New Evaluation of Patent Infringement in the Cross-Border Divided Transactions—In Terms of Patent Economic Value

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I. INTRODUCTION

The legislative purpose of patent law is to promote overall industrial development, a concept based upon the principles of utilitarianism. To achieve such a legislative purpose, inventors are granted exclusive rights via a patent. However, innovation is encouraged by competitors by limiting the duration of the exclusive rights granted to an inventor.[1] Further, a patent's economic value is necessarily encapsulated in the legislative purpose of patent law. Yet, patents remain subject to the law of the jurisdiction granting the patent itself. Importantly, a patent's prospective value may be memorialized by legislatures in accordance with social, economic, cultural, and technological circumstances at the time a patent law was enacted.[2]

Often, a patent's economic value is reflected in statutes related to the requirements of patentability. Similarly, a patent's economic value may be evident in statutes relating to patent infringement, including the available remedies in cases of infringement. The goals of patent law, however, may be hindered equally by both over-protective and under-protective infringement laws.[3] Remedies for infringement that over-compensate or under-compensate may likewise hinder the legislative goals at the heart of patent law.[4] Despite jurisprudence that would seemingly assign patents a static value, new technologies continue to emerge, calling into question pre-existing patent laws. Some patent disputes seem to affirm pre-existing laws. Some argue, though, that recent

1. *See* Mark A. Lemley, *Property, Intellectual Property, and Free Riding*, 83 TEX. L. REV. 1031, 1031-32 (2005) (explaining that the utilitarian purpose of intellectual property law is not make the owner enjoy the full value of intellectual property but to avoid occurrence of the free-riding acts).

2. *See* Mark A. Lemley, *IP in a World Without Scarcity*, 90 N.Y.U. L. REV. 460, 504-05 (2015) (analyzing the impact of new technologies upon the jurisprudence of scarcity, which the original IP legislators firmly trusted, and what new possible roles the modern IP may play in responding to new things).

3. *See* Phillips v. AWH Corp., 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc) ("It is a 'bedrock principle' of patent law that 'the claims of a patent define the invention to which the patentee is entitled the right to exclude.'") (citation omitted); *see* Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 856-60 (1990) (discussing the new technologies adopted in patent infringement according to the doctrine of equivalents).

4. *See* Thomas F. Cotter, *Four Principles for Calculating Reasonable Royalties in Patent Infringement Litigation*, 27 SANTA CLARA COMPUT. & HIGH TECH. L.J. 725, 736-37 (2011); *see* ROBERT P. MERGES, JUSTIFYING INTELLECTUAL PROPERTY 150-51 (2011) ("The size or scope of an IP right ought to be proportional to the value or significant of the work covered by the right.").

dispute resolutions are evidence of a deviation from the outcomes originally contemplated by legislators.[5]

Ultimately, emerging technologies continue to challenge the innovation-driven goals embedded in patent law. An often-cited example concerns patent infringement actions for infringing products with multi-components.[6] Recently, courts and academia have focused on the apportionment of a patent's value when awarding damages[7] or when providing injunctive relief.[8] These remedies or actions risk "holding up" patents or royalty stacking as inventors respond to the technological convergence and standardization in specific industrial development.[9] Here, we must reflect on two issues legislators likely did not anticipate when drafting various patent legislation. First, current technological development and market demand has extended beyond the status quo. Second, patent owners are employing various strategies, when exercising their exclusive rights, that are burdening the efficiency of the patent system.

5. *See* Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1576-77 (2003); *see* Jonathan S. Masur & Adam K. Mortara, *Patent, Property and Prospectivity*, 71 STAN. L. REV. 963, 1006-07 (2019).

6. *See* PATENT REMEDIES AND COMPLEX PRODUCTS: TOWARD A GLOBAL CONSENSUS 1-4 (C. Bradford Biddle et al. eds., 2019).

7. Under the approach of reasonable royalties, the concept of apportionment in patent damages has been considered in many jurisdictions, including the United States. *See* Thomas F. Cotter, *A Research Agenda for the Comparative Law and Economic of Patent Remedies*, *in* PATENT LAW IN GLOBAL PERSPECTIVE 666-67 (Ruth L. Okediji & Margo A. Bagley eds., 2014). By contrast to the concept of apportionment, the market value rule, first introduced in the United States' courts, involves a base calculation of patent damages in consideration of the entire end product, which contains the patented component, rather than merely the smallest salable unit with the patented feature. *See* Anne Layne-Farrard, *The Patent Damages Gap: An Economist's Review of U.S. Statutory Patent Damages Apportionment Rules*, 26 TEX. INTELL. PROP. L.J. 31, 36-46 (2018).

8. The United States Supreme Court's decision in eBay, Inc. v. MercExchange L.L.C. has sparked rich academic dialogue and reflection over the remedy which included the grant of equitable permanent injunction against the multi-components infringing product. 547 U.S. 388, 390-94 (2006). Many are concerned about the possible threat that the legal injunctive relief would enable the patentee to obtain excessive compensation in patent damages. *See* Mark A. Lemley & Carl Shapiro, *Patent Holdup and Royalty Stacking*, 85 TEX. L. REV. 1991, 2008-09 (2007); *see* THOMAS F. COTTER, COMPARATIVE PATENT REMEDIES: A LEGAL AND ECONOMIC ANALYSIS 56-57 (2013).

9. *See* Norman V. Siebrasse & Thomas F. Cotter, *Judicially Determined FRAND Royalties*, *in* THE CAMBRIDGE HANDBOOK OF TECHNICAL STANDARDIZATION LAW: COMPETITION, ANTITRUST AND PATENTS 367-70 (Jorge L. Contreras ed., 2018).

Originally, legislators could assume that a single patent would provide one technical function to a single product or process.[10] This assumption, perhaps, is most apparent in the devised remedy system, where injunctive relief was considered the natural remedy without any need for an equitable limitation to a holder's patent rights.[11] However, the demand for plural technologies in a market has led to the phenomenon where more than one patent may be awarded for a single end product, in which each patent merely represents a part or component of such a product.[12] In such a scenario, there has been significant controversy in the calculation of damages because the infringement occurs across multiple patents that are collectively fixed into a single end product.[13] Additionally, there is concern that an automatic grant of injunctive relief would inequitably lead to abusive leverage for the patentee, thereby paving the way for rent-seeking or over-compensation in litigation.[14]

Although this Article does not seek to address the related issue of emerging technologies and patent damages, the discussed example of patent damages showcases the challenge of new technological development to the inherent jurisprudence of patent law. Apart from patent damages, according to the observations of this Article, patent infringement via new technologies has gradually impacted the "all elements rule"[15] and the territoriality principle,[16] both of which were

10. *See* Ted M. Sichelman, *Innovation Factors for Reasonable Royalties*, 25 TEX. INTELL. PROP. L.J. 277, 288 (2018) ("The *Georgia-Pacific* test was created in a case involving a simple product, where there was only one patent in dispute. The rapid advancement in technology and electronics has resulted in products containing many components that may be covered by several hundreds or even thousands of patents.") (footnotes omitted).

11. *See* eBay Inc. v. MercExchange, L.L.C, 547 U.S. 388, 393-94 (2006) ("In reversing the District Court, the Court of Appeals departed in the opposite direction from the four-factor test. The court articulated a 'general rule,' unique to patent disputes, 'that a permanent injunction will issue once infringement and validity have been adjudged.'") (citation omitted).

12. *See, e.g.*, Life Techs. Corp. v. Promega Corp., 137 S. Ct. 734, 738-39 (2017).

13. *See* Microsoft Corp. v. AT&T Corp., 550 U.S. 437, 449-55 (2007).

14. Timothy R. Holbrook, *Extraterritoriality in U.S. Patent Law*, 49 WM. & MARY L. REV. 2119, 2148-50 (2008).

15. Warner-Jenkinson Co., Inc. v. Hilton Davis Chem. Co., 520 U.S. 17, 29 (1997). While the all elements rule functions are critical to claim construction to determine literal infringement, the rule acts as merely an exception to constrain the excessive application of the doctrine of equivalents. *See* ROBERT L. HARMON ET AL., PATENTS AND THE FEDERAL CIRCUIT 579-80 (11th ed. 2013).

16. *See* Microsoft Corp. v. AT&T Corp., 550 U.S. 437, 454-55 (2007) ("The presumption that United States law governs domestically but does not rule the world applies with particular force in patent law."); *see also* WesternGeco LLC v. ION Geophysical Corp., 138 S. Ct. 2129, 2136 (2018) ("Courts presume that federal statutes 'apply only within the territorial jurisdiction of

devised to firmly supported the legislative goal of innovation-driven patent value.

Recently, a patent infringement dispute for an emerging technology dealt with both the all elements rule and the principles of territoriality. The technology concerned a transaction system of electronic commerce (e-commerce) in conjunction with an interaction system of social networking; these systems were enhanced by the development of financial or software-related inventions.[17] The central premise of the technology invited multiple participants to jointly facilitate a transaction or communication, thereby initiating an interaction that crossed the borders defining jurisdictions.[18] In this situation, patent infringement would be hard to ascertain due to a limited recognition of cross-border and divided patent infringement.[19] Importantly, the most concerning issue in a cross-border and divided infringement case is that no single participant practices a claim of the process or system patent in a singular jurisdiction.[20] Thus, traditional patent infringement could not be assessed using the all elements rule or territoriality principle, though the patent at issue remained illegally exploited.[21]

This Article attempts to introduce an alternative approach in lieu of a more traditional approach to patent infringement. This alternative approach focuses on the fulfilment for technical features of the patent to interpret the all elements rule and the territoriality principle. By focusing on such the fulfilment , the economic interests associated with the patent's value are maintained.[22] Though this Article argues that the proposed approach is not made to replace traditional tools to interpret infringement, the traditional approach may play a significant role in justifying the jurisprudence of the technical-driven approach. Ultimately, the proposed approach focuses on a patent's economic value, which may help the court determine patent infringement in cases of multi-participant and cross-

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the United States.' . . . This principle, commonly called the presumption against extraterritoriality, has deep roots.") (citations omitted).

