

EXHAUSTION IN THE SERVICE OF PROGRESS[♦]

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ABSTRACT

*Under the doctrine of patent exhaustion, an authorized sale of a patented item exhausts the patentee's rights with respect to that item, leaving the purchaser and subsequent owners free to use or resell it without fear of an infringement lawsuit. In 2017, the U.S. Supreme Court issued its landmark decision in *Impression Products v. Lexmark International*, which strengthened the exhaustion doctrine in various significant ways. The Court held that an authorized sale of a patented item exhausts all patent rights with respect to that item, regardless of any restrictions on use or resale the patentee purports to impose. The Court further held that exhaustion is triggered not only by local sales but also by authorized sales outside the United States. The decision is likely to have considerable implications across various industries.*

This Article examines the immensely valuable but underexplored role that the exhaustion doctrine could play in the context of cumulative innovation. Research and development efforts often involve the need to use earlier patented inventions. Yet, licensing transactions between follow-on inventors and patent owners are characterized by particularly high transaction costs and other factors that may impede the ability of the parties to reach an agreement. As a result, the patent system ends up at times stifling technological progress rather than promoting it.

*This Article demonstrates that this concern may be mitigated by the *Impression Products* decision. The patent exhaustion doctrine, as construed by the Supreme Court, could constitute an effective policy tool for facilitating cumulative innovation in a variety of settings. For instance, under the post-*Impression Products* exhaustion doctrine, a*

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patent owner would not be able to invoke patent law to prevent a purchaser of a patented product from reverse engineering said product while developing an improved version or a compatible product, using the patented product as a research tool in the investigation of any subject matter, or combining the product with other components or integrating it into a larger system. Most importantly, the post-Impression Products exhaustion doctrine would shield such activities of a follow-on inventor notwithstanding any contractual post-sale restrictions and regardless of the location of the sale. Overall, applying the exhaustion doctrine to cumulative innovation settings in the manner proposed by this Article could have vast implications for our innovation ecosystem.

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INTRODUCTION

Under the doctrine of patent exhaustion, the sale of a patented item by or under the authorization of the patent owner exhausts the patent rights with respect to that item.¹ Thus, following such sale, the patent

¹ See, e.g., *Impression Prods. v. Lexmark Int'l, Inc.*, 137 S. Ct. 1523, 1529 (2017); *Quanta Comput., Inc. v. LG Elecs., Inc.*, 553 U.S. 617, 625 (2008); *Bowman v. Monsanto Co.*, 569 U.S. 278, 283 (2013); *Lexmark Int'l, Inc. v. Impression Prods.*, 816 F.3d 721, 726 (Fed. Cir. 2016). The term “patented item” (or alternative terms, such as “patented product” or “patented article”) is typically used in the context of the exhaustion doctrine in a broad sense, encompassing both an item that comprises a product invention and an item embodying the essential features of a process

owner cannot invoke patent law to control that item.² The purchaser and all subsequent owners of that item are free to use or resell it, just like any other item of personal property, without fear of an infringement lawsuit.³ In 2017, the Supreme Court significantly expanded the scope of the exhaustion doctrine in *Impression Products v. Lexmark International* (“the *Impression Products* decision”).⁴ The decision sets significant limitations on the ability of a patent owner to control patented articles after selling them. The Court held, among other things, that even if an authorized sale of a product is made under contractual restrictions regarding the use or resale of the product, the patent owner could not enforce such restrictions through an infringement lawsuit.⁵ The Court further held that exhaustion is triggered even by an authorized sale of a product outside the United States.⁶ Thus, a patentee cannot rely on patent law to prevent importation of patented articles that have been sold abroad.

The *Impression Products* decision may have considerable implications for both producers and consumers of patented products in various industries. Among other things, by holding that post-sale restrictions cannot be enforced through patent law, the Court has made it more difficult for producers of patented products to engage in product differentiation.⁷ At the same time, companies that sell products outside the United States for lower prices are now facing an increased concern that such products will be imported and sold locally.⁸

This Article focuses on a different context where the exhaustion doctrine, as construed in the *Impression Products* decision, may have a significant impact—cumulative innovation. The potential application of the exhaustion doctrine in this domain has not been sufficiently explored in patent literature.⁹

invention. See *infra* notes 29–31 and accompanying text (discussing exhaustion of process patents).

² *Impression*, 137 S. Ct. at 1529; *Quanta*, 553 U.S. at 638.

³ *Impression*, 137 S. Ct. at 1529; *Bowman*, 569 U.S. at 280.

⁴ *Impression*, 137 S. Ct. 1523.

⁵ *Id.* at 1535 (“Once a patentee decides to sell—whether on its own or through a licensee—that sale exhausts its patent rights, regardless of any post-sale restrictions the patentee purports to impose, either directly or through a license.”).

⁶ *Id.* (“An authorized sale outside the United States, just as one within the United States, exhausts all rights under the Patent Act.”).

⁷ See *infra* pp. 94–95.

⁸ See *infra* note 62 and accompanying text.

⁹ For notable exceptions, see Ariel Katz, *The First Sale Doctrine and the Economics of Post-Sale Restraints*, 2014 BYU L. REV. 55 (2014) (maintaining that the design of optimal exhaustion rules should take into account the growing importance of user innovation); Julie E. Cohen & Mark A. Lemley, *Patent Scope and Innovation in the Software Industry*, 89 CALIF. L. REV. 1, 30–35 (2001) (discussing the possibility of construing various doctrines, including the exhaustion doctrine, in a manner that would enable reverse engineering of software inventions); Pamela Samuelson, *Freedom to Tinker*, 17 THEORETICAL INQUIRIES L. 563 (2016) (describing the role that exhaustion plays in intellectual property law in providing a zone of freedom to tinker to those

Technological research and development (R&D) is commonly conducted in a cumulative manner, involving the use of earlier patented inventions.¹⁰ In certain cases, a follow-on inventor may be able to secure a license to use the patented invention for such purposes. Yet, theoretical and empirical studies show that the chances that the inventors will reach an agreement to this effect are not high.¹¹ Patent law must take this into account to ensure that the exclusive rights granted to the patent owner do not end up stifling technological innovation rather than promoting it.

One of the primary measures that is often employed by legal systems to address this potential market failure is an experimental use exception from infringement liability.¹² Such an exception typically allows for certain research uses of the patented invention to take place during the patent term without the patent owner's advance permission. Such uses may ultimately result in the development of follow-on inventions for the benefit of society. Yet, in the United States, the scope of the experimental use exception is so limited that it is practically non-existent.¹³

Against this background, this Article examines the possibility of employing the exhaustion doctrine as an alternative policy tool to facilitate cumulative innovation. It appears that the exhaustion doctrine could indeed serve as an important policy tool in a variety of cumulative innovation settings that involve the use of a patented article sold by or under the authorization of the patentee. For instance, under the exhaustion doctrine, it seems that follow-on inventors can freely engage in reverse engineering patented products, which may lead to the development of improvements, variations, and compatible products.¹⁴ Another scenario of cumulative innovation where a robust exhaustion rule could be beneficial is the use of patented research tools in experiments designed to investigate various subject matters.¹⁵ Likewise, under the exhaustion doctrine, patent owners cannot invoke patent law to prevent the combination of their products with other components or their products' integration into larger systems.¹⁶ Most importantly, the post-*Impression Products* exhaustion doctrine would shield such activities of a follow-on inventor from a patent infringement lawsuit

who have acquired products in the marketplace); *see also* Andrew W. Torrance & Eric von Hippel, *The Right to Innovate*, 2015 MICH. ST. L. REV. 793 (2015) (discussing the importance of protecting consumer innovation from excessive negative impacts caused by legislation and regulation).

¹⁰ *See infra* notes 64–71 and accompanying text.

¹¹ *See infra* notes 75–84 and accompanying text.

¹² *See infra* notes 85–90 and accompanying text.

¹³ *See infra* notes 91–95 and accompanying text.

¹⁴ *See infra* notes 103–107 and accompanying text.

¹⁵ *See infra* notes 115–117 and accompanying text.

¹⁶ *See infra* p. 103.

notwithstanding any contractual post-sale restrictions. Indeed, contract clauses that purport to control the use of patented products, including ones that prohibit reverse engineering, are not infrequent.¹⁷ While there is a possibility that these kinds of contractual restrictions could be enforced in state courts through contract law, bringing an action under breach of contract is much less effective for patent owners than a patent infringement lawsuit.¹⁸

Beyond that, by holding that exhaustion is triggered by sales outside of the United States, the Court seems to have enabled follow-on inventors to purchase patented items abroad (for cheaper prices, if available), use them as research tools, as a basis for improvements, or as components in larger systems, and then import the ensuing products and distribute them in the United States without fear of infringement liability.¹⁹

The application of the exhaustion doctrine in such scenarios certainly does not obviate the need for a broad experimental use exception. Such an exception could be valuable in various circumstances that do not trigger exhaustion—for instance, in the case of a follow-on inventor who wishes to use a patented process that is not embodied in a product sold by the patentee.²⁰ In any event, applying patent exhaustion in cumulative innovation settings in the manner proposed by this Article could be immensely valuable in reducing the chilling effect that patents may have on follow-on researchers and increasing competition in innovative industries.

This Article proceeds as follows: Part I introduces the doctrine of patent exhaustion and analyzes the facts and holding of the *Impression Products* decision. Part II focuses on cumulative innovation, describing the phenomenon and the way the law currently addresses it. Part III attempts to connect these previously unconnected dots by exploring the potential use of the exhaustion doctrine to facilitate cumulative innovation in a variety of settings. Finally, Part IV addresses some of the challenges and potential criticisms of the thesis advanced in this Article.

I. PATENT EXHAUSTION AND THE *IMPRESSION PRODUCTS* DECISION

The longstanding doctrine of patent exhaustion, also known as the first sale doctrine, provides that when the patentee, or someone under its authority, sells a product embodying the patented invention, such sale exhausts the patentee's right to control the use and resale of that

¹⁷ For examples, see *infra* notes 133–134 and accompanying text.

¹⁸ See *infra* Section IV.A.

¹⁹ See *infra* Section III.B.3.

²⁰ See *infra* note 165 and accompanying text.

product.²¹ Clearly, the sale of a patented item only exhausts the rights of the patentee with respect to such particular item and does not extinguish the patent altogether.²² Thus, the purchaser is not entitled to make, use, or sell additional copies of the patented item.²³

The doctrine of patent exhaustion has evolved in the United States through judicial decisions, though there is no congressionally prescribed exhaustion rule in the Patent Act.²⁴ The main policy justification for the exhaustion doctrine is the desire to accommodate free use and alienability of patented goods released into the stream of commerce.²⁵

The origin of the patent exhaustion doctrine is commonly traced to *Bloomer v. McQuewan*.²⁶ The Supreme Court in that case held that when the patent owner sells an item, and the item “passes to the hands of the purchaser, it is no longer within the limits of the monopoly” and instead becomes the “private, individual property” of the purchaser, with the rights and benefits that come along with ownership.²⁷

The exhaustion doctrine has undergone various developments over the years.²⁸ In recent years, the Supreme Court visited patent exhaustion

²¹ See, e.g., *Quanta Comput., Inc. v. LG Elecs., Inc.*, 553 U.S. 617, 625 (2008) (“The longstanding doctrine of patent exhaustion provides that the initial authorized sale of a patented item terminates all patent rights to that item.”); see also *Glass Equip. Dev. v. Besten, Inc.*, 174 F.3d 1337, 1344 n.1 (Fed. Cir. 1999) (“The first sale doctrine stands for the proposition that, absent unusual circumstances, courts infer that a patent owner has given up the right to exclude concerning a patented article that the owner sells.”); Amelia Smith Rinehart, *Contracting Patents: A Modern Patent Exhaustion Doctrine*, 23 HARV. J.L. & TECH. 484, 484 (2010) (noting that the exhaustion doctrine is also known as the first sale doctrine); Joseph L. Roth, *Exhaustion Cannot Stifle Innovation: A Limitation on the “First Sale” Doctrine*, U.C. IRVINE L. REV. 1231, 1234 (2015) (“Under the [first sale] doctrine, the first authorized sale of a patented article “exhausts”—or eliminates—the patent owner’s right to control the use of that particular article.”).

²² See, e.g., Cohen & Lemley, *supra* note 9, at 31 (“It is not the patent right itself that is exhausted, of course.”).

²³ See, e.g., *Bowman v. Monsanto Co.*, 569 U.S. 278, 284 (2013) (clarifying that “the doctrine restricts a patentee’s rights only as to the ‘particular article’ sold; it leaves untouched the patentee’s ability to prevent a buyer from making new copies of the patented item”) (citation omitted); see also Cohen & Lemley, *supra* note 9, at 31 (“The patentee retains the rights to prevent anyone else, including the buyer, from making, using, or selling additional copies of the patented item.”); Rinehart, *supra* note 21, at 535 n.4 (“Under current law, the patent owner retains his right to exclude purchasers of the articles from making the patented invention anew.”).

²⁴ See, e.g., Roth, *supra* note 21, at 1239 (“To this day, the doctrine is entirely judge-made—there is not, and never has been, a first-sale patent statute.”).

