replanting of the seeds. As limited by the technology agreement,²³⁶ the farmer lacks the authority to grant the “right to make” to the granary, and the granary never had the authority to assign the right to its buyer.²³⁷ It would make little sense to allow any vendor with the right to sell an invention to also grant the right to reproduce it. The right to reproduce should remain with the patent holder and its designees.

229. *See id.* at 1344–45.

230. *See id.* at 1345.

231. *See id.*

232. *See supra* note 148 and accompanying text. Under a theory of dual permissions, the exhaustion of the right to use would not include an accompanying exhaustion of the right to make. *See Osborne, supra* note 55, at 648. The latter *must* be obtained from the rights holder or another authorized entity. *See id.*

233. *See Bowman*, 657 F.3d at 1345 (explaining how Monsanto prohibits all sales of first-generation seeds and allows sale of second-generation seeds only to local granaries as commodity seeds).

234. *See id.* at 1346.

235. *See supra* note 134 and accompanying text.

236. *Cf. supra* note 176 and accompanying text.

237. *See Bowman*, 657 F.3d at 1346; *see also Vernor v. Autodesk, Inc.*, 621 F.3d 1102, 1112 (9th Cir. 2010).

A. Alignment with Patent Policies

Requiring grants for both rights creates bright-line rules that fit well within established patent law principles.²³⁸ Strong incentives are necessary to protect self-replicating technologies from the economic dangers of misappropriation.²³⁹ The requirement also provides a certainty which is currently lacking and encourages further innovation.²⁴⁰ Supporting a strong patent system removes the complications that would arise by applying the exhaustion doctrine and requiring the patent holder to maintain contractual privity to protect its investment.²⁴¹

1. Competitive Economic Rationale

Instituting patent exhaustion at the first point of sale for self-replicating technologies would create an environment that punishes innovation and rewards parasitic behavior. Where the technology at issue is an input for a production cycle with exponential returns, the sale of customer seed at each generation would significantly erode the patentee's revenue stream.²⁴² The situation would make it potentially impossible for the inventor to recoup its sizable investment in research and development required to create the technology in the first place.²⁴³

This is the classic free-rider problem, and it is particularly relevant for inventions that are easy to copy once they have been introduced to the public.²⁴⁴ Self-replicating technologies only exacerbate this problem since they provide both the input and the

238. See Craig Allen Nard & John F. Duffy, *Rethinking Patent Law's Uniformity Principle*, 101 NW. U. L. REV. 1619, 1620 (2007) (identifying uniformity, encouraging technological innovation, and providing *predictable* litigation rules as criteria for evaluating Federal Circuit precedent).

239. Allowing even a single self-replicating article to circumvent patent law has the potential of destroying the entire market for the good. See *supra* note 127 and accompanying text.

240. See *supra* Part II.C.

241. See Chin, *supra* note 209, at 16 (advocating a second layer of licensing in which farmers could sell their commodity seed only to granaries who have signed contracts to not resell the seeds for planting).

242. See *supra* note 127 and accompanying text.

243. See *Why Does Monsanto Sue Farmers Who Save Seeds?*, *supra* note 5.

244. Jason Savich, Note, *Monsanto v. Scruggs: The Negative Impact of Patent Exhaustion on Self-Replicating Technology*, 22 BERKELEY TECH. L.J. 115, 120 (2007) ("Absent such protection, free-riders who do not bear the costs of R & D, could quickly copy the invention and capitalize on the inventor's work.").

process for practicing the invention.²⁴⁵ One solution to this economic conundrum, albeit a poor one, involves incorporating the present value of all future sales into the price for the first sale.²⁴⁶ Where it now costs an Indiana farmer \$50 per acre to plant Roundup Ready soybeans, the price could rise to \$50,000 or more per acre if the initial price reflects all the possible future earnings represented by that one bag of seeds.²⁴⁷ Presumably, no farmer could afford such an exorbitant cost and would not buy seeds. Monsanto must then either drop the price or not sell at all.²⁴⁸ Furthermore, faced with such a scenario, Monsanto has no incentive to create new and better seeds.²⁴⁹ Such a price would be more detrimental than the free-rider problem, as neither the public nor the inventor would benefit.²⁵⁰

2. Innovative Rationale

Perhaps the most fundamental rationale behind the US patent system lies in the belief that an exclusionary monopoly induces innovation by allowing inventors to recoup the costs associated with their research.²⁵¹ Progress is rarely the result of a flash of genius and is more often the product of diligence and hard work.²⁵² Removing the inventor's ability to exclude others from practicing the patent diminishes his incentive to invent in the first place.²⁵³ Even if an

245. Katherine J. Strandburg, *What Does the Public Get? Experimental Use and the Patent Bargain*, 2004 WIS. L. REV. 81, 105 (applying the "free-rider 'incentive to invent' analysis" to self-disclosing technologies).