17. Douglas W. Arner et al., *The Evolution of Fintech: A New Post-Crisis Paradigm?*, 47 GEO. J. INT'L L. 1271, 1273-74 (2016).

18. *See id*. at 1291-93.

19. *See* Mark A. Lemley et al., *Divided Infringement Claims*, 33 AIPLA Q.J. 255, 256-58, 270-71 (2005).

20. *See id*. at 263-65.

21. *See id*. at 268-71.

22. *See* Lee Petherbridge, *The Claim Construction Effect*, 15 MICH. TELECOMMS. & TECH. L. REV. 215, 218-19 (2008) ("The task of claim construction requires translating the words of the claim into a meaningful technological context, so it is perhaps no surprise that claim construction presents one of the most difficult problems in patent law.").

border electronic transaction, or social communication to determine the party responsible for the patent's infringement.

The overall structure of the Article is divided into six Parts, beginning with this Introduction in Part I. Part II affirms the significant role of the all elements rule and the territoriality principle in the system of patent law. Respectively, from the angles of patentability requirements, patent prosecution and administration, and patent infringement, this Article also addresses the jurisprudences behind the all elements rule and the territoriality principle. Part III observes that the decentralizing tendency of modern technological development, and its disruptive effect of these new technologies, are subject to the traditional interpretation of the all elements rule and the territoriality principle. In view of the aforesaid challenges brought up by new technologies, Part IV proposes two main possibilities, patent amendment versus patent law interpretation, to resolve the predicament. However, Part V argues that the most appropriate way to reconcile the impact of new technologies for the purpose of securing legislative policy is through the interpretation of patent law. Part VI concludes the overall strength of the proposed approach. Overall, this Article adopts the approach of patent economic value to strengthen the flexibility and justification for a new meaning of the all elements rule and the territoriality principle to respond to emerging technological challenges.

II. THE ALL ELEMENTS RULE AS JURISPRUDENCE IN THE CONTEXT OF PATENT LAW

Though recognized by courts, the all elements rule has rarely been codified in statutes. Likewise, the TRIPS Agreement, a harmonizing force for intellectual property law globally, does not officially comment on the all elements rule.[23] The existence of the all elements rule naturally flows from the origins of patent law and is inherent in the fundamental jurisprudence of patent law. Under most jurisdictions in the global patent community, the all elements rule is implicated by case law or judicial decisions when the court faces disputes of patentability and infringement.[24] Without the all elements rule, patent law would struggle

23. *See generally* Agreement on Trade-Related Aspects of Intellectual Property Rights, art. 34, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299 [hereinafter TRIPS Agreement]; *see generally* Convention on the Grant of European Patents, Oct. 5, 1973, 1065 U.N.T.S. 199 [hereinafter European Patents Convention] (describing the mechanism to receive a European patent).

24. *Compare* Trintec Indus., Inc. v. Top-U.S.A. Corp., 295 F.3d 1292, 1296 (Fed. Cir. 2003) ("[T]he strict identity required of the test for novelty") *with* European Patents Convention,

to govern technological innovation. For example, the line between prior art and patentable inventions would become blurred. Further, public notice would be insufficient, generating further issues of patent infringement.[25]

A. The All Elements Rule to Support Patentability

Patentability refers to the various requirements that must be met to obtain a patent. After passing an examination by a patent agency, an invention transforms into a protected status in which the patentee enjoys various exclusive rights. Importantly, an invention deemed patentable has demonstrated the invention to be of patentable subject matter and to be different from existing prior art (i.e., novel). As the patented invention contributes knowledge beyond pre-existing prior art, the associated social costs, i.e., exclusive rights granted to the patentee, are sufficiently offset.[26]

Generally, patentability has such requirements as novelty,[27] non-obviousness, [28] utility, [29] and enablement. [30] After reviewing these

supra note 23, art. 54(1) ("An invention shall be considered to be new if it does not form part of the state of the art."). *See e.g.*, JANICE M. MUELLER, PATENT LAW 230 (5th ed. 2016); CONCISE EUROPEAN PATENT LAW 38-39, 41 (Richard Hacon & Jochen Pagenber eds., 2d ed. 2008); VISSER'S ANNOTATED EUROPEAN PATENT CONVENTION 83-84 (Visser et al. eds., 2018 ed.).

25. *See* Timothy R. Holbrook, *Equivalency and Patent Law's Possession Paradox*, 23 HARV. J.L. & TECH. 1, 6 (2009) ("The patent system is arguably providing a windfall: it protects an invention the patent holder did not invent, and furthermore *could not* have invented. Such scope of exclusion has serious implications for a system of innovation. It has the potential to allow the patent holder to block or control a downstream innovation even though that innovation is beyond what she invented or disclosed.") (footnote omitted).

26. *See* ROBERT P. MERGES, JUSTIFYING INTELLECTUAL PROPERTY 130-31 (2011) ("Proportionality carries an inherent distributional element: each creator should obtain rights commensurate with and proportional to the value of his contribution.").

27. *Compare* 35 U.S.C. § 102(a)(1) ("[T]he claimed invention was patented, described in a printed publication, or in public use, on sale, or otherwise available to the public before the effective filing date of the claimed invention."), *with* European Patents Convention, *supra* note 23, art. 54-55 ("[I]nvention shall be considered to be new if it does not form part of the state of the art").

28. *Compare* 35 U.S.C. § 103 ("A patent for a claimed invention may not be obtained . . . if the differences between the claimed invention and the prior art are such that the claimed invention . . . would have been obvious"), *with* European Patents Convention, *supra* note 23, art. 56 ("An invention shall be considered as involving an inventive step if, having regard to the state of the art, it is not obvious") (emphasis added).

29. *Compare* 35 U.S.C. § 101 (Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter"), *with* European Patents Convention, *supra* note 23, art. 57 ("An invention shall be considered as susceptible of industrial application if it can be made or used in any kind of industry").

30. *Compare* 35 U.S.C. § 112(a) ("[A] written description of the invention . . . as to enable any person skilled in the art to . . . to make and use the same"), *with* European Patents Convention,

requirements, it is not difficult to see how the all elements rule has played a central role in the determination of patentability.

1. Novelty Requirement and All Elements Rule

The legislative purpose of novelty protects two primary interests.[31] One interest seeks to protect the current market by establishing a requirement that the proposed invention differs from pre-existing prior art.[32] This requirement ensures no one is relying on publicly available ideas, i.e. prior art, when seeking a patent.[33] This further prevents wasteful duplication in research and development for specific technologies, requiring an invention to be distinguishable from the prior art. Thus, this requirement achieves the innovation-based policy cherished by patent law.[34]

The second interest, at the heart of the novelty requirement's legislative purpose, focuses on the contributions by prior art. Any idea encompassed in the prior art has been recognized by the public.[35] Thus, no additional contribution could sufficiently offset the social cost of the exclusive rights, provided that the same idea is ultimately encompassed in a patent.[36] To justify the grant of a patent, an invention must necessarily contribute beyond that of the prior art.[37] Per its legislative purpose, the

supra note 23, art. 83 ("[A]pplication shall disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art").

31. *See* Dan L. Burk & Mark A. Lemley, *Inherency*, 47 WM. & MARY L. REV. 371, 383-84 (2005); *see also* Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989, 1001 (1997).

32. *See* Burk & Lemley, *Inherency*, *supra* note 31, at 383-84 (2005) (examining the concept of inherency as a function of the novelty requirement, which protects public benefit from interference of the patent right).

33. *Compare* 35 U.S.C. § 102(a) ("[T]he claimed invention was patented, described in a printed publication, or in public use, on sale, or otherwise available to the public before the effective filing date of the claimed invention."), *with* European Patents Convention, *supra* note 23, art. 54(2) ("The state of the art shall be held to comprise everything made available to the public by means of a written or oral description, by use, or in any other way . . . .").

34. *See* WILLAM M. LANDES & RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW 302-03 (2003).

35. Lemley, *The Economics of Improvement in Intellectual Property Law*, *supra* note 31, at 1001.

36. *Id.* ("If your 'invention' duplicates another's, then in theory you have not added any social value to justify obtaining an exclusive right.") (footnote omitted).

37. *See* Mark F. Grady & Jay I. Alexander, *Patent Law and Rent Dissipation*, 78 VA. L. REV. 305, 340 (1992) ("An important economic purpose of the novelty requirement is simply to decide who should be the private enforcer against rent dissipation. If an invention is already old by the time someone applies for a patent, there is little need to avoid a rent-dissipating race to improve.").

novelty requirement may be satisfied only if the invention is distinguishable from that of the prior art.[38] A patent may be granted even if the distinguishable physical feature in the invention, after comparison with the prior art, is recognized as contributing a new invention under the patent.