²⁵ See, e.g., *id.* at 484 (“The patent exhaustion doctrine . . . evolved . . . to accommodate the free movement of patented goods in commerce.”) and 492 (noting that “enforcement of . . . resale or use restrictions would create an obstacle to the free use and alienability of personal property.”). Another policy rationale underlying the exhaustion doctrine that is often noted by courts and scholars is that a patent owner should not be allowed to “double dip,” i.e., collect more than her fair reward. *Id.* at 1242.

²⁶ *Bloomer v. McQuewan*, 55 U.S. 539 (1853); see, e.g., Roth, *supra* note 21, at 1240 (“Courts and scholars generally trace the first-sale doctrine to the mid-nineteenth-century case of *Bloomer v. McQuewan*.”).

²⁷ *Bloomer*, 55 U.S. at 549–50.

²⁸ One notable doctrine that has evolved as part of exhaustion jurisprudence is the repair-reconstruction dichotomy: while repairing a patented product whose patent rights have been exhausted is permissible, the reconstruction of same product amounts to the making of a new

three times.²⁹ In *Quanta Computer, Inc. v. LG Electronics, Inc.*, the Court held that the exhaustion doctrine applies not just with respect to product patents but also in regard to method patents—in this case, methods of operating a computer system—provided that the sold item substantially embodies the patent in suit.³⁰ The Court clarified that an item is considered to be substantially embodying the patent when its only reasonable and intended use is to practice the patent, and it embodies the essential features of the patented invention.³¹

A few years later, in *Bowman v. Monsanto Co.*,³² the Court held that patent exhaustion does not permit a farmer to reproduce patented GMO seeds through planting and harvesting without the patent holder's permission.³³ In reaching this conclusion, the Court relied on the well-settled rule that exhaustion does not extend to the right to make new copies of the patented item.³⁴

In 2017, the Supreme Court issued its highly anticipated decision in the *Impression Products* case.³⁵ The decision strengthens and extends the scope of the exhaustion doctrine and sets significant limitations on the ability of patent owners to control their products after their initial sale. The underlying dispute was about toner cartridges for laser printers designed, manufactured, and sold by Lexmark to consumers in the United States and around the globe.³⁶ Lexmark owns a number of patents covering components of those cartridges and the manner by which they are used.³⁷ When a cartridge runs out, it can be refilled and used again.³⁸ This creates an opportunity for other companies—known

article, and thus, constitutes patent infringement. See *Aro Mfg. Co. v. Convertible Top Replacement*, 365 U.S. 336 (1961). Courts have struggled in drawing the line between repair and reconstruction. See *Mallinckrodt, Inc. v. Medipart, Inc.*, 976 F.2d 700, 709 (Fed. Cir. 1992) (“Although the rule is straightforward its implementation is less so, for it is not always clear where the boundary lies: how much ‘repair’ is fair before the device is deemed reconstructed.”); Mark D. Janis, *A Tale of the Apocryphal Axe: Repair, Reconstruction and the Implied License in Intellectual Property Law*, 58 MD. L. REV. 423, 425 (1999) (“The repair-reconstruction dichotomy has baffled and annoyed courts for decades, often driving courts to employ ‘loose language.’”).

²⁹ Before *Quanta Computer, Inc. v. LG Elecs., Inc.*, 553 U.S. 617 (2008), the Supreme Court last decided a patent exhaustion case in *United States v. Univis Lens Co.*, 316 U.S. 241 (1942). Rinehart, *supra* note 21, at 485 n.9 (noting the sixty-six year hiatus prior to *Quanta*).

³⁰ *Quanta*, 553 U.S. at 629 (noting that “this Court has repeatedly held that method patents were exhausted by the sale of an item that embodied the method.”).

³¹ *Id.* at 631–33, relying on *Univis*, 316 U.S. 241. In both cases, the sold article was found to be substantially embodying the patent because it carried out all the inventive processes, and the only step necessary to practice the patent was the application of common processes or the addition of standard parts.

³² *Bowman v. Monsanto Co.*, 569 U.S. 278 (2013).

³³ *Id.* at 280.

³⁴ *Id.* at 284; see *supra* text accompanying note 23.

³⁵ *Impression Prods. v. Lexmark Int’l, Inc.*, 137 S. Ct. 1523, 1529 (2017).

³⁶ *Id.* at 1529.

³⁷ *Id.*

³⁸ *Id.*

as remanufacturers—to acquire empty cartridges from consumers, refill them, and then resell them at a lower price than the price offered by Lexmark.³⁹ In order to incentivize consumers to avoid selling spent cartridges to such companies, Lexmark marketed the cartridges in two ways: for a full price, with no limitations; and for a discounted price, in exchange for the customer’s contractual commitment to use the cartridge only once and to refrain from transferring it to anyone but Lexmark.⁴⁰

Impression purchased empty cartridges from consumers in the United States, including cartridges that were sold to consumers at a discount, and refilled and resold the cartridges. Impression also purchased empty cartridges from consumers outside the United States and imported them back into the country in order to refill and resell them. Lexmark filed a patent infringement lawsuit against Impression Products for both schemes. Lexmark argued that by refilling and reselling the discounted cartridges and by importing cartridges into the United States—in both cases, with no authority from Lexmark—Impression Products ran afoul of its patent rights.⁴¹ Impression’s only defense was that Lexmark’s sales, both in the United States and abroad, exhausted Lexmark’s patent rights in the cartridges, so Impression was free to refill and resell the cartridges and to import them if acquired abroad.⁴²

Impression filed motions to dismiss with respect to both sets of cartridges. The district court granted the motion as to the domestic discounted cartridges but denied the motion as to the cartridges Lexmark sold abroad. Both parties appealed.⁴³

The United States Court of Appeals for the Federal Circuit considered the appeals and a divided en banc court ruled for Lexmark with respect to both sets of cartridges. The court accepted Lexmark’s position that a patent owner may sell an item while retaining the right to enforce post-sale restrictions through patent infringement lawsuits.⁴⁴ Viewing the exhaustion doctrine as derived from the prohibition on

³⁹ *Id.*

⁴⁰ *Id.* at 1529–30. To enforce this restriction, Lexmark installs a microchip on each cartridge sold at a discount that prevents reuse once the toner runs out. Yet, remanufacturers developed methods to counteract the effect of the microchips. “With that technological obstacle out of the way, there was little to prevent the remanufacturers from using the Return Program cartridges in their resale business. After all, Lexmark’s contractual single-use/no-resale agreements were with the initial customers, not with downstream purchasers like the remanufacturers.” *Id.* at 1530.

⁴¹ *Id.* at 1530.

⁴² *Id.*

⁴³ *Id.*

⁴⁴ *Lexmark Int’l, Inc. v. Impression Prods.*, 816 F.3d 721, 735 (Fed. Cir. 2016) (en banc). In holding this, the Federal Circuit adhered to its own decision in *Mallinckrodt, Inc. v. Medipart, Inc.*, 976 F.2d 700 (Fed. Cir. 1992).

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making, using, selling, or importing items “without authority,”⁴⁵ set forth in 35 U.S.C. §271(a), the Federal Circuit reasoned that a sale of a patented article by the patentee presumptively grants “authority” to use or resell the item, yet it is just that—a presumption.⁴⁶ When the sale is made under clearly communicated, otherwise-lawful restrictions, it does not confer on the buyer the authority to engage in the conduct that the restriction precludes.⁴⁷ Thus, “[t]he patentee does not exhaust its § 271 rights to charge the buyer who engages in those acts—or downstream buyers having knowledge of the restrictions—with infringement.”⁴⁸ The Federal Circuit also held that the sale of an item outside the United States does not exhaust the rights of the U.S. patent owner with respect to that item, and, hence, its importation constitutes patent infringement.⁴⁹

The Supreme Court granted certiorari and reversed the Federal Circuit’s decision with respect to both domestic and international exhaustion. The Court emphasized that the limit on patent rights imposed by the exhaustion doctrine functions automatically upon the sale of the item, which terminates all patent rights to that item.⁵⁰ Once ownership passes to the purchaser, the item becomes her personal property, and the patentee may no longer control its use or disposition.⁵¹ As part of its justification, the Court explained that upon the sale of an item, the patentee receives its reward, and thus, “the purpose of the patent law is fulfilled” with respect to such item; there is no justification for imposing further limitations on the ability to use and enjoy the thing sold.⁵² At this point in time, “patent rights yield to the common law principle against restraints on alienation.”⁵³ The Court criticized the reasoning used by the Federal Circuit as a basis for its decision, while clarifying that “the exhaustion doctrine is not a presumption about the authority that comes along with a sale; it is a limit on the scope of the

⁴⁵ *Lexmark*, 816 F.3d at 734 (quoting 35 U.S.C. § 271(a) (2010)).

⁴⁶ *Id.* at 742.

⁴⁷ *Id.* at 735, 742.

⁴⁸ *Id.* at 774.

⁴⁹ *Id.* In holding this, the Federal Circuit adhered once again to its own precedent. In *Jazz Photo Corp. v. Int’l Trade Comm’n*, 264 F.3d 1094 (Fed. Cir. 2001), the court had held that a patentee’s decision to sell a product abroad did not terminate its ability to bring an infringement suit against a buyer that imported the article and sold it in the United States. The Federal Circuit clarified that a buyer may still rely on a foreign sale as a defense for infringement, but only by establishing an express or implied license—a separate defense from exhaustion—based on patentee communications or other circumstances of the sale. *Lexmark*, 816 F.3d at 727.

⁵⁰ *Impression Prods. v. Lexmark Int’l, Inc.*, 137 S. Ct. 1523, 1531 (2017).

⁵¹ *Id.*

⁵² *Id.* at 1532.

⁵³ *Id.* at 1531. The Supreme Court has recently highlighted, in the context of copyright law, that exhaustion has “an impeccable historic pedigree,” tracing its lineage back to the “common law’s refusal to permit restraints on the alienation of chattels.” *Kirtsaeng v. John Wiley & Sons, Inc.*, 568 U.S. 519, 538 (2013).

patentee's rights."⁵⁴ Accordingly, even when a patentee sells an item under an express restriction, it does not retain patent rights in that item.⁵⁵ Applying these principles to the case at hand, the Court concluded that Lexmark exhausted its patent rights in the cartridges the moment it sold them. The single-use/no-resale restrictions may have been clear and enforceable under contract law, but they do not entitle Lexmark to retain patent rights in an item that it has elected to sell.⁵⁶

With respect to the geographical scope of the exhaustion doctrine, the Court held that an authorized sale of an item outside the United States exhausts the exclusive rights of the patent owner with respect to that item.⁵⁷ The Court rejected Lexmark's argument that a foreign sale does not trigger exhaustion, because the patentee may not be able to sell for the same price that it could in the United States. The Court held that exhaustion is triggered by the patentee's decision to sell and receive whatever fee it decides is appropriate for the article, as "the Patent Act does not guarantee a particular price, much less the price from selling to American consumers."⁵⁸ Ultimately, since Lexmark exhausted its exclusive rights with respect to the cartridges sold abroad, Impression was free to import the cartridges and sell them in the United States.

Justice Ginsburg concurred in the Court's holding regarding domestic exhaustion but dissented from the Court's holding on international exhaustion.⁵⁹

The *Impression Products* decision is likely to have significant implications across various industries.⁶⁰ As a result of the decision, anyone in the business of refurbishing, repairing, or reselling used products could now continue engaging in such practices—for the benefit of consumers of such products—without fear of being sued for patent infringement.⁶¹ At the same time, by restricting the ability of patent owners to set effective limitations on use and resale of patented

⁵⁴ *Impression*, 137 S. Ct. at 1527.

⁵⁵ *Id.* at 1532–33 (referring also to *Boston Store of Chicago v. Am. Graphophone Co.*, 246 U.S. 8 (1918); *United States v. Univis Lens Co.*, 316 U.S. 241 (1942); *Quanta Comput., Inc. v. LG Elecs., Inc.*, 553 U.S. 617 (2008)).

⁵⁶ *Impression*, 137 S. Ct. at 1531.

⁵⁷ *Id.* at 1527.

⁵⁸ *Id.* at 1537.

⁵⁹ *Id.* at 1538–39.

⁶⁰ See, e.g., Daniel Hemel & Lisa Larrimore Ouellette, *Licensing in the Shadow of Impression Products*, WRITTEN DESCRIPTION (May 31, 2017), <https://writtendescription.blogspot.com/2017/05/licensing-in-shadow-of-impression.html#more> ("Judging by the media coverage, the Supreme Court's decision today in *Impression Products, Inc. v. Lexmark Inc.* will have dramatic implications for producers and consumers of patented products around the world.")

