ARTICLES

COORDINATION-FOCUSED PATENT POLICY

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This Article explores the practical consequences of an important shift that has recently taken place in patent theory. Although it was long agreed that the

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purpose of granting patents is to reward invention, today many scholars instead attempt to justify the patent system based on its role in facilitating information exchange and enabling technical coordination among firms. This change in justification is controversial, and its viability remains a fiercely contested question. But despite intense attention at the level of theory, little has been said about the consequences of this debate for patent policy itself. This Article addresses that void, developing a set of mid-level principles from coordination theory and showing how these principles affect a wide range of policy questions.

This analysis has a number of implications. For example, it has long been thought that the coordination function requires granting broader patent rights and doing so at an earlier point in time than the traditional rewards function. Based on this assumption, many scholars have concluded that a coordination-focused system would inevitably be more expensive than a rewards-focused one. But upon closer examination, the coordination function could potentially flourish with just the opposite policies—narrower patents granted later in time—and so might actually be cheaper to implement. This illustrates the importance of bringing coordination theory down to details. In many ways, current patent law reflects the long-assumed constraints of rewards theory; a move towards coordination goals opens a number of degrees of policymaking freedom that have not been previously recognized. Moreover, coordination theory can sometimes inform patent policymaking in cases where the conventional rewards theory proves ambiguous, and so merits further exploration regardless of whether coordination is ultimately accepted as a principal justification for the patent system.

INTRODUCTION

For its first two centuries, the U.S. patent system had a mission that was clear and well understood. Courts and commentators long agreed that the purpose of offering patent protection was to reward invention.[1] According to this view, the patent system addresses a free-rider problem, subsidizing activities that would otherwise occur below the socially optimal level. In this way, the patent system is designed to effect a kind of decentralized tax-and-spend policy, with consumers bearing higher prices so that inventors may be compensated for inventive contributions they would not otherwise have adequate incentives to make.[2]

[1] *See* WARD S. BOWMAN, JR., PATENT AND ANTITRUST LAW: A LEGAL AND ECONOMIC APPRAISAL 2-3 (1973); F.M. SCHERER & DAVID ROSS, INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE 621-24 (3d ed. 1990) (giving a standard rewards-based explanation as the logic of patent protection); Louis Kaplow, *The Patent-Antitrust Intersection: A Reappraisal*, 97 HARV. L. REV. 1813, 1817, 1821-22 (1984) (same).

[2] *See* Anup Malani & Jonathan S. Masur, *Raising the Stakes in Patent Cases*, 101 GEO. L.J. 637, 638 (2013).

In recent years, this consensus has broken. Scholars have since observed a variety of purposes the patent system may serve beyond simply rewarding inventive accomplishment.[3] For example, commentators have suggested that patents may play an important role in reducing transaction costs around information, allowing for more open communication, mitigating the need for trade secret protection, and facilitating technology transfer.[4] Expanding this theory slightly, they have also noted that patents can be used to encourage public disclosure, reduce the costs of identifying potential collaborators, and enable smoother intra- and inter-firm cooperation.[5] Picking up on this theme of collaboration, another group of commentators has investigated the role that patents may play in the formation, operation, and dissolution of joint ventures.[6] This emerging work suggests that a view of patents as merely rewards for invention may oversimplify their function in facilitating the development of

[3] The movement to explore alternative uses of the patent system can be traced to the groundbreaking article by Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 277-79 (1977). A number of scholars building on (and in some cases rebutting) Kitch's work have prompted renewed interest in these alternative theories in the last decade or so. *See, e.g.*, John F. Duffy, *Rethinking the Prospect Theory of Patents*, 71 U. CHI. L. REV. 439 (2004); Mark A. Lemley, *Ex Ante Versus Ex Post Justifications for Intellectual Property*, 71 U. CHI. L. REV. 129 (2004).

[4] *See* WILLIAM M. LANDES & RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW 328-30 (2003); Nancy T. Gallini & Ralph A. Winter, *Licensing in the Theory of Innovation*, 16 RAND J. ECON. 237, 238, 241 (1985); Paul J. Heald, *A Transaction Costs Theory of Patent Law*, 66 OHIO ST. L.J. 473, 488-89, 497 (2005) [hereinafter Heald, *Transaction Costs Theory*]; Paul J. Heald, *Transaction Costs and Patent Reform*, 23 SANTA CLARA COMPUTER & HIGH TECH. L.J. 447, 457 (2007); Julien Pénin, *Patents Versus Ex Post Rewards: A New Look*, 34 RES. POL'Y 641, 649 (2005) (discussing the role of patents in technology transfer).

[5] *See* LANDES & POSNER, *supra* note 4, at 329; Ashish Arora & Robert P. Merges, *Specialized Supply Firms, Property Rights and Firm Boundaries*, 13 INDUS. & CORP. CHANGE 451, 468-70 (2004); Colleen V. Chien, *Opening the Patent System: Diffusionary Levers in Patent Law*, 89 S. CAL. L. REV. 793, 835-39 (2016); Heald, *Transaction Costs Theory*, *supra* note 4, at 475 nn.15-16; Roberto Mazzoleni & Richard R. Nelson, *Economic Theories About the Benefits and Costs of Patents*, 32 J. ECON. ISSUES 1031, 1039 (1998); Robert P. Merges, *A Transactional View of Property Rights*, 20 BERKELEY TECH. L.J. 1477, 1487-90 (2005); Julien Pénin, *Patent Policy: A Need to Focus on Both Appropriation and Coordination Failure*, 16 EUR. J. ECON. & SOC. SYS. 109, 111 (2003) ("[P]atents could be used to solve both the appropriation and the coordination failure that appear within the process of knowledge production.").

[6] *See* William E. Kovacic, *Intellectual Property Policy and Competition Policy*, 66 N.Y.U. ANN. SURV. AM. L. 421, 424 (2011); Antoine Bureth et al., Patenting Practices Within the Upper-Rhine Biovalley Network: Exclusion and Coordination Rationales 8-9 (July 22, 2005) (unpublished manuscript), http://vecchio.liuc.it/ricerca/istitutoeconomia/laweconomicsjuly2005/papers/Bureth_et_al_LIUCpaper.pdf [https://perma.cc/2BTB-SAUL].

new technology—that patents may also serve an important role in allowing firms to coordinate their efforts after patenting has occurred.

This movement is controversial. Other commentators have questioned these coordination-related justifications for patent rights, suggesting that the patent system is ill-equipped to play these roles, is outmatched by superior approaches to these problems, or is otherwise best left to its traditional rewards-focused responsibilities.[7] But a purely rewards-focused understanding of the patent system has its challenges as well.[8] As others have noted, there are a variety of nonpatent alternatives that may be able to solve rewards problems as well as (or even better than) the patent system.[9] Perhaps for this reason, a growing group of commentators now invoke theories related to coordination when seeking to explain or justify our patent laws.[10]

Despite extensive discussion about the legitimacy of these coordination roles for the patent system, very little has been said about the consequences of this debate for patent policy itself. The incongruity is often striking. For example, in their much-cited book, *The Economic Structure of Intellectual Property Law*, William Landes and Richard Posner conclude that the strongest arguments for the patent system have nothing to do with the traditional story about rewarding invention, instead justifying the system with theories that fall

[7] *See, e.g.*, Michael J. Burstein, *Exchanging Information Without Intellectual Property*, 91 TEX. L. REV. 227, 246-47, 262 (2012); Robin Feldman & Mark A. Lemley, *Do Patent Licensing Demands Mean Innovation?*, 101 IOWA L. REV. 137, 139 (2015); Mark A. Lemley, *The Myth of the Sole Inventor*, 110 MICH. L. REV. 709, 748 (2012); Liza S. Vertinsky, *Making Room for Cooperative Innovation*, 41 FLA. ST. U. L. REV. 1067, 1094-1102 (2014) (arguing that prolific patent rights can inhibit cooperation).

[8] *See* LANDES & POSNER, *supra* note 4, at 326-27; Heald, *Transaction Costs Theory*, *supra* note 4, at 474-75, 499-503; F. Scott Kieff, *Coordination, Property, and Intellectual Property: An Unconventional Approach to Anticompetitive Effects and Downstream Access*, 56 EMORY L.J. 327, 401-04 (2006); Pénin, *supra* note 5, at 117-19 (summarizing objections to the traditional rewards account); Bureth et al., *supra* note 6, at 5-6 (summarizing prior empirical work); Robert W. Hahn, The Economics of Patent Protection: Policy Implications from the Literature 4, 17-22 (Oct. 30, 2003) (unpublished manuscript), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=467489 [https://perma.cc/D9R3-8SEF].

[9] *See infra* notes 37-41 and accompanying text.

[10] *See, e.g.*, LANDES & POSNER, *supra* note 4, at 328 (arguing that, without patents, firms would invest more resources in preserving secrecy); Heald, *Transaction Costs Theory*, *supra* note 4, at 486-91; Paul J. Heald, *Optimal Remedies for Patent Infringement: A Transactional Model*, 45 HOUS. L. REV. 1165, 1170 (2008) (suggesting that the "primary function" of patent law "is to create a property right that reduces the cost of contracting between inventive firms and firms needing inventions"); Kitch, *supra* note 3, at 276; Oskar Liivak, *Maturing Patent Theory from Industrial Policy to Intellectual Property*, 86 TUL. L. REV. 1163, 1179 (2012); Mazzoleni & Nelson, *supra* note 5, at 1037-38; Merges, *supra* note 5, at 1487-90; Pénin, *supra* note 5, at 110-11.

soundly within the coordination function.[11] But just a few pages later they conclude that these justifications—while "compelling in the aggregate"—tell them nothing about what patent policy should actually look like.[12] And this admission is indicative of a much larger problem. Although a number of scholars have embraced an entirely different justification for the patent system than the one that has been assumed for over two hundred years, no one has thoroughly examined the consequences of this shift in purported mission.[13] Instead, commentators have simply assumed that coordination-focused policy would look exactly the same as rewards-focused policy, or that, if there were any differences, coordination policy would require awarding earlier, broader patent grants.[14] As a result, the debate about these novel justifications for the patent system has proceeded without a well-developed understanding of what would be required for the patent system to serve these roles effectively.[15]

Part of the reason the coordination function is not better understood is that commentators have not always agreed on what the term means.[16] Without a stable definition, the coordination function unsurprisingly lacks a unifying, fully developed theory, which has in turn made it very difficult to determine what coordination-focused patent policy would actually entail. To these ends, this Article synthesizes a number of the various theories sometimes associated with coordination into a specific, unified account. In short, the coordination function includes any voluntary exchange of technical information made in reliance on the exclusive rights of patents—a definition that embraces many, but importantly not all, of the uses of the patent system that are sometimes

[11] *See* LANDES & POSNER, *supra* note 4, at 326-30. An extensive discussion of what this Article means by "coordination function" is included in Part II.

[12] *See* LANDES & POSNER, *supra* note 4, at 330-31.

[13] Indeed, the most extensive investigation of the policy implications of these theories seems to be found in the 1977 article that first postulated them. *See* Kitch, *supra* note 3, at 280-89. More recently, Paul Heald has explored the consequences of a transactional focus for patent remedies. *See* Heald, *supra* note 10, at 1172-74. Colleen Chien offers several proposals intended to encourage information sharing, but she does not develop the policy implications of coordination theory itself. *See* Chien, *supra* note 5, at 855-62.

[14] *See* DAN L. BURK & MARK A. LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT 80-81 (2009) (noting that coordination goals are typically associated with a policy of granting broad patents conferring "almost total control"); Burstein, *supra* note 7, at 245-46, 278 (observing that the coordination rationale supports the argument that "intellectual property should be granted early in the innovation process and should be broad and strong"). This view can be traced to the early days of coordination theory, see Kitch, *supra* note 3, at 280-89, but is long overdue for reevaluation, see *infra* Sections IV.B & IV.C.

[15] *See* LANDES & POSNER, *supra* note 4, at 330-31 (discussing the need for further development of the policy implications of coordination theory); Pénin, *supra* note 5, at 125 (same).

[16] *See infra* notes 56-58 and accompanying text.

associated with coordination.[17] This Article then develops this core theory into a set of mid-level principles, and shows how these principles implicate a large number of important policy questions.[18] The result is the first comprehensive analysis of how patent law would need to adapt if coordination goals were to be accepted as a primary purpose of the patent system.

A reasonable skeptic might ask whether any of this actually matters. After all, if either rewards theory or coordination theory leads to a system of "strong" patent rights, what really is the difference? But, as this Article will show, one's answer to the question of "why have a patent system?" has substantial and far-reaching consequences for a wide array of second-order questions. Upon reflection, this should not come as a surprise: the rewards and coordination functions solve different problems. They have quite different theories of operation, which in turn lead to divergent intermediate principles of what the patent system should offer patent holders. For example, the rewards-versus-coordination debate has significant consequences for the ideal stability of patent grants, the reliability of the right to exclude, and the optimal breadth of patent protection. These mid-level values in turn implicate a wide range of policy levers, such as the amount of scrutiny given to patent applications,[19] the scope of patent claims,[20] the timing of patent grants,[21] the degree of deference paid to the patent office once a patent has issued,[22] and the antitrust analysis applied to mergers of competing patent portfolios.[23]

These policy implications fill a critical void in the ongoing debate about the desirability of using the patent system to facilitate coordination at all. Both the rewards function and the coordination function have substitutes outside the patent system—grants, prizes, and tax credits in the case of the rewards function,[24] more rigorous enforcement of contractual restraints and trade secrets in the case of the coordination function.[25] By shedding light on the relationship between the coordination function's mission and the specifics of its implementation, this Article contributes to the greater debate about the

[17] *See infra* Part II.

[18] *See infra* Parts III & IV.

[19] *See infra* Section IV.A.

[20] *See infra* Section IV.B.

[21] *See infra* Section IV.C.

[22] *See infra* Section IV.A.

[23] *See infra* Section IV.B.

[24] *See* Daniel J. Hemel & Lisa Larrimore Ouellette, *Beyond the Patents-Prizes Debate*, 92 TEX. L. REV. 303, 307, 311-12 (2013); Joseph E. Stiglitz, *Economic Foundations of Intellectual Property Rights*, 57 DUKE L.J. 1693, 1719-24 (2008).

[25] *See* Heald, *Transaction Costs Theory*, *supra* note 4, at 476; Mark A. Lemley, *The Surprising Virtues of Treating Trade Secrets as IP Rights*, 61 STAN. L. REV. 311, 336-37 (2008).

advantages and disadvantages of addressing these goals with the patent system as compared to nonpatent alternatives.

Moreover, a closer examination of the coordination function yields insights that remain salient even if coordination is ultimately rejected as a principal justification for the patent system. In the event the rewards function retains its seat as the dominant reason for having a patent system, the coordination function may nonetheless serve as an important second-order consideration. As this Article will show, one benefit of coordination theory is that it sometimes provides guidance in situations where the implications of rewards theory prove ambiguous. Thus, a deeper understanding of the coordination function may assist rewards-focused policymaking as well, providing tie-breaking factors and marginal benefits without sacrificing the primacy of rewards goals.

This Article proceeds in four parts. Part I introduces the rewards function of the patent system and the traditional approaches to patent policy that have followed therefrom. Part II discusses several coordination-related understandings of the patent system and defines the coordination function for purposes of this Article. Part III explores the theory of how patents can facilitate coordination in greater detail and identifies several features of the patent system that will have a significant influence on the coordination function's effectiveness. Part IV applies the results of Part III to a number of topics in patent law and explains how these questions would need to be evaluated differently for a patent system increasingly focused on coordination as opposed to rewards.

I. THE TRADITIONAL JUSTIFICATION: REWARDING INVENTION

A. *Theoretical Foundations*

According to the traditional rewards theory, the purpose of the patent system is to incentivize invention through the promise of a regulatory bequest of market power.[26] In exchange for producing some socially useful invention, the inventor is given a time-limited exclusive right to her creation. In principle, that exclusive right vests its holder with some market power, which in turn transfers wealth back to the inventor. At the same time, the exercise of this market power results in some deadweight loss, which is to be accepted—or not—as the cost of rewarding inventive activity through a system of exclusive rights.[27]

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[26] *See* Hahn, *supra* note 8, at 5-7 (summarizing the traditional rewards theory). Mazzoleni and Nelson refer to this theory as the "invention motivation" theory. *See* Mazzoleni & Nelson, *supra* note 5, at 1033, 1035.