Novelty is universally required and typically codified as a substantive provision in different jurisdictions.[39] Although the wording of related provisions may vary by jurisdiction, the courts' adopted method when testing the novelty requirement reflects a substantially harmonized approach.[40] When comparing prior art to the invention, the fundamental test evaluates whether the prior art contains all elements of the claimed invention, probing the issue of identical anticipation.[41] Accordingly, a claimed invention may be deemed not novel if all the elements or steps encompassed in the claim are covered in each corresponding element or step disclosed.[42] Under identical anticipation, the value of a patent, at least with regard to the novelty requirement, is presented as a distinguishable part of an invention.[43]

However, when comparing the invention to the prior art, a Person Having Ordinary Skill in the Art's (PHOSITA) viewpoint may play a critical role.[44] Importantly, the jurisprudence of inherency, which disregards differences in a PHOSITA, complies with a corresponding element-to-element or step-or-step interpretation.[45] Overall, it may be clearly ascertained that the all elements rule functions substantially as a

38. *See* HARMON ET AL., *supra* note 15, at 122-24.

39. *See, e.g.*, 35 U.S.C. § 102; European Patents Convention, *supra* note 23, art. 54-55.

40. *See* MUELLER, *supra* note 24, at 230 (addressing the test of "strict identity" for the novelty requirement); *see also* PATENT LAW: A HANDBOOK ON EUROPEAN AND GERMAN PATENT LAW 62-63 (Maximilian Haedicke & Henrik Timmann eds., 2014) (focusing on interpretation of the novelty requirement according to Section 3 of German Patent Act).

41. *See* ROBERT A. MATTHEWS, JR., 3 ANNOTATED PAT. DIG. § 17:40 Westlaw (database last updated Apr. 2022); *see also* ROBERT P. MERGES & JOHN F. DUFFY, PATENT LAW AND POLICY 364-66 (7th ed. 2017) (citation omitted).

42. *See* MATTHEWS, *supra* note 41, § 17:41; MERGES & DUFFY, *supra* note 41, at 394.

43. *See* Sean B. Seymore, *Rethinking Novelty in Patent Law*, 60 DUKE L.J. 919, 922-23 (2011) (describing how the novelty requirement makes the invention be beyond possession of the public).

44. *See* Robin A. Weatherhead, *Investigating Inherency: Inception to AIA*, 97 J. PAT. & TRADEMARK OFF. SOC'Y 26, 31 (2015).

45. Though often considered an extension of the traditional novelty requirement, the concept of inherency does not override the all elements rule adopted for anticipation. *See id.* at 26; *see id.* (surveying the development of inherency in the U.S. and questioning whether the concept should exist post-AIA); *see* Burk & Lemley, *Inherency*, *supra* note 31, at 383-84.

gatekeeper to assist a PHOSITA in determining whether an invention possesses the necessary innovative step required to obtain a patent.

2. Non-Obviousness Requirement and All Element Rule

Rather than comparing individual elements or steps, the requirement of non-obviousness focuses on the difference in technological status between an invention and the prior art.[46] Looking to the technology wholistically and combining all reference documents, the requirement of non-obviousness probes whether the technological contribution of an invention goes beyond that of the prior art for the same or similar technical problem.[47] If a PHOSITA would not have successfully and efficiently solved the technical problem through any possible "teaching, suggestion, or motivation" from the prior art and other references, then the claimed invention is considered to exceed the prior art, i.e., non-obvious.[48] Satisfying the obviousness requirement, this inventive step away from prior art supports a conclusion of non-obviousness.[49]

As the obviousness inquiry focuses on the inquiry by a PHOSITA, it is necessary to examine the references available to the PHOSITA.[50]

46. The difference between prior art and the invention is not the ultimate evaluation of non-obviousness but merely serves the first step in the whole test. *See* Lemley, *The Economics of Improvement in Intellectual Property Law*, *supra* note 31, at 1001-02.

47. *See* Graham v. John Deere Co., 383 U.S. 1, 15 (1966) ("It refers to the difference between the subject matter sought to be patented and the prior art, meaning what was known before as described in section 102."); *see also* KSR Intern. Co. v. Teleflex Inc., 550 U.S. 398, 419-20 (2007) ("One of the ways in which a patent's subject matter can be proved obvious is by noting that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims.") (footnote omitted).

48. The test of teaching, suggestion and motivation (the TSM test) has been the significant doctrine for determination of the non-obviousness requirement under U.S. patent law. The U.S. Supreme Court criticized the narrow application of the TSM test made by the US Court of Appeals for the Federal Circuit in the KSR case. *See KSR*, 550 U.S. at 419; *see id.* ("The flaws in the analysis of the Court of Appeals relate for the most part to the court's narrow conception of the obviousness inquiry reflected in its application of the TSM test.").

49. Patent law in the European countries tends to use the term "inventive step" to express the concept of non-obviousness stipulated by U.S. Patent Act. *Compare* European Patents Convention, *supra* note 23, art. 56 *with* 35 U.S.C. § 103. Furthermore, the European approach prefers to adopt the problem-solution approach. *See* Actavis Group PTC EHF v. ICOS Corp. [2019] UKSC [15], [5] (appeal taken from Eng.) ("In order to assess inventive step in an objective and predictable manner, the so-called 'problem-and-solution approach' should be applied . . . In the problem-and-solution approach there are three main stages: (i) determining the 'closest prior art,' (ii) establishing the 'objective technical problem' to be solved, and (iii) considering whether or not the claimed invention, starting from the closest prior art and the objective technical problem, would have been obvious to the skilled person.").

50. *KSR*, 550 U.S. at 401.

Though a PHOSITA evaluates the technical statuses of the references, it is hard to imagine a scenario where the PHOSTIA would be moved by irrelevant prior art, which though having similar elements of an invention, was structurally different or addressed a different problem.[51] Thus, the all elements rule provides an adequate approach, helping to adjust the scope of the prior art used when assessing for obviousness.

3. Other Patentability and All Elements Rule

With regards to the remaining patentability requirements, utility and enablement, the all elements rule likewise plays a role. Utility addresses the practical effects that are produced by synergizing all the elements or steps of an invention, and determines if such effects are concrete and reliable enough to meet the requirement of usefulness.[52] By contrast, the requirement of enablement, analyzed by whether there is adequate disclosure in the specification, considers the idea of undue experimentation. Undue experimentation, however, is necessarily limited to the practice of the all elements or steps of any claim.[53] Here, enablement does not depend on the elements themselves, but rather, enablement looks at how well a patent describes all the elements such that a PHOSITA may make and use the invention.

B. The All Elements Rule to Justify the Exclusive Right

While the all elements rule may be used to determine the patentability of an invention, the same rule functions to measure the scope of the exclusive rights conferred to the patent holder.[54] These exclusive rights help to achieve patent law's goals of cumulative innovation and radical improvement to existing technologies.[55] Distinguished from the rights enjoyed by traditional property owners, the exclusive rights

51. *See Graham*, 383 U.S. at 22.

52. *See* Brenner v. Manson, 383 U.S. 519, 534-35 (1966) ("The basic *quid pro quo* contemplated by the Constitution and the Congress for granting a patent monopoly is the benefit derived by the public from an invention with substantial utility. Unless and until a process is refined and developed to this point—where specific benefit exists in currently available form—there is insufficient justification for permitting an applicant to engross what may prove to be a broad field.").

53. *See* In re Wands, 858 F.2d 731, 737 (Fed. Cir. 1988) ("Enablement is not precluded by the necessity for some experimentation such as routine screening. However, experimentation needed to practice the invention must not be undue experimentation.") (footnotes omitted).

54. Dan L. Burk & Mark A. Lemley, *Fence Posts or Sign Posts? Rethinking Patent Claim Construction*, 157 U. PA. L. REV. 1743, 1749-50 (2009).

55. *See* Lemley, *Property, Intellectual Property, and Free Riding*, *supra* note 1, at 1033.

conferred under patent law concern ownership of an intangible idea conceptualized as an invention.[56]

A patent's written description acts a core mechanism to facilitate sufficient disclosure and dissemination of the related patent to the general public.[57] As a result, in various jurisdictions, an inventor retains discretion in writing a claim, so long as all the necessary technical features are disclosed in the patent.[58] However, the claim itself provides more than disclosure. Importantly, a claim's most significant purpose is to provide the boundaries of the patent, thereby giving the public sufficient notice of the material encompassed within the patent.[59] Therefore, the boundary of a patent, as outlined by its claims, necessarily impacts the scope of the exclusive rights conferred to the patent owner.[60]

As such, claim construction directly impacts the extent of exclusive rights granted to the patent owner.[61] Claim construction determines whether the public's activity steps into the scope of the exclusive rights, thereby leading to patent infringement. Working in conjunction with the claim, the specification provides intrinsic evidence that clarifies the scope of a claim.[62] This is particularly important when the claim is ambiguous, as the specification can strongly support a given claim construction.[63]

1. All Elements Rule for Determination of Literal Infringement

Claim construction is strictly bound by the all elements rule when assessing direct patent infringement. As a consequence, only when someone practices all the elements or the steps of a claim, without authorization of the patentee, does such activity constitute patent infringement.[64] Due to the all elements rule, such illegal activity is

56. Burk & Lemley, *Fence Posts or Sign Posts?*, *supra* note 54, at 157.

57. *See* Jeanne C. Fromer, *Patent Disclosure*, 94 IOWA L. REV. 539, 548-49 (2009).

58. *See* ERNEST BAINBRIDGE LIPSCOMB, III, 3 PATENT CLAIMS § 3:3 Westlaw (database last updated Dec. 2020).

59. *See* Burk & Lemley, *Fence Posts or Sign Posts?*, *supra* note 54, at 1780.

60. *See* Phillips v. AWH Corp., 415 F.3d 1301, 1312 (Fed. Cir. 2005) (en banc) ("It is a 'bedrock principle' of patent law that 'the claims of a patent define the invention to which the patentee is entitled the right to exclude.'") (citation omitted).