⁶¹ See Adam Liptak & Vinu Goel, *Supreme Court Rules Patent Laws Can't Be Used to Prevent Reselling*, N.Y. TIMES (May 30, 2017), <https://www.nytimes.com/2017/05/30/business/supreme-court-patent-rights-lexmark.html> (quoting Stanford Law School professor Mark Lemley, who said that such businesses would now be protected from patent infringement claims).

articles, the decision makes it more difficult for businesses to engage in product differentiation and price discrimination, which may ultimately result in increased prices for certain patented goods. Notably, the decision to adopt a rule of international exhaustion enables importation of goods sold by patent owners in foreign markets at lower prices, which could cause a great deal of concern for firms that operate in local markets. In the pharmaceutical industry, for example, the decision might push U.S. companies to raise prices of drugs sold in developing countries in order to alleviate the concern that such drugs will be imported and sold for lower prices in the local markets.⁶² All in all, it is difficult to assess the net economic impact of the *Impression Products* decision, and this Article does not take a general stand on whether the case was rightly decided from a policy perspective.⁶³

This Article focuses on a different context where the *Impression Products* decision—by strengthening the exhaustion doctrine—may have a noticeable impact: the ability to use patented products for the purposes of cumulative innovation. There are strong reasons to believe that in this domain, the decision would be a net positive. Part II will describe the phenomenon of cumulative innovation, the main policy considerations at stake, and the manner by which the patent system currently handles it. Thereafter, in Part III, the analysis will turn back to the exhaustion doctrine and will explore the potential beneficial role that it may play in fostering innovation and progress.

II. CUMULATIVE INNOVATION

Technological R&D is often conducted in a cumulative manner.⁶⁴

⁶² Notably, this concern may be mitigated by FDA regulation that imposes restrictions on importation of prescription drugs manufactured abroad. *See* 21 U.S.C. § 331(d) combined with *id.* at § 355; *see also id.* at § 381(d) (banning re-importation of prescription drugs manufactured in the United States). *But see* Daniel J. Hemel & Lisa Larrimore Ouellette, *Trade and Tradeoffs: The Case of International Patent Exhaustion*, 116 COLUM. L. REV. SIDEBAR 17, 22 n.21 (2016) (noting that the ban on re-importation is subject to limitations and depends on discretionary government enforcement).

⁶³ In addition to the efficiency question that cannot be resolved absent conclusive empirical evidence that is not available yet, the adoption of an international exhaustion rule may have distributive consequences that are likely good for the United States but bad for lower income countries. *See generally* Hemel & Ouellette, *supra* note 62 (demonstrating that such a rule would likely lower prices of patented goods in the U.S. and raise prices abroad and would also impose costs on foreign governments that choose to subsidize access to patented goods for their own citizens).

⁶⁴ For the prevalence of cumulative innovation in different technological fields, see, for example, Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839 (1990) (providing a general account of cumulative innovation in various industries); Donna M. Gitter, *International Conflicts over Patenting Human DNA Sequences in the United States and the European Union: An Argument for Compulsory Licensing and a Fair-Use Exemption*, 76 N.Y.U. L. REV. 1623, 1691 (2001) (focusing on follow-on research involving patented DNA sequences); Clarisa Long, *Patents and Cumulative Innovation*, 2 WASH. U. J.L. & POL'Y 229, 233–45 (2000) (discussing cumulative innovation biomedical research). For a

Today's inventors must frequently build upon the discoveries and inventions of their predecessors while making their own contribution. When the prior art is protected by patents, there is a potential conflict between the exclusive rights of the patent owners and the need to use the patented inventions to make further developments.

The phenomenon of cumulative innovation is evident in a few typical scenarios. The patented invention could be a basic technology that serves as the foundation for a variety of applications in multiple fields. For example, Bluetooth technology, which provides wireless connectivity between devices in close proximity to each other, is built into numerous electronic devices, from laptops to mobile phones to wireless headsets to remote controls.⁶⁵ Another common scenario of cumulative innovation is when the later invention is an improvement of the original one. In the mobile phone industry, for example, new, improved products are released regularly.⁶⁶ A follow-on invention could also involve the finding of a new use for the original invention. Consider, for instance, the case of a new therapeutic use for an existing medical product.⁶⁷ A different type of a follow-on invention is a complementary invention—a new product or process that is related to the original invention and can be used with it.⁶⁸ This is the case, for example, when an application is designed to run on a certain platform.⁶⁹ Finally, a patented invention might constitute a research tool that could be used in the investigation of other subject matters.⁷⁰ Consider, for

detailed account of cumulative innovation, see Ofer Tur-Sinai, *Cumulative Innovation in Patent Law: Making Sense of Incentives*, 50 IDEA 723 (2010).

⁶⁵ For a settlement of a lawsuit issued by the Washington Research Foundation, the owner of patents allegedly underlying Bluetooth technology, against major producers of products incorporating the technology, see Richard Wilson, *CSR Pays \$15m to Settle Bluetooth Patent Case*, ELECTRONICSWEEKLY.COM (Apr. 19, 2007), <http://www.electronicweek.com/Articles/2007/04/19/41210/csr-pays-15m-to-settlebluetooth-patent-case.htm>. For other examples of basic technologies with a variety of applications, see Carmen Matutes et al., *Optimal Patent Design and the Diffusion of Innovations*, 27 RAND J. ECON. 60, 60–61 (1996).

⁶⁶ Improvements have been prevalent in the cellular phone industry even in the pre-smartphone era. See, e.g., Michael R. Franzinger, Comment, *Latent Dangers in a Patent Pool: The European Commission's Approval of the 3G Wireless Technology Licensing Agreements*, 91 CALIF. L. REV. 1693, 1698 (2003). Another example of a technological field where improvements are common is the computer industry. See, e.g., SUZANNE SCOTCHMER, *INNOVATION AND INCENTIVES* 129 (2006); Ian Ayres & Gideon Parchomovsky, *Tradable Patent Rights*, 60 STAN. L. REV. 863, 870–71 (2007); Richard R. Nelson, Comment, *Intellectual Property Protection for Cumulative Systems Technology*, 94 COLUM. L. REV. 2674, 2675–76 (1994).

⁶⁷ See NUNO PIRES DE CARVALHO, *THE TRIPS REGIME OF PATENT RIGHTS* 199 (2d ed. 2005).

⁶⁸ See, e.g., Elias G. Carayannis, Edgar Gonzalez & John Wetter, *The Nature and Dynamics of Discontinuous and Disruptive Innovations from a Learning and Knowledge Management Perspective*, in THE INT'L HANDBOOK ON INNOVATION 115, 121 (Larisa V. Shavinina ed., 2003) (noting “the invention of the mouse to support computer-human interaction” as an example for a complementary invention).

⁶⁹ See Pamela Samuelson & Suzanne Scotchmer, *The Law and Economics of Reverse Engineering*, 111 YALE L.J. 1575, 1615 (2002).

⁷⁰ See *infra* notes 115–117 and accompanying text. In this scenario, the basic invention is

example, the use of polymerase chain reaction (PCR), a technique for the amplification of DNA segments, as a research tool in numerous contexts.⁷¹

Given the importance of cumulative innovation, it must be encouraged by the legal system. The question is how to promote this goal while balancing it with other policy considerations that underlie the patent system. The primary economic theory used to justify patent law is the incentive to invent theory.⁷² According to this theory, the purpose of the patent system is to promote technological progress by providing an economic incentive to engage in R&D.⁷³ In a cumulative innovation setting, providing ample incentives to innovate might be particularly challenging. On the one hand, the law needs to ensure that the exclusive rights granted to one inventor do not unduly restrict the ability of other inventors to access, experiment with, and build upon prior inventions. On the other hand, there is a need to preserve the incentives of early inventors in the chain by enabling them to make sufficient profits that exceed their R&D costs.⁷⁴

It would be ideal if we could rely on sequential inventors to conclude voluntary license agreements that enable cumulative innovation while dividing market profits between the inventors in an efficient manner. However, due to certain difficulties associated with bargaining in a cumulative innovation setting, the chances for the conclusion of such voluntary agreements may not be high.⁷⁵ When it comes to an *ex ante* agreement—i.e., an agreement concluded before the follow-on R&D project takes place—the likelihood that the parties will be able to reach an agreement is particularly low. Among other things, at this early stage, transaction costs may be particularly high due to the great level of uncertainty surrounding the relevant parameters, including

typically not embedded in the final version of any ensuing products, even though it was used in the process of their development. See *infra* note 171 and accompanying text.

⁷¹ See, e.g., Marcela Agne Alves Valones et al., *Principles and Applications of Polymerase Chain Reaction in Medical Diagnostic Fields: A Review*, 40 BRAZ. J. MICROBIOLOGY 1, 5 (2009) (noting the use of PCR as a research tool in dentistry).

⁷² See, e.g., Kenneth W. Dam, *The Economic Underpinnings of Patent Law*, 23 J. LEGAL STUD. 247, 247 (1994); Yusing Ko, *An Economic Analysis of Biotechnology Patent Protection*, 102 YALE L.J. 777, 791–92 (1992).

⁷³ Dam, *supra* note 72, at 248. This incentive-based justification has roots in the U.S. Constitution, which empowers Congress to “promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Rights to their respective Writings and Discoveries.” U.S. CONST. art. I, § 8, cl. 8.

⁷⁴ See, e.g., Ofer Tur-Sinai, *Beyond Incentives: Expanding the Theoretical Framework for Patent Law Analysis*, 45 AKRON L. REV. 243, 252 (2012) (“From the perspective of the ‘incentive to invent’ theory, the challenge is to design patent law in a manner ensuring a division of profits between the inventors that allows each one to cover her costs and make a sufficient profit.”).

⁷⁵ See, e.g., Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989, 1052–65 (1997); Merges & Nelson, *supra* note 64, at 874–75; Maureen A. O’Rourke, *Toward a Doctrine of Fair Use in Patent Law*, 100 COLUM. L. REV. 1177, 1179 (2000).

R&D costs, the risk associated with the project, and the expected value of the resulting invention.⁷⁶ The bargaining inventors are also likely to find it difficult to agree upon their relative contributions to the follow-on invention.⁷⁷ Moreover, having no exclusive legal rights to her prospective invention at this point in time, the follow-on inventor might hesitate to disclose confidential information about her research agenda to the patent owner, which may use such information for its own benefit in case the deal falls through.⁷⁸ Further, in some situations, the original patentee may simply wish to retain sole control of the market, and therefore, it avoids licensing its invention to others to block them from improving upon the invention or designing around it.⁷⁹ When a follow-on inventor needs to rely on multiple patented inventions, collecting all the necessary licenses may be too costly and burdensome, and a “tragedy of the anticommons” may emerge.⁸⁰

The concerns noted above are not merely theoretical, but rather are backed by empirical evidence regarding delays or impediments to follow-on innovation resulting from high transaction costs and licensing failures.⁸¹ While some other empirical studies suggest that the effect of

⁷⁶ See Ofer Tur-Sinai, *The Trans-Pacific Partnership: Experimental Use of Patents on the International Agenda*, 16 N.C. J.L. & TECH. 63, 74 (2014); Tur-Sinai, *supra* note 64, at 753; see also Rebecca S. Eisenberg, *Proprietary Rights and the Norms of Science in Biotechnology Research*, 97 YALE L.J. 177, 217 (1987) (discussing the difficulty of valuing the right to use a patented invention before the research project is completed); Timothy J. Engling, *Improvements in Patent Licensing*, 78 J. PAT. & TRADEMARK OFF. SOC'Y 739, 741–42, 746 (1996) (maintaining that a future improvement cannot be valued upfront); Merges & Nelson, *supra* note 64, at 895 n.251 (pointing out that valuation problems in licensing transactions are difficult enough after an invention has been developed and are seemingly even more difficult prior to its development).

⁷⁷ See Tur-Sinai, *supra* note 76, at 74. This difficulty may exist even after the follow-on invention has been developed, “as each inventor may have an inflated idea of their own contribution or not understand the other’s contribution.” See, e.g., Tur-Sinai, *supra* note 64, at 751; Robert Merges, *Intellectual Property Rights and Bargaining Breakdown: The Case of Blocking Patents*, 62 TENN. L. REV. 75, 89–91 (1994).

⁷⁸ See Howard F. Chang, *Patent Scope, Antitrust Policy, and Cumulative Innovation*, 26 RAND J. ECON. 34, 38 n.6 (1995) (noting that while the follow-on inventor may not be able to induce the original inventor to get into a deal without disclosing her idea, such disclosure may undermine her bargaining power). See generally Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention*, in THE RATE AND DIRECTION OF INVENTIVE ACTIVITY: ECONOMIC AND SOCIAL FACTORS 609, 615–16 (Richard R. Nelson ed., 1962) (noting the quandary of disclosing information without legal rights to the invention).

⁷⁹ See, e.g., Tur-Sinai, *supra* note 64, at 751.

⁸⁰ Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCI. MAG. 698 (1998).

⁸¹ See, e.g., Merges & Nelson, *supra* note 64, at 884–908 (providing various examples from the history of science for cases where a patent had a chilling effect on follow-on R&D); Merges, *supra* note 77, at 84–87 (providing a historical account of the hindering effect of patents on follow-on R&D in the early days of the radio industry); Janice M. Mueller, *No “Dilettante Affair”: Rethinking the Experimental Use Exception to Patent Infringement for Biomedical Research Tools*, 76 WASH. L. REV. 1, 3 (2001) (describing the counter-productive enforcement practice of the owner of the patent on the PCR technique (a revolutionary DNA amplification process)); Henrik Holzapfel & Joshua D. Sarnoff, *A Cross-Atlantic Dialog on Experimental Use and Research Tools*, 48 IDEA 123, 143–44 n.98 (2008) (citing studies that present evidence for

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patents on the ability to conduct follow-on R&D may actually not be substantial,⁸² such studies are non-conclusive⁸³ and have a limited scope.⁸⁴ In any event, even if there may be cases where follow-on inventors can secure a voluntary agreement or otherwise pursue their R&D project without delay, despite the need to rely on patented inventions, this would certainly not always be the case.