[27] *See* 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, 619 (Nat'l Bureau of Econ. Res. ed., 1962); Pénin, *supra* note 5, at 113.

In this view, by offering an incentive to invent, the patent system addresses a classic free-rider problem. Without some form of regulatory intervention, an inventor would be unable to appropriate enough of the benefits of her invention to recoup the cost of making it, leading to the under-production of inventions generally.[28] The goal of the rewards function is to correct this potential market failure by enabling inventors to appropriate more of the benefits of their new technologies.[29]

Traditionally, rewards theory was focused on incentivizing the earliest stages of invention.[30] Commentators have since expanded on this original rewards theory, noting that patents may also incentivize continued investment in technologies after patent rights have been obtained. Many technologies require significant investment to go from proof of concept to being widely available on the market.[31] As with the initial inventive steps, an inventor may hesitate to invest in the later stages of this process given the ease with which her competitors could appropriate the benefits of that investment.[32] Under this commercialization incentives theory, in addition to any rewards a patent may provide to perform the initial step of invention, a patent may also enable an inventor to realize greater returns from investing in commercialization and other post-patenting refinements.[33]

Rewarding invention or commercialization with a system of exclusive rights has costs. First there is the administrative overhead of operating a patent system—the time and expense of filing patent applications, examining them,

[28] *See* LANDES & POSNER, *supra* note 4, at 294; Kitch, *supra* note 3, at 266; Pénin, *supra* note 5, at 111-12; Pénin, *supra* note 4, at 643; Hahn, *supra* note 8, at 8-9.

[29] *See* BOWMAN, *supra* note 1, at 2-3; Pénin, *supra* note 4, at 645-55; Hahn, *supra* note 8, at 7-8.

[30] *See* Ted Sichelman, *Commercializing Patents*, 62 STAN. L. REV. 341, 357-59 (2010).

[31] *See id.* at 348-54.

[32] *See* Mazzoleni & Nelson, *supra* note 5, at 1041; Sichelman, *supra* note 30, at 353-54, 372-74.

[33] *See* Michael Abramowicz, *The Danger of Underdeveloped Patent Prospects*, 92 CORNELL L. REV. 1065, 1067 (2007); F. Scott Kieff, *Property Rights and Property Rules for Commercializing Inventions*, 85 MINN. L. REV. 697, 707-10 (2001); Kitch, *supra* note 3, at 276. As others have noted, the observation that patents may provide incentives to commercialize does not so much change the basic model of patents as rewards, but rather expands the scope of what kinds of activity they can be used to reward. *See* Burstein, *supra* note 7, at 241; Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1037 (1989); Liivak, *supra* note 10, at 1168-69; Mazzoleni & Nelson, *supra* note 5, at 1033, 1040. Nonetheless, the two rewards theories should not be equated, as the goal of rewarding invention might lead to very different policies than the goal of rewarding commercialization. This Article focuses on the consequences of a move towards coordination theory; the policy implications of the commercialization-rewards theory are left for another day.

litigating patent disputes, and so on.[34] Then there are the costs imposed by the exclusives rights themselves: deadweight losses as a result of the inventor's market power, impaired incentives for future researchers to improve the patented technology, artificial pressure for competitors to design around the patents, and so on.[35] For the rewards function to justify having a patent system, the social benefits of transferring wealth to innovators must exceed the administrative costs, deadweight losses, and dynamic harms that come as a result.[36]

As others have noted, there are a variety of policy alternatives that could provide similar incentives to inventors and commercializers: government grants, tax deductions, publicly and privately administered prizes, indirect subsidies for research, to name a few.[37] The traditionally recognized advantage of the patent system over these alternatives is its administrative simplicity.[38] Rather than trying to place a dollar value on any given contribution, the patent office simply grants exclusive rights commensurate with the inventor's achievement and allows the market to sort out what those rights are actually worth.[39]

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[34] *See* Mark A. Lemley, *Property, Intellectual Property, and Free Riding*, 83 TEX. L. REV. 1031, 1064 (2005).

[35] *See* Pénin, *supra* note 4, at 643-44. For a number of references discussing the dynamic costs of awarding exclusive rights, see *infra* note 50.

[36] *See* Kaplow, *supra* note 1, at 1822; *see also* SUZANNE SCOTCHMER, INNOVATION AND INCENTIVES 98-103 (2004).

[37] *See* Hemel & Ouellette, *supra* note 24, at 311-12; Camilla A. Hrdy, *Commercialization Awards*, 2015 WIS. L. REV. 13, 20-21; Pénin, *supra* note 5, at 111-12.

[38] *See* ADAM SMITH, LECTURES ON JURISPRUDENCE 82-83 (R.L. Meek et al. eds., 1978); Pénin, *supra* note 5, at 112-13. More recently, scholars have questioned whether the benefits of this administrative simplicity outweigh the disadvantages of rewarding invention through a system of exclusive rights. *See, e.g.*, Michael Abramowicz, *Perfecting Patent Prizes*, 56 VAND. L. REV. 115, 122-23 (2003); Steven Shavell & Tanguy van Ypersele, *Rewards Versus Intellectual Property Rights*, 44 J.L. & ECON. 525, 539 (2001).

[39] *See* SCOTCHMER, *supra* note 36, at 38-40 (discussing the comparative benefits of patents and prizes). The observation that patents can create incentives both to invent and to commercialize reveals one potential advantage of patents over other forms of direct rewards. Once commercialization incentives are considered, patents look like a one-step governmental intervention that goes a long way, both rewarding the initial invention and allowing the inventor to capture additional benefits following from continued investment in the technology. *See supra* note 33 and accompanying text. Achieving the same benefits through a system of prizes, by contrast, could require successive rounds of administrative action. However, some scholars have argued that the existing system of early-stage patent grants does not create sufficient incentives to see an invention through to commercialization, suggesting that an additional, second-stage patent grant or extension may in some circumstances be beneficial. *See* Abramowicz, *supra* note 33, at 1110-14; Sichelman, *supra* note 30, at 400-11; *see also* Michael Risch, *Reinventing Usefulness*, 2010

Alternative reward mechanisms have analogous costs and benefits. For example, a system of governmentally administered cash prizes could instead be used to transfer wealth to inventors, but it would also impose administrative costs in the form of time and expense preparing prize applications, soliciting expert opinions, reviewing applications, and distributing rewards.[40] These grants would also cause deadweight losses as a result of the taxes necessary to fund the grants.[41] Whether the patent system or a prize system can achieve the desired level of wealth transfer at lower cost is a subject of much debate, and may very well depend on the time and circumstances of a particular project.

Importantly, as far as the objective of rewarding invention or commercialization is concerned, the choice between a patent system and a prize system is merely one of cost-effectiveness.[42] If prizes or another form of direct public funding could create the same incentives to invent with lower administrative costs, smaller deadweight losses, and less significant dynamic harms, the patent system could (and should) be replaced by the alternative regime.[43] And, in fact, in the United States today it appears invention and commercialization are incentivized through a combination of patents, prizes, and other forms of government subsidy.[44]

B. *Patent Policy Under a Rewards-Focused Patent System*

The design of a rewards-focused patent system takes place in the shadow of the costs and benefits described in Section I.A. Increasing patent term, broadening patent rights, and granting patentee antitrust immunities will all tend to increase the expected wealth transfer to successful inventors and commercializers, while also tending to impose additional deadweight losses.[45] In the other direction, changes in policies that limit the rights of patent holders will decrease their expected wealth transfer, while also reducing deadweight losses. In the standard rewards view, all of these rights and liabilities are essentially tradable; what one policy takes away, another policy can typically give back.[46]

BYU L. REV. 1195, 1248-50 (explaining that this problem could be addressed by increasing the threshold of patentability). Others have questioned the need to use the patent system to provide commercialization incentives in the first place. *See, e.g.*, Lemley, *supra* note 7, at 739-45.

[40] *See* Abramowicz, *supra* note 38, at 206-11; Hemel & Oullette, *supra* note 24, at 361-62; Pénin, *supra* note 4, at 644-45.

[41] *See* Abramowicz, *supra* note 38, at 201-06; Hemel & Oullette, *supra* note 24, at 314.

[42] *See* Pénin, *supra* note 4, at 645-46.

[43] *See* Hemel & Ouellette, *supra* note 24, at 312-15; Kieff, *supra* note 33, at 710; Sichelman, *supra* note 30, at 358-59.

[44] *See* Hemel & Ouellette, *supra* note 24, at 315-26.

[45] *See* Kaplow, *supra* note 1, at 1830-33.

[46] *See id*.; *see also* SCOTCHMER, *supra* note 36, at 107, 109-11; Richard Gilbert & Carl

In this way, there is a basic fungibility among patent policies in a rewards-focused system. A new antitrust immunity is theoretically interchangeable with a patent term extension—each will increase inventor rewards and impose deadweight losses.[47] As between the two, (and holding all else equal) the better policy is the one that provides the larger private reward at lower public cost.[48] As a result, a policymaker might be able to improve the patent system by drastically reducing patentee antitrust immunities and increasing patent term (or vice versa). Thus, a wide range of patent policies—application filing fees, patent term extensions, antitrust immunities, claim scope, and so on—implicate essentially the same balancing of the benefits of rewarding inventors against the public costs of doing so, and can be substituted one for the other as circumstances require.[49]

However, the fact that policies are formally interchangeable does not imply they are all equally desirable. As others have noted, some patent policies will be more or less likely to lead to undesirable levels of racing, vary in terms of the specific kinds of invention they reward, or have different consequences for incentives to create the next generation of technological improvements.[50] Still, the essential task confronting the rewards-focused policymaker is assembling the most cost-effective bundle of patent term, exclusive rights, and immunities to incentivize the creation of new inventions.[51] While some policy levers may be more attractive than others, almost any policy change affecting the level of inventor rewards can be offset by pulling a different policy lever somewhere else.

II. DEFINING THE COORDINATION FUNCTION

For almost two centuries, the rewards function was the dominant—though not exclusive[52]—justification for the patent system. In more recent years, however, commentators have noted a variety of roles the patent system may

Shapiro, *Optimal Patent Length and Breadth*, 21 RAND J. ECON. 106, 106-07 (1990); Paul Klemperer, *How Broad Should the Scope of Patent Protection Be?*, 21 RAND J. ECON. 113, 114-16 (1990).

[47] *See* Daniel A. Crane, *Intellectual Liability*, 88 TEX. L. REV. 253, 271-72 (2009); Kaplow, *supra* note 1, at 1855-67.

[48] *See* SCOTCHMER, *supra* note 36, at 109-11; Kaplow, *supra* note 1, at 1855-67.

[49] *See* SCOTCHMER, *supra* note 36, at 107, 109-11 (discussing the fungibility of patent term and breadth).

[50] *See* Abramowicz, *supra* note 33, at 1068-69; Nancy T. Gallini, *Patent Policy and Costly Imitation*, 23 RAND J. ECON. 52, 53 (1992); Kaplow, *supra* note 1, at 1837-39 (exploring the possibility that inventors will value some forms of rewards more than others); Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 869-70 (1990).

[51] *See* Kaplow, *supra* note 1, at 1822.

[52] The disclosure justification also has a storied provenance. *See infra* Section II.B.1.

serve beyond the transfer of wealth to inventors of new technologies. Much of this literature has been motivated by a rather troubling empirical question: Why do so many inventors apply for patents when so few patents turn out to have much enforcement value? After all, fewer than 2% of issued patents are ever involved in litigation, and commentators estimate that fewer than 5% of patents are ever licensed for a royalty.[53] Moreover, in many industries survey respondents rank patents as less important than other strategies for recouping their investment in innovation.[54] The apparent inability of the traditional rewards view to fully explain the extent of participation in the patent system has thus led scholars to search more deeply for roles the patent system may be serving in practice.[55]

Because prior work examining alternative uses of the patent system has often been focused on explaining the behavior of private actors, there has not been much need to distinguish where one function of the patent system ends and the other begins. Those participating in the patent system likely do so for a blend of reasons, and a novel observation about how some actors use the patent system hardly needs to be exclusive of any other theory.[56] Further complicating matters, many of these functions are commonly associated with Edmund Kitch's landmark article, *The Nature and Function of the Patent System*. Although Kitch suggested a number of ways that the patent system

[53] *See* Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 NW. U. L. REV. 1495, 1501, 1507 (2001).

[54] *See* Richard C. Levin et al., *Appropriating the Returns from Industrial Research and Development*, 1987 BROOKINGS PAPERS ON ECON. ACTIVITY 783, 816; Edwin Mansfield, *Patents and Innovation: An Empirical Study*, 32 MGMT. SCI. 173, 180 (1986); Wesley M. Cohen, Richard R. Nelson & John P. Walsh, *Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Marketing Firms Patent (or Not)* 28 (Nat'l Bureau of Econ. Res., Working Paper No. 7552, 2000), http://www.nber.org/papers/w7552 [https://perma.cc/8XTT-TCZ5]. Apart from these studies focused on patentee behavior, some scholars have questioned whether increasing patent value actually leads to more innovation at a systemic level—further undermining the traditional rewards theory. *See* Heald, *Transaction Costs Theory*, *supra* note 4, at 499-503 (summarizing this literature).

[55] *See, e.g.*, Clarisa Long, *Patent Signals*, 69 U. CHI. L. REV. 625, 626-27 (2002); Pénin, *supra* note 4, at 642, 646-48. In addition to the coordination-related explanations described below, there are a number of other plausible answers to this question. *See, e.g.*, Stuart J.H. Graham & Ted Sichelman, *Why Do Start-Ups Patent?*, 23 BERKELEY TECH. L.J. 1063, 1064-70 (2008); Bronwyn H. Hall & Rosemarie Ham Ziedonis, *The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry, 1979-1995*, 32 RAND J. ECON. 101, 125 (2001); Lemley, *supra* note 53, at 1504-06; Gideon Parchomovsky & R. Polk Wagner, *Patent Portfolios*, 154 U. PA. L. REV. 1, 5-6 (2005).

[56] *See, e.g.*, Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1615-30 (2003); Kitch, *supra* note 3, at 266; Long, *supra* note 55, at 637 (observing that prior explanations for patentee behavior are not incorrect, but "present an incomplete picture").

could increase the output from resources used for technological innovation,[57] subsequent commentators have tended to discuss them all under the broad rubric of "prospect theory," and have not consistently distinguished among the various uses Kitch described.[58]

As a starting point for this discussion, this Article offers a more specific definition of the term "coordination function." As used in this Article, "coordination function" refers to the voluntary exchange of technical information made in reliance on the exclusive rights of patents. Several theories of how the patent system can facilitate coordination fall squarely within this definition, as explored in Section II.A. A few variants on these core theories are not as easy to categorize, and require a bit of qualification in order to determine whether they are or are not within the scope of the coordination function. These "it depends" theories are discussed in Section II.B.[59]

A. *The Core of the Coordination Function*

The theory at the heart of the coordination function is that patents may reduce risk in transactions around technical information. Whenever a firm shares information with value that depends on the firm's ability to control future uses of that information, it puts some of that value at risk. The recipient of the information may breach its promises, the information may turn out to be valuable in some way not anticipated by the parties' original agreement, or a third party may simply intercept the disclosure. As the theory goes, a patent's *in rem* exclusivity—its ability to restrain others without needing to show a contractual relationship or even a chain of direct copying—can mitigate the

[57] *See* Kitch, *supra* note 3, at 265, 275-79.

[58] *See, e.g.*, BURK & LEMLEY, *supra* note 14, at 69-72; NIVA ELKIN-KOREN & ELI M. SALZBERGER, THE LAW AND ECONOMICS OF INTELLECTUAL PROPERTY IN THE DIGITAL AGE: THE LIMITS OF ANALYSIS 83 (2013). Moreover, the term "prospect theory" is often used as shorthand for the patent policies Kitch initially suggested these functions would imply. *See* Abramowicz, *supra* note 33, at 1068; Duffy, *supra* note 3, at 440-43 (describing the "prospect features" of patent law as "the rules permitting fairly broad patents to be issued in the early stages of technical development"); Donald G. McFetridge & Douglas A. Smith, *Patents, Prospects, and Economic Surplus: A Comment*, 23 J.L. & ECON. 197, 197-98 (1980); Sichelman, *supra* note 30, at 345.