61. *See* Petherbridge, *supra* note 22, at 217-18; *see* Burk & Lemley, *Fence Posts or Sign Posts?*, *supra* note 54, at 1744; *see* JOSHUA D. SARNOFF & EDWARD D. MANZO, PATENT CLAIM CONSTRUCTION IN THE FEDERAL CIRCUIT § 1.1 Westlaw (database last updated July 2022).

62. *See Phillips*, 415 F.3d at 1315-16.

63. *See* Peter S. Menell et al., *Patent Claim Construction: A Modern Synthesis and Structured Framework*, 25 BERKELEY TECH. L.J. 711, 749-52 (2010).

64. *See* Limelight Networks, Inc. v. Akamai Techs., Inc., 572 U.S. 915, 924 (2014); *but see* Merges & Nelson, *On the Complex Economics of Patent Scope*, *supra* note 3, at 866 ("The

commonly referred to as literal infringement.[65] Under claim construction, literal infringement cannot be found if an infringer follows a mere part of the elements or steps of a claim.[66] When dealing with a potentially infringing product or process, the omission of any element or step found in the patent is strong evidence to distinguish the accused product or process.[67] Undeniably, in the view of a PHOSITA, claim construction can be expected to adjust the interpretation of any element or step under a claim because claim construction is thought to recognize the inventor's true intention when drafting the claims.[68] Regardless of the effect as a result of a broader or narrower interpretation of a claim, an evaluation of literal infringement is certainly subject to the all elements rule.

2. All Elements Rule for Application of Doctrine of Equivalents

Developed by courts to promote equitable review, the Doctrine of Equivalents was created to prevent infringers from evading literal infringement.[69] The Doctrine of Equivalents, in line with the patent law's policy goal of innovation, evaluates whether an accused infringing act would deliver any substantial contribution over what the infringed patent

reverse doctrine of equivalents solves the problem by, in effect, excusing the improver from infringement liability-and therefore removing the original patentee's holdup right.").

65. Literal infringement is evaluated in claim construction to ensure whether the accused product or process may be read into the all elements or steps of any claim.

66. *See* MATTHEWS, *supra* note 41, § 12:29; *see also* ALEXANDER HARGUTH & STEVEN CARLSON, PATENTS IN GERMANY AND EUROPE: PROCUREMENT, ENFORCEMENT AND DEFENSE 182-83 (2011).

67. *See also* Samuel F. Ernst, *The Supreme Court Case that the Federal Circuit Overruled: Westinghouse v. Boyden Power Brake Co.*, 68 SYRACUSE L. REV. 53, 78-79 (2018) ("The reverse doctrine of equivalents allows the judge in a patent case to investigate beyond the semantic game of literal infringement; to weigh the equities to determine if the accused innovation is substantially superior to the claimed invention and has solved the problems in the prior art in a way that the patent holder failed to do.") (footnote omitted).

68. *See* SARNOFF & MANZO, *supra* note 61, § 1:1 n.15.

69. *Compare* Graver Tank & Mfg. Co. v. Linde Air Prods. Co., 339 U.S. 605, 607 (1950) ("[C]ourts have also recognized that to permit imitation of a patented invention which does not copy every literal detail would be to convert the protection of the patent grant into a hollow and useless thing. Such a limitation would leave room for—indeed encourage—the unscrupulous copyist to make unimportant and insubstantial changes and substitutions in the patent which, though adding nothing, would be enough to take the copied matter outside the claim, and hence outside the reach of law.") *with* European Patents Convention, Protocol on the Interpretation of Article 69, art. 2, Nov. 29, 2000 ("For the purpose of determining the extent of protection conferred by a European patent, due account shall be taken of any element which is equivalent to an element specified in the claims.").

has done by comparison with the relevant prior art.[70] Notably, even if the substitution of any element or step of a claim is evaluated to be an insubstantial change to the inventive contribution of the infringed patent as a whole, the infringing act may still constitute imputable patent infringement.[71]

Though the Doctrine of Equivalents may expand the scope of a claim when determining infringement, the result does not stray far from the expectations imposed by the all elements rule.[72] Moreover, the Doctrine of Equivalents is limited by the original claim elements. Thus, the Doctrine does not permit an expansion of a claim through the creation of elements or steps. Rather, the Doctrine remains bound by all elements or steps in the original invention.

3. All Elements Rule connected with Indirect Infringement

In some jurisdictions, a finding of indirect infringement may still be viewed as a fulfillment of the all elements rule. Indirect infringement, though potentially seen as an exception of the all elements rule, imposes liability upon a person actively contributing direct infringement or inducing others to commit direct infringement.[73] Evaluation of indirect infringement serves to prevent direct infringement, or at least increase the costs of committing direct infringement.[74]

Jurisdictions take various approaches to curb infringement.[75] For example, while German patent law is concerned with the risk of direct infringement to the domestic market,[76] U.S. patent law addresses the

70. *See* Merges & Nelson, *On the Complex Economics of Patent Scope*, *supra* note 3, at 854-56.

71. *See* Warner-Jenkinson Co., Inc. v. Hilton Davis Chem. Co., 520 U.S. 17, 39-40 (1997); *see* MATTHEWS, *supra* note 41, § 17:40; *see Graver Tank & Mfg.*, 339 U.S. at 608; *see* Eli Lilly & Co. v. Actavis UK Unlimited [2017] UKSC 48, [66].

72. *See* HARMON ET AL., *supra* note 15, at 601-02.

73. *Compare* 35 U.S.C. § 271(b) (inducing infringement) *and* 35 U.S.C. 271(c) (contributory infringement), *with* Patents Act 1977, c. 37, § 60(2) (UK) (combining the concepts of inducing and contributory infringement). *See also* Patentgesetz [PatG] [German Parent Act], Dec. 16, 1980, *Bundesgesetzblatt BGBl* I at 1, as amended by Act of Oct. 8, 2017, *BGBl* at 3546, § 10 (Ger.).

74. *See* Sarah R. Wasserman Rajec, *Infringement, Unbound*, 32 HARV. J.L. & TECH. 117, 146 (2018).

75. *Id.* at 147 ("The roots of indirect infringement doctrine are consistent with protecting patent holders' investments and ability to enforce their exclusive rights.").

76. *See* PATENT LAW: A HANDBOOK ON EUROPEAN AND GERMAN PATENT LAW, *supra* note 40, at 755.

dependency of indirect infringement upon direct infringement.[77] Importantly, indirect infringement is shown by merely establishing the nexus between indirect infringement and direct infringement, even if the inducer or contributor of infringement did not practice all the elements or steps of a claim.[78] Thus, regardless of legislation or a judicially-fashioned doctrine, indirect infringement shares the justification of the all elements rule.

III. THE PRINCIPLE OF TERRITORIALITY AS JURISPRUDENCE IN THE CONTEXT OF PATENT LAW

A. Patent Prosecution and Territoriality

Territoriality plays a significant role in the exclusive rights enjoyed by a patentee. According to the jurisprudence of territoriality, the grant of a patent is a domestic affair in a given jurisdiction.[79] In other words, a patent administrative agency is the only authority that examines whether the invention satisfies a jurisdiction's requirements of patentability.[80] It is impossible for other administrative agencies outside the jurisdiction to conduct a patent examination to determine the patentability of any invention.[81]

Certainly, it is undeniable that some exceptions would be created for territoriality during an examination of patentability. For example, the Patent Cooperation Treaty works as an international cooperation, working to reduce administrative costs for the examination of a patent in the national jurisdiction.[82] Under the Patent Cooperation Treaty, the

77. *See* Aro Mfg. Co. v. Convertible Top Replacement Co., 365 U.S. 336, 341 (1961) ("It is plain that § 271(c)—a part of the Patent Code enacted in 1952—made no change in the fundamental precept that there can be no contributory infringement in the absence of a direct infringement."); *see* HARMON ET AL., *supra* note 15, at 577.

78. *See* Christopher A. Cotropia & Mark A. Lemley, *Copying in Patent Law*, 87 N.C. L. REV. 1421, 1430 (2009) ("An inducement claim doesn't necessarily involve copying—a defendant might independently develop a technology, then learn of a patent covering it, and still encourage another to infringe that patent.").

79. Paris Convention for the Protection of Industrial Property art. 4, Mar. 20, 1883, 21 U.S.T. 1583, 828 U.N.T.S. 305 [hereinafter Paris Convention] ("(1) Patents applied for in the various countries of the Union by nationals of countries of the Union shall be independent of patents obtained for the same invention in other countries, whether members of the Union or not. (2) The foregoing provision is to be understood in an unrestricted sense, in particular, in the sense that patents applied for during the period of priority are independent, both as regards the grounds for nullity and forfeiture, and as regards their normal duration.").

80. *Id.*

81. *Id.*

82. Patent Cooperation Treaty art. 27, *modified on* Oct. 3, 2001, 28 U.S.T. 7645, 1160 U.N.T.S. 231 (administered by WIPO, which has 153 contracting parties).

international administrative patent agency designated by the World Intellectual Property Organization (WIPO) may conduct the initial examination and the publication of a patent application in the later prosecution, at the request of the applicant.[83] Similarly, the European Patent Office (EPO) conducts patent prosecution for any invention filed as a European Patent, granting a European Patent for the qualified invention beyond the borders of the members of the European Convention.[84] A European Patent is effective in the member states designated for patent protection.[85] In the coming future, the Unitary Patent will be granted by the EPO.[86] The EU's approach demonstrates a policy aimed to provide international cooperation in patent prosecution and to provide a common effect of granted patents.