246. Posting of Yee Wah Chin, to Jeremy Sheff, *Self-Replicating Technologies*, PATENTLY-O (May 1, 2012, 12:42 AM), <http://www.patentlyo.com/patent/2012/04/self-replicating-technologies.html>.

247. These numbers are entirely hypothetical. For a more mathematically sound analysis, however, consider that one seed may create a plant with fifty new seeds, each of which is capable of creating a similar plant. After two growing cycles, one seed has become 2,500 seeds, and after three seasons, 125,000 seeds. Thus, Monsanto must price a single seed equivalent to the value of over one hundred thousand seeds to capture the value lost if the right to make is exhausted.

248. See Sheff, *supra* note 221.

249. See *id.*

250. See *id.*

251. See Estelle Derclaye, *Eudemonic Intellectual Property: Patents and Related Rights as Engines of Happiness, Peace, and Sustainability*, 14 VAND. J. ENT. & TECH. L. 495, 500–01 (2012).

252. See *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 15 (1966) (rejecting the "flash of creative genius" test for patentability (quoting *Cuno Eng'g Corp. v. Automatic Devices Corp.*, 314 U.S. 84 (1941))).

253. See Niels Melius, *Trolling for Standards: How Courts and the Administrative State Can Help Deter Patent Holdup and Promote Innovation*, 15 VAND. J. ENT. & TECH. L. 161, 169 (2012) ("[B]ecause companies produce an invention only if it can be profitable, patent exclusivity allows an inventor to recover research and development costs, prevents free-riding, and thus creates incentives for innovation.").

inventor does decide to invest the time, energy, and funds necessary for proper research, the inventor will prefer to retain his work as a trade secret because the patent system will offer no protection or financial incentive.²⁵⁴ This deprives the public of the new knowledge.

3. Why Licenses and Contracts Are Unnecessarily Convolutd

Reliance on contract law for post-sale restrictions is convoluted and does not address the primary issue of incentivizing innovation without creating unnecessary burdens on consumers.²⁵⁵ Bowman purchased the commodity seeds from his local grain elevator without any restrictions or encumbrances.²⁵⁶ Monsanto was not a party in the transaction in any sense other than being the patent holder of the technology imbued in the product.²⁵⁷ The current license and post-sale-restriction frameworks are insufficient to prevent the unencumbered sale of patented seeds to farmers.²⁵⁸

For Monsanto to control the product, it must control each step in the process.²⁵⁹ Monsanto would need to require the farmers to purchase the seed directly from Monsanto, promising only to plant a single crop and not save or reuse the seeds.²⁶⁰ Additionally, Monsanto would need to require the farmers to sell their crops only to Monsanto-certified granaries.²⁶¹ Monsanto would need to enter into contractual relationships with each granary, requiring the granaries to keep the patented seed separate from unpatented seed and to sell the patented seed only if the purchaser signs another technology agreement.²⁶²

This setup is far from desirable for a number of reasons. Most importantly, it requires Monsanto to vertically integrate itself throughout the entire seed business.²⁶³ It would need to act as inventor, producer, seller, and storage-facility owner.²⁶⁴ Not only placing a large financial burden on the agribusiness, the setup also is likely to conflict with antitrust proponents, who already argue that

254. See James W. Beard, *The Limits of Licensing: Quanta v. LGE and the New Doctrine of Simultaneous Exhaustion*, 2008 UCLA J.L. & TECH. 3, 4–5.

255. See *supra* note 241 and accompanying text.

256. *Monsanto Co. v. Bowman*, 657 F.3d 1341, 1345 (Fed. Cir. 2011), *cert. granted*, 133 S. Ct. 420 (2012).

257. See *id.* at 1346.

258. See *id.*

259. See *supra* note 241 and accompanying text.

260. See *Bowman*, 657 F.3d at 1344–45.

261. See *supra* note 241 and accompanying text.

262. See *supra* note 241 and accompanying text.

263. See Sheff, *supra* note 221.

264. See *id.*

Monsanto abuses its substantial market influence.²⁶⁵ A simple and straightforward dual-permission requirement for self-replicating technologies avoids this confusion, while still providing adequate incentives for investment and innovation.

VI. CONCLUSION

Self-replicating technologies have brought fresh discussion to the scope of patents—particularly among groundbreaking biotechnological creations. While the traditional patent exhaustion doctrine would remove the patent holder's ability to control the use of a sold item, complications arise when to use the article requires making the patented article as well. The rationale supporting the classic patent exhaustion doctrine is insufficient to support exhaustion of both patent rights. Software and copyright law offer alternative legal frameworks, including technology-specific statutory exceptions, licensing arrangements, and the fair use doctrine. The unique issues surrounding self-replicating technologies, however, fail to align with the frameworks' underlying rationales. Ultimately, only robust patent rights and a refusal to apply the patent exhaustion doctrine to actions like Bowman's comport with patent law's purpose of advancing innovation and the sciences.

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265. *See id.*

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