[59] There are also a few theories that are sometimes associated with coordination but which fall outside the scope of the definition given above. For example, the patent system might play an important role in rewarding commercialization, but this rewards-based theory is outside the scope of the coordination function as defined here. *See infra* note 102. Likewise, some conceptions of signaling theory are also outside the scope of the coordination function, for reasons explained in Section II.B.2. The definition given above is relied upon throughout the following analysis; to be clear, adopting a different definition of the coordination function could lead to sharply different conclusions about what coordination-focused patent policy would entail.

risks of sharing information with a counterparty, allowing for more efficient development and exploitation of new technologies.

There are many potential benefits tied up in this idea of patents reducing the risk of losing control over technical information. Perhaps the simplest is that having patent protection as a fallback may reduce the costs of keeping secrets within a firm.[60] A strong patent portfolio may mitigate the risks and costs of misappropriation of confidential information, reducing the need for confidentiality agreements, physical protections, and intra-firm segregation.[61] Patents may also reduce the perils encountered when transferring information outside the firm.[62] Without some kind of legal backstop, it can be quite difficult to bargain and trade for a secret. In some cases—though certainly not all[63]—it is impossible to set the price for information without knowing what the information is, and of course a buyer may not be willing to pay anything at all once she has been given the information in question.[64] Although in some cases contractual mechanisms can mitigate this problem, the seller nonetheless faces the risk that valuable information may be inadvertently transferred without compensation during the negotiations period.[65] Patents may be able to provide an alternate source of protection around transactions, and thus facilitate the negotiated transfer of information from one firm to another.[66]

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[60] *See* Heald, *Transaction Costs Theory*, *supra* note 4, at 487-89; Kitch, *supra* note 3, at 279.

[61] *See* LANDES & POSNER, *supra* note 4, at 328; Heald, *Transaction Costs Theory*, *supra* note 4, at 488-89. As Dan Burk and Brett McDonnell have noted, the benefits of reduced reliance on trade secrecy and other precautions can accrue to employer and employee alike. *See* Dan L. Burk & Brett H. McDonnell, *The Goldilocks Hypothesis: Balancing Intellectual Property Rights at the Boundary of the Firm*, 2007 U. ILL. L. REV. 575, 608-09. Relatedly, a strong patent portfolio may obviate the need to steer development efforts towards particular technologies or products for which secrecy is likely to be more effective. *See* LANDES & POSNER, *supra* note 4, at 328; Kitch, *supra* note 3, at 279.

[62] *See* Pénin, *supra* note 4, at 649.

[63] *See* Burstein, *supra* note 7, at 256-58 (describing various transactions that can occur with little risk to secrecy-dependent value).

[64] This challenge is known as Arrow's Information Paradox. *See* Arrow, *supra* note 27, at 614-16; *see also* James J. Anton & Dennis A. Yao, *The Sale of Ideas: Strategic Disclosure, Property Rights, and Contracting*, 69 REV. ECON. STUD. 513, 514 (2002). Because the nature of information varies, this issue is more serious in some types of transactions than others. *See* Anton & Yao, *supra*, at 514-15; Burstein, *supra* note 7, at 274.

[65] *See* Merges, *supra* note 5, at 1487-90; Janusz A. Ordover, *A Patent System for Both Diffusion and Exclusion*, 5 J. ECON. PERSP. 43, 50 (1991).

[66] *See* LANDES & POSNER, *supra* note 4, at 329; Ashish Arora, *Contracting for Tacit Knowledge: The Provision of Technical Services in Technology Licensing Contracts*, 50 J. DEV. ECON. 233, 246-47 (1996) (observing bundling of patent licenses with complementary know-how). Variants of this argument are sometimes categorized under the disclosure function. *See, e.g.*, Eisenberg, *supra* note 33, at 1029-30. However, at other times the term

But the potential risk-reducing benefits of patents are not limited to transactions for the sale of technical information itself. It can also be quite difficult to arrange for services to be performed that merely require the use of confidential information.[67] Because of the challenges of contracting around information, possessors of valuable nonpublic knowledge may abstain from otherwise mutually beneficial transactions for fear of losing control of how that knowledge will be used in the future. For example, it may be difficult for a firm to obtain financing when the firm's prospective value depends heavily on the secrecy of its information. Similarly, a firm contemplating outsourcing some aspects of production or design may hesitate to do so, given the risk that proprietary information will be misused by its counterparty. A strong patent portfolio on the underlying technology may allow the firm to disclose specific plans based on that technology more widely, enabling greater transparency with investors, more effective outsourcing, and earlier engagement with potential partners and customers.[68]

Another way patents may facilitate collaboration is by making it easier to form and resolve joint ventures. One of the well-known risks of joining a research partnership is that the collaboration may result in the inadvertent transfer of existing information from a firm to its partners.[69] Patents can be used to define and protect the technology that each party possessed prior to the partnership, reducing the risk of misappropriation or opportunistic behavior by collaborators.[70] On the other end of the joint venture lifecycle, patents may simplify the process of dividing the fruits of the partnership, allowing the parties to contract for future control of technology that did not exist at the time the collaboration began.[71]

"disclosure" is used to refer to functions that are distinct from coordination. *See infra* Section II.B.1.

[67] *See* Kitch, *supra* note 3, at 277.

[68] *See id.* at 277-78; *see also* Heald, *Transaction Costs Theory*, *supra* note 4, at 497-98; Pénin, *supra* note 4, at 650. For discussions of the relationship between transaction costs and vertical integration, see Benjamin Klein, Robert G. Crawford & Armen A. Alchian, *Vertical Integration, Appropriable Rents, and the Competitive Contracting Process*, 21 J.L. & ECON. 297, 298 (1978); Robert P. Merges, *Intellectual Property and the Costs of Commercial Exchange: A Review Essay*, 93 MICH. L. REV. 1570, 1573-74 (1995). For discussions of similar benefits in the context of trade secrecy, see Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 485-87 (1974) (describing how trade secret protection can facilitate licensing and dissemination); Lemley, *supra* note 25, at 335-36 (describing how trade secret protection can serve as a partial solution to Arrow's Information Paradox).

[69] *See* Bureth et al., *supra* note 6, at 8-9; Merges, *supra* note 68, at 1582-83; Ordover, *supra* note 65, at 55-56; Pénin, *supra* note 5, at 124.

[70] *See* Arora & Merges, *supra* note 5, at 458-59; Pénin, *supra* note 5, at 124; Pénin, *supra* note 4, at 650.

[71] *See* Bureth et al., *supra* note 6, at 8-9, 17-18.

In many of these roles, patents are essentially providing a solution to the various problems with using contracts to arrange transactions around information. For a host of reasons—the difficulties of describing information precisely, evidentiary uncertainty, and the limitations of contractual remedies, to name a few[72]—it may be challenging to mitigate these risks by mutual agreement. This is not to say it would be impossible to conduct any transactions at all in the absence of patent protection—there are clearly some transactions that will occur either way.[73] The theory, rather, is that a framework of exclusive rights can reduce the risks involved in evaluating, entering, and enforcing agreements involving the exchange of information.[74]

Patents may also be useful for facilitating information sharing in contexts where contracting is simply not an option.[75] For example, if a firm wants to make a broad announcement about an important technical development in hopes of identifying potential partners, it may not be possible to contract with all the relevant recipients to establish the terms of that disclosure—particularly if the very reason for the announcement is to discover previously unknown candidates for collaboration. Similarly, if hundreds of competitors want to collaborate to develop a new industry standard, it may not be practical to contractually settle exactly who owns which technologies before getting down to the standard-setting work itself. A background of exclusive rights, the theory goes, may allow for smoother multilateral exchanges of information, reducing duplicative efforts, opening the development process to outside collaborators, and enabling innovations that no firm would be able to achieve on its own.[76]

All of these theories—as varied and far-reaching as they are—boil down to a simple idea: patents may be able to facilitate the voluntary exchange of technical information in the shadow of their exclusive rights. In some cases, the voluntary exchange is for the patented invention itself—that is, the technology described in the patent specification that justified the patent grant

[72] *See* Heald, *Transaction Costs Theory*, *supra* note 4, at 480-81; Edmund W. Kitch, *The Law and Economics of Rights in Valuable Information*, 9 J. LEGAL STUD. 683, 690-93 (1980); Kitch, *supra* note 3, at 278; Merges, *supra* note 5, at 1491-93, 1497-98, 1503-04.

[73] *See* Burstein, *supra* note 7, at 256-57.

[74] *See* Merges, *supra* note 5, at 1484-85; Merges, *supra* note 68, at 1589-91; Pénin, *supra* note 5, at 124; Ted Sichelman & Stuart J.H. Graham, *Patenting by Entrepreneurs: An Empirical Study*, 17 MICH. TELECOMM. & TECH. L. REV. 111, 129-30 (2010).

[75] *See* FED. TRADE COMM'N, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY 19 (2003), http://www.ftc.gov/os/2003/10/innovationrpt.pdf [https://perma.cc/389B-KPGL] [hereinafter FTC REPORT]; Bureth et al., *supra* note 6, at 7; Kitch, *supra* note 3, at 278; Mazzoleni & Nelson, *supra* note 5, at 1039; Merges, *supra* note 5, at 1507-08; *see also* Ronald J. Mann, *Do Patents Facilitate Financing in the Software Industry?*, 83 TEX. L. REV. 961, 993-96, 1013 (2005) (describing how patents can facilitate information sharing around software).

[76] *See* LANDES & POSNER, *supra* note 4, at 329; Pénin, *supra* note 5, at 111.

in the first place. In other cases, the exchanged information consists of technical details that happen to fall within the scope of the patent's exclusivity—not only potentially helpful know-how that was omitted from the original disclosure, but also further developments that might have been made well after the patent was filed.[77] Either way, these theories contemplate the voluntary exchange of technical information made in reliance on the exclusive rights of patents, and thus fall unambiguously within the definition of the coordination function.

B. *Theories with an Element of Coordination*

There are also several theories at the edge—uses of the patent system that are in some sense within the coordination function and in some sense not. This Section introduces these potentially ambiguous cases and discusses their relationship to the core theory of the coordination function.

1. Disclosure

Of the various non-rewards justifications for the patent system, disclosure has by far the longest history. The Supreme Court mentioned disclosure as a goal of the patent system as early as 1832, and has repeatedly described disclosure as a central component of the patent bargain, sometimes even as *the* consideration offered by the patentee in exchange for exclusive rights.[78]

A complication to this storied legacy is that "disclosure" has at times been invoked to mean two very different things. In one sense, the "disclosure function" refers to the doctrinal requirement that a patent applicant include a

[77] For a discussion of how patents may enable the transfer of complementary, secret information, see Ashish Arora, *Licensing Tacit Knowledge: Intellectual Property Rights and the Market for Know-How*, 4 ECON. INNOVATION & NEW TECH. 41 (1995). Although in theory a firm must choose between patent protection (which requires disclosure) and trade secrecy (which forbids it), in practice this line is blurry, and many firms are able to "have it both ways" by disclosing enough to get a patent while also keeping valuable, related information as a trade secret. *See* Michael Risch, *Trade Secret Law and Information Development Incentives*, *in* THE LAW AND THEORY OF TRADE SECRECY 169 (Rochelle C. Dreyfuss & Katherine J. Strandburg eds., 2011); Sichelman & Graham, *supra* note 74, at 136.

[78] *See* Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 481 (1974) ("When a patent is granted and the information contained in it is circulated to the general public and those especially skilled in the trade, such additions to the general store of knowledge are of such importance to the public weal that the Federal Government is willing to pay the high price of 17 years of exclusive use . . . ."); Sinclair & Carroll Co. v. Interchemical Corp., 325 U.S. 327, 331 (1945) ("The primary purpose of our patent system is not reward of the individual but the advancement of the arts and sciences. . . . [I]t is not a certificate of merit, but an incentive to disclose."); Grant v. Raymond, 31 U.S. (6 Pet.) 218, 247 (1832) (describing disclosure as "the advantage for which the privilege [of patenting] is allowed, and . . . the foundation of the power to issue the patent").

written description of her invention in such clear, concise, and exact terms as to enable a person skilled in the art to make and use the invention.[79] This is the traditional understanding of the patent system's role in increasing disclosure—the disclosure legally required in a patent application as part of the quid pro quo of a patent grant.[80] Under this understanding of disclosure, the success or failure of the patent system turns on what is in patent applications themselves.[81] However, in other contexts, the term "disclosure function" can refer to the patent system's ability to facilitate information transfer more broadly.[82] As the theory goes, a system of *in rem* exclusive rights may encourage publication and exchange of technical information that an owner would otherwise have needed to keep confidential to preserve its value.[83] In this understanding of disclosure, the measure of the patent system's success turns not necessarily on the quality of the disclosure contained in patent applications, but rather on the ease and frequency with which patent holders share information with the public or others in their industry as a result of having patent protection in place.[84]

Thus there are two distinct concepts joined together under the rubric of disclosure: one in which the patent system is disclosure-*forcing*, and another in which the patent system is disclosure-*facilitating*.[85] And these two concepts are rooted in quite different theories about the problem to be solved by the patent system. The disclosure-forcing argument for patenting is based on a concern that, in the absence of patents, secrecy would give inventors de facto exclusive

[79] 35 U.S.C. § 112(a) (2012).

[80] *See* Mazzoleni & Nelson, *supra* note 5, at 1039. To be sure, these doctrinal requirements have a role to play in a rewards-focused framework as well. For example, the enablement and written description requirements work to limit and demarcate claim scope, thus ensuring that an inventor does not obtain protection for things she has not actually invented, and increasing the certainty of claim boundaries. *See* Timothy R. Holbrook, *Possession in Patent Law*, 59 SMU L. REV. 123, 146-47, 157-58 (2006). The traditional disclosure theory goes even further, elevating these requirements to a justification for granting patents in the first place.

[81] *See* C. T. TAYLOR & Z.A. SILBERSTON, THE ECONOMIC IMPACT OF THE PATENT SYSTEM: A STUDY OF THE BRITISH EXPERIENCE 210-13 (1973); Lisa Larrimore Ouellette, *Do Patents Disclose Useful Information?*, 25 HARV. J.L. & TECH. 545, 557-59 (2012); Jason Rantanen, *Peripheral Disclosure*, 74 U. PITT. L. REV. 1, 5 (2012); Sean B. Seymore, *The Teaching Function of Patents*, 85 NOTRE DAME L. REV 621, 623-27 (2010); Note, *The Disclosure Function of the Patent System (or Lack Thereof)*, 118 HARV. L. REV. 2007, 2014 (2005).

[82] Pénin, *supra* note 4, at 651; *see also* Clark D. Asay, *The Informational Value of Patents*, 31 BERKELEY TECH. L.J. 259, 264-66 (2016) (distinguishing between disclosure requirements and signaling functions).

[83] *See* Mazzoleni & Nelson, *supra* note 5, at 1039-40.

[84] *See* FTC REPORT, *supra* note 75, at 19; Burk & McDonnell, *supra* note 61, at 610; Lemley, *supra* note 7, at 745-49.

[85] *See* Rantanen, *supra* note 81, at 6-7 (making a similar distinction).

control over their inventions for an indefinite period of time.[86] From this perspective, it is preferable to give inventors time-limited exclusive rights rather than to let them keep their secrets forever. The idea is that the requirements of patent law will prompt possessors of valuable nonpublic information to make disclosures in patent applications instead of simply relying on secrecy.[87] As a result, this theory lacks a voluntary disclosure of technical information made in reliance on patent-based exclusivity, and falls outside the scope of the coordination function. The disclosure-facilitating argument for patenting, by contrast, is focused on the concern that, in the absence of patents, the risk of losing control over useful technical information would force firms to maintain this information as a secret notwithstanding existing reasons for those firms to share it with others. The goal of facilitating disclosure is not to artificially encourage disclosure for its own sake, but rather to enable the exchange of information when it is already privately desirable to do so.[88] Reduced to this description, the disclosure-facilitating justification for the patent system falls squarely within the coordination function, since it contemplates the voluntary exchange of technical information made in reliance on patent exclusivity.[89]

2. Signaling

Another function that the patent system may serve is signaling. However, as with disclosure, the term "signaling" actually refers to several distinct concepts, some of which fall within the coordination function and some of which do not. As a result, discussion of patent "signaling" requires further

[86] As others have noted, this fear may be unfounded. Secrets are vulnerable to independent invention and reverse engineering. *See, e.g.*, Lemley, *supra* note 25, at 330. Some inventions are "self-disclosing," meaning that secrecy would end as soon as a product hit the market. *See* Katherine J. Strandburg, *What Does the Public Get? Experimental Use and the Patent Bargain*, 2004 WIS. L. REV. 81, 104-06.