When dealing with issues of territoriality, the inquiry should focus on the actual effect of a specific activity, rather than merely considering the geographical location of the activity. As long as the ultimate authority for the determination of patentability remains in the jurisdiction where the patent application on an invention was filed, the existence of evidence outside the national jurisdiction will not influence the compliance of territoriality under patent law.[87] For example, he requirements of novelty and non-obviousness illustrate issues associated with the principle of territoriality. Both requirements may not be determined without comparison to the relevant prior art. In different jurisdictions, most legislations adopt the concept of internationalism to delimit the scope of

83. *See id*. art. 27(5) ("Nothing in this Treaty and the Regulations is intended to be construed as prescribing anything that would limit the freedom of each Contracting State to prescribe such substantive conditions of patentability as it desires . . . . [A]ny Contracting State is free to apply . . . the criteria of its national law in respect of prior art and other conditions of patentability not constituting requirements as to the form and contents of applications.").

84. *See* European Patents Convention, *supra* note 23, arts. 2-4.

85. *See id.* art. 2(2) ("The European patent shall, in each of the Contracting States for which it is granted, have the effect of and be subject to the same conditions as a national patent granted by that State, unless otherwise provided in this Convention.").

86. The system of the unitary patent in the EU is established to admit a single supranational patent with the same effect over the EU for the applicant without specific designation on jurisdictions. Such the system is expected to work with the mechanism of the unitary court to achieve its original policy goal. *See e.g.*, Council Regulation No. 1257/2012, 2012 O.J. (L 361) 1 (implementing enhanced cooperation in the area of the creation of Unitary Patent protection); Council Regulation No. 1260/2012, 2012 O.J. (L 361) 89 (implementing enhanced cooperation in the area of the creation of Unitary Patent protection with regard to the applicable translation arrangements); Council Notice of Agreement on a Unified Patent Court, 2013 O.J. (C 175) 1 (implementing agreement where the Unified Patent Court settles all European patent disputes).

87. *See also* Dariush Keyhani, *Patent Law in the Global Economy: A Modest Proposal for U.S. Patent Law and Infringement Without Borders*, 54 VILL. L. REV. 291, 297 (2009).

the prior art.[88] In other words, any reference recognized as prior art should be viewed as significant evidence, even if the reference was produced or proven in a foreign jurisdiction.[89] As such, territoriality is not violated when a domestic patent agency takes into consideration the foreign reference as evidence of the patent material's practice preceding the filing of the patent in a given jurisdiction.

B. International Priority Right and Territoriality

Moreover, the priority of a patent application may be impacted by interpretations of territoriality. Here, priority is affected by the timing of the reference activity, regardless of a given geographic territory.[90] For example, international priority may be dated back to the Paris Convention.[91] The main purpose of international priority is to benefit an international patent application underlying the same invention in different jurisdictions, while preventing any disadvantageous result from the loss of novelty of a later application due to the publication of a former application.[92] Currently, domestic patent applications are permitted to request the filing date of an early application in other jurisdictions as the critical date for a current application provided that the two applications share the same invention, and the interval between the two applications is within twelve months.[93] The reference activity, e.g., the earlier patent application in the foreign jurisdiction, determines the critical date of the later application.[94]

88. The Leahy-Smith Invents Act (AIA) amended the concept of prior art under U.S. patent law to completely accept evaluation of foreign references, particularly with regards to the interpretation of "public use" and "on sale" against determination of the novelty requirement. Leahy-Smith Invents Act (AIA), Pub L. No. 112-29, 125 Stat. 284 (2011). Notably, the phrase of "in this country" has been eliminated from the current text of Section 102 of Patent Act. *See also* 35 U.S.C. § 102(a) (1) ("A person shall be entitled to a patent unless—(1) the claimed invention was patented, described in a printed publication, or in public use, on sale, or otherwise available to the public before the effective filing date of the claimed invention . . . .").

89. *See* ALAN J. KASPER ET AL., PATENTS AFTER THE AIA: EVOLVING LAW AND PRACTICE 6-29 (2016).

90. Roberto Rosas, *Foreign Patent Decisions and Harmonization: A View of the Presumption Against Giving Foreign Patent Decisions Preclusive Effect in United States Proceedings in Light of Patent Law International Harmonization*, 18 J. MARSHALL REV. INTELL. PROP. L. 1, 19 (2018).

91. *See* Paris Convention, *supra* note 79, art. 4.

92. 35 U.S.C. § 119(a).

93. *Id.*

94. *Id.*

C. Exclusive Right Bound by Territoriality

1. Interpretation of Territoriality to Delimit the Scope of Patent Rights

The requirements for patentability present a symmetry, which grants exclusive rights after comparison to the relevant prior art.[95] From this approach, territoriality serves as the ultimate geographical boundary for the exercise of exclusive rights, though it may be hard to imagine a patent holder exercising such rights in an area outside the original granting jurisdiction.[96] As mentioned above, territoriality's justification originates from the effect of a patent affirmed by the local patent agency's conferring the exclusive rights to the patentee. Unlike copyright, which is internationally protected by the special provision of the Berne Convention, any jurisdiction reserves its discretion to decide whether an invention may be given legal protection by granting a patent to cover that invention.[97] Consequently, a patentee in one jurisdiction, where the related patent was granted, cannot justifiably exercise its exclusive rights in other jurisdictions.[98] Importantly, if the patentee could exercise such exclusive rights in other jurisdictions, the original jurisdiction would necessarily be limited in its decision about patentability of the invention in the first place.[99]

2. Interaction of Exclusive Right with Illegal Cross-Border Transactions

A problem exists at the convergence of the all elements rule and the territoriality principle. Originally, the all elements rule merely indicated the technical boundary of a claimed invention, which was to be embodied

95. *See* Alan Devlin, *Patent Law's Parsimony Principle*, 25 BERKELEY TECH. L.J. 1693, 1721 (2010).

96. *See* Timothy R. Holbrook, *What Counts As Extraterritorial in Patent Law?*, 25 B.U. J. SCI. & TECH. L. 291, 294-95 (2019) (noting that CAFC is willing to evaluate the cross-border patent infringement under the strong presumption against the extraterritorial reach of patent law in some cases); *see* Timothy R. Holbrook, *Is There a New Extraterritoriality in Intellectual Property?*, 44 COLUM. J.L. & ARTS 457, 473-77 (2021).

97. *See* Berne Convention for the Protection of Literary and Artistic Works arts. 5(1) & (4) Sept. 9, 1886, 25 U.S.T. 1341, 1161 U.N.T.S. 3 [hereinafter Berne Convention].

98. The effect of territoriality doesn't always reach to the issue of forum choice. In other words, a court in a jurisdiction, which is outside the court that granted a patent originally, may still hear cases of patent infringement that occurred the separate jurisdiction in accordance with that court's discretion as endowed by related domestic laws.

99. *See* Amy L. Landers, *U.S. Patent Extraterritoriality Within the International Context*, 36 REV. LIT. 28, 29 (2016).

in the patented product or incorporated in the patented process.[100] By contrast, the territoriality principle seemed to focus on the results of the exercise of exclusive rights in the jurisdiction where the patent was granted.[101]

To ensure that the aforesaid result is at the right location under territoriality, the all element rules play a significant role by measuring the geographical meaning of territoriality. Certainly, in terms of patent infringement, the exercise of the exclusive rights may justify the evaluation of infringement on the practice of any claim derived from an invention without authorization, further leading to remedies against that infringement. Therefore, while the exclusive rights are exerted to prevent or deter someone from manufacturing and distributing an infringing product pursuant to the all elements rule, the concept of territoriality instead prioritizes the final place of manufacture or distribution of the infringing products or utilization of the patented process. However, in absence of special provisions dealing with extraterritoriality, the practice of any claim occurring outside the patent granting country does not constitute patent infringement in that jurisdiction.[102]

A comparative view of legislative experience shows us that such legislation on extraterritorial governance has faced significant scrutiny by courts.[103] Interestingly, Section 271(f) was added in the U.S. Patent Act to serve as an exception to the jurisprudence of territoriality, facilitating room for a more flexible interpretation.[104] Yet, Section 271(f) does not completely deny the jurisprudence of territoriality, instead reserving

100. Claim construction, regardless of the evidence's source (i.e., intrinsic or extrinsic evidence) is always made around the technical meaning of a claim. Further, claim construction helps to establish the technical contribution described by the claim, distinguishing the claim from relevant prior art.

101. Holbrook, *What Counts As Extraterritorial in Patent Law?*, *supra* note 96, at 295.

102. *See* Deepsouth Packing Co. v. Laitram Corp., 406 U.S. 518, 531 (1972) ("To the degree that the inventor needs protection in markets other than those of this country, the wording [of various statutes] reveals a congressional intent to have him seek it abroad through patents secured in countries where his goods are being used. Respondent holds foreign patents; it does not adequately explain why it does not avail itself of them.").

103. *See* Holbrook, *Extraterritoriality in U.S. Patent Law*, *supra* note 14, at 2136 ("Although the courts' application of the presumption against extraterritorial application of U.S. laws has been inconsistent in other contexts, the Supreme Court has consistently applied it in the context of patent law. The Court, therefore, espouses a dialectic approach in which courts narrowly construe the Patent Act to limit the extraterritorial reach of U.S. patents to trigger an appropriate response, if any, from Congress.") (footnotes omitted); *see also* Roberto Romandini & Alexander Klicznik, *The Territoriality Principle and Transnational Use of Patented Inventions — The Wider Reach of a Unitary Patent and the Role of the CJEU*, 44 INT'L. REV. INTELL. PROP. & COMP. L. 524, 525-26 (2013).