In order to deal with this perceived market failure and ensure that the patent system does not have a chilling effect on follow-on R&D, many legal systems around the world have implemented an “experimental use exception” from patent infringement liability.⁸⁵ Such

delays or impediments to scientific research that result from patent licensing costs, licensing failures, or the chilling effect of uncertain potential liability); Jay P. Kesan, *Transferring Innovation*, 77 *FORDHAM L. REV.* 2169, 2182–83 (2009) (describing empirical studies indicating, among other things, the slowdown of development in industry as university patenting has increased); Ron A. Bouchard, *Balancing Public and Private Interests in the Commercialization of Publicly Funded Medical Research: Is There a Role for Compulsory Government Royalty Fees?*, 13 *B.U. J. SCI. & TECH. L.* 120, 144 (2007) (noting that “there is significant evidence to suggest that the scientific commons is eroding and that there is at least the potential for development of an anticommens”); see also James Bessen, *Holdup and Licensing of Cumulative Innovations with Private Information*, 82 *ECON. LETTERS* 321, 322 (2004) (demonstrating that *ex ante* licensing, in particular, is not a prevalent practice in industries characterized by cumulative innovation).

⁸² See, e.g., John P. Walsh et al., *Effects of Research Tool Patents and Licensing on Biomedical Innovation*, in *PATENTS IN THE KNOWLEDGE-BASED ECONOMY* 285 (Wesley M. Cohen & Stephen A. Merrill eds., 2003) (providing survey results indicating that the patenting of research tools in the biomedical industry has generally not been viewed as having a substantial negative effect on further research in the field). The main explanation for the results, supplied in the study, is that “firms and universities have been able to develop ‘working solutions’ that allow their research to proceed,” which one of is, simply, “taking licenses.” *Id.* at 286. The authors opine that “it is typically not that difficult to contract” and state that “[l]icensing is routine in the drug industry.” *Id.* at 322. For descriptions of other studies suggesting, in general, that scholars may have been overly concerned with the results of proprietarizing upstream research results, see Joshua D. Sarnoff & Christopher M. Holman, *Recent Developments Affecting the Enforcement, Procurement, and Licensing of Research Tool Patents*, 23 *BERKELEY TECH. L.J.* 1299, 1325–31 (2008); Katherine J. Strandburg, *User Innovation Community Norms: At the Boundary Between Academic and Industry Research*, 77 *FORDHAM L. REV.* 101, 103 n.8 (2009).

⁸³ See, e.g., Walsh et al., *supra* note 82, at 286 (conceding that there is “some evidence of delays associated with negotiating access to patented research tools, and there are areas . . . where access to foundational discoveries can be restricted.”).

⁸⁴ For example, the study of Walsh et al., *supra* note 82, focused entirely on research tools and was based on seventy interviews with individuals involved in biomedical research exclusively. For the limitation of this study, see also Rebecca S. Eisenberg, *Noncompliance, Nonenforcement, Nonproblem? Rethinking the Anticommons in Biomedical Research*, 45 *HOUS. L. REV.* 1059, 1076, 1098 (2008) (noting that it focused primarily on the effects of patents on the research science community itself while paying relatively little attention to the effects of such patents on downstream product development). Based on this and various other empirical studies, Eisenberg concludes that within the academy, the main impediment encountered by scientists is actually not patents but gaining access to tangible materials and data that they cannot readily duplicate in their own laboratories. However, downstream product-developing firms face a growing burden of transaction costs to identify and clear patent rights. *Id.* at 1098–99.

⁸⁵ See *infra* notes 86–87 (providing examples for countries that employ an experimental use exception from patent infringement). For studies supporting a wide experimental use exception, see, for example, Eisenberg, *supra* note 76, at 224–31; Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 *U. CHI. L. REV.* 1017, 1078 (1989); Irving N. Feit, *Biotechnology Research and the Experimental Use Exception to Patent*

an exception allows for certain experimental uses of a patented invention to take place during the patent term, even without the patent owner's advance permission. The scope of such experimental use exception varies between legal systems. One important question as to which extensive differences exist between various legal systems is whether the exception applies to experimental acts done for commercial purposes or not. In some jurisdictions, the fact that a commercial purpose underlies the experimental activity does not preclude an application of the exception,⁸⁶ while in other jurisdictions, the exception only encompasses non-commercial research.⁸⁷ Another question that is not treated uniformly is whether the exception only covers experiments *on* an invention—i.e., acts done for experimental purposes relating to the subject matter of the patented invention—or also experiments *with* an invention, encompassing experimental uses that aim at researching or developing a different subject matter.⁸⁸

When an experimental use exception is applicable, a follow-on inventor can work on her project without the need to disclose the matter to the original patentee. Upon completion, the follow-on inventor may even apply for a patent on her invention, if it meets the patentability criteria.⁸⁹ Sure enough, as the experimental use exception only applies to experimental activities carried on during the development stage, a follow-on inventor who wishes to commercially exploit her invention

Infringement, 71 J. PAT. & TRADEMARK OFF. SOC'Y 819, 839–41 (1989); Mueller, *supra* note 81, at 66; Tom Saunders, Case Comment, *Renting Space on the Shoulders of Giants: Madey and the Future of the Experimental Use Doctrine*, 113 YALE L.J. 261, 268 (2003); Katherine J. Strandburg, *What Does the Public Get?: Experimental Use and the Patent Bargain*, 2004 WIS. L. REV. 81, 119–52 (2004); Wendy Thai, *Toward Facilitating Access to Patented Research Tools*, 6 MINN. J.L. SCI. & TECH. 373, 390–97 (2004); Tur-Sinai, *supra* note 64, at 754–58. Sure enough, to the extent that patents do not pose a significant problem for follow-on researchers (*see supra* note 82 and accompanying text), the line-drawing costs associated with the enforcement of an experimental use exception could outweigh any benefits.

⁸⁶ See, e.g., Patentgesetz (PatG) [Patent Law], Dec. 16 1980, BUNDESGESETZBLATT, Teil I [BGBL. I] at 14, § 11.2 (Ger.), last amended by Gesetz [G], Oct. 19, 2013, BGBL. I at 3380, art. I (Ger.), translated in BUSINESS TRANSACTIONS IN GERMANY app. 11 (Bernd Ruster ed., 2014); *see also* Patent Act, 1977, c. 37 § 60(5)(b) (U.K.).

⁸⁷ See, e.g., Ley de la Propiedad Industrial [LPI] [Law of Industrial Property], art. 22, Diario Oficial de la Federación [DOF] 25-06-1991, últimas reformas DOF 29-06-2010 (Mex.); Law No. 24.481, art. 36 (Arg.); *see also infra* notes 91–95 and accompanying text regarding the United States.

⁸⁸ For countries that employ an exception of the first type, see, for example, Patent Act, 1977, c. 37, § 60(5)(b) (U.K.), available at <http://www.ipo.gov.uk/patentsact1977.pdf>; CODE DE LA PROPRIÉTÉ INTELLECTUELLE [Intellectual Property Code], art. L613-5(b) (Fr.), available at www.jpo.go.jp/shiryoku_e/s_sonota_e/fips_e/pdf/france_e/e_chiteki_zaisan.pdf; Patents Act 1992 § 42(b) (Act No. 1/1992) (Ir.), <http://www.irishstatutebook.ie/1992/en/act/pub/0001/index.html>. For countries that employ an exception of the second type, see, for example, Belgium: 143 Loi sur les brevets d'invention [Patent Act] of Mar. 28, 1984, MONITEUR BELGE [M.B.] [Official Gazette of Belgium], Jan. 28, 1997, art. 28(1)(b); Patents Law, 5727-1967 § 1 (Isr.).

⁸⁹ In such a scenario, the original patent and the follow-on patent are sometimes referred to as “blocking patents.” See, e.g., SCOTCHMER, *supra* note 66, at 129; Lemley, *supra* note 75, at 1008–10; Merges & Nelson, *supra* note 64, at 860–62.

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may still need a license to manufacture and sell it, to the extent that such activity falls under the scope of the original patent. Yet, the chances of concluding such an *ex post* agreement are presumably higher than the chances of agreeing on the matter *ex ante*, particularly if the follow-on inventor has already applied for patent protection.⁹⁰ Hence, the experimental use exception is considered a significant tool in facilitating cumulative innovation.

However, the experimental use exception under United States patent law has been construed very narrowly by the courts. Among other things, courts have consistently held that the existence of a commercial purpose at the basis of the experimental activity negates the exception, even if the intention is to exploit the invention only after the original patent expires.⁹¹ In *Madey v. Duke University*, the Federal Circuit refused to apply the exception even in the context of basic research conducted by scientists in a nonprofit research university.⁹² The court held that “so long as the act is in furtherance of the alleged infringer’s legitimate business and is not solely for amusement to satisfy idle curiosity, or for strictly philosophical inquiry, the act does not qualify for the very narrow and strictly limited experimental use defense.”⁹³ In finding infringement, the court ruled that research projects conducted in a university setting “unmistakably further the institution’s legitimate business objectives, including educating and enlightening students and faculty participating in these projects,” and that such projects “also serve, for example, to increase the status of the institution and lure lucrative research grants, students, and faculty.”⁹⁴

Over the years, much criticism has been made of the narrow scope of the experimental use exception in the United States, but the law on this point has not changed.⁹⁵ Against this background, Part III will turn back to the exhaustion doctrine and explore the possibility of using it to foster cumulative innovation.

⁹⁰ See *supra* note 78 and accompanying text with respect to the difficulty of conducting negotiation with the original patentee absent legal protection. Yet, although *ex post* agreements are considered easier to negotiate than *ex ante* agreements, they too cannot be taken for granted. As a result, it may be efficient to employ a compulsory license regime that enables commercial exploitation of a follow-on product while dividing the profit between the inventors in an efficient manner. For a detailed discussion, see Tur-Sinai, *supra* note 64, at 760–66.

⁹¹ See, e.g., *Embrex, Inc. v. Serv. Eng’g Corp.*, 216 F.3d 1343, 1349 (Fed. Cir. 2000) (stating the narrow construction of the experimental use exception); *Ares-Serono, Inc. v. Organon Int’l B.V.*, 862 F. Supp. 603, 608 (D. Mass. 1994) (clarifying that “[t]he experimental use exception does not protect experiments or tests which have a commercial purpose”); *Pfizer, Inc. v. Int’l Rectifier Corp.*, No. 73-58, 1982 U.S. Dist. LEXIS 17411, at *12 (C.D. Cal. July 20, 1982) (holding that experimental use “cannot be invoked for the protection of one who uses a patented invention commercially”).

⁹² *Madey v. Duke Univ.*, 307 F.3d 1351 (Fed. Cir. 2002) *cert. denied*, 539 U.S. 2639 (2003).

⁹³ *Id.* at 1362.

⁹⁴ *Id.*

⁹⁵ See, e.g., *supra* note 85.

Before proceeding, one clarification is in order. This Article uses the term “cumulative innovation” in a broad sense. First, the analysis is not restricted to R&D that leads to patentable inventions. Sub-patentable innovation can greatly benefit society even though it does not merit patent protection. Thus, patent law must be designed in a manner that would not unduly restrict such activity.⁹⁶ As an example, consider a combination of a patented component with other components. Such a combination may be considered obvious under current patentability standards and not qualify for patent protection,⁹⁷ but it may still promote consumer welfare by increasing competition in the relevant markets and perhaps serve later as the basis for further improvements or variations.⁹⁸ Second, while considering the role of the patent system in facilitating cumulative innovation, the analysis must encompass certain uses of patented inventions that do not necessarily fit the traditional paradigm of incremental innovation that is commonly depicted as “standing on the shoulders of giants.”⁹⁹ Patented inventions may also be used for the purposes of “non-linear innovation”—i.e., “innovation that breaks up with convention, identifies misconceptions, or disputes existing paradigms” and “steps off” the shoulders of giants”—and patent law should enable such socially valuable endeavors.¹⁰⁰

III. EXHAUSTION AS A TOOL TO FACILITATE CUMULATIVE INNOVATION

The time has come to examine the role that the exhaustion doctrine may play in facilitating cumulative innovation. As the analysis in this Part will demonstrate, exhaustion can serve as an important policy tool in this context.

This Article’s basic premise is that when a patented invention is embedded in a product sold by or under the authority of the patentee, the purchaser may use it for any purpose, including that which is R&D-related. The purchaser may also resell it to a different entity that will then use it for such purposes. The potential impact on the innovation ecosystem cannot be overstated.

⁹⁶ For a comprehensive treatment of cumulative innovation in this context, see Jerome H. Reichman, *Of Green Tulips and Legal Kudzu: Repackaging Rights in Subpatentable Innovation*, 53 VAND. L. REV. 1743, 1756–76 (2000).

⁹⁷ See Michal Shur-Ofry, *Connect the Dots: Patents and Interdisciplinarity*, 51 U. MICH. J.L. REFORM 55, 70–72 (2017) (discussing the doctrinal treatment of combinations under patent law).