[87] *See* Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 154-56 (1989); Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 480-92 (1974). A number of commentators have questioned whether the goal of forcing disclosure can justify the costs of the patent system. *See, e.g.*, Eisenberg, *supra* note 33, at 1028-30; Sichelman, *supra* note 30, at 377-78. As a result, the more common view is to explain the disclosure requirements as a rational policy choice in view of other theories that justify the patent system. *See, e.g.*, Jeanne C. Fromer, *Patent Disclosure*, 94 IOWA L. REV. 539, 548-49 (2009); Lemley, *supra* note 25, at 332 & n.87; Ouellette, *supra* note 81, at 557.

[88] *See* Mazzoleni & Nelson, *supra* note 5, at 1039; Rantanen, *supra* note 81, at 20.

[89] *Cf.* Rantanen, *supra* note 81, at 36. This divergence only underscores the need for greater clarity about what is meant by "disclosure." Ambiguous use of the term unhelpfully conjoins two distinct theories of the patent system, and thus leads to indeterminate or conflicting implications for patent policy. *See id*. at 39-40 (contrasting these two understandings of disclosure theory).

elaboration before one can confidently classify it as being within the coordination function or outside it.

One understanding of signaling is rooted in the challenges outsiders face in verifying information about a firm's capacities for research and development. For example, two firms may both claim to be leaders in the same field, making it difficult for investors, potential employees, and partners to identify which is actually the better prospect. According to this theory, a firm can signal its strength by investing in patents.[90] As between the two firms claiming to be leaders in their field, the one with stronger research and development capabilities will find it profitable to file more applications, and over time will tend to be awarded more patents.[91]

Notably, this first version of signaling theory does not rely on the ability to exclude others from using any particular technology.[92] Rather, the signaling function operates based on a perceived correlation between a firm's ability to obtain patents and other, more-difficult-to-observe characteristics of the firm.[93] If this form of signaling were the only function of the patent system,[94] there would be no need to offer exclusive rights at all—the challenges of verifying technical achievement could be addressed by a merit recognition system wholly apart from patents.[95] And, because this version of the signaling theory does not depend on the exclusive rights conveyed by a patent to enable the transfer of technical information, it falls outside the definition of the coordination function.

However, there is another understanding of signaling that complicates the story. This alternate signaling theory is rooted in the difficulties a firm may face when it comes to identifying potential partners for the development of a nascent technology. Unlike real property, where it may be easy to observe what neighbors are doing, researchers in a technical field may be unaware of

[90] *See* Long, *supra* note 55, at 636-37; Jessica Silbey, *Patent Variation: Discerning Diversity Among Patent Functions*, 45 LOY. U. CHI. L.J. 441, 458-60 (2013).

[91] *See* Long, *supra* note 55, at 650, 667. Long additionally suggested that information contained in patent applications may be more reliable than other sources because applicants are subject to a duty of candor in patent proceedings. *Id.* at 649-50.

[92] *See id.* at 636-37.

[93] *Id.*

[94] To be clear, however, this is not a claim that proponents of the signaling theory generally make. *See, e.g.*, *id.* at 637. For a discussion of the interplay between exclusive rights and the signaling function of patents, see Mann, *supra* note 75, at 1022.

[95] For example, significant technical or academic accomplishments could be recognized by a system of prestigious prizes or peer-selected honors. *See, e.g.*, INT'L MATHEMATICAL UNION, FIELDS MEDAL DETAILS, http://www.mathunion.org/general/prizes/fields/details/ [https://perma.cc/2QYT-4TBQ] (last visited July 11, 2016); NOBEL MEDIA AB, NOBELPRIZE.ORG: THE OFFICIAL WEBSITE OF THE NOBEL PRIZE, http://www.nobelprize.org [https://perma.cc/HBX5-4B9D] (last visited July 11, 2016); *see also* Pénin, *supra* note 4, at 651.

potential collaborators performing similar work. This can lead to duplicative investment, increased search costs, and incompatible technologies.[96] A publicly recorded patent right, the theory goes, may provide a "beacon" to others in the industry, allowing potential partners to find each other and cooperate at an earlier stage of the development cycle.[97]

The proper classification of this latter signaling theory turns on the following question: Why exactly do private firms need a government-issued patent right in order to find each other? If the answer is that firms need help identifying competent partners in a particular technology area,[98] then this latter form of signaling is no different than the former—both are rooted in the problem of conveying information credibly, and both could be addressed without legal rights to exclude. But if the answer is that, without exclusive rights, it would be too risky for firms to share the information necessary to find (and be found by) potential partners, then this latter form of signaling is effectively a restatement of the core disclosure-facilitating theory described in Section II.B.1.

So while both of these signaling theories relate to more efficient exchange of information, they appear to be rooted in quite different stories of market failure. If "signaling" refers to the challenges of conveying information credibly, then patents are but one form of prize that could be used to identify technical competence. But if "signaling" refers to the difficulty of disclosing information without losing control over it, then the exclusive rights of the patent system are essential to addressing the problem. The latter is within the coordination function, the former is not.[99]

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To summarize, three general theories discussed by commentators fall within the definition of the coordination function: (1) patents can reduce risk in

[96] *See* Kitch, *supra* note 3, at 278-79.

[97] *See id.*; *see also* Kieff, *supra* note 8, at 414; F. Scott Kieff, *IP Transactions: On the Theory & Practice of Commercializing Innovation*, 42 HOUS. L. REV. 727, 735 (2005).

[98] *See, e.g.*, Bureth et al., *supra* note 6, at 8.

[99] It may seem counterintuitive that some forms of signaling are within the coordination function while others are not. But the two signaling theories describe the significance of patent exclusivity in starkly different terms. The core contribution of the first signaling theory is that the value promised to successful inventors may come from sources other than a patent's legal right to exclude. *See, e.g.*, Long, *supra* note 55, at 636-37 ("The patentee may desire information disclosure, even if the value of the exclusive rights (protection) obtained in exchange is zero."). By contrast, proponents of the latter signaling theory have emphasized the critical importance of property-like rights to exclude. *See, e.g.*, Kieff, *supra* note 8, at 341 ("To achieve this [private ordering] role effectively, [patents] must operate as rights of exclusion around which coordination can take place.").

bilateral transactions around information; (2) patents can facilitate multilateral collaboration; and, (3) patents can facilitate broader voluntary disclosure.

The various theories within the coordination function share a rather humble charter: reducing costs and risks so that otherwise privately desirable transactions can occur.[100] This is in contrast to rewards-centric uses of the patent system, which typically seek to stimulate some desired conduct through the promise of something valuable.[101] Rather than offering a public subsidy in exchange for the desired conduct, the coordination function merely seeks to facilitate output-enhancing interactions among private actors.[102]

It is worth noting that there is a basic tension at the heart of coordination theory. Whereas rewards theory seeks to justify the static costs of patents based on the dynamic benefits of rewarding invention in the long run,[103] coordination theory seeks to justify the static costs of patents by reducing other static

[100] Implicit in coordination-related justifications for the patent system is the assumption that these private exchanges yield public benefits. For a discussion of the social benefits of sharing and exchange in the context of real property, and of how the threat of strategic behavior can inhibit such sharing, see Daniel B. Kelly, *The Right to Include*, 63 EMORY L.J. 857, 871-72 (2014).

[101] *See supra* Section II.A.

[102] Some theories may straddle this distinction. For example, the suggestion that the patent system plays an important role in facilitating commercialization appears to draw on aspects of both the rewards and the coordination functions. Part of the claim is that patents may reduce free riding and create incentives to invest in commercialization, which is at heart a rewards theory. Another part of the claim is that patents may enable broader disclosure and facilitate the transactions necessary to move early-stage technologies from inventors to commercializers, which is at heart a coordination theory. *See* LANDES & POSNER, *supra* note 4, at 329; Mazzoleni & Nelson, *supra* note 5, at 1040. For a dialogue regarding this distinction, see Ted Sichelman, *Commercializing Information with Intellectual Property*, 92 TEX. L. REV. SEE ALSO 35, 41 (2014); Michael J. Burstein, *Reply—Commercialization Without Exchange*, 92 TEX. L. REV. SEE ALSO 45, 46 (2014). And some theories may resist categorization as *either* rewards or coordination. For example, Kitch famously argued that patents can reduce competition for innovation and that this reduction in competition can actually lead to more efficient development of new technologies by avoiding duplicative investments. *See* Kitch, *supra* note 3, at 276; *see also* SCOTCHMER, *supra* note 36, at 152. *But see* Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989, 1048-58 (1997) (disputing the theory); Merges & Nelson, *supra* note 50, at 872-74 (same). Unlike the rewards and coordination theories, this idea is not rooted in the difficulties of excluding others from uses of information at all. In fact, the generalized form of the supposed problem—overinvestment in entry—can occur in situations having nothing to do with information or emerging technologies. *See* Michael Abramowicz, *An Industrial Organization Approach to Copyright Law*, 46 WM. & MARY L. REV. 33, 48-55 (2004) (describing an example of overinvestment in the construction of gas stations).

[103] *See supra* note 27 and accompanying text.

costs.[104] The potential for failure is real. Initiatives to grant more patents or to make them stronger might reduce the costs of collaboration for some projects, only to increase the costs of collaboration for other projects.[105] Thus, it is neither obvious nor inevitable that the coordination function will succeed at all, much less justify the full costs of having a patent system.

For these reasons and others, a number of commentators have argued that the coordination function neither convincingly describes nor plausibly justifies the patent system.[106] However, their analysis has consistently relied on a fundamental assumption that has not been very thoroughly examined: that a coordination-focused patent system would operate more or less like the current rewards-focused system.[107] The next Part explores coordination theory in more detail to inform the question: What would a coordination-focused patent system actually look like?

III. THE COORDINATION FUNCTION: FROM THEORY TO MID-LEVEL PRINCIPLES

Part II surveyed a wide array of alternative uses of the patent system and synthesized a core definition of the coordination function. But, as others have noted, it is one thing to state these potential benefits of the patent system, and another thing to understand what a coordination-focused patent system would require to be effective.[108] This Part explores coordination theory in more detail to identify the characteristics of the patent system that are important for coordination and those that are not.

A. *What Does the Coordination Function Require?*

To understand what the coordination function requires to operate, it is first necessary to establish what it would mean for the patent system to serve this function well. As discussed in Part II, the goal of the coordination function is to facilitate output-enhancing information exchange among private actors by reducing the risk that exchanged information will later be used in ways its

[104] And, of course, under either theory patents may impose dynamic costs as well. *See supra* notes 35, 50 and accompanying text.

[105] *See* Fromer, *supra* note 87, at 551-52; Merges & Nelson, *supra* note 50, at 871-75; Vertinsky, *supra* note 7, at 1068.

[106] *See, e.g.*, Burstein, *supra* note 7, at 246-47, 262; Feldman & Lemley, *supra* note 7, at 139; Lemley, *supra* note 7, at 748.

[107] To the extent their analysis has contemplated differences between rewards- and coordination-focused policies, commentators have typically associated a coordination-focused system with patent rights that are broad, strong, and granted early. *See, e.g.*, BURK & LEMLEY, *supra* note 14, at 80-81; Burstein, *supra* note 7, at 245-46, 278.

[108] *See* LANDES & POSNER, *supra* note 4, at 330-31 (observing the need for more development in this area); Pénin, *supra* note 5, at 125 (same).

original possessor did not intend.[109] The theory is that a backdrop of exclusive rights will allow firms with confidential information to reduce precautions and share that information more freely when it is beneficial for them to do so. On the theory's own terms, success is measured by the amount of privately beneficial information sharing that occurs in reliance on patent rights.

So which characteristics of the patent system determine whether a lot or a little patent-backed information sharing will occur? To answer this question, consider the share-or-conceal decision from the perspective of a firm possessing valuable technical information.[110] The firm could obtain some benefits by choosing to share this information.[111] But those benefits are counterbalanced by a risk that the information's value will be diminished through a loss of future control.[112] The essential question facing the firm is whether the expected benefits of sharing this confidential information exceed the expected loss that may occur from future unplanned use by others.

In a world without patents, the decision to share any particular piece of information is a straightforward one. The firm must simply compare the expected benefits of information sharing to the expected harms that could result from losing control over that information. When the benefits of sharing are large compared to the risk of loss, the firm will elect to share.[113] For example, the benefits of telling customers some general details about new products likely far exceed the downside of competitors also learning the same information. But when the benefits of sharing pale in comparison to what the firm stands to lose, secrecy is the better path. For example, even if the firm could make additional sales by showing customers its complete design

[109] *See supra* Section II.A.

[110] Throughout this discussion, the term "information sharing" is used to include both a deliberate transfer of information and a reduction in precautions to prevent transfer. Each is a decision by a firm to loosen its grip on some valuable information.

[111] Call these benefits available from sharing the information B. Because the goal of coordination theory is only to enable information exchange where there are already private benefits to doing so, B is greater than 0 by hypothesis. If there are no private benefits to sharing information (i.e., $B \leq 0$), then no information sharing will occur, and coordination theory suggests no reason to try to alter this result.

[112] Call the control-dependent value that can be lost through future misuse of the information S, and the probability of that loss d. Sharing information thus gives the firm a certain benefit B, but also an expected loss given by dS. As with the benefits of information sharing, this expected loss is greater than 0 by hypothesis. If there are no risks of loss as a result of information sharing (i.e., $dS \leq 0$), the firm will share the information regardless of B and regardless of patent protection. It is the marginal cases—where private benefits are available but are overshadowed by the risks that come along with disclosure—that the coordination function seeks to affect.

[113] The firm will engage in the information-sharing activity provided that the expected benefits of the activity outweigh the expected risk of losing the information's control-dependent value, that is, so long as $B > dS$.

schematics, the risk of losing control over such information is usually too great to justify this level of transparency.[114]

The goal of the coordination function is to influence this balancing, allowing the firm to engage in more privately beneficial information sharing than it otherwise would. Patents do this, the theory goes, by reducing the expected losses from engaging in information sharing. If a patent-holding firm elects to share its confidential information and later discovers the information is being used in a way it does not approve of, it can bring a patent suit to attempt to restore some of the control-dependent value it enjoyed prior to disclosure.[115] In this way, the expected loss the firm faces from sharing its information is reduced, potentially allowing more privately beneficial information exchanges to occur.[116]

To illustrate, consider a firm that has just finished designing its latest product. The firm could manufacture the product itself, or it could hire an outside company to do it. In this hypothetical, outsourcing would allow the firm to make each unit more cheaply, but require disclosing the firm's valuable design plans to an outside party.[117] This creates a risk that the plans may end up in the hands of a competitor, destroying much of their value to the firm.[118] To a certain extent, the firm can seek to avoid this result by choosing an outsourcing partner with a good reputation and putting strict nondisclosure terms in the contract, but such precautions can only go so far. The expected benefits of outsourcing come with some risk that the plans will be disclosed or used in a way that harms the firm.

So the firm must weigh these expected risks and benefits. In the absence of patents, the firm will outsource only if the expected benefits of doing so are

[114] Holding the probability of loss d constant, the greater the control-dependent value at risk S, the greater the benefit B necessary for information sharing to be worth the gamble.

[115] Bringing a patent infringement suit against those using the previously confidential information will impose a positive enforcement cost C, but offer a probability p of restoring some amount of exclusivity value X. So, whereas in the absence of patent protection divulgence means a loss of the full amount of the original control-dependent value S, it will now result in a loss of $S + C$, but will potentially be offset by patent-based exclusivity with expected value pX.