104. *See generally* 35 U.S.C. §271(f).

special and limited legal evaluation on issues of indirect infringement.[105] In the United States, courts have adopted a more conservative position than expected to resist a broad application of Section 271(f).[106] For example, *Microsoft Corp. v. AT&T Corp.* presents a strict interpretation of the claim language, "component" and "supplies," excluding the exportation of master disks of Windows software or the related electronic transmission from the scope of extraterritorial indirect infringement.[107] Following a similar track in interpreting Section 271(f)(1), the Supreme Court of the United States held that a singular component corresponding to a patent did not satisfy the text requirement of "all or a substantial portion of the components of a patented invention" and exportation of the component was not bound by Section 271(f)(1).[108] Ultimately, the concept of territoriality still dominates the interpretation of patent infringement through the all elements rule in cases involving cross-border transactions.

IV. CHALLENGES OF NEW EMERGING TECHNOLOGIES OVER ALL ELEMENT RULE AND TERRITORIALITY

A. Disruptive Decentralization of Participation under Electronic Commerce

As new technologies emerge in commercial activities, transaction models have likewise begun to evolve. A traditional transaction may still be generally considered as resource-centralization.[109] Under such an

105. *See id.* ("[W]here such components are uncombined in whole or in part, in such manner as to actively induce the combination of such components outside of the United States in a manner that would infringe the patent if such combination occurred within the United States, shall be liable as an infringer.").

106. Microsoft Corp. v. AT&T Corp., 550 U.S. 437, 443 (2007); Life Techs. Corp. v. Promega Corp., 137 S. Ct. 734, 743 (2017).

107. *Microsoft*, 550 U.S. at 449-54.

108. *Life Techs. Corp.*, 137 S. Ct. at 742-43 (citation omitted). In *Life Techs. Corp.*, the defendant manufactured and exported an enzyme — "the Taq polymerase"—to the U.K. to combine with other elements, thereby infringing on a patent for a genetic test kit, *id*. The Court held "that the phrase 'substantial portion' in 35 U.S.C. § 271(f)(1) has a quantitative, not a qualitative, meaning . . . [and that] § 271(f)(1) [did] not cover the supply of a single component of a multicomponent invention," *id*.

109. *See* Max Raskin, *The Law and Legality of Smart Contracts*, 1 GEO. L. TECH. REV. 305, 316-17 (2017). Compared with traditional trades, the technologies of blockchain seem to go along with the concept of decentralization in the electronic commerce to enhance the scale of security and the possibilities of common participation in any transaction. *See* Kevin Werbach, *Trust, But Verify: Why the Blockchain Needs the Law*, 33 BERKELEY TECH. L.J. 487, 507-10 (2018). Both the

observation, it is not difficult observe that a specific party often facilitates a transaction with a counterparty to conserve resources. Though the other party may cooperate in making the transaction, other parties form a supply chain that assists in the transaction. In other words, resource-centralization designates a specific party as a supplier in a transaction, while the counterparty is a user.

Yet, the cooperation between the specific party and other parties to consummate the transaction will not involve, as the parties are concerned, the appearance of a typical transaction.[110] Rather, the transaction usually involves an unequal or divided contribution from the involved parties. For example, party A would like to sell item X to party B. Although A must purchase related material from party C, and accept party D's technical inputs to manufacture item X for the sale, party A appears to be the only party concerned with providing party B with item X, at least on the surface. However, there has been a joint contribution to the manufacture of item X prior to party A's sale of item X to party B. While the seller A, is the only party to make a sale contract, the other participants, parties C and D, supported party A in its sales contract with party B. The traditional service is shared with a similar token under the concept of centralized resources.

Modern transactions through e-commerce or social networks have changed the business model of centralized resources.[111] To facilitate a complete online transaction with the digital-interface sale or service, a multi-participant operation necessarily is implicated to achieve the business aims of the product, breaking through such constraints as time and place of the transaction.[112] Distinguished from the traditional business model, the transaction under e-commerce usually encompasses more than one participant to facilitate the online sale or service. However, it is

decentralized ledger and smart contract are playing the dispensable role in functioning the blockchain mechanism.

110. *See* Raskin, *supra* note 109, at 316-17; *see* Werbach, *supra* note 109, at 507-10.

111. *See* Werbach, *Trust, But Verify*, *supra* note 109, at 507-10; *see* W. Keith Robinson, *Economic Theory, Divided Infringement and Enforcing Interactive Patents*, 67 FLA. L. REV. 1961, 1977-79 (2015).

112. *See* Lemley et al., *Divided Infringement Claims*, *supra* note 19, at 256 ("A person may invent a new and useful process that requires steps (a) and (b) of a claimed process to be performed by one person and step (c) to be performed by another person. These distributed or divided patent claims are surprisingly common, particularly in the field of computer networking, where a patented process may involve some steps performed on the client side and others performed on the server side."); *see also* Robinson, *Economic Theory, Divided Infringement and Enforcing Interactive Patents*, *supra* note 111, at 1977-79.

common practice to only identify one participant as the party responsible for the transaction.[113]

Generally, an e-commerce transaction is made through three contributions of online operations: an information terminal, a transaction terminal, and a financial terminal. In an information terminal, the terminal establishes a transaction platform via an information current to support the transaction, usually via a cloud, calculating and disseminating large amounts of data.[114] Without synchronization to a transaction terminal, the information terminal would never provide a contribution in an online transaction. [115] In a transaction terminal, the terminal establishes a transaction platform via a friendly facility and mechanism for the users to complete an online transaction, implicating designs that promote safe and fair transactions. [116] Finally, in a financial terminal, after a sale is concluded, the mechanism of financial consideration and payment for the service is necessary. [117] Thus, in the ordinary model of e-commerce, diversified participation is necessary across the three terminals.

In another example, consider that party A runs an established platform for online transactions, and is responsible for the design and implementation of related systems and servers. These responsibilities could include informational connectivity and interoperation, delivery of digital content, and transaction security. Party B cooperates with party A to provide the financial service necessary to support the online transaction, so that a user may make a payment through a credit card or other equivalent ways. Parties C and D utilizes party A's platform to then perform an online transaction. When party C initiates, negotiates, and performs with party D via the systems embedded in the platform, party C enjoys the benefit of the payment mechanism. On the surface, the focus of the online transaction seems to be addressed by the two parties concerned, C and D, but the transaction necessarily involves the

113. *See* Lemley et al., *Divided Infringement Claims*, *supra* note 19, at 111 ("The law concerning use appears to be straightforward until one considers interactive inventions. Interactive inventions, broadly defined, are inventions that require interaction between more than one claimed components or the performance of claimed method steps by more than one actor. Interactive inventions have become more prominent in the last several decades with the advancement of the Internet and other connective technologies."); *see also* W. Keith Robinson, *Using Interactive Inventions*, 69 DEPAUL L. REV. 95, 107-10 (2019).

114. *See* GEORGE B. DELTA & JEFFREY H. MATSUURA, LAW OF THE INTERNET § 6.04 (4th ed. Supp. 2020).

115. *Id.* § 6.03.

116. *Id.*

117. *Id.* § 6.02. In the case of financial terminals, it may be anticipated that banks or financial institutes serve jointly with the financial terminal.

contributions from parties A and B. This illustrates the new business model of multi-participants and joint contributions in e-commerce.[118]

The online transaction system under e-commerce may become a meaningful concept for reviewing patent protection, especially when such systems incorporate blockchain technology[119] or the application of artificial intelligence.[120]

1. Illegal Exploitation of Patent Value under Cross-Border Multi-Participation

When an online transaction is protected under a patent, the business model of multi-participants and joint contributions represent an inevitable challenge against current patent law, particularly with regard to infringement.[121] Importantly, when multiple parties participate in the unauthorized use of the patented system or process, more than one party necessarily infringes on the patent.[122] Theoretically, all participants, including the two parties directly transacting, may be theoretically assumed to have exploited their corresponding part of the patent. Thus, the joint contribution may result in no party obtaining the entire economic interest of the patent value. However, patent law faces a predicament when analyzing infringement in instances where no party has completely practiced all the elements or steps of any claim.[123] In such an instance, a

118. The significant improvement in computer-related technologies, as an inventive concept, seems to open a door for financial-technology inventions to pass, the two-prong test for patentability in the U.S. *See* Mayo Collab. Servs. v. Prometheus Lab'ys, Inc., 566 U.S. 66, 77 (2012).

119. The technique of blockchain is to use a chronological and immutable database, consisting of multiple blocks to accommodate activities or transactions through a distributed ledger. Each block should be orderly validated by the agreement of specific participants, usually, according to the smart contract. Bitcoin is the famous example of blockchain's application as a cryptocurrency. *See* Kevin Werbach & Nicolas Cornell, *Contracts Ex Machina*, 67 DUKE L.J. 313, 326-28 (2017) (addressing the three elements of a blockchain: the distributed ledger of transactions, decentralized network and participants' consensus).

120. *See* FUTURE of Artificial Intelligence Act of 2017, H.R. 4625, 115th Cong. § 3(a)(1)(A) (2017) [hereinafter FUTURE of Artificial Intelligence Act of 2017] ("Any artificial systems . . . may be developed in computer software, physical hardware, or other contexts not yet contemplated. They may solve tasks requiring human-like perception, cognition, planning, learning, communication, or physical action. In general, the more human-like the system within the context of its tasks, the more it can be said to use artificial intelligence.").

121. *See* Lemley et al., *Divided Infringement Claims*, *supra* note 19, at 256-57.

122. *See id.* at 256 ("These claims exist where patents are infringed only by aggregating the conduct of more than one actor or conduct that occurs in more than one country, respectively. Patent law doesn't deal well with either class of divided patent claim.").