⁹⁸ Cf. Samuelson & Scotchmer, *supra* note 69, at 1483 (noting that reverse engineering may promote consumer welfare even when it does not lead to additional innovation by providing consumers with a competing product at a lower price).

⁹⁹ See, e.g., Suzanne Scotchmer, *Standing on the Shoulders of Giants: Cumulative Research and the Patent Law*, 5 J. ECON. PERSP. 29 (1991).

¹⁰⁰ Michal Shur-Ofry, *Non-Linear Innovation*, 61 MCGILL L.J. 563, 566 (2016).

A. Permitted Uses Under Exhaustion

There are different types of uses for a patented product that follow-on inventors can engage in as part of their R&D process. One such use is reverse engineering, which is typically defined as the process of extracting know-how or knowledge from a human-made artifact.¹⁰¹ It is conducted by “starting with the known product and working backward to divine the process which aided in its development or manufacture.”¹⁰² Reverse engineering of a patented product should be considered lawful under the exhaustion doctrine, as long as it does not involve the making of a copy of the patented product.¹⁰³

Reverse engineering is often an essential step in the process of improving a product.¹⁰⁴ As stated by the Supreme Court in *Bonito Boats v. Thunder Craft Boats*, reverse engineering is “an essential part of innovation,” likely to yield variations on the product that “may lead to significant advances in the field.”¹⁰⁵ Alongside improvements and variations, reverse engineering might also be a necessary step in the process of developing compatible products.¹⁰⁶ In addition, as recently highlighted by Michal Shur-Ofry, reverse engineering of technological products may be instrumental in exposing “negative information”—i.e., fallibilities, flaws, and errors—which, in turn, has an essential role in promoting innovation.¹⁰⁷

¹⁰¹ See Samuelson & Scotchmer, *supra* note 69, at 1577. Some inventions are readily apparent once embodied in a product. Consider, for instance, a paper clip. See Cohen & Lemley, *supra* note 9, at 23. However, in many industries—such as the software, semiconductor chip, and chemical industries—reverse engineering is often a necessary step towards extracting knowledge about the characteristics of the invention. *Id.* at 24–25.

¹⁰² *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 476 (1974).

¹⁰³ See Cohen & Lemley, *supra* note 9, at 32 (noting that reverse engineering of a product (other than software) generally does not involve copying and is thus permitted under the exhaustion doctrine); Samuelson & Scotchmer, *supra* note 69, at 1584 (making a similar argument). Notably, reverse engineering of patented software products generally involves the making of a copy while decompiling the software. See Cohen & Lemley, *supra* note 9, at 14 (“It is impossible to use software without ‘making’ a copy, at least temporarily, in the memory of a computer.”).

¹⁰⁴ See, e.g., Samuelson & Scotchmer, *supra* note 69, at 1582 n.23 (citing Pooley, who identifies various reasons for engaging in reverse engineering, including developing improvements); Cohen & Lemley, *supra* note 9, at 7 (maintaining that reverse engineering is where many improvers begin); see also *supra* note 66 and accompanying text (discussing improvements).

¹⁰⁵ *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 160 (1989); see Samuelson & Scotchmer, *supra* note 69, at 1583.

¹⁰⁶ See, e.g., Samuelson & Scotchmer, *supra* note 69, at 1582 n.23 (citing Pooley, who identifies this among the purposes for which reverse engineering may be conducted); Cohen & Lemley, *supra* note 9, at 18 (noting that reverse engineering may be used, *inter alia*, for producing products for downstream markets that are compatible with the original invention); see also Cohen & Lemley, *supra* note 9, at 21 (stating that reverse engineering is an important means of preserving compatibility between products, which is particularly important in markets characterized by network effects, such as software); Michal Shur-Ofry, *Access-To-Error*, 34 *CARDOZO ARTS & ENT. L.J.* 357, 373 (2016) (referring to the practice of reverse engineering for the purpose of achieving “interoperability”).

¹⁰⁷ Shur-Ofry, *supra* note 106, at 384–85 (discussing the use of reverse engineering to expose negative information); *id.* at 364–70 (noting the important role of negative information in

One could express doubt regarding the importance of reverse engineering in the context of patentable inventions, considering the disclosure a patent applicant is required to make as part of the “patent bargain.”¹⁰⁸ Indeed, pursuant to 35 U.S.C. § 112, a patent application must include a specification that contains a written description of the invention.¹⁰⁹ However, various commentators have observed that patent disclosures actually do not convey enough useful information.¹¹⁰ In fact, it appears that under the current disclosure requirements, patent applicants can often withhold valuable information from patent specifications, while continuing to protect their “know-how” through trade secrecy.¹¹¹ Moreover, at times, only certain components of a

promoting innovation).

¹⁰⁸ The notion of the “patent bargain” refers to the “bilateral relationship between the inventor and the state, under whose terms the inventor must disclose in exchange for protection of a property right in the invention.” Shubha Ghosh, *Patents and the Regulatory State: Rethinking the Patent Bargain Metaphor After Eldred*, 19 BERKELEY TECH. L.J. 1315, 1338 (2004); *see also* Wendy J. Gordon, *Intellectual Property*, in THE OXFORD HANDBOOK OF LEGAL STUD. 617, 632 (Peter Cane & Mark Tushnet eds., 2003) (discussing the notion of patent as bargain: “the government gives the possibility of exclusivity and in exchange the patent applicant gives disclosure”); Jeanne C. Fromer, *Patent Disclosure*, 94 IOWA L. REV. 539, 553 (2009) (“The accepted understanding in patent policy and doctrine is that disclosure of a patented invention to the public—and its dedication to the public after the expiration of the patent term—is part of a quid pro quo the patentee must provide to gain the broad patent right.”). In the Supreme Court’s words, “[T]he quid pro quo [for the patent grant] is disclosure of a process or device in sufficient detail to enable a person skilled in the art to practice the invention once the period of the monopoly has expired.” *Universal Oil Prods. Co. v. Globe Oil & Ref. Co.*, 322 U.S. 471, 484 (1944).

¹⁰⁹ In fact, the inventor must adequately disclose three separate elements: (1) enough information to indicate that the inventor is in possession of the claimed invention (the “written description” requirement); (2) the manner and process of making and using the invention, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same (the “enablement” requirement); and (3) the best mode contemplated by the inventor of carrying out his invention (the “best mode” requirement). *See* 35 U.S.C. § 112 (2012); DONALD S. CHISUM, 3 CHISUM ON PATENTS § 7–9 (2010); Fromer, *supra* note 108, at 546.

¹¹⁰ *See, e.g.*, Eisenberg, *supra* note 85, at 1029 (noting that “some people have questioned whether patent disclosures in fact convey enough information to be useful to the public”); Gordon, *supra* note 108, at 632 (“It has been argued that the enabling disclosure of the patent application is often not enabling at all.”); Samuelson & Scotchmer, *supra* note 69, at 1584 (acknowledging that “a patent does not teach technologists everything they might want to know . . .”). For a recent study that explores the extent to which scientific researchers look to patents as a source of technical information and find them to convey enough information to reproduce the invention, see Lisa Larrimore Ouellette, *Who Reads Patents?*, 35 NATURE BIOTECH. 421 (2017).

¹¹¹ *See, e.g.*, Eisenberg, *supra* note 85, at 1029 n.52 (referring to this practice); R2 Med. Sys., Inc. v. Katecho, Inc., 931 F. Supp. 1397, 1420 (N.D. Ill. 1996) (trade secrets may cover information that lies outside the disclosure requirements of the claimed invention). Notably, under the recently enacted Leahy-Smith America Invents Act (Pub. L. No. 112-29, 125 Stat. 284 (2011)), a failure to disclose the “best mode” can no longer serve as the basis for challenging the validity of the patent in litigation. *See* 35 U.S.C. § 282(b)(3)(A) (2012). As a result, it is likely that the best mode requirement is now largely ignored during prosecution as well. For criticism of this legislation, see Brian J. Love & Christopher B. Seaman, *Best Mode Trade Secrets*, 15 YALE J.L. & TECH. 1 (2012) (pointing at the likelihood that following this development, some patentees will attempt to claim both patent and trade secret protection by failing to disclose best mode); *see also*

product are patented, and as the disclosure only pertains to such components, the only way to obtain information about the unpatented components that are maintained in secrecy is through reverse engineering of the product.¹¹² For these reasons, patent disclosure does not substantially lessen the importance of reverse engineering as a tool for determining the characteristics of an invention.

Experimenting with the invention can sometimes take a different form that does not involve reverse engineering. For instance, experimental uses of an invention may include its testing in search of new potential uses or applications.¹¹³ Similarly, experiments may be conducted in an attempt to modify certain features of the invention, substitute its components with equivalent ones, or use the invention in different settings than the ones prescribed by the original manufacturer. Such experiments could ultimately lead to improvements in the product itself or in the best mode to operate it. These types of experimentation also seem to be permitted under the exhaustion doctrine, provided that they do not necessitate making a copy of the patented product.¹¹⁴

Another type of activity that involves the use of a patented invention for purposes of follow-on R&D is the use of a patented research tool in the process of developing a different invention.¹¹⁵ Research tools are essentially “products or processes used in research to investigate subjects other than the tools themselves.”¹¹⁶ To illustrate, in the biomedical field, research tools encompass “cell lines, monoclonal antibodies, reagents, animal models, growth factors, combinatorial chemistry and DNA libraries, clones and cloning tools (such as PCR),

Fromer, *supra* note 108, at 552 (maintaining that “patentees rationally have little to no incentive to offer more information than the patent laws require and have an incentive to obfuscate information they provide whenever possible.”).

¹¹² See, e.g., Samuelson & Scotchmer, *supra* note 69, at 1620 (discussing the practice of platform developers to patent some components of their systems while maintaining APIs as trade secrets); Cohen & Lemley, *supra* note 9, at 18 (noting that reverse engineering may be the only way to obtain access to unpatented components of a computer program).

¹¹³ See *supra* note 67 and accompanying text (discussing this scenario).

¹¹⁴ See Katz, *supra* note 9, at 114 (noting that exhaustion “allows a user who possesses a copy or an artifact to experiment with it without the need to obtain permission from the IP owners[.]”). Notably, in *Wilbur-Ellis Co. v. Kuther*, 337 U.S. 422, 425 (1964), the Supreme Court held that modifying components of a patented product in order to enhance its functionality did not count as an impermissible reconstruction of the product (“[I]n adapting the old machines to a related use [they] were doing more than repair in the customary sense; but what they did was kin to repair for it bore on the useful capacity of the old combination, on which the royalty had been paid.”). For a discussion, see Janis, *supra* note 28, at 470–71. For the repair-reconstruction dichotomy, see *supra* note 28.

¹¹⁵ See *supra* notes 70–71 and accompanying text (discussing this scenario).

¹¹⁶ Holzapfel & Sarnoff, *supra* note 81, at 124–25; see also Mueller, *supra* note 81, at 4, 14 (defining research tools in the biomedical industry as “the many varied resources used by scientists to conduct research and development of new drugs, therapies, diagnostic methods, and other therapeutic products”). For other possible definitions of the term “research tools,” see Sarnoff & Holman, *supra* note 82, at 1302.

methods, laboratory equipment, and machines.”¹¹⁷ Some research tools are sold in the free market. If this is the case, then under the exhaustion doctrine, the purchaser can clearly use the research tools to investigate any subject matter and develop new inventions.

As a final case in point, experiments can also involve attempts to combine the patented invention (or components of it) with different items or integrate it into a larger system.

Notably, under the exhaustion doctrine, the freedom that a follow-on inventor who purchased a patented product enjoys does not necessarily end when the development stage of the follow-on invention is over. The R&D efforts may successfully result in the development of a product that embodies the patented invention—for example, a new machine of which the patented product constitutes a component. In such a case, the follow-on inventor is free to manufacture such a machine on an ongoing basis while using patented products as components, provided that she continues to purchase the patented products rather than making them on her own.

Altogether, then, it appears that under the exhaustion doctrine, follow-on inventors are permitted to engage in various uses of patented inventions that may ultimately advance technological progress. This observation may sound like an obvious application of the exhaustion doctrine, but the connection between these two traditionally separate areas of patent law and policy is, in fact, not so apparent. Patent exhaustion is a nineteenth-century doctrine rooted in common law principles and designed primarily to preserve free movement of goods in commerce,¹¹⁸ whereas cumulative innovation is an area of concern that only in recent decades started to occupy economists and legal scholars.¹¹⁹ Accordingly, the ability to rely on exhaustion as a policy tool in the context of cumulative innovation has only been seldom mentioned in patent literature. Most scholarship that deals with cumulative innovation does not even list exhaustion as a relevant policy tool, while discussions of patent exhaustion tend to ignore its potential application in cumulative innovation settings.¹²⁰

Discussing the potential role that the exhaustion doctrine could play in this domain is particularly important considering the long

¹¹⁷ Principles and Guidelines for Recipients of NIH Research Grants and Contracts on Obtaining and Disseminating Biomedical Research Resources: Final Notice, 64 Fed. Reg. 72,090, 72,092 n.1 (Dec. 23, 1999).

¹¹⁸ See *supra* note 25 and accompanying text.