[116] In terms of the model, this fallback exclusion strategy allows the firm to share information so long as $B > d(S + C - pX)$. On certain conditions (discussed below), patents can decrease the right side of that inequality, allowing more information-sharing opportunities with benefits B to become worth their risks. Moreover, patent protection might be able to reduce the likelihood that an unplanned use occurs at all—that is, it may decrease d. For example, if the disclosing firm can reliably bring a patent suit against those who use the disclosed information without the firm's permission, other parties may be deterred from misappropriating the information in the first instance.

[117] In this example, the benefits to the firm of outsourcing are B.

[118] The probability that a competitor will obtain the plans is d, and the loss to the firm from this occurring is S.

large compared to the probability and magnitude of harm from unplanned future use.[119] But if the firm has the option of bringing a patent infringement suit, it enjoys a chance of restoring some of the exclusivity value that might be lost in the event of an unplanned use.[120] This infringement-suit option can reduce the downside risk that the firm faces when deciding whether or not to share its information in the first place. As a result, the firm may find more outsourcing opportunities worthwhile than it would in the absence of patent protection.[121]

Viewed from this perspective, the patent system's success in enabling information sharing turns on the ability of patents to reliably restore a firm to the position it would have enjoyed under secrecy. A maximally effective (though not necessarily cost-justified) coordination-focused patent system would give the firm a risk-free right to restore its prior exclusivity after disclosure has occurred. This would allow a firm to have the best of two worlds: it would receive all the benefits of disclosure and engagement with others, while at the same time enjoying all the control and exclusivity value afforded by secrecy. Such airtight patent rights, combined with powerful remedies, would moot the share-versus-conceal question entirely, allowing information sharing to occur whenever there is any benefit to doing so.[122]

When patent rights provide something less than that, their effect is to reduce, rather than eliminate, the risk a firm faces when it elects to share its information. Consider the possibility that the remedies provided by patent law

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[119] As in the generalized form of the model, the firm will only take this risk if $B > dS$.

[120] Specifically, the firm now faces a probability p of restoring X of the lost control value through patent remedies.

[121] The patent-holding firm will take the risk of sharing information when $B > d(S + C - pX)$. Because a firm without patents would already share information in cases where $B > dS$, patents facilitate incremental information sharing only when $d(S + C - pX) < dS$, which can be rewritten as $pX > C$. When that condition doesn't hold, the firm will simply ignore its patent portfolio, and make its information-sharing decisions as it would in the absence of patents. Note that the relevant decision the coordination function seeks to influence is the decision to share or withhold information in the shadow of patent rights, not the decision to acquire patents or to enforce them. Even in a coordination-focused system, firms with patents may sometimes find it profitable to sue independent adopters who did not actually acquire the technology through the patent-holding firm's disclosure, as they frequently do today. *See* Christopher A. Cotropia & Mark A. Lemley, *Copying in Patent Law*, 87 N.C. L. REV. 1421, 1464-65 (2009). The attractiveness of such suits—which under coordination theory are an unintended byproduct of patent protection—could be reduced through an independent derivation defense. *See infra* Section III.B.3.

[122] To see this, remember that a firm will share its information when $B > d(S + C - pX)$. If C approaches 0 (patent remedies are cheap to obtain), p approaches 1 (patent holder victory is guaranteed), and X approaches S (patent remedies restore all control-dependent value), the downside risk of sharing is effectively eliminated, and any information-sharing opportunity with positive benefit ($B > 0$) will satisfy the condition.

may be less valuable to the firm than the control the firm previously enjoyed under secrecy. There are a number of reasons this is likely to be true: patent rights are temporally and geographically limited; the technical scope of patents sometimes leave room for circumvention; and courts can decline to enter injunctions. In that case, the firm still faces some potential downside from sharing its information—if future unplanned use occurs, the resulting patent remedies will not fully restore the firm to its prior position. When this occurs, patents alleviate some, but not all, of the risks of sharing information.[123]

Another way patent rights may leave a firm with some residual risk from information sharing is from the failure of those rights themselves. However strong or weak they are, patent remedies only become available if the firm can prevail in an infringement suit.[124] But there are a number of ways a recipient of previously confidential information may escape patent liability entirely. She may find ways to use the information that do not infringe the patent. She may show that the scope of the patent's claims is narrower than it appears. She may succeed in defeating the validity of the patent itself. These defenses introduce the very real chance that a patent may later to turn out not to provide any fallback protection at all. As with weaker patent remedies, the possibility that patent protection will fail leaves a disclosing firm with some residual risk of loss.[125]

[123] Again, the firm will share its information when $B > d(S + C - pX)$. If patent remedies do not fully restore the information's original control-dependent value, then $X < S$. Because the probability p of getting patent remedies can never be greater than 1, it follows that the expected value of patent-based exclusivity must be less than the information's original control-dependent value (i.e., $pX < S$). When that is the case, the right side of the inequality above—$d(S + C - pX)$—must be greater than 0, meaning that the firm still faces some residual expected loss as a result of a decision to share information.

[124] This does not mean the firm will necessarily need to proceed to a full patent trial. But a credible threat to do so will typically be necessary to achieve a settlement outcome that restores the firm's lost value.

[125] A decrease in the probability of obtaining patent remedies has a similar effect as a decrease in the value of the remedy itself. *See supra* note 123. As the probability p of successful enforcement gets smaller, the expected value of patent-based exclusivity pX gets smaller as well. Once the expected value of patent remedies becomes smaller than the original control-dependent value of the information (i.e., $pX < S$), then $d(S + C - pX)$ must be greater than 0, and firms still face some residual expected loss as a result of a decision to share information. Note that some reductions in the probability of a patentee victory can (at least theoretically) be offset by offering patent remedies that more than restore the information's original control-dependent value—that is, by setting $X > S$. But there is likely a limit to the extent that generous patent remedies can offset small probabilities of patent victory. First of all, a patent court's ability to compensate patent holders is not infinite—patent remedies are necessarily limited by time, geography, technical scope, and the resources of the infringers before the court. Second, even when it is feasible to compensate patent holders beyond the control-dependent value that was lost, the risk aversion of patent

Thus, the success of the coordination function is critically dependent on two factors: the reliability of patent rights, and the ability of those rights to provide secrecy-like exclusion. When patents provide a high likelihood of obtaining secrecy-like exclusion, they will induce a large amount of patent-backed information sharing, and the coordination function will be maximally effective. Conversely, if the likelihood of a patent victory is low and patent remedies are weak, the patent system will not offer much comfort in the case of an unplanned future use, and very little patent-backed information sharing will occur.

B. *Several New Degrees of Freedom*

The generalized coordination theory described in the prior section leads to two requirements that have a significant effect on the coordination function's effectiveness: reliable patent rights and secrecy-like exclusion. These are not particularly surprising, for the same characteristics would increase the effectiveness of the rewards function as well.[126] However, the more interesting aspects of the coordination story are found in what it does not say. This Section highlights the ways in which the operation of the coordination function departs from that of the traditional rewards function.

1. No Direct Reliance on the Initial Allocation of Patent Rights

The coordination function operates by giving firms an alternate mechanism for controlling how information is used after disclosure.[127] To serve this function effectively, patents must offer predictable rights of sufficient scope to enable firms to reliably backstop their private arrangements. But, notably, nothing in this framework depends on the initial allocation of patent grants. This feature of the coordination function relaxes several conditions that are necessary for a well-functioning rewards system.

When it comes to the traditional rewards function, the initial allocation of patent rights is critical. The work of the rewards function is, after all, to increase incentives to invent by transferring a thing of value to those who successfully produce a new invention.[128] Errors in the initial allocation of patents directly frustrate this goal because they weaken the relationship between the desired conduct (invention) and the promised reward (a patent).[129]

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holders may prevent generous remedies from completely offsetting low likelihoods of victory.

[126] In this context, "effectiveness" refers only to the power of the incentives offered to the inventors of first-generation technologies. This does not imply that such maximalism would constitute optimal rewards-focused patent policy. *See supra* Section I.B.

[127] *See supra* Section III.A.

[128] *See* Mazzoleni & Nelson, *supra* note 5, at 1033, 1035.

[129] *See* Abramowicz, *supra* note 38, at 180 (noting that a prize system requires some method of identifying worthwhile innovations and rejecting others). This can happen

As a result, the rewards function implies a compelling interest not only in granting patents to those who deserve them, but also in denying them to (and perhaps revoking them from) those who do not.

As the coordination function does not seek to incentivize private conduct through the promise of a prize, it has no direct dependence on the initial allocation of patents. Instead, what matters is the final allocation—that patents ultimately end up in the hands of parties who can rely on them to transfer technical information. Though in practice the matter is more complex,[130] at a theoretical level the coordination function could be served just as well by a system that allocates patents randomly and makes them easy to trade as it could by a system that awards patents cautiously.

One way of looking at this distinction is that some version of the Coase theorem is applicable in the case of the coordination function, but not in the case of the rewards function. For purposes of the coordination function, if rights are inefficiently allocated, private negotiation is available to reach a more efficient configuration.[131] This process will not be free—there will certainly be transaction costs in identifying partners and negotiating the trade. But when it comes to the rewards function, mistakes in allocation cannot be solved by Coasian bargaining at all. The purpose of the patent grant is to affect distribution, so it is no comfort to say that the parties can trade after the fact.

Particularly when the costs of trading patents are high, the coordination function may still justify a resource-intensive effort to try to put patents in the proper hands from the beginning.[132] But the significance of the initial allocation of patents is indirect: it matters only to the extent it affects the final allocation of patents and the costs of reaching that state. This is in sharp

through mistakes in either direction. For example, when a patent is improperly denied to a rightful inventor, ex ante incentives to invent are reduced because inventors face an increased risk that even if they succeed in achieving a patentable invention, they will nonetheless be denied their reward. *See* Andres Sawicki, *Better Mistakes in Patent Law*, 39 FLA. ST. U. L. REV. 735, 762 (2012). Going the other way, a patent that is improperly granted also reduces incentives to invest in invention because it introduces the possibility that an applicant will receive the benefits of a patent whether or not she deserves them. The incentives to invest in invention—the very core of the rewards function—thus depend both on the likelihood that a patent will be granted if an invention is achieved and on the likelihood that a patent will not be granted if an invention is not achieved. *See generally* Stephen Yelderman, The Value of Accuracy in the Patent System (working paper) (on file with author).

[130] *See infra* Section IV.A.

[131] *See* Mark A. Lemley, *Reconceiving Patents in the Age of Venture Capital*, 4 J. SMALL & EMERGING BUS. L. 137, 147-48 (2000) (applying Coase in this way); *see also* Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089, 1094-95 (1972) (discussing similar implications).

[132] *See infra* Section IV.A.

contrast to the rewards function, where accuracy in the initial allocation of patents is critical to the function's success.

2. No Intermediate Goal of Wealth Transfer

The coordination function is in many ways less ambitious than the traditional rewards function. All that is necessary for the coordination function to succeed is the creation of reliable private rights to exclude others from using a particular body of information. Allocating these rights to private parties may well have other effects: distributional consequences, the creation of market power, or subtle pressures on industry structure, just to name a few. But these consequences are collateral, and as a result, a policymaker may find she has much more latitude implementing the coordination function than she does implementing the rewards function.

As the rewards function seeks to directly incentivize investment in research and development by promising a patent as a prize, it is inherently sensitive to the total ex ante value proposition offered by the patent system.[133] For example, an increase in the costs of acquiring or maintaining a patent will reduce the value of the promised patent reward—particularly because the costs of securing a patent are certain to be incurred, and the potential benefits of successful enforcement of that patent are probabilistic.[134] Similarly, it is critical that at least some patents result in monopoly rents sufficient to justify the persistent costs and risks of investing in research and participating in the patent system.[135] If the total package of costs and benefits offered by the patent system does not result in some upside when an invention turns out to be a success, the patent system will fail in its goal of creating additional incentives to try.[136]

The coordination function does not depend on any such promise of riches, which opens up a variety of policy options that would not be possible under the rewards function. For one, there is no need to distribute patents as privately valuable grants—they could be allocated by auction, for instance, allowing competitive bidding to reduce the private surplus inherent in patent issuance.[137]

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[133] *See* Abramowicz, *supra* note 38, at 124; Liivak, *supra* note 10, at 1165.

[134] *See* Stephen Yelderman, *Improving Patent Quality with Applicant Incentives*, 28 HARV. J.L. & TECH. 77, 93 (2014).

[135] *See* Dennis D. Crouch, The Patent Lottery: Exploiting Behavioral Economics for the Common Good, 16 GEO. MASON L. REV. 141, 142-43 (2008); Ariel Katz, Making Sense of Nonsense: Intellectual Property, Antitrust, and Market Power, 49 ARIZ. L. REV. 837, 841-42 (2007); Mark A. Lemley & Mark P. McKenna, Is Pepsi Really A Substitute for Coke? Market Definition in Antitrust and IP, 100 GEO. L.J. 2055, 2094-96 (2012).

[136] However, these benefits need not flow exclusively from wealth transfer. *See* Long, *supra* note 55, at 636-37.

[137] *See* Harold Demsetz, *Why Regulate Utilities?*, 11 J.L. & ECON. 55, 63 (1968). For a thorough discussion on the costs, benefits, and feasibility of allocating patents by auction,

And even once patents are issued, their role in coordination is simply to allow an information-sharing firm to restore the control-dependent value that it previously possessed. Some changes in the scope, duration, or intensity of patent rights may not affect the coordination function at all, provided they leave intact this core ability to reliably restore control.

This theoretical distinction does not imply there are no practical limits. Some changes affecting patent value may not impair the coordination function, but others will. For example, a change in patentability standards that makes it significantly more difficult to obtain patents in the first instance could weaken the coordination function (as well as the rewards function), since the exchange of technical information in reliance on patents depends on having an adequate stock of patents in circulation upon which to rely.[138] If patents become too difficult or expensive to obtain, firms may forgo the coordination function of patents and rely on secrecy instead. The lack of a wealth-transfer goal opens up a variety of policy options, but this newfound flexibility is not infinite.

3. The Possibility of Independent Derivation

Another way coordination-focused patent policy can afford to be flexible relates to use of patented technology by firms that did not receive any information from the original disclosing firm. The central work of the coordination function is to restore a disclosing firm to the position it was in prior to disclosure. But this is as far as it must go. Once those who received the original confidential information (as a direct or indirect result of the disclosure) have been restrained from using or further disclosing the information, the patent system has completed its mission. There is no need to interfere with others who have come upon the same thing independently.

This is in contrast to the rewards function, where the ability to exclude independent third parties is an important determinant of the value of patent rights and therefore the system's effectiveness. If a patent only included the right to exclude copyists, the prize for achieving a successful, patentable invention would be significantly smaller.[139] From the perspective of the rewards function, this change in the private value would provide a weaker incentive to engage in research and participate in the patent system.[140]

see Michael Abramowicz, *The Uneasy Case for Patent Races over Auctions*, 60 STAN. L. REV. 803 (2007).

[138] *See infra* Section IV.C.

[139] *See* Mark A. Lemley, *Should Patent Infringement Require Proof of Copying?*, 105 MICH. L. REV. 1525, 1529-32 (2007).

[140] Rewards-focused reasoning might, however, contemplate a limited defense in cases where the cost of providing exclusion is particularly high compared to the private value of that exclusion, such as in a case of near-simultaneous invention. *See, e.g.*, Stephen M. Maurer & Suzanne Scotchmer, *The Independent Invention Defense in Intellectual Property*, 69 ECONOMICA 535, 540-42 (2002); Carl Shapiro, *Prior User Rights*, 96 AM. ECON. REV.

The effectiveness of the coordination function does not turn on the private value of patents, or on the number of potential infringers that can be hauled in to court to contribute to the inventor's prize purse. Instead, the central question is whether the accused infringer is one who directly or indirectly received previously confidential information from the patent holder. When the answer to that question is confidently "no," there is no reliance interest from a prior information exchange at play, and future coordination will not be affected by whether the accused party is deemed an infringer. Independent derivation could thus be made a defense to patent infringement without reducing the effectiveness of the coordination function.

This potential exception is in some ways similar to the independent invention defense that has been proposed by commentators,[141] or to the prior user defense recently created by the America Invents Act (the "AIA").[142] But there are important differences as well. To illustrate, consider a scenario in which Firm A sends some design plans out for bid in reliance on its patent portfolio. Firm B receives the bid package, but instead of agreeing to work with Firm A, decides to steal the plans and compete directly against Firm A. Firm A resorts to its patent fallback plan, asserting various patents against Firm B in hopes of restoring the exclusivity it originally enjoyed in its design plans.