123. *See*, *e.g.*, Dmitry Karshtedt, *Causal Responsibility and Patent Infringement*, 70 VAND. L. REV. 565, 592 (2017) ("So-called "divided infringement' is another problematic area of patent

singular participant would not be accused of patent infringement merely because its activity corresponds to the practice of only part of a feature in a claim. Thus, an intangible a-symmetry addressing patent infringement, driven by the all elements rule, exists between the unauthorized practice of any claim and the illegal exploitation of the economic interest derived from any claim.

2. Divided Cross-Border Participation against the All Element Rules and Territoriality

Under the all elements rule, the infringer usually benefits from the whole economic interest resulting from infringing activities, and subsequently may transfer the illegal economic interest to other parties.[124] Any symmetry provided by the all elements rule is impaired when divided patent infringement occurs as a result of multi-parties' participation and joint contributions in an e-commerce transaction.[125] In an e-commerce model, the initiator likely becomes both a collector and an assignor of the illegal economic interest obtained by the unauthorized practice of all the elements or steps included in a patented system for online transactions. While the entire economic interest from a patent indeed produces a market advantage, under the governance of the all elements rule, the patent-protected invention also enters the public domain because an entire claim has not been directly implicated by a participant in an online transaction. Certainly, so long as a geographical factor is considered in divided infringement, the unjust asymmetry will progressively worsen due to

law. . . . [T]his label refers to the phenomenon of method claims that cannot be infringed because no single entity performs all of the claim's steps."); Lynda J. Oswald, *Simplifying Multi-Actor Patent Infringement Cases Through Proper Application of Common Law Doctrine*, 51 AM. BUS. L.J. 1, 12 (2014) ("The Patent Act does not specifically address the liability of multiple parties whose individual actions must be aggregated to support direct infringement of a multistep process or method patent claim."). *See also* Timothy R. Holbrook, *Method Patent Exceptionalism*, 102 IOWA L. REV. 1001, 1047 (2017) ("[I]n the context of what has come to be known as 'divided infringement' . . . [t]his situation arises when the patented invention is utilized by multiple parties.") (footnotes omitted).

124. Traditionally for direct infringement, the infringer is the only actor to practice all the elements of any claim. It is reasonably inferred from the all elements rule that the infringer is the first person to receive the sum of the economic interest through patent infringement to catch the infringed patent value.

125. Under divided infringement, when the infringing activity is done, all the participants for the transaction instantly and jointly become the first receiver of the illegally exploited patent even though the harm caused by infringement remains the same as that caused by the single infringer.

interference of the territoriality in the determination of divided infringement.[126]

V. RECONSTRUCTION OF ALL ELEMENTS RULE AND TERRITORIALITY FOR NEW ADAPTION OF PATENT LAW

In patent infringement cases involving newer technology, a primary concern is an application of patent law that would deviate from the innovation-driven goal in an inequitable way. Facing such possible unexpected results, various jurisdictions are tasked with a pressing priority to determine how to incorporate new technologies in existing patent legislation.[127]

A. Evaluation for the Model of Patent Act Amendment

To alleviate the potential for inequitable results, according to my observation, there are two potential approaches to pursue such a goal.

1. Special Provisions for All Elements Rule and Territoriality

New technologies have disrupted the approaches to implement the fundamental value of patent law in the existing statutory regime.[128] As mentioned above, the dispute regarding a cross-border, divided infringement case sheds light on the deficiency of the all elements rule and territoriality. Substantially, this problem teaches us that the traditional understanding and application of such principles has not always followed legislators' original expectations.

However, this does not mean courts should abandon the all elements rule and the territoriality principle merely to resolve the dispute of divided infringement in an online transaction.[129] Historically, the two principles served patent law by establishing a legal framework for issues, including the requirements of patentability, the scope of the exclusive rights, patent acquisition and administration, exceptions and limitations of a patent

126. *See* Holbrook, *Extraterritoriality in U.S. Patent Law*, *supra* note 14, at 2173-74 ("Moreover, even having patents in all relevant countries may not eliminate territoriality concerns, particularly if the system crosses national boundaries. It would be possible for such divided claims to still evade the patent system of both countries if those countries generally use a strict territorial approach to patent law.").

127. *See* Richard H. Stern, *The Bundle of Rights Suited to New Technology*, 47 U. PITT. L. REV. 1229, 1258-59 (1986).

128. *See id*.

129. *See* Nathaniel Grow, *Joint Patent Infringement Following Akamai*, 51 AM. BUS. L.J. 71, 113, 116-17 (2014) (criticizing the courts expansion of inducement infringement beyond existence of direct infringement under the all elements rule).

right, and patent infringement and enforcement.[130] To abandon the all elements rule and territoriality would inevitably necessitate the complete break-down and reestablishment of patent law.

Possibly, legislators may concentrate upon the difficulty faced by interpretation of the all elements rule and territoriality by specifying how infringement is evaluated in the context of a multi-party, cross-border, e-commerce transactions. Here, legislators would be forced to address the serious question of whether other provisions under patent law would be adjusted if such changes were made to the all elements rule and the territoriality principle.[131] Furthermore, as diversified technological development has been recognized, divided infringement may be the tip of the iceberg for the future of patent law. When existing patent law is amended to resolve the dispute caused by a specific technology, the resulting principles may not necessarily be translatable to other fields of technology.[132]

B. Attempts for Flexible Interpretation for Patent Law in Terms of Patent Value

As a milder approach, the best approach may be to grant a new approach, reinvigorating the two principles. Rather than concentrating on the technical aspect through claim construction, there may be an alternative way to promote the principles of the all elements rule and the territoriality principle.

130. *See* Lemley et al., *Divided Infringement Claims*, *supra* note 19, at 270-71 ("The locus-of-infringement approach seems a reasonable effort to compromise between a rule that would require all elements of a patented claim to be practiced in the same country-and thus make it impossible to enforce networking patents at all against distributing defendants -and a rule that would apply the patent law wherever any element was practiced, leaving a computer operator vulnerable to suit in multiple jurisdictions throughout the world.").

131. Since the all elements rule serves a guidance for determining patent value showed in comparison with prior art, it is difficult to find its replacement in the context of patent law with the sufficient justification. However, the concept of territoriality under patent law seems to reconcile interest conflicts derived from the innovative activities among the states. *See generally* 35 U.S.C. § 271(f). Previously, policy-oriented developments often changed or adjusted the landscape of territoriality to achieve the expected policy goal.

132. The field and nature of technologies seems to serve better as a lever for the court to give a flexible interpretation over the fundamental issues under patent law than the amendment of patent law. *See* Burk & Lemley, *Policy Levers in Patent Law*, *supra* note 5, at 1578-79.

1. New Interpretation for All Element Rule through Patent Economic Value

Following an economic analysis, the patent "value" of an invention may be inferenced from the additional technical contribution made beyond the prior art.[133] Such contribution may be measured by the difference between the patented idea concept and the next best alternative to address a similar technical question.[134] In fact, this inference directly implicates the non-obviousness requirement, especially when considering the jurisprudence of utilitarianism. Looking at the practice of the claims under the patent, a patent's value may also be equated to the difference in profits between the patented products made and sold and the next best alternative product the patentee would have made and sold without patent infringement. The technical value of a patent, after being deemed non-obviousness, should correspond to its economic value in the market. This value will also be reflected in the practice of the exclusive right as licensing royalty or damages.[135]

In other words, the economic value of a patent is substantially derived from its technical value.[136] While claim construction delimits a patent's scope, such construction simultaneously implicates the possible profits of the patented product that might be delivered as the economic value in the market. Usually, we rely upon the all elements rule to implement claim construction in the view of a PHOSITA for determination of patent infringement by examining if the accused product

133. *See* Dan L. Burk & Mark A. Lemley, *Tailoring Patents to Different Industries*, *in* BIOTECHNOLOGY AND SOFTWARE PATENT LAW: A COMPARATIVE REVIEW OF NEW DEVELOPMENTS 32 (Emanuela Arezzo & Gustavo Ghidini eds., 2011) ("If different industries acquire, value, and use patents differently, and if the optimal number, scope, and division of patent rights differ by industry, then it seems easy to conclude that we need different patent statutes for each industry.").

134. Here, the patent value addressed is considered in terms of a technical aspect of the invention in relation to an expected advantageous status the patentee will enjoy in the market.

135. *See* Burk & Lemley, *Policy Levers in Patent Law*, *supra* note 5, at 1590 ("The effective scope of patents that do issue also varies tremendously by industry. This variance results from the relationship between a patent and a product. In some industries, such as chemistry and pharmaceuticals, a single patent normally covers a single product. Much conventional wisdom in the patent system is built on the unstated assumption of such a one-to-one correspondence.").

136. *See* Graham v. John Deere Co., 383 U.S. 1, 17-18 (1996) ("Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented.").

would be technically read into any claim.[137] If the answer is affirmative, the manufacture and sale of the accused product constitute literal infringement.[138] After considering the economic value of a patent, the all elements rule works to secure the profit of the patented product or process enjoyed by the patentee in the market.

The economic value of a patent is completely subject to the patentee's discretion in terms of selling the invention to the public.[139] As soon as patent infringement occurs as the result of the unauthorized implementation of any claim of a patent, the patent owner's dominion and control, particularly in terms of the patent's economic value, is diminished by an infringer.[140] During patent infringement, all or part of the economic value derived from the practice of a patent is anticipated to be legally divided between an infringer and third parties. Thus, the all elements rule seems to have an alternative meaning in terms of the economic value of a patent, as the all elements rule focuses instead on the technical value.

2. New Interpretation for Territoriality through Patent Economic Value

After considering the economic value of a patent, territoriality will not be dependent upon where the elements of a patent were technically practiced. Instead, territoriality may be used to probe the location of where the economic value of a patent is eventually aggregated.[141] The aggregation of economic value means that the patentee substantially enjoys the advantages in the market from the patent's economic value. The determination of the aggregate economic value may deliver an alternative justification for interpretation in the principle of territoriality.

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137. *See* E-Pass Techs., Inc. v. 3Com Corp., 473 F.3d 1213, 1221 (Fed. Cir. 2007) ("Under the 'all elements' rule, 'the doctrine of equivalents must be applied to individual elements of the claim, not to the invention as a whole' . . . . [T]he 'all-elements' rule may foreclose resort to the doctrine of equivalents where "the evidence is such that no reasonable jury could conclude that an element of an accused device is equivalent to an element called for in the claim, or that the theory of equivalence to support the conclusion of infringement otherwise lacks legal sufficiency.") (citations omitted).

138. *See id*.

139. *See* United States v. Univis Lens Co., 316 U.S. 241, 251 (1942) ("[W]hen the patentee has received his reward for the use of his invention," that law provides "no basis for restraining the use and enjoyment of the thing sold.") (citations omitted).

140. *See id*.

141. *See* Graeme B. Dinwoodie, *Developing a Private International Intellectual Property Law: The Demise of Territoriality?*, 51 WM. & MARY L. REV. 711, 768-69 (2009) ("Social and commercial structures that were predominantly national in the late nineteenth century have taken on a more international hue, creating a transnational marketplace where the grounding of national rights in national differences is less compelling.").

3. How Patent Value to Help Case Law for Interpretation of Divided Infringement

Recognizing a patent's economic value may address the issues posed by differing jurisdictional approaches to the all elements rule and territoriality. Importantly, the concept of patent economic value may allow for an interpretation of the all elements rule to be flexible enough to deal with issues of divided infringement. As mentioned above, divided infringement can be traced to the development of new technologies or business models. Importantly, divided infringement involves multiple participants practicing all elements of a claim without a single individual practicing all the elements. Such a concept has troubled courts in various jurisdictions that seek to preserve the all elements rule.[142]

a. U.S. Case Law Developed to Evaluate Divided Infringement

In the United States, courts have utilized the doctrine of vicarious liability to resolve disputes of divided infringement. In *Akamai Technologies, Inc. v. Limelight Networks, Inc.*, the United States Court of Appeals for the Federal Circuit concluded participants jointly engaging in the patented method as liable for infringement.[143] The court's decision seemed to focus on the fact that the responsible party had substantial influence over the activities of other participants in the practice of the patent method. Thus, the resulting practice of the patented method could be equitably attributable to the party's influence.[144] Importantly, the court concentrated upon who would "direct or control" others' performances to jointly facilitate patent infringement, though no party completely practiced any claim nor engaged in a joint enterprise of patent infringement.[145] Consequently, the court concluded that customers could not independently perform the function of tagging and serving content. Rather, the customers had to follow Limelight's conditions via the contract's terms.[146] Even though the patented method had been jointly

142. Festo Corp. v. Shoketsu Kinzoku Kogoyo Kabushiki Co., 234 F.3d 588, 608 (Fed. Cir. 2000).

143. *See* Akamai Techs., Inc. v. Limelight Networks, Inc., 797 F.3d 1020, 1022 (Fed. Cir. 2015) (en banc).

144. *See id*. at 1022-23.

145. *See id*. at 1022 ("Where more than one actor is involved in practicing the steps, a court must determine whether the acts of one are attributable to the other such that a single entity is responsible for the infringement. We will hold an entity responsible for others' performance of method steps in two sets of circumstances: (1) where that entity directs or controls others' performance, and (2) where the actors form a joint enterprise.") (footnote omitted).

146. *Id*. at 1023-25.

practiced by Limelight and its customer, the court held that Limelight committed infringement.[147] Following the *Akamai* case, the Federal Circuit seemed to solidify its position in reconciling the dispute between the all elements rule and divided infringement by addressing the direct or control criterion. In the case of *Eli Lilly v. Teva Parenteral Medicines*, a generic drug manufacturer, the defendant, was held to have induced infringement under Section 271(b).[148] Here, the generic manufacturer, via their label, had induced physicians to direct or control their patients to use the drug in an infringing manner.[149]

Likewise, the Federal Circuit extended the direct or control criterion to the cooperation of a business model in a case concerning a patent with the Transportation Security Administration (TSA).[150] In *Travel Sentry v. Tropp*, the patent-protected business model concerned the operation of a master key possessed by the TSA, which opened a special lock device used by consumers.[151] Divided infringement potentially occurred when parts of the step disclosed in the first claim of the patent were performed by the infringer, Travel Sentry, by selling the lock to consumers. Additionally, TSA potentially infringed the patent through its use of the master key to unlock the device.[152] The Federal Circuit, assessing the issue under its direct or control criterion, held that the infringer conditioned the planned business model through the practice of the claim and by directing TSA's timing and manner of executing the unlocking mechanism.[153]

b. Review for the Criteria for Determination of Divided Infringement

There has been a question as to whether the relationship between the parties is critical in issues of divided infringement. Certainly, the relationships existing between a social network service provider and the user, such as in the case of *Akamai Technologies v. Limelight Networks, Inc.*, or between a doctor, pharmacist, or patient, in the case of *Eli Lilly v. Teva Parenteral Medicines*, or between two collaborators, in the case of *Travel Sentry v. Tropp*, seems to be sufficient to infer the "direct or

147. *Id.* at 1025.
148. 845 F.3d 1357, 1368-69 (Fed. Cir. 2017).
149. *Id.* at 1365-68.
150. Travel Sentry v. Tropp, 877 F.3d 1370, 1385 (Fed. Cir. 2017).
151. *Id.* at 1372-74.
152. *Id.* at 1377.
153. *Id.* at 1376.

control" exerted by one party over another.[154] Nonetheless, an issue remains about the role of an existing relationship between the parties in the context of divided infringement.

There are at least two possible and contrasting opinions addressing that question. The first opinion points to the nature of vicarious liability, placing more weight on an existing relationship of the responsible party with other participants.[155] For example, a responsible party may utilize its pre-existing relationship to influence the decision of another party. Yet, the existing relationship is not definite, and thus, it may be difficult *ex-ante* to examine the relationships necessary to determine liability in divided patent infringement.[156] Currently, the types of relationships considered essential for divided infringement remain unpredictable. Moreover, the element of causation connecting a party's influence with patent infringement is not usually addressed by the courts.[157]

The second opinion shifts focus to the issue of "direct or control."[158] The relationship between an actor and a supervisor, under a theory of vicarious liability, seems to be inefficient in e-commerce situations where participants share in executing a patented system across an e-commerce transactions.[159] However, as the idea of decentralization adds interest to technological development and business models, the ease of commercial transactions enjoyed by users is vulnerable to the tendency of personalization. When users are given more autonomy over implementing a business strategy on a transaction system, the dominant role played by a technological supplier is inevitably diluted.[160] Thus, the

154. *See* Akamai Techs., Inc. v. Limelight Networks, Inc., 797 F.3d 1020, 1025 (Fed. Cir. 2015) (en banc); *see e.g.*, *Eli Lilly*, 845 F.3d at 1361; *see Travel Sentry*, 877 F.3d at 1380.

155. *See Akami Techs*., 797 F.3d at 1022-23; *see also* Karshtedt, *Causal Responsibility and Patent Infringement*, *supra* note 123, at 570 ("The vicarious liability fix is problematic as a matter of basic tort doctrine, provides limited guidance for future cases, and might fail to fit a large number of divided infringement scenarios in which liability might be warranted.").

156. *See* Karshtedt, *Causal Responsibility and Patent Infringement*, *supra* note 123, at 640 (extending comments on Professor Sachs's critique on the doctor-patient relationship under the *Eli Lilly* case for determination of divided infringement) (footnote omitted); *see also* Dmitry Karshtedt, *Divided Infringement, Economics, and the Common Law*, 67 FLA. L. REV. F. 329, 337-38 (2018).

157. *See* Karshtedt, *Causal Responsibility and Patent Infringement*, *supra* note 123, at 571-72, 636.

158. *See* Robinson, *Economic Theory, Divided Infringement and Enforcing Interactive Patents*, *supra* note 111, at 2004.

159. *See* Karshtedt, *Causal Responsibility and Patent Infringement*, *supra* note 123, at 595 ("This doctrine, therefore, simply does not fit the manufacturer-customer scenarios discussed here, for one generally has no right or ability to supervise one's customers.").

160. *See id.*

more freedom a user enjoys, the less domination by a technological supplier could be recognized.[161]

c. Patent Economic Value Driven to Interpretation of Divided Infringement

When determining patent infringement, the jurisprudence of the all elements rule begins by assessing the technical features of any claim embodied in the end product. However, the assessment of the technical features does not serve as the only probe into the core justification of the all elements rule. The economic value of a patent might also function as another benchmark, determining if all the elements of any claim have been illegally practiced.[162] Both the economic value and the technical value of a patent substantially serve as opposing sides of the same coin. While the economic value of a patent is justified by its technical value, the technical value of a patent will not be recognized in the market absent an analysis of the practiced claim.[163]

Rather than a paradigm shift, the economic value of practicing a claim in a market should have been on legislators' minds when they developed the existing regulatory scheme.[164] Though courts do not often emphasize a patent's economic value in interpreting infringement, moving forward courts should consider economic value as a current analyses may be incapable of dealing with