¹¹⁹ See, e.g., Nelson, *supra* note 66, at 2676 (arguing that the problems associated with the grant of strong patent rights in cumulative technologies are not adequately dealt with in the standard isolated invention model); Tur-Sinai, *supra* note 64, at 725 (pointing out that the traditional thinking in patent law assumes that each patented invention stands alone and tends to ignore the phenomenon of cumulative innovation).

¹²⁰ For notable exceptions, see *supra* note 9.

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stalemate on the experimental use front, which buttresses the need to consider alternative policy tools that could be used to foster follow-on innovation.¹²¹

Remarkably, absent an explicit discussion and clarification of these issues, potential users of patented inventions may mistakenly think that some of the aforementioned uses actually do require the patentee's consent.¹²² Consider, for instance, reverse engineering. As trade secret law does not forbid reverse engineering, some may think that patent law—which is known to provide a stronger protection—does prohibit reverse engineering. In fact, the Supreme Court, in its landmark decision in *Kewanee Oil v. Bicron Corp.*,¹²³ made a statement that may be viewed as reflecting this very notion. While comparing between trade secrets and patents, the Court noted:

Trade secret law provides far weaker protection in many respects than the patent law. While trade secret law does not forbid the discovery of the trade secret by fair and honest means, e.g., independent creation or reverse engineering, patent law operates “against the world,” forbidding any use of the invention for whatever purpose for a significant length of time.¹²⁴

It is true, of course, that patent law prohibits any use of the invention during the patent term—including reverse engineering—but pursuant to the exhaustion doctrine, this prohibition does not apply to a purchaser of a patented product. To the extent the law on this point is not entirely clear, it is important to remove any doubts in order to limit the chilling effect that patents may have on follow-on innovators.

B. *Exhaustion as an Effective Policy Tool Under Impression Products*

To some extent, the foregoing discussion could have been held prior to the *Impression Products* decision. Yet, as the decision has significantly strengthened the exhaustion doctrine, it seems more appropriate than ever to hold such a discussion now. In fact, the decision extends the exhaustion doctrine in three concrete manners that make it an even more effective policy tool, both in general and in the specific context of cumulative innovation: (1) by rejecting the “presumption regarding authority” rationale and reinstating exhaustion as a limit on patent scope; (2) by holding that post-sale restrictions cannot be enforced through patent law; and (3) by switching to an international exhaustion regime. The next paragraphs will explore the

¹²¹ See *supra* notes 91–95 and accompanying text.

¹²² Cf. James Gibson, *Risk Aversion and Rights Accretion in Intellectual Property Law*, 116 YALE L.J. 882 (2007) (discussing the tendency of risk-averse intellectual property users to seek a license when none is needed).

¹²³ *Kewanee v. Bicron Corp.*, 416 U.S. 470 (1974).

¹²⁴ *Id.* at 489–90.

potential impact of each of these particular aspects of the decision.

1. The Rationales Underlying the Doctrine

As explained above, the Federal Circuit's decision in *Lexmark v. Impression Products* relied on a view of the exhaustion doctrine as a presumption regarding authority that comes along with a sale.¹²⁵ This is not the first time such a conception of exhaustion appears in Federal Circuit jurisprudence.¹²⁶ The Supreme Court criticized this line of reasoning and clarified that exhaustion is a limit on patent scope, which is justified by broader policy considerations that exceed the parties' expectations.¹²⁷ This concept of the exhaustion doctrine embraced by the Supreme Court could facilitate a more straightforward application of the doctrine in some settings of cumulative innovation.

Envisage, for instance, a patented cellular phone sold to an individual consumer in an anonymous market transaction. The consumer conducts reverse engineering to figure out the manner by which certain features of the phone operate, and based on her findings, she ultimately develops an improved version of the phone. The patent owner files a patent infringement lawsuit against the consumer, arguing that her conduct constitutes an unauthorized use of the protected invention.

Under a view of exhaustion as a presumption regarding authority, such an argument may have merits. More generally, under such an approach, it could sensibly be argued that exhaustion should only apply with respect to uses that the patentee would have likely authorized considering the nature and circumstances of the transaction. In the cellular phone example, such uses are likely to include only regular uses of the product for personal or business purposes. Construed in this manner, the exhaustion doctrine would arguably not encompass reverse engineering and the construction of an improved product, as it is not likely that the patent owner had contemplated such uses when pricing its consumer products. Interestingly, this perception of exhaustion seems to obscure the differences between exhaustion and the implied license defense.¹²⁸

¹²⁵ See *Lexmark Int'l, Inc. v. Impression Prods.*, 816 F.3d 721, 734, 735, 742, 774 (Fed. Cir. 2016); see also *supra* notes 45–48 and accompanying text.

¹²⁶ See, e.g., *Glass Equip. Dev. v. Besten, Inc.*, 174 F.3d 1337 (Fed. Cir. 1999) (“The ‘first sale doctrine’ stands for the proposition that, absent unusual circumstances, courts infer that a patent owner has given up the right to exclude concerning a patented article that the owner sells.”).

¹²⁷ *Impression Prods. v. Lexmark Int'l, Inc.*, 137 S. Ct. 1523, 1527 (2017); see *supra* note 54 and accompanying text.

¹²⁸ Under the implied license defense, “buying a product carries with it an implied right to use and resell the product.” *Cohen & Lemley, supra* note 9, at 31. Courts have frequently conflated the two doctrines. *Id.* However, these are separate doctrines. See, e.g., *Quanta Comput., Inc. v. LG Elecs., Inc.*, 553 U.S. 617, 637 (2008); *Lexmark*, 816 F.3d at 726; see also *Cohen & Lemley, supra* note 9, at 31 (noting that “while patent exhaustion stems from inherent limits on the grant

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In contrast, under the view of exhaustion as a “patent policy” limit on patent scope that does not rely on a presumption of authority and is not dependent upon the parties’ expectations,¹²⁹ once the article has been released into the stream of commerce, it can be freely used in any lawful manner.

2. No Enforcement of Post-Sale Restrictions Through Patent Law

For many years, the Federal Circuit has treated the exhaustion doctrine as a default rule that may be contracted around, enabling patent owners to enforce through patent infringement lawsuits any clearly communicated, otherwise-lawful post-sale restrictions.¹³⁰ As part of the *Impression Products* decision, the Supreme Court held that post-sale restrictions do not entitle a patent owner to retain patent rights in an item that it has elected to sell.¹³¹ In other words, violations of such restrictions no longer have remedies in patent law.¹³²

This shift from a default rule to an immutable rule of exhaustion is dramatic. Its implications, in the context of cumulative innovation, are straightforward: any restrictions on use, including prohibitions on

of the patent right, implied license is a doctrine of quasi-contract, and depends on the beliefs and expectations of the parties to the sales transaction”); Janis, *supra* note 28, at 502–05 (noting the role that the parties’ intent plays in determining the scope of an implied license). One other aspect where there is a difference between the two doctrines has to do with the ability to restrict the freedom of purchasers to use the invention. While an implied license can be disclaimed by an express statement to the contrary, as the exhaustion doctrine is based on patent policy and not on intent, it should be harder to avoid by contract. See Cohen & Lemley, *supra* note 9, at 32–33.

¹²⁹ As the Supreme Court clarified, “[e]xhaustion does not arise because of the parties’ expectations about how sales transfer patent rights. More is at stake when it comes to patents than simply the dealings between the parties, which can be addressed through contract law.” *Impression*, 137 S. Ct. at 1528. For the Federal Circuit’s resort to the parties’ expectations in construing the exhaustion doctrine, see *Lexmark*, 816 F.3d at 743 (“[A] buyer cannot reasonably expect that the seller is conferring authority that the seller is expressly denying[.]”).

¹³⁰ See *supra* notes 44–48 and accompanying text (describing the Federal Circuit’s holding on this matter in *Lexmark v. Impression Prods.*). The rule was promulgated in *Mallinckrodt, Inc. v. Medipart, Inc.*, 976 F.2d 700, 701 (Fed. Cir. 1992) (“Use in violation of a valid restriction may be remedied under the patent law, provided that no other law prevents enforcement of the patent.”) and was applied consistently by the Federal Circuit ever since, including in the *Quanta* case.

¹³¹ See *supra* note 55 and accompanying text. Note that despite the reference of the Supreme Court to certain of its previous decisions, the Court had never explicitly overturned this rule prior to the *Impression Prods.* decision. In *Quanta Comput., Inc. v. LG Elecs., Inc.*, 553 U.S. 617 (2008), for example, the Court overturned the Federal Circuit on the ground that the relevant post-sale restrictions were not included in the license, but it did not even cite *Mallinckrodt* and certainly did not overturn it. See Rinehart, *supra* note 21, at 503 (“Unfortunately, *Quanta* does not address the viability of *Mallinckrodt* or whether the exhaustion doctrine should be considered immutable rather than a default rule.”). In any event, even if the Court attempted to change the rule in *Quanta*, it apparently did not set a clear precedent, as the Federal Circuit continued to adhere to *Mallinckrodt* even after the *Quanta* decision. See Roth, *supra* note 21, at 1267 (describing relevant case law). Notably, in the *Impression* decision as well, the Supreme Court did not mention *Mallinckrodt*; yet, by accepting the appeal on the Federal Circuit’s decision that relied on *Mallinckrodt*, it clearly overturned it.

¹³² See Rinehart, *supra* note 21, at 486.

reverse engineering, could no longer be enforced through patent infringement lawsuits. Similarly, single-use or field-of-use limitations attached to the sale of a research tool would not be enforceable. Likewise, violations of restrictions on combining a patented product with other components or integrating it into other systems would not have remedies in patent law.

To be sure, provisions of the type described above do exist in reality. No Reverse Engineering clauses, for instance, are often included in agreements for the sale of various innovative products. Consider the following language, taken from the Terms and Conditions of Sale form used by a manufacturer of products in the precious metals industry: “In consideration of receipt of the [g]oods, Customer covenants and agrees not to reverse engineer any [g]oods purchased and not to assist any other party (including a parent, member, subsidiary, affiliate or otherwise) to do so.”¹³³ Another example is the following clause, taken from a form used for sales of hardware and software by a company in the eye-tracking business: “The [p]urchaser may not reverse engineer, decompile, or disassemble any part of the [p]roduct, nor attempt in any manner to obtain the source code of the software.”¹³⁴ Indeed, there have been cases where courts enforced such contractual restrictions.¹³⁵

3. International Exhaustion

Up until the *Impression Products* decision, a patentee’s sale of a product abroad did not terminate its ability to bring an infringement suit against a purchaser that imported the product and sold it in the United States.¹³⁶ The Federal Circuit in *Impression Products* adhered to this rule, but the Supreme Court reversed, holding that an authorized sale of a patented product abroad triggers exhaustion of the U.S. patent with respect to that item.¹³⁷

This switch to an international exhaustion regime could have an impact on the ability to conduct cumulative innovation using patented products purchased outside the United States. For instance, a patented component (e.g., a microprocessor) purchased abroad, perhaps at a lower price than its United States price, can be integrated into a larger

¹³³ *Heraeus Precious Metals North America Daychem LLC: Terms and Conditions of Sale*, HERAEUS (Sept. 1, 2013), https://www.heraeus.com/media/media/group/doc_group/products_1/specialty_chemicals/Sales_Terms_Conditions.pdf.

¹³⁴ *Gazepoint: Terms and Conditions*, GAZEPOINT, <http://www.gazept.com/wp-content/uploads/2013/07/Terms-and-Conditions-Rev1.3.pdf> (last visited Aug. 27, 2018).

¹³⁵ *See, e.g.*, *K&G Oil Tool & Serv. Co. v. G&G Fishing Tool Serv.*, 314 S.W.2d 782, 785–86 (Tex. 1958) (enforcing an agreement not to disassemble a magnetic fishing tool); *Pioneer Hi-Bred Int’l, Inc. v. DeKalb Genetics Corp.*, 51 U.S.P.Q.2d (BNA) 1797 (S.D. Iowa 1999) (enforcing a “bag tag” prohibiting purchasers of PVPA-protected corn seed from using the seed for breeding or research purposes).

¹³⁶ *Jazz Photo Corp. v. Int’l Trade Comm’n*, 264 F.3d 1094 (2001).

¹³⁷ *See supra* notes 57–58 and accompanying text.

system (e.g., a computer). Such a system can then be imported and distributed in the United States, regardless of any provisions in the sale agreement that purport to restrict the purchaser of the patented component from doing so.

IV. CHALLENGES AND POTENTIAL CRITICISM

Before concluding, it is important to address the main challenges and potential lines of criticism that this Article's thesis may encounter. This Part raises five potential challenges and attempts to counter each in turn.

A. *Contract Law*

One possible challenge has to do with the fact that the *Impression Products* decision only concerned patent law. The Supreme Court did not rule out the possibility of enforcing post-sale restrictions under contract law in a state court. Thus, patent owners could presumably still restrict purchasers of patented products from various types of conduct, including ones that may serve as the basis for cumulative innovation.

However, it is important to note that nowhere in the *Impression Products* decision was it explicitly held that the contractual route is indeed open. The Court used non-conclusive language while referring to the option of enforcing the clauses under contract law.¹³⁸ In any event, any statements made by the Court regarding the ability to sue under contract law constitute dicta and are not binding in subsequent cases under the principle of *stare decisis*.

Once the question of enforceability of post-sale restrictions in contract law is squarely presented for adjudication, it is likely that the issue of preemption will arise. Generally speaking, the preemption doctrine mandates that if there is a conflict between a state law and a federal one, the state law be invalidated.¹³⁹ Preemption analysis is typically made under the Supremacy Clause of Article VI of the Constitution, which provides that the laws of the United States "shall be the Supreme Law of the Land . . . any Thing in the Constitution or Laws

¹³⁸ See, e.g., *Impression Prods. v. Lexmark Int'l, Inc.*, 137 S. Ct. 1523, 1531, 1533 (2017) ("The single-use/no-resale restrictions in Lexmark's contracts with customers may have been clear and enforceable under contract law, but . . . Lexmark cannot bring a patent infringement suit against Impression Products to enforce the single-use/no-resale provision accompanying its Return Program cartridges. Once sold, the Return Program cartridges passed outside of the patent monopoly, and whatever rights Lexmark retained are a matter of the contracts with its purchasers, not the patent law.")

¹³⁹ See, e.g., Camilla A. Hrdy, *The Reemergence of State Anti-Patent-Laws*, 89 U. COLO. L. REV. 133, 158 (2018) ("'Preemption' generally describes a situation in which federal law 'preempts,' or supersedes, a state or local law."); Dmitry Karshedt, *Contracting for a Return to the USPTO: Inter Partes Reexaminations as the Exclusive Outlet for Licensee Challenges to Patent Validity*, 51 IDEA 309 (2011) (noting that under the preemption doctrine, in case of a conflict between federal and state law, the federal law controls and the state law is invalidated).

of any state to the Contrary notwithstanding.”¹⁴⁰ When a state law interferes with the underlying goals of a federal law, it may be struck down as preempted.¹⁴¹

In the case of post-sale restrictions on use or resale of patented products, one could argue that state laws enabling enforcement of such restrictions are preempted by federal patent law.¹⁴² The argument could be that by enabling enforcement of this type of restrictions, the state law prevents the sold item from being released into the stream of commerce, free of the patentee’s control.¹⁴³ Thus, the enforcement of such restrictions undermines the ability to fulfill the policy goals undergirding the exhaustion doctrine pursuant to the *Impression Products* decision.¹⁴⁴ In support of a preemption argument, one may point at the unequivocal language used by the Court in categorizing the exhaustion doctrine as a hard limit on patent scope.¹⁴⁵ Nevertheless, the precise contours of the preemption doctrine in the context of patent law are not clear,¹⁴⁶ particularly in regard to preemption of state contract rules,¹⁴⁷ and it is quite possible that courts would ultimately find no preemption in these cases.

Aside from preemption, certain contract law doctrines may be useful in striking down post-sale restrictions, particularly when the contract at hand is a standard form contract rather than an agreement concluded between commercial parties dealing at arm’s length. Among such doctrines, the public policy exception to contract enforcement or

¹⁴⁰ U.S. CONST. art. VI, cl. 2; see Hrdy, *supra* note 139, at 158.

¹⁴¹ See, e.g., Hrdy, *supra* note 139, at 158 (noting that “the Federal Circuit currently assesses preemption of state anti-patent law by considering whether the challenged state law interferes with the underlying goals of the Patent Act and is therefore preempted under the Supremacy Clause.”).

¹⁴² For a similar argument, see James B. Kobak, Jr., *Lexmark, The Overruling of Mallinckrodt and The Future of Restraints on Alienation for Patented Goods*, 99 J. PAT. & TRADEMARK OFF. SOC’Y 609, 611 (2017) (noting that if restrictions violate fundamental limits on patent scope, preemption may come into play). *But cf.* Christina Bohannon, *Copyright Preemption of Contracts*, 67 MD. L. REV. 616, 618 (2008) (noting, in connection with copyright law, that courts never preempt contract claims, no matter how much their terms conflict with the provisions of the Copyright Act).

¹⁴³ *But see infra* notes 150–155 and accompanying text (noting differences between contract claims and patent claims that perhaps make such an argument less convincing).

¹⁴⁴ One may question whether patent policy in this context is indeed to guarantee the freedom to use and resell patented items released in the stream of commerce (in which case, there is a plausible argument for preemption) or merely to give effect to the public policy against *in rem* restraints on alienation of property, while not being concerned with bilateral restrictions imposed as part of a contractual relationship. I am indebted to Joshua Sarnoff for this observation.

¹⁴⁵ See *supra* note 127 and accompanying text.

¹⁴⁶ See Mark A. Lemley, *Beyond Preemption: The Law and Policy of Intellectual Property Licensing*, 87 CALIF. L. REV. 111, 139 (1999) (noting that “it is difficult to predict the precise contours of federal patent protection”).

¹⁴⁷ *Id.* at 143 (discussing the lack of uniformity in judicial decisions concerning preemption of contract terms under patent law and copyright law).

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the unconscionability doctrine may prove particularly relevant.¹⁴⁸ In addition, in certain instances, rules regarding contract formation may enable a court to avoid enforcement.¹⁴⁹

In any event, even if the possibility to sue for a breach of contract exists, it is surely not as effective or as rewarding as the enforcement of post-sale restrictions through a patent infringement lawsuit. For one thing, the remedies for a breach of contract are generally not as broad as the remedies for patent infringement. Even after the Supreme Court decision in *eBay, Inc. v. MercExchange, LLC*,¹⁵⁰ which made it more difficult for patent plaintiffs to obtain injunctions, injunction is still a common remedy in patent infringement lawsuits.¹⁵¹ In contrast, under contract law, specific performance is deemed an extraordinary remedy, awarded at the court's discretion.¹⁵² The shift from infringement remedies to contract remedies could also decrease the magnitude of monetary damages available to the plaintiff.¹⁵³ Among other things, while contract monetary remedies are limited to expectation damages, in a patent infringement suit, the court may award punitive damages and recovery of attorney's fees as well.¹⁵⁴

Aside from the difference in the remedies available to the plaintiff, another major limitation of the contractual route is that it cannot be used against entities with which the patent owner does not have a privity of contract.¹⁵⁵ In the circumstances discussed in the *Impression Products*

¹⁴⁸ For relevant discussion, see Daniel Laster, *The Secret Is Out: Patent Law Preempts Mass Market License Terms Barring Reverse Engineering for Interoperability Purposes*, 58 BAYLOR L. REV. 621, 693–97 (2006). Notably, the patent misuse doctrine (*see infra* note 161) is irrelevant in such cases, where the enforcement of post-sale restrictions under patent law is already barred under the exhaustion doctrine and the only question is whether the patentee should be allowed to enforce such restrictions under contract law.

¹⁴⁹ Notably, when Article 2B of the U.C.C. governs the contract, it is exempted from the code's general requirements for contract formation. *See* Bohannon, *supra* note 142, at 620–21. In the *Impression Products* case, Lexmark and Impression stipulated that “Lexmark has an express and enforceable contractual agreement with each of its end-user customers[,]” and “it [was] undisputed that all end users receive[d] adequate notice of the restriction supporting the discounted price before [making] their purchases.” *Lexmark Int'l, Inc. v. Impression Prods.*, 816 F.3d 721, 728 (Fed. Cir. 2016).

¹⁵⁰ *eBay, Inc. v. MercExchange, L.L.C.*, 547 U.S. 388 (2006).

¹⁵¹ *See, e.g.*, Megan M. La Belle, *Against Settlement of (Some) Patent Cases*, 67 VAND. L. REV. 375, 402 (2014) (“[E]ven after eBay, permanent injunctions remain the norm in patent cases when there is a finding of infringement.”).

¹⁵² *See, e.g.*, Alan Schwartz, *The Case for Specific Performance*, 89 YALE L.J. 271, 272 (1979).

¹⁵³ *See* Omri Ben-Shahar, *Contract versus Property Damages*, 12 ACADEMIA SINICA L.J. 1, 7–8 (2013) (“In patent law, the shift from contract to infringement remedies could also increase the magnitude of damages.”).

¹⁵⁴ 35 U.S.C. §§ 284–85 (2012); *see also* Ben-Shahar, *supra* note 153, at 8 (noting, in addition, the longer statute of limitations available under patent law).

¹⁵⁵ *See, e.g.*, Kobak, *supra* note 142, at 611 (noting that “[contract rights] very likely would create no remedies at all against those not in privity with the patent owner. And it takes little imagination to predict the impracticality and loss of market goodwill generated if a company tried to launch a blitzkrieg of litigation directed against the activities of tens of thousands of its ultimate customers”). In addition, the ability of individual consumers to satisfy judgments may

decision, for instance, Lexmark could not have sued Impression in contract law, but only the individual consumers. Needless to say, suing individual consumers may be overly expensive and involve loss of market goodwill.

For these reasons, even if the contractual route is still open, there can be no doubt that the *Impression Products* decision decreases the ability of patent owners to effectively limit purchasers' freedom to use patented products by including post-sale restrictions in the contracts of sale.

B. Licenses

A different aspect that could weaken the potential impact of the *Impression Products* decision has to do with the distinction between sales and licenses embedded in patent exhaustion jurisprudence and reaffirmed by the Supreme Court in *Impression Products*. The Court clarified that while an authorized sale of a patented product—whether by the patentee or by its licensee¹⁵⁶—triggers exhaustion, a mere license does not trigger exhaustion.¹⁵⁷ The Court explained that “[a] patentee can impose restrictions on licensees because a license does not implicate the same concerns about restraints on alienation as a sale. . . . Because the patentee is exchanging rights, not goods, it is free to relinquish only a portion of its bundle of patent protections.”¹⁵⁸ Considering this distinction, the effect of the *Impression Products* decision is probably more limited than what may seem at first glance, as it applies only to a subset of the transactions.

In fact, by expanding and strengthening the exhaustion doctrine, the *Impression Products* decision may incentivize firms to avoid sales of patented products and adopt business models that do not entail full transfer of ownership to the consumers, including subscription-based

not be clear.

¹⁵⁶ So long as the licensee complies with the license when selling an item, the sale is treated, for purposes of patent exhaustion, as if the patentee made the sale itself. *Impression Prods. v. Lexmark Int'l, Inc.*, 137 S. Ct. 1523, 1535 (2017). In contrast, when the licensee exceeds authority, exhaustion does not apply as this does not constitute an authorized sale. This latter scenario was discussed in *Gen. Talking Pictures Corp. v. Western Elec. Co.*, 305 U.S. 124 (1938).

¹⁵⁷ *Impression*, 137 S. Ct. at 1534; see also Kobak, *supra* note 142, at 614.

¹⁵⁸ *Impression*, 137 S. Ct. at 1534. It should be noted that contrasting “sales” with “licenses” may obscure an important distinction between two different facets of a deal involving the transfer of physical possession of a product embodying a patent: (1) the transaction in the chattel and (2) the transaction in the patent. See Sean O'Connor, *The Use of MTAs to Control Commercialization of Stem Cell Diagnostics and Therapeutics*, 21 BERKELEY TECH L.J. 1017, 1018–19 (2006) (emphasizing the importance of distinguishing between the physical property rights grant and any intellectual property rights licenses that are included in material transfer agreements). O'Connor notes that “most institutions refer to the legal conveyances of permission to use the biological materials qua physical property as well as qua IP as ‘licenses.’” *Id.* at 1019. While the term “license” may accurately characterize the intellectual property facet of the deal, the transaction in the chattel itself could be a lease, bailment, or any other transaction conveying less than full ownership of the chattel.

models and leasing. Structuring the deal so that ownership does not pass to consumers would circumvent an application of the exhaustion doctrine and enable businesses to continue imposing effective limitations on the use and resale of the products.¹⁵⁹

Sure enough, businesses may attempt to hide the true economic nature of a transaction and disguise it as a mere license even when it is actually a sale.¹⁶⁰ Dealing with such practices, courts will be entrusted with the challenging task of telling apart such de facto sales from other deals that truly should not be characterized as sales.¹⁶¹

C. *The Underlying Policy Considerations*

A possible critique may be that this Article proposes to utilize a doctrine, which has been developed to facilitate free movement of patented goods in commerce, to promote an entirely different policy consideration: fostering cumulative innovation.

Indeed, the exhaustion doctrine has been developed against the backdrop of the common law's hostility toward restraints on alienation. Yet, the policy considerations that account for the development of the doctrine do not mandate a narrow construction that limits the settings to which it can be applied. In fact, all the cases presented above as examples for potential applications of the exhaustion doctrine that could facilitate cumulative innovation are situations where the original rationale underlying the doctrine is applicable as well.

Beyond that, perhaps the time has come, alongside the doctrinal expansion of patent exhaustion by the Supreme Court, to broaden the doctrine's theoretical basis as well. A move from the historical perception of exhaustion that is strongly tied to traditional notions of "freedom of property" to a more modern and all-inclusive concept could be beneficial. There is, in fact, a basis for such a broader conception of the exhaustion doctrine in the *Impression Products* decision. As explained above, while rejecting the "authority" rationale embraced by the Federal Circuit, the Court clarified that the doctrine serves as "a

¹⁵⁹ See Aaron Perzanowski, *Lexmark and the Future of Sales*, THE END OF OWNERSHIP (June 1, 2017), <http://www.theendofownership.com/blog/2017/6/1/thoughts-on-impression-products-v-lexmark> ("Another potential concern is that companies like Lexmark will stop selling products altogether and move to lease, rental, or subscription models that don't entail transfers of ownership to consumers.").

¹⁶⁰ Roth, *supra* note 21, at 1264 (maintaining that the first-sale doctrine may prove too easy to circumvent, if "patent owners will simply begin calling their purchasers licensees."). In using the term "license" in the text, I follow the Court's terminology, despite the disadvantages of using such term in this context. See *supra* note 158.

¹⁶¹ To be sure, even if a transaction is not classified as a sale, and no exhaustion is triggered, the ability to enforce post-sale restrictions via patent law is not guaranteed. Even to the extent such restrictions are valid as far as contract law is concerned (see *supra* note 148 and accompanying text for the discussion of potential limitations on contract enforcement), such restrictions may constitute patent misuse and render the patent unenforceable even against users that are not protected by exhaustion.

limit on the scope of the patentee's rights."¹⁶² Limitations on patent scope exist, in general, to balance between the exclusive rights of the patent owner and other interests that constitute a part of patent policy. These interests include the desire to allow free movement of patented goods in commerce. However, patent policy also encompasses the need to enable and promote cumulative innovation. Therefore, especially in light of the absence of a meaningful experimental use exception, enlisting the exhaustion doctrine—another scope-limiting doctrinal tool—to balance between the interests of the patentee and follow-on inventors seems warranted.

D. *Experimental Use*

One may wonder—considering that the courts have construed the experimental use exception so narrowly, regardless of much criticism by patent scholars—how can we expect the courts to be willing to apply a different doctrine to reach similar ends?

The immediate answer to this question lies at the practical level. The narrow construction of the experimental use exception is deeply embedded in United States patent law. Changing the law in this area is not a trivial step and it may encounter strong objection by relevant interest groups.¹⁶³ In contrast, the exhaustion doctrine as shaped in the *Impression Products* decision already constitutes an effective tool that could be applied by courts to promote the relevant policy considerations without the need to significantly broaden it.

Beyond that, there is an important difference between these two policy instruments. The experimental use exception, to the extent applicable, is not dependent upon the user purchasing the patented article from the patent owner or an authorized licensee. Under the exception, even when the patented invention is not offered at all for sale, one can freely use it for experimental uses. Most importantly, the exception permits the user to manufacture the invention on its own for experimental purposes. In contrast, the exhaustion doctrine only permits research uses of products sold by the patent owner and does not allow the making of additional units of the patented invention.¹⁶⁴ In this important sense, then, the exhaustion doctrine is a more “modest”

¹⁶² *Impression*, 137 S. Ct. at 1527; see also Cohen & Lemley, *supra* note 9, at 31 (“The exhaustion doctrine finds its basis in the foundations of patent policy, which seeks not only to grant exclusive rights to patentees but also to limit those rights.”).

¹⁶³ See, e.g., Christopher M. Holman, *Biotechnology's Prescription for Patent Reform*, 5 J. MARSHALL REV. INTELL. PROP. L. 318, 325 (2006) (noting that the biotechnological industry “is against virtually all of the major proposed reforms [to patent law] that would weaken patents or restrict the rights of patent holders.”); Jay P. Kesan & Andres A. Gallo, *The Political Economy of the Patent System*, 87 N.C. L. REV. 1341, 1353–61 (2009) (discussing the lobbying efforts on behalf of pharmaceutical companies in order to maintain a strong patent system).

¹⁶⁴ See *supra* note 23 and accompanying text.

policy instrument, which courts are likely to find easier to apply.

Sure enough, as a result of these differences between the scopes of the doctrines, the ability to apply the exhaustion doctrine in cumulative innovation settings does not obviate the need for a robust experimental use exception. Such an exception is still very much needed in circumstances that do not trigger exhaustion, including in the case of process inventions that are not substantially embodied in items sold by the patentee.¹⁶⁵ Naturally, the doctrines may overlap to a certain extent, and an interesting question, set aside for the time being, is to what extent is it important to define the contours of each doctrine in a precise manner to avoid such overlap?¹⁶⁶

E. *Incentives to Invent*

Finally, one may argue that the proposed use of the patent exhaustion doctrine does not sufficiently take into account the need to secure incentives to innovate.

Indeed, in structuring patent law, policy makers should strike a balance between the need to incentivize innovation *ex ante* and the need to ensure access to the ensuing products *ex post*.¹⁶⁷ Naturally, construing a limit on patent scope in a manner that increases access to patented inventions may result in decreasing patent incentives. However, employing exhaustion in cumulative innovation settings pursuant to this Article's proposal is not likely to reduce incentives in a significant manner.

To begin, the exhaustion doctrine does not enable use of the patented invention for free. Exhaustion is only triggered in cases of an authorized sale of a patented product, for which the patentee receives an amount of money deemed by it to be satisfactory compensation. Further, as explained above, the right to "make" the invention is not exhausted by a sale of a patented article.¹⁶⁸ Therefore, if there is a need for additional units of the original product in order to manufacture the follow-on invention on an ongoing basis after its initial development, such units must be purchased from the original patent owner. This would be the case, for instance, when the follow-on invention is an

¹⁶⁵ For discussion, see *supra* notes 30–31 and accompanying text.

¹⁶⁶ See generally John M. Golden, *Redundancy: When Law Repeats Itself*, 94 TEX. L. REV. 629 (2016) (discussing redundancy in designing legal rules).

¹⁶⁷ See, e.g., Gideon Parchomovsky & Peter Siegelman, *Towards an Integrated Theory of Intellectual Property*, 88 VA. L. REV. 1455, 1458–59 (2002) (discussing the tradeoff between *ex ante* and *ex post* perspectives underlying patent and copyright law); Gaia Bernstein, *In the Shadow of Innovation*, 31 CARDOZO L. REV. 2257, 2295 (2010) (noting that patents are traditionally "viewed as a tradeoff between the benefit of encouraging innovation and the cost of limiting access to the resulting innovation"); Oskar Liivak, *Rethinking the Concept of Exclusion in Patent Law*, 98 GEO. L.J. 1643, 1662 (2010) (noting that the access versus incentives tradeoff is at the heart of most policy discussions about intellectual property).

¹⁶⁸ See *supra* note 23 and accompanying text.

improvement upon, a variation, or a larger system consisting of, the original product.¹⁶⁹ In these cases, then, the patent owner would continue getting rewarded for each purchased unit—unless, of course, the parties reach an agreement that allows the second inventor to independently make additional units of the original invention in return for a share of the profits in the market for the follow-on invention.

The situation is different in the case of patented research tools.¹⁷⁰ In this scenario, the original invention is not embedded in the final version of second-generation products, even though it has been used in the process of their development.¹⁷¹ Therefore, producing the ensuing product does not require purchasing additional units of the tool from the original patentee. Nevertheless, this does not necessarily reduce the incentives to develop research tools to a sub-optimal level. While an invention could coincidentally serve as a research tool in an individual case, many research tools are designed from the outset to serve as such.¹⁷² In these cases, the patentee could reasonably expect that the use of its research tool may lead to the development of other inventions and factor this expectation into pricing. In addition, the patentee could include in the sale contract an arrangement that entitles it to a royalty on sales of any ensuing products. Such arrangements, often termed “reach-through royalties,” are prevalent in licenses of research tools, although their use is controversial.¹⁷³ A detailed discussion of the costs and benefits of this practice exceeds the scope of this Article’s inquiry, but arguably, it does not deserve the same level of hostility under a

¹⁶⁹ In contrast, there will be no need to purchase units from the original patentee if the follow-on inventor manages to design around the patented invention and develop a non-infringing substitute. For the importance of enabling competitors to design around patents, see, for example, Gordon, *supra* note 108, at 632; see also *Westvaco Corp. v. Int’l Paper Co.*, 991 F.2d 735, 745 (Fed. Cir. 1993); *Texas Instruments, Inc. v. U.S. Int’l Trade Comm’n*, 805 F.2d 1558, 1572 (Fed. Cir. 1986); *Yarway Corp. v. Eur-Control USA, Inc.*, 775 F.2d 268, 277 (Fed. Cir. 1985).

¹⁷⁰ See *supra* notes 115–117 and accompanying text.

¹⁷¹ See HAROLD EINHORN & ERIC E. BENSON, PATENT LICENSING TRANSACTIONS (updated through October 2013), § 6A-20 (noting that research tools, by definition, form no part of the resulting product); Tur-Sinai, *supra* note 64, at 732 (describing this feature as the defining characteristic of the research tools scenario, as distinguished from other cumulative innovation settings). *But see* SCOTCHMER, *supra* note 66, at 132 (demonstrating that some research tools may end up embodied in the second-generation product).

¹⁷² In the biotechnology field, for instance, many patents have been issued for various technologies used during laboratory research. See Mueller, *supra* note 81, at 12–14. Similarly, in the nanotechnology field, patents cover the building blocks of the industry, such as atomic force microscopes that can manipulate individual molecules. See Mark A. Lemley, *Patenting Nanotechnology*, 58 STAN. L. REV. 601, 603–04 (2005). For examples of patented research tools in nanotechnology, see also Siva Vaidhyanathan, *Nanotechnology and the Law of Patents: A Collision Course*, in PATENTING OF NANOTECH INVENTIONS: A DEBATE 43, 44–45 (C. Sri Krishna ed., 2007).

¹⁷³ See, e.g., Kimberlee A. Stafford, *Reach-Through Royalties in Biomedical Research Tool Patent Licensing: Implications of NIH Guidelines on Small Biotechnology Firms*, 9 LEWIS & CLARK L. REV. 699, 700 (2005); Holzapfel & Sarnoff, *supra* note 81, at 148.

preemption analysis as clauses that strictly prohibit research uses.¹⁷⁴

Finally, where the follow-on invention is a complementary product to the original invention, its development and marketing could in fact increase demand for the original invention.¹⁷⁵ Therefore, once again, the application of the exhaustion doctrine to enable research use is not likely to unduly decrease incentives to invent.

On a final note, it is important to bear in mind that, as a general matter, the connection between the scope of patent protection and the level of incentives provided by the patent system is not necessarily linear.¹⁷⁶ Thus, even though the *Impression Products* decision expands the scope of the exhaustion doctrine, such expansion, as well as the application of the doctrine in cumulative innovation settings pursuant to this Article's proposal, would not necessarily result in a corresponding decrease in incentives to innovate.

CONCLUSION

This Article provides a novel analysis of the potential role of the patent exhaustion doctrine in the context of cumulative innovation. The analysis leads to the conclusion that the exhaustion doctrine, particularly as construed by the Supreme Court in the *Impression Products* decision, could play a very important role in fostering innovation and progress.

Under the exhaustion doctrine, once a patented product is sold by or under the authority of the patent owner, the purchaser may use it for any purpose. As this Article demonstrates, one type of such permitted use is the reverse engineering of the patented product, which could lead to the development of an improvement, a variation, or a compatible product. A purchaser of a patented product may also test it in search of new uses or applications, modify it in various manners, or use it in different settings than the ones prescribed by the original manufacturer. When the patented invention is a research tool, the purchaser can use it to investigate any subject matter. Finally, a purchaser of a patented product can combine it with different components or integrate it into a larger system. All of these uses may ultimately promote technological progress for the benefit of society.

While some of these uses may have been permitted even under the pre-*Impression Products* exhaustion doctrine, the Supreme Court in

¹⁷⁴ See *supra* notes 142–143 and accompanying text.

¹⁷⁵ See *supra* notes 68–69 (discussing this scenario).

¹⁷⁶ See Michal Shur-Ofry, *IP and the Lens of Complexity*, 54 IDEA 55, 96 (2013) (“The expectations that each increase in the scope of IP will lead to a proportionate increase in the level of innovation; that each limitation of that scope will result in a corresponding decrease in innovation; or that we can promote external socially desired values simply by limiting or calibrating the scope of intellectual property protection—are unrealistic.”).

Impression Products strengthened the doctrine in various significant manners that make it an even more effective policy tool. Notably, the Court's ruling that post-sale restrictions can no longer be enforced through patent law makes it harder for patent owners to control the use of their products, including use for research purposes. Even to the extent that the possibility to sue for a breach of contract in a state court still exists, it is surely not as effective as a patent infringement lawsuit. At the same time, the switch to an international exhaustion regime opens the door to a vast array of practices by follow-on inventors that could have a significant impact on the rate and direction of cumulative innovation.

Overall, the Article demonstrates that enlisting patent exhaustion to facilitate follow-on innovation is now not only feasible but also carries significant benefits. While exhaustion cannot serve as an all-encompassing solution to the challenges at hand, it can certainly constitute a valuable policy tool, particularly considering the narrow scope of the experimental use exception under United States patent law. Interestingly, employing exhaustion in this context is an unintended consequence of the law, as the doctrine emerged in the nineteenth-century in response to entirely different concerns.¹⁷⁷ Yet, the analysis demonstrates that there is no material doctrinal mismatch that should prevent the application of this common law doctrine to complex modern-day situations that involve cumulative innovation. In years to come, it is our hope that the law on this important issue will continue to evolve in a manner that properly balances the various considerations at stake.

¹⁷⁷ See *supra* note 25 and accompanying text.