As traditionally conceived, an independent invention or prior user doctrine could give Firm B a potential defense on these facts. When Firm A asserts a patent, Firm B would have the opportunity to show that it independently conceived and reduced to practice Firm A's claimed invention before hearing about it from Firm A.[143] If so, Firm A would have no patent remedies against Firm B. But for purposes of the coordination function, inquiring about the origin of the claimed invention is the wrong question. Rather, the inquiry must focus on whether Firm B independently created the previously confidential information (here, the design plans) before it came into contact with Firm A. Because Firm B took its design plans from Firm A, it should not be able to invoke an independent derivation defense, even if it may have independently invented the subject matter of Firm A's patents some time before.

92, 95 (2006); Samson Vermont, *Independent Invention as a Defense to Patent Infringement*, 105 MICH. L. REV. 475, 489-90, 493-94 (2006).

[141] *See, e.g.*, Maurer & Scotchmer, *supra* note 140, at 535; Shapiro, *supra* note 140, at 92; Vermont, *supra* note 140, at 475.

[142] Leahy-Smith America Invents Act, Pub. L. No. 112-29, § 5(a), 125 Stat. 297 (codified at 35 U.S.C. § 273 (2012)).

[143] Vermont, *supra* note 140, at 484-86. In other formulations, the defendant would be required to demonstrate steps towards commercialization as well. *See* Lemley, *supra* note 139, at 1533-34. Under the AIA, Firm B would need to show that it used the claimed invention commercially in the United States at least one year prior to the patent's filing date. *See* 35 U.S.C. § 273(a).

In the other direction, there are situations in which the independent derivation defense would apply and these other defenses would not. For example, independent invention and prior use typically require that the defendant conceived of the invention either before or around the same time as the plaintiff did.[144] But for independent derivation, the critical date is the day the plaintiff encountered the defendant's disclosure. So if Firm B independently created some design plans well after Firm A filed a patent, but before Firm B had any opportunity to copy Firm A's design plans, the independent derivation defense should be available. For purposes of the coordination function, all that matters is that Firm B did not obtain its design plans from Firm A.

Caution is in order here. The case for using patents to facilitate coordination is rooted, in part, in problems of proof when it comes to tracing the flow of information.[145] As presumptively *in rem* rights, patents offer the possibility of exclusion even in cases where evidence of copying is lacking. An independent derivation defense would need to be carefully crafted to avoid forfeiting the very evidentiary advantages that make patents useful in situations where other exclusion mechanisms have failed. For example, if the patent holder were required to prove that the defendant obtained a particular piece of valuable information from the patent holder, the patent system might have little ability to facilitate publication or multilateral exchange over and above the existing nonpatent alternatives. But, designed properly, an independent derivation defense could be perfectly compatible with a robust coordination-focused patent system.

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For all of these reasons, a purely coordination-focused patent system could look radically different from the patent system as it exists today. In some ways, the design of this hypothetical new system would be more constrained—the success of the coordination function depends critically on patents constituting reliable rights that bring strong remedies. But in other ways, a coordination-focused system could afford to be more flexible. Patents could be handed out randomly, or initially allocated by a public auction. Changes could be made affecting their private value, so long as the core rights of reliable exclusion were preserved. Claims of infringement could be subjected to new defenses, carving out third-parties who had no prior contact with the patent holder. On the whole, it is not clear whether patent rights would be stronger or weaker if the current system were replaced by a purely coordination-focused regime.

[144] The AIA requires that the defendant had a commercial use at least one year before the plaintiff's filing date. *See* 35 U.S.C. § 273(a). Other proposals are more forgiving, but nonetheless terminate the possibility of independent invention at some constructive notice date. *See, e.g.*, Vermont, *supra* note 140, at 485-87.

[145] *See supra* notes 72-74 and accompanying text.

What is clear is that equivalence between coordination- and rewards-focused policies should no longer be presumed.

IV. IMPLICATIONS FOR PATENT POLICY

As the prior Parts discussed, it is too simplistic to assume that invoking coordination theory as a justification for the patent system will inevitably lead to the same policy prescriptions as rewards theory. The coordination function is directed at a different problem, and it employs a distinctive method for addressing that problem. As a result, the features of the patent system that will determine its effectiveness are different too. If the reason for having a patent system were to change completely from rewarding invention to facilitating coordination, it would be appropriate to revisit every area of patent doctrine that was previously settled under rewards-focused reasoning to at least consider whether this change in purpose justifies a change in law. Nothing of the status quo should be assumed or taken for granted.

For example, consider the initial allocation of patents. If, as noted in Part III, the coordination function is compatible with handing out patents randomly, or by auction, what should be done with the patent eligibility doctrines that comprise the very heart of patent law, such as the requirements of novelty, nonobviousness, and enablement?[146] In fact, why even bother to examine patents at all? If the coordination function is embraced as the exclusive purpose of the patent system, the entire patent examiner corps could be replaced by a troop of patent auctioneers.

But, since any shift from rewards goals to coordination goals will likely be gradual—and, after all, the two objectives are not mutually exclusive—it is also worth considering how recognition of the coordination function would call for changes to patent policy at the margin, without explicitly abandoning a concurrent goal of rewarding invention. This Part highlights various characteristics and policies of the existing system that would need to be reevaluated as the coordination function takes on more prominence in comparison to the rewards function.

A. *Reliability of Issued Patents over Correction of Patent Office Mistakes*

A longstanding feature of the patent system is its two-stage review process, wherein an application is first examined by the patent office and then

[146] The apparent failure of "ex post" theories (including coordination theory) to explain such doctrines has been a cause of prior criticism. *See, e.g.*, Lemley, *supra* note 3, at 137-40. It is possible that these requirements play some role in increasing the cost effectiveness of the coordination function (such as limiting patent rights to emerging technology areas where valuable nonpublic information is likely to exist), but, for the reasons cited above, they do not appear to be essential.

scrutinized a second time by a court when a patentee seeks to enforce it.[147] The interaction of these two review periods implicates a number of patent policies: the level of scrutiny to be applied at each stage, the deference (if any) to be applied from one stage to the other, the desirability of encouraging post-grant challenges, and so on. On one end of the spectrum, one could have a registration system, in which patents are issued by the patent office without any substantive examination, only to be reviewed de novo by courts should they come to litigation.[148] On the other end, one could have a system of ironclad patent grants, wherein applications are given extensive substantive review by the patent office, after which questions of patentability could be revisited only in cases of outright fraud.

Importantly, the allocation of responsibilities between the first- and second-stage decisionmakers is independent of the total amount of scrutiny applied throughout the process. Either the registration system or the ironclad grant system described in the prior paragraph could be implemented with many or few precautions against erroneous patent enforcement—the difference between the two approaches is only when those precautions would be applied.

A shift from the rewards function to the coordination function has potential significance for both the total amount of scrutiny to be applied and the allocation of that scrutiny between first- and second-stage decisionmakers. When it comes to the total amount of scrutiny, the consequences of this shift from rewards to coordination are somewhat ambiguous. On one hand, the success of the rewards function depends directly on the ability of the patent system to award patents to those who deserve them and denied to those who do not.[149] When a patent is erroneously granted, erroneously denied, or given to the wrong party, it weakens the correlation between the desired conduct and the promised reward.

The coordination function does not have this same reliance on initial allocation, but it does require that patents end up in the hands of firms with confidential information to exchange. When a firm is denied a patent that it needed to facilitate information transfer, the firm will have to go to the

[147] In recent years, this two-stage system has been complicated by the creation of multiple post-grant review processes, whereby the patent office itself may engage in further scrutiny after the patent has issued. *See* Gregory Dolin, *Dubious Patent Reform*, 56 B.C. L. REV. 881, 914-23 (2015) (providing an in-depth examination of the review processes established by the AIA). These processes are difficult to classify, because in some ways they are a form of extended first-stage examination, and in other ways they are an alternate forum for second-stage examination. *See* Cuozzo Speed Techs., LLC v. Lee, 136 S. Ct. 2131, 2142-44 (2016) (observing that new review processes have elements of both agency proceedings and judicial proceedings).

[148] *See* F. Scott Kieff, *The Case for Registering Patents and the Law and Economics of Present Patent-Obtaining Rules*, 45 B.C. L. REV. 55, 70-72 (2003).

[149] *See supra* notes 128-29 and accompanying text.

secondary market to acquire it. If the costs of doing this are substantial, the firm may forego the patent system altogether, instead relying on other methods of protecting its confidential information. In this way, the initial allocation of patents can affect the success of the coordination function just as it does the rewards function.

As a result, there is not a simple, generalizable answer as to whether the rewards function or the coordination function would call for greater total investment in patent scrutiny. When the cost of trading patents is high,[150] a focus on coordination might make it even more important to ensure that patents are initially assigned where they belong. But when the cost of trading patents is low, the balance could come out the other way—that is, the coordination function could tolerate a much rougher system of allocation than the rewards function. So whether the rewards function or the coordination function calls for greater care in the allocation of patents might very well depend on the circumstances.

However, when it comes to dividing that scrutiny between the steps of initial examination and subsequent review, the policy implications of a move from rewards to coordination are clearer. The effectiveness of the coordination function depends significantly on the reliability of patent grants.[151] If patents are frequently narrowed or invalidated after issuance, a firm choosing to share information faces greater risk that its patent fallback plan will fail when called upon. Earlier certainty about the validity and scope of patent rights would thus make the system a more reliable tool for mitigating the potential downsides of disclosure.

Another, perhaps more subtle, way in which the coordination function depends on the stability of patent rights relates to the cost of trading patents. The coordination function does not depend directly on the initial allocation of patent rights—Coasian bargaining is at least theoretically available as an alternate means of correcting mistaken patent grants.[152] To the extent that the indeterminacy and instability of patent rights renders them more expensive to trade, overreliance on second-stage revocation may quixotically increase the systemic cost of erroneous grants, and actually increase the need to apply even more scrutiny at the first stage. Or, to put it positively, shifting scrutiny to an earlier point in the patenting process may enable bargaining as an alternate solution to erroneous allocations, and thus reduce the degree of scrutiny required overall.

From the perspective of the rewards function, the private incentives created by the patent system depend little on when patent awards become finalized. Uncertainty about patent rights might diminish their value a bit, but this is not

[150] And there is reason to believe this is often the case. *See* Merges & Nelson, *supra* note 50, at 874-75.

[151] *See supra* notes 124-25 and accompanying text.

[152] *See supra* notes 130-31 and accompanying text.

fatal—any incentives to invent lost as a result of frequent post-grant revocation can be compensated by more generous policies somewhere else.[153] Because stability itself has no special role to play in the rewards function, a rewards-focused system can afford to regularly grant patents with serious doubts about their validity and rely on private litigation to fix errors after the fact.[154]

A move towards the coordination function complicates this "grant first, verify later" strategy. The consequences here reach far, as the trade-off between first- and second-stage review is practically everywhere in patent law. For example, accepting coordination as a goal of the patent system could warrant a reevaluation of the degree of patent office scrutiny applied to applications prior to issuance,[155] the strength of the presumption of validity after a patent has issued,[156] the need for bounties or other incentives to challenge patents,[157] the enforceability of agreements not to bring challenges,[158] and the antitrust analysis applied to reverse settlement payments.[159]

Although each of these domains will require its own analysis, a recent dispute involving the presumption of validity illustrates how policy might

[153] *See* Abramowicz, *supra* note 38, at 215-18 (observing that harms from uncertainty to a prize system are easily overstated); Doug Lichtman & Mark A. Lemley, *Rethinking Patent Law's Presumption of Validity*, 60 STAN. L. REV. 45, 57-59 (2007) (identifying various sources of uncertainty confronting patentees).

[154] *See* Lemley, *supra* note 53, at 1508-11. And indeed a number of rewards-focused cases invoke the compelling public interest in seeing validity challenges litigated to completion. *See, e.g.*, FTC v. Actavis, Inc., 133 S. Ct. 2223, 2230-34 (2013); Caraco Pharm. Labs., Ltd. v. Novo Nordisk A/S, 132 S. Ct. 1670, 1677 (2012); Blonder-Tongue Labs., Inc. v. Univ. of Ill. Found., 402 U.S. 313, 349-50 (1971); Lear, Inc. v. Adkins, 395 U.S. 653, 670-71 (1969); Asahi Glass Co. v. Pentech Pharm., Inc., 289 F. Supp. 2d 986, 994 (N.D. Ill. 2003); *In re* Cipro Cases I & II, 348 P.3d 845, 850, 868 (Cal. 2015).

[155] *See* Lemley, *supra* note 53, at 1497; Mark Lemley, Doug Lichtman & Bhavan Sampat, *What to Do About Bad Patents*?, 28 REGULATION, Winter 2005-2006, at 10, 12-13.

[156] *See* Lichtman & Lemley, *supra* note 153, at 45.

[157] *See generally* Joseph Scott Miller, *Building a Better Bounty: Litigation-Stage Rewards for Defeating Patents*, 19 BERKELEY TECH. L.J. 667 (2004); John R. Thomas, *Collusion and Collective Action in the Patent System: A Proposal for Patent Bounties*, 2001 U. ILL. L. REV. 305.

[158] *See generally* Rochelle Cooper Dreyfuss, *Dethroning* Lear*: Licensee Estoppel and the Incentive to Innovate*, 72 VA. L. REV. 677 (1986); Rochelle Cooper Dreyfuss & Lawrence S. Pope, *Dethroning* Lear*? Incentives to Innovate After* MedImmune, 24 BERKELEY TECH. L.J. 971 (2009).

[159] *See generally* Michael A. Carrier, *Unsettling Drug Patent Settlements: A Framework for Presumptive Illegality*, 108 MICH. L. REV. 37 (2009); David W. Opderbeck, *Rational Antitrust Policy and Reverse Payment Settlements in Hatch-Waxman Patent Litigation*, 98 GEO. L.J. 1303 (2010); James F. Ponsoldt & W. Hennen Ehrenclou, *The Antitrust Legality of Pharmaceutical Patent Litigation Settlements*, 2006 U. ILL. J.L. TECH. & POL'Y 37.

come out differently under rewards- or coordination-focused points of view. When the patent office has considered prior art and specifically granted a patent in view of that art, the case for applying a strong presumption of validity in subsequent litigation is straightforward. After all, theories sounding in *either* rewards or coordination would advise a court to be cautious about second-guessing the judgment of the expert agency.[160] But what if—as in the recent Supreme Court case of *Microsoft Corp. v. i4i Ltd. Partnership*[161]—new art is discovered that the patent office did not have the opportunity to consider? With principles of agency deference out of the way, one must confront the question of whether it is more important for patent grants to be settled or right.[162] From the perspective of rewards theory, the answer is straightforward. The rewards function, after all, places a high value on allocating patents to the parties that deserve them, with comparatively less significance placed on the stability of patent rights over time. This, in turn, suggests the presumption of validity should carry less force when a challenger produces prior art that the patent office did not consider—a result that both the *i4i* Court[163] and rewards-focused commentators have endorsed.[164]

Under the coordination view, the importance of patent reliability is significantly heightened. The fact that the patent office might have reached a different outcome if it had more complete information does not undermine the core justification for the strong presumption of validity, which is to facilitate patent-backed information exchange by protecting the reliance interests of patent holders. Thus, absent fraud or other misbehavior by the patentee,[165] a coordination-focused approach would suggest that the strength of the

[160] *See* Intervet Am., Inc. v. Kee-Vet Labs., Inc., 887 F.2d 1050, 1054 (Fed. Cir. 1989) ("The presumption of validity . . . carries with it a presumption the examiner did his duty and knew what claims he was allowing.").

[161] 564 U.S. 91 (2011).

[162] *See id.* at 111.

[163] Although the presumption of validity still applies in cases of new evidence, the patent office's judgment loses "significant force," and the existence of evidence not considered by the agency is typically noted for the jury. *Id.* Recent experiments have suggested that, in practice, flagging the existence of new evidence like this may have the same effect as if no heightened presumption were applied at all. *See* David L. Schwartz & Christopher B. Seaman, *Standards of Proof in Civil Litigation: An Experiment from Patent Law*, 26 HARV. J.L. & TECH. 429, 432, 459 (2013).

[164] Doug Lichtman and Mark Lemley tie this concern to rewards goals concisely, concluding that the presumption "seems to encourage investment in the wrong inventions . . . [,] technologies that are likely redundant to things society knew before." Lichtman & Lemley, *supra* note 153, at 58.

[165] Even under a coordination-focused approach, it may be useful to weaken the presumption in some circumstances as a way of disciplining applicants' behavior during the examination process—as in the case when the applicant knew of a prior art reference but did not disclose it.

presumption of validity should not turn on the nature of the evidence that happens to be brought against the patent.

This is but one example of how a move towards the coordination function would call existing patent doctrine into question—the various policy questions highlighted above will undoubtedly require more extensive analysis. As a general rule, however, coordination-focused patent policy will tend to prefer rules favoring earlier certainty, at least as compared to the traditional rewards-based approach.

B. *Technological Exclusivity over Market Exclusivity*

Another persistent issue at the heart of patent policy is the breadth of protection that ought to be afforded to a successful patentee. From the perspective of rewards-focused policymaking, this balancing comes down to questions about exactly how much society would benefit from increased in incentives to invent and how much these increased incentives would cost. In general, the broader the claim scope, the larger the reward promised by the patent system, and the larger the costs imposed on the rest of society.[166] In the other direction, the narrower the claim scope, the smaller the incentives created by the patent system, and the lower the costs to everyone else.[167]

Setting claim scope to produce a right-sized reward is a famously difficult undertaking. For the rewards function to be effective, the patent system must award valuable patents for valuable inventions.[168] This means claim scope must be broad enough to create market power in cases where the underlying invention turns out to be important.[169] But market power is also a driver of the major costs of the patent system—the static and dynamic losses from the patentee's exclusive use of the invention.[170] What makes this trade-off more difficult than, say, selecting the size of the purse in a cash prize system, is that there will not always be a predictable relationship between the scope of technical exclusivity (the breadth as defined by the patent's claims) and the scope of market exclusivity (which will determine the patentee's market power and hence the value of the patent prize).[171] For example, a technically broad

[166] *See* Yelderman, *supra* note 134, at 88-89.

[167] *Id.*

[168] *See* Liivak, *supra* note 10, at 1165.

[169] *See* SCOTCHMER, *supra* note 36, at 103-05; Crouch, *supra* note 135, at 142-43; Katz, *supra* note 135, at 837, 858-59, 859 n.117, 862-63; Lemley & McKenna, *supra* note 135, at 2111-14.

[170] *See* Liivak, *supra* note 10, at 1172-73. In IP theory generally, this balancing is often referred to as the "incentives vs. access" tradeoff. *See* Glynn S. Lunney, *Reexamining Copyright's Incentives-Access Paradigm*, 49 VAND. L. REV. 483, 556-571 (1996).

[171] *See* Michael A. Carrier, *Unraveling the Patent-Antitrust Paradox*, 150 U. PA. L. REV. 761, 791-92 (2005). For a thorough discussion of the relationship between technical exclusivity and market exclusivity, see Jeanne C. Fromer & Mark A. Lemley, *The Audience*

patent could turn out to have little competitive significance if a handful of alternative solutions using fundamentally different technologies emerge soon thereafter. And a technically narrow patent could inadvertently dominate an entire product market if it happens to cover a critical step in a larger process. This can lead to significant divergence in individual cases between a patentee's technical accomplishment and the value of the prize awarded.[172]

These questions about the right-sizing of exclusive rights are not limited to the initial granting of claims by the patent office. They also emerge when patentees attempt to enforce their rights in technology areas far from the original invention, expand the scope of their exclusivity through acquisitions of competitors' portfolios, and seek broader claims late in the patent lifecycle.[173] From the perspective of the rewards function, each raises a similar question about whether the expected benefits from increasing patent rewards are worth their expected cost in light of available alternatives to achieve the same results. In practice this is quite difficult, particularly because it is so challenging to map technical exclusivity onto market exclusivity in a predictable way.[174]

The coordination function implies a very different set of concerns when it comes to claim scope. The success of the coordination function depends on information-holding firms' ability to exclude others from making future use of information that will be the subject of disclosure.[175] If the scope of protection afforded by a patent portfolio is too narrow, it may be incapable of backstopping contractual agreements around technical information or enabling wider information sharing.[176] But this does not mean the coordination function calls for patents of unlimited scope. Once a firm's portfolio is broad enough to prevent others from using the firm's particular technology, the benefits of providing broader scope diminish substantially.[177] Thus, the coordination

in Intellectual Property Infringement, 112 MICH. L. REV. 1251, 1285-94 (2014).

[172] *See* F.M. Scherer, *The Innovation Lottery: The Empirical Case for Copyright and Patents*, *in* EXPANDING THE BOUNDARIES OF INTELLECTUAL PROPERTY: INNOVATION POLICY FOR THE KNOWLEDGE SOCIETY 3-21 (Rochelle Cooper Dreyfuss et al. eds., 2001); Crouch, *supra* note 135, at 149-54. Michael Abramowicz makes a similar observation (albeit from a different angle) in noting the difficulties of valuing patents for purposes of a government-funded buyout. *See* Abramowicz, *supra* note 38, at 155-56.

[173] *See, e.g.*, BOWMAN, *supra* note 1, at 200-03; Kaplow, *supra* note 1, at 1867-73.

[174] *See* Janet Freilich, *The Uninformed Topography of Patent Scope*, 19 STAN. TECH. L. REV. 150, 155-57 (2015). For a similar point regarding the failure of patent scope to account for market structure, see SCOTCHMER, *supra* note 36, at 117-18.

[175] *See supra* Section III.A.

[176] *Cf.* Burstein, *supra* note 7, at 259-60.

[177] It is possible that broader scope could facilitate disclosure and exchange of certain nontechnical information: customer lists, marketing techniques, and so on. However, these are outside the scope of the coordination function because they do not relate to the transfer of technical information. *See supra* Section II.A. The costs and benefits of using exclusive rights to enable disclosure of nontechnical information are likely quite different and would

function would call for claim scope that provides just enough technical exclusivity to facilitate sharing of information about the firm's specific technology, but without reaching to competing solutions.

This highlights an important distinction between the coordination and rewards theories: the benefits of the coordination function flow from technical exclusivity, not market exclusivity. Provided that a patent, or a portfolio of patents, confers exclusive rights broad enough to prevent others from using the shared information, the degree to which competition is displaced at the level of product markets is irrelevant to the success of the coordination function.[178]

A simple example illustrates how the appropriateness of claim scope would be assessed differently under either a rewards- or coordination-focused patent system. Suppose there is a pressing and widespread problem that everyone would like to see solved. Firms A, B, and C set down different technological paths, each in pursuit of its own particular solution. And it turns out that all three are successful: Firm A files for a foundational patent on its approach, as do Firms B and C on their respective approaches. All three firms continue to work diligently to commercialize their technologies, investing in further research and preparing to ramp up production.

In a perfect world, how broad should each firm's exclusive rights be in this situation? From a rewards perspective, the answer is not entirely clear. Should the patent office grant Firm A claims that cover the entire product market, or just its particular solution? Should antitrust authorities allow Firm A to buy Firm B's patent portfolio? Should a court enforce a three-way license agreement between the competitors that sets a minimum price on any infringing products that any of the three firms sell? These questions are more difficult to answer than they might first appear. If unrestrained competition is allowed to break out among the three firms, there is a risk that prices will quickly fall to marginal cost, preventing the firms from recouping their extensive investments in research and development. But if competition is eliminated entirely, the private rewards afforded by the patent system could be inappropriately large, resulting in unnecessary deadweight losses and other social harms. Though in individual cases the analysis may not be so nuanced, rewards theory constantly confronts the same recurring dilemma: whether an n-competitor product market offers sufficient incentives to invent, or whether some additional reduction in competition should be granted or available.[179]

From a coordination perspective, the solution is straightforward: each firm should be granted patent protection broad enough to enable sharing of

require their own analysis.

[178] The degree of market exclusivity would still matter to a coordination-focused policymaker, however, because it will have a significant effect on the public costs of offering patent protection. The insight here is only that the benefits of the coordination function do not depend on awarding market exclusivity.

[179] *Cf.* Crane, *supra* note 47, at 271-75.

information related to its specific technology. Exclusivity that assures each firm that others will not be able to use its particular solution to the problem should be sufficient to reduce the cost of further development and increase the firm's technical transparency. Critically, the effectiveness of the coordination function does *not* turn on the extent of the market power created by the patents in question. In fact, the goals of coordination can be perfectly satisfied even if Firms A, B, and C end up in brutal three-way competition in the relevant product market. And, though the question of how broad patent protection must be to facilitate information sharing may at times be difficult to answer, it is a question the patent office is institutionally better equipped to navigate, as it depends on the state of technology rather than the state of competition.

This observation is an important one, not least because it suggests that much of the debate about the desirability of using the patent system to facilitate coordination has been based on flawed assumptions. Since its inception, the coordination function has been associated with a policy of issuing broad patent claims early in a technology's lifecycle.[180] Operating on this premise, commentators have been divided as to whether this feature of the coordination function is a blessing or a curse.[181] But this long-held assumption overlooks the distinction between technical and market exclusivity. It should be possible, in most cases, to create technical exclusivity with scope equal to or less than the scope necessary to create market exclusivity. So there may actually be less need for broad claims in a patent system focused on coordination than in one focused on rewards.[182]

Another consequence of this distinction is that coordination theory may offer some help with problems that have transfixed rewards theory, such as the antitrust analysis that should be applied to a merger of competing patent portfolios. In this situation, rewards theory asks the antitrust regulator to trade static harms (increased market power) against potential dynamic benefits (increased incentive to invent).[183] This balancing is tough enough at a macro

[180] *See* Kitch, *supra* note 3, at 267-68. Indeed, this association is so strong that it is often unclear whether "prospect theory" refers to the goal of coordinating development or this particular collection of patent policies. *See supra* note 58 and accompanying text.

[181] *See* LANDES & POSNER, *supra* note 4, at 319; SCOTCHMER, *supra* note 36, at 112-14; Abramowicz, *supra* note 33, at 1081; Duffy, *supra* note 3, at 442-46, 499-500; McFetridge & Smith, *supra* note 58, at 198.

[182] The conclusion here would be quite different if the "coordination function" were defined to include a goal of reducing duplicative investments by granting a pioneer the ability to restrict subsequent entry—a theory based on that definition might well depend on market, not simply technological, exclusivity. *See supra* note 102. This illustrates the peril of commingling theories of coordination and theories of duplicative investments under the banner of "prospect theory." Analytically, they solve different problems and, as demonstrated here, could have very different policy implications.

[183] *See* Kaplow, *supra* note 1, at 1868-69.

level, but it is even more difficult to perform through a series of individual enforcement decisions. As a result, current patent and antitrust rules can provide few concrete answers as to when patent portfolio aggregation is procompetitive and when it is anticompetitive.[184]

A coordination-focused patent system would offer a much simpler principle for determining when patent portfolio aggregation is justified and when it is not. As discussed above, the coordination function depends on a firm holding a patent portfolio that allows it to reliably exclude others from using its particular technological solution. Sometimes such protection will be granted in the form of a single patent or multiple patents issued to the same firm. In other cases, the initial patent grants will fracture the rights across multiple owners in a way that makes them incapable of facilitating coordination. In this situation, coordination-focused patent policy would recognize an efficiency justification in favor of combining multiple patent portfolios. But, importantly, the coordination function's focus on technical exclusivity over market exclusivity would also impose a limit. When two competing portfolios relate to different technologies, there is no added coordination benefit to be found in their aggregation, and further combinations may only serve to reduce competition. Thus the coordination view could provide a framework for distinguishing between desirable and undesirable combinations of patent portfolios, a line that existing, rewards-based doctrine often struggles to draw.

C. *A Window of Patent Maturity over Precise Timing of Eligibility and Expiration*

Another persistent set of issues in the theory and implementation of the patent system relates to time. At what point in the development of a technology should patent rights be awarded? For how long should they last? What is the significance of the period between when an inventor is eligible to apply for a patent and when that patent legally comes into force?

When cash prizes are used to reward invention, the timing of prize eligibility is critical. If the prize for accomplishing some result is given too early, the system may create inappropriately large incentives to race towards that premature finish line, followed by inappropriately small incentives to actually complete the project.[185] On the other hand, if the prize is awarded too late in

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[184] *See* U.S. DEP'T OF JUSTICE & FED. TRADE COMM'N, HORIZONTAL MERGER GUIDELINES 31 (2010) (noting that "the ability of the merged firm to appropriate a greater fraction of the benefits resulting from its innovations" is sometimes cognizable as a merger-specific efficiency), http://www.justice.gov/atr/public/guidelines/hmg-2010.pdf [https://perma.cc/BJA5-D4D6]; *see also* SCOTCHMER, *supra* note 36, at 161, 177-78; Keke Feng, *Patent-Related Mergers and Market Definition Under the 2010 Horizontal Merger Guidelines: The Need to Consider Technology and Innovation Markets*, 34 T. JEFFERSON L. REV. 197, 201 (2011).

[185] *See* Abramowicz, *supra* note 38, at 176-77.

the process, the incentives to achieve the desired result are weakened, at least because of the risk that a firm may be the first to accomplish the big breakthrough, only to be foiled by a second-mover that steps in to claim the prize.[186] Thus, it is not only important that the reward be the right size and given to the right person, but also that all of this happen at an appropriate point in the technology development cycle.

Providing incentives to invent through a patent system mitigates some, but not all, of these problems. One of the benefits of using exclusive rights in lieu of cash prizes is that they can create incentives both before and after they are awarded.[187] If an inventor becomes eligible for a patent before the invention is truly completed, it's not the end of the world, because the inventor will still have some incentive to continue development of the project—doing so improves the value of her patent. This takes some of the pressure off the question of when an invention should become patent-eligible, though there are nonetheless complex issues at play in correctly balancing pre- and post-grant incentives and in ensuring that patents expire at an appropriate time.[188]

A move towards coordination goals further relaxes the requirement that inventions become eligible for patents at a precise point in a technology's development. The coordination function is not intended to directly incentivize any specific conduct, so it does not imply a need to align the timing of a prize with the arc of any particular private accomplishment. Just as the coordination function does not depend directly on *who* is awarded patents, it does not necessarily depend on the precise timing of *when* they become eligible for patents.

However, there is another set of timing concerns that does matter for the coordination function. The first relates to the fact of technological change. The coordination function works by assuring a firm disclosing confidential information that it will be able to regain control of how that information is used later on.[189] The ability of patents to do this depends on the relationship between the exclusive rights in the firm's portfolio and the subject matter of the information to be disclosed in reliance on that portfolio. This relationship can evolve over time. As technology progresses, a portfolio that might have once facilitated a lot of information exchange may cease to be useful for coordination. For example, a thick pile of patents related to VHS tapes may have had a lot of coordination value to consumer electronics manufacturers in the 1980s and 1990s, but such a portfolio likely lost much of this value as the industry moved to DVDs and Blu-Rays. If technology moves on but the firm's

[186] *See id.* at 187-88 (discussing the possibility of gamesmanship around timing of patent grants).

[187] *See* Kitch, *supra* note 3, at 276-77.

[188] *See* Abramowicz, *supra* note 33, at 1080-81; Duffy, *supra* note 3, at 476-80; Kieff, *supra* note 33, at 710-12; Sichelman, *supra* note 30, at 393-94.

[189] *See supra* Section III.A.

portfolio stays the same, both the likelihood of successful patent-based exclusion and the value of that exclusion will fall. As the relationship between the firm's present activities and its patent portfolio weakens, patent-based exclusion ceases to be a realistic fallback, and the effectiveness of the coordination function is reduced.

Another concern arises from the fact that patent grants are statutorily limited in time. In some situations, this legal expiration date may make patent remedies a very weak substitute for secrecy. For example, if a patent is set to expire in six months, it may do little to backstop the transfer of information that could have been profitably kept secret for a longer time period. This does not mean patents with little term left are useless for coordination—only that the types of information transfer a patent can facilitate will diminish over its lifetime. For example, even a single year of patent protection may be enough to enable the exchange of information with only short-term value, or with value that could not have been effectively maintained for very long under secrecy anyhow. The ability of a patent to backstop information exchange thus turns on both the length of the patent's remaining term and the length of time that the information could have been kept secret in the absence of a voluntary disclosure.[190] Holding all else equal, the ability of a patent to facilitate disclosure will diminish as expiration nears.

A third concern cuts the other way. While the twin threats of technical obsolescence and legal expiration tend to reduce the usefulness of patents over time, the need for reliability tends to favor older patents. Typically, a patent application starts with a large amount of uncertainty that gradually resolves over time. Beginning with the initial filing of an application, there is often doubt as to whether a patent will issue, whether it will hold up in court, what exactly it will be able to exclude, and so on.[191] As time goes on, more information is revealed: the patent office grants a patent (or does not), competitors introduce prior art (or do not), validity challenges are brought (or are not), a court affirms the patent's broad scope (or narrows it). Each round of review reduces uncertainty about the strength and scope of the patent rights in question.

[190] This implies there may be some information transfers that cannot be very effectively backstopped even by young patents—such as disclosures of information with significant long-term value that could have been protected by secrecy for much longer than the patent term. *See* Steven N.S. Cheung, *Property Rights in Trade Secrets*, 20 ECON. INQUIRY 40, 43 (1982) (describing valuable technical information kept secret for more than a century).

[191] To be sure, there may be some cases where even early-stage applications or young patents have a high degree of reliability. For example, some breakthroughs might be so significant that an inventor can be confident that she is the first to arrive at a particular solution, even before the formal steps of patent office review and district court litigation have occurred.

Though developments for individual patents can go in either direction, a survivorship effect causes the reliability of patents to rise over time. A good number of patents fail—they are rejected, invalidated, or their scope is narrowed substantially—and hence become irrelevant for purposes of coordination. Others survive—they issue, their validity is affirmed, their scope is interpreted broadly. And these survivors begin to provide a predictable sphere of exclusion within which firms can exchange information with lower risk. Because of this survivorship effect, older, previously tested patents are more likely to be reliable, and thus may have more ability to backstop information exchange than younger patents or still-pending applications.

These competing considerations inform when a patent will reach its peak usefulness for purposes of coordination. Often, if a patent is too young, it will not be reliable enough to backstop the exchange of information. But, on the other hand, if a patent is too old, it will also not be useful for backstopping exchange, either because of its limited remaining term or the looming threat of technical obsolescence. As a result, the coordination value of any given patent likely peaks somewhere in the middle of its lifespan: after the patent has issued (and perhaps survived some degree of post-grant litigation or administrative review), but before further technological development makes it irrelevant to ongoing industry activities. It is these patents in the middle—sufficiently tested, but not yet obsolete—that are best positioned to serve the coordination function.[192]

These timing considerations suggest this is another area where the longstanding assumptions about coordination theory must be updated. The conventional wisdom is that the coordination function requires awarding patent rights at very early stages of technical development.[193] But, upon examination, it is not clear whether the coordination function requires triggering patent eligibility any earlier in time than the rewards function does. Direct comparisons are difficult, since the optimal timing of patent eligibility for purposes of the rewards function is so complicated.[194] But, in practice, the current rewards-focused system allows for patent eligibility quite early in the

[192] Without a stable stock of patents meeting these criteria, the coordination function may run in fits and starts. For example, there may have been some period of time when VHS patents were obsolete but the industry's DVD patents were not yet mature. If that were the case, the ability of patents to facilitate information exchange would be expected to wane during the interim. Moreover, in some industries, technology may move so much faster than the patent system that the opportunity for patent-backed information exchange is virtually nonexistent. *See* Mann, *supra* note 75, at 978-79.

[193] As with the question of claim scope, this assumed policy implication goes back to some of the earliest discussions of the coordination function. *See* Kitch, *supra* note 3, at 267-68.

[194] *See supra* note 188.

development process, typically well before inventions have been commercialized or reduced to practical form.[195]

The success of the coordination function does not turn directly on when inventions become patent-eligible at all. Instead, the coordination function is sensitive to the window of patent maturity—the time between when a patent becomes reliable and when it expires or becomes technologically irrelevant. Of course, the coordination function has some dependence on the timing of eligibility, because a patent cannot be reliable if there is no legal right to claim it yet. But the timing of patent eligibility and the timing of patent maturity can often be manipulated independently. One could, hypothetically, design a patent system that puts the finish line for patentability fairly late in the development process—for example, only after a commercially viable prototype is physically presented to patent examiners—but that then moves to escalate the reliability of those rights with lightning speed—an intense one-month examination window, say, followed by an irrebuttable presumption of validity. Even though such a system would set patent eligibility at a comparatively late point in time, it would allow patents to become reliable at a comparatively early point in time, thus allowing the system to serve a coordination function despite the late patent grants.

Viewed from the perspective of the coordination function, the current timing of patent rights leaves much to be desired. Inventions become eligible for patenting early in the development process, but it is typically years before any patents actually issue,[196] and years still before those patents become reliable through testing in litigation or administrative review.[197] These steps not only delay when patents will be available for coordination, but also shorten the expected window during which they will be useful, as technical obsolescence always looms on the horizon.[198]

Surprisingly, then, a move towards coordination might actually mean more freedom when it comes to the substantive doctrines that control the timing of patent eligibility.[199] Instead of requiring "broad, early grants,"[200] the

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[195] *See* Christopher A. Cotropia, *The Folly of Early Filing in Patent Law*, 61 HASTINGS L.J. 65, 72-82 (2009); Sichelman, *supra* note 30, at 355-66.

[196] *See* U.S. PATENT & TRADEMARK OFFICE, PERFORMANCE AND ACCOUNTABILITY REPORT FOR FISCAL YEAR 2014, at 17 (2014), http://www.uspto.gov/about/stratplan/ar/USPTOFY2014PAR.pdf [https://perma.cc/Z7M6-HKUU] (reporting that the average time to first action after a patent application is eighteen months and average total pendency is twenty-seven months).

[197] *See generally* Dolin, *supra* note 147.

[198] *See* Feldman & Lemley, *supra* note 7, at 173 (observing that rapid technical obsolescence combined with patent office delays may prevent patents from facilitating technology transfer).

[199] The most prominent doctrines controlling the timing of patent eligibility are the requirements of enablement, written description, and patentable subject matter. *See*

coordination function depends on the process of patenting—things like the number of patent examiners, the speed and efficiency of the patent office, the window for administrative review, and the level of deference paid to these early rounds of administrative decisionmaking. As a result, the timing concerns of the coordination function may have more to do with the backlog of applications pending at the patent office than the substantive doctrines of patent eligibility with which it is so often associated.

D. *Core Rights over Bundle of Value*

Another important difference between the rewards function and the coordination function is the manner in which different policies interact to influence the patent system's effectiveness overall. As the rewards function depends on transferring a prize of appropriate private value to an inventor, courts and commentators typically evaluate the patent system from a "total bundle of value" perspective, which considers the costs and benefits of participating in the patent system from start to finish. By contrast, the effectiveness of the coordination function depends significantly on patent holders having a certain core set of rights at a particular juncture in time. This difference suggests that courts and commentators would need to approach their tasks differently if coordination goals were to gradually displace rewards goals.

The conventional approach to rewards-focused policymaking calls for careful stewardship of the entire value proposition the patent system presents to prospective inventors.[201] The lure of patenting depends on the details of every step of the process: the cost of filing an application, the length of patent term, the methodology for calculating damages, the availability of exhaustion defenses, the licensing terms that are prohibited by antitrust law, and so on. Further complicating matters, in a perfect world, a policymaker would coordinate all these tools to provide an appropriate reward to inventors at the lowest possible cost to society.[202] The underlying theory is indifferent to the question of *how* invention is rewarded, so a policymaker has a great deal of flexibility in assembling the package of rights and duties that will do so at the least cost.

These rewards-focused trade-offs are not limited to questions of patent law. Under the rewards view, almost anytime there is a question involving the intersection of patent law and another field of law (such as contracts or antitrust), there is an opportunity to infuse the prevailing doctrine of the other domain with patent-specific considerations.[203] Indeed, almost any legal

Sichelman, *supra* note 30, at 355.

[200] *See supra* notes 14, 58.

[201] *See supra* notes 47-49 and accompanying text.

[202] *See* Gilbert & Shapiro, *supra* note 46, at 106; Kaplow, *supra* note 1, at 1830-33.

[203] *See, e.g.*, Lear, Inc. v. Adkins, 395 U.S. 653, 673-74 (1969) (declining to enforce contractual term based on patent policy concerns); Walker Process Equip., Inc. v. Food

question that arises in the lifecycle of a patent is potentially relevant for refining the patentee's bundle.[204] The basic fungibility at the heart of rewards-focused policymaking results in a nearly limitless terrain of policy levers.

When it comes to the coordination function, however, such far-reaching substitutability cannot be assumed. The core features of strong and reliable patent-based exclusion cannot be traded against other features of patent policy. Rather than balancing the total value proposition of the patent bundle against deadweight losses, patent policymakers would need to focus on ensuring that the bundle contains the core rights necessary to enable information transfer.[205]

In some ways this shift is constraining, but in other ways it is liberating. The constraint is that the coordination function leaves a policymaker with far less latitude to compromise the core patent rights and make up the difference somewhere else. On the other hand, the emphasis on core rights creates freedom of movement on many other questions. For example, patent application fees and examination standards can be adjusted based on administrative considerations, and without regard for the rewards-focused concern that such changes will undermine the system's value to prospective inventors. Moreover, it becomes possible to restore the integrity of adjacent areas of law (such as antitrust and contract) that have become infused with overtones of patent policymaking. Under the coordination function, there is not the same need to enlist noncore doctrines in service of patent law.

One could debate whether, on balance, these changes are more constraining than they are liberating, or vice versa. But they are certainly quite simplifying. As others have observed, assembling a bundle of rights that will transfer an appropriate reward to inventors at the lowest possible cost to society is much easier said than done.[206] For example, is it more cost-effective to reward

Mach. & Chem. Corp., 382 U.S. 172, 179-80 (1965) (Harlan, J., concurring); Brulotte v. Thys Co., 397 U.S. 29, 31-34 (1964); *In re* Indep. Serv. Orgs. Antitrust Litig., 203 F.3d 1322, 1327-28 (Fed. Cir. 2000) (refusing to impose antitrust liability for unconditional refusal to sell patented parts absent fraud on the patent office, sham litigation, or illegal tying); Image Tech. Servs., Inc. v. Eastman Kodak Co., 125 F.3d 1195, 1218 (9th Cir. 1997) (holding that a patent monopolist's desire to exclude others from the patented technology is a "presumptively valid business justification for any immediate harm to consumers").

[204] *See* Crane, *supra* note 47, at 271-75; Kaplow, *supra* note 1, at 1855-67; Ordover, *supra* note 65, at 50.

[205] To be clear, this does not mean that the coordination function depends only on the simple right to exclude others from using transferred information. One can imagine drastic policies that would frustrate the coordination function just as well—for example, confiscatory taxes on patent transfers that would prevent patents from reaching the hands of those who are well-positioned to use them to backstop information transfers. *See supra* Section III.B.1. However, short of such extremes, there is a broad range of policy alternatives that will make little difference for the coordination function.

[206] *See* Gallini, *supra* note 50, at 63; Gilbert & Shapiro, *supra* note 46, at 106; Kaplow, *supra* note 1, at 1842-45; Klemperer, *supra* note 46, at 120-24; Oskar Liivak, *Establishing*

invention by expanding antitrust immunities, or by requiring a higher burden of proof to invalidate an issued claim? Is it preferable to reduce the scope of patent remedies, or raise application fees? Sometimes, perhaps, a rewards-focused policymaker will have the information she needs to appropriately balance these objectives. But sometimes—perhaps even frequently[207]—rewards theory will point in indeterminate or conflicting directions, requiring consideration of secondary factors to break the tie.

In this way, recognition of the potential coordination value of the patent system could be useful even if coordination goals do not displace rewards goals. The optimal policy for implementing the coordination function will sometimes be ambiguous as well, but lessons from coordination theory are often revealing in situations where rewards theory is ambivalent. For example, as between an additional antitrust immunity that will be extremely valuable to patentees on rare occasions and an equally valuable but modest increase in the likelihood a court will find a claim valid, the coordination function would break the tie in favor of the latter. Antitrust giveaways have (at most) an indirect effect on the coordination function, while improvements in the reliability of patents are almost always helpful. Similarly, as between reducing the scope of patent remedies and increasing the cost of obtaining a patent, the coordination function again provides a clear answer: As far as coordination is concerned, there is little harm to increasing the cost of acquiring a patent, but the force of patent remedies is directly determinative of the system's effectiveness. If the rewards function is indifferent, the policymaker is better off increasing acquisition costs rather than trimming the scope of patent-based exclusion.

In this way, coordination theory could have an important role to play in patent policy, even if the coordination function itself is only recognized as a secondary goal of the patent system. While each case will require its own analysis, as a general rule coordination theory would advise rewarding invention through straightforward, reliable rights to exclude, rather than through more complex bundles of value.

CONCLUSION

This Article has defined the coordination function, set out a theory of that function's operation, and shown how a number of characteristics of the patent system would likely be different if it were geared towards coordination instead of rewards. This analysis suggests that much of the prior debate about the desirability of using the patent system to pursue these goals has been rooted in unfounded assumptions about what such a system would actually look like.

an Island of Patent Sanity, 78 BROOK. L. REV. 1355, 1349-50 (2013); Liivak, *supra* note 10, at 1175.

[207] *See* Liivak, *supra* note 206, at 1337.

However, it is important to note what this Article has *not* done: It has not made a case either for or against the coordination function. This Article accepts the coordination justification for the sake of argument in order to explore its underlying theory and consequences for patent policy. It does not evaluate the costs and benefits of using patents in this way, and certainly does not suggest that the normative desirability of coordination goals is a foregone conclusion.

This Article is studiously neutral on these first-order matters for a simple reason: a deeper understanding of the policy implications of the coordination function is a critical prerequisite to evaluating the desirability of using the patent system this way. In some ways, the requirements of the coordination function may be a refreshing change from the concerns that have so far driven rewards-focused patent policy. In other ways, a coordination-focused approach to policymaking may only exaggerate present concerns with the rewards-focused system. In either event, it is clear that the differences between a rewards-focused and coordination-focused system are real, and these differences may be enough to seal the case for or against the coordination function.

There is also a need for future work comparing the expected costs and benefits of addressing coordination problems through both patent and nonpatent mechanisms. In the absence of patent protection, parties seeking to forge agreements for or around technical information can be expected to rely on a combination of trade secrets, reputational interests, noncompete agreements, and other contractual restraints. The comparative costs and benefits of these approaches vis-à-vis patents remain largely unexplored.

Moreover, it is unclear whether the case for the coordination function will be the same across all of the various technical fields that share our unified patent system. It is possible that contracts and trade secrets work well enough for some industries, while the need for patent-backed information exchange in other industries is acute. Just as the case for the rewards function varies from industry to industry,[208] the case for coordination may be strong in some fields and weak in others. It would be particularly valuable to understand how the rewards and coordination justifications interact on an industry-by-industry basis.

It is also possible that the right question to ask may be not whether or not it is desirable to use the patent system to facilitate coordination, but how much patent-based coordination is worth its cost. It is one thing to accept that the patent system is useful for facilitating some amount of coordination, yet another thing to determine the optimal level of patent-backed coordination. Future work will need to address the question of when the costs of these exclusive rights begin to exceed their benefits.

Finally, the ultimate goal of this inquiry will likely be to re-integrate the rewards and coordination functions for a unified approach to patent policy. As

[208] *See generally* BURK & LEMLEY, *supra* note 14.

many of the costs of using a system of proprietary rights to incentivize invention are shared with the costs of using the same system to coordinate private development, it is quite possible that the optimal level of rewards-focused patent protection and the optimal level of coordination-focused patent protection are interdependent. In other words, there may be significant synergies available by using the patent system for both purposes simultaneously, enabling a degree of protection that would not be justified by either benefit standing alone. And, conversely, new developments undermining one justification may cause the optimal level of both kinds of protection to fall, inasmuch as each depends on the other. There thus remains much to be explored regarding the interrelationship of these two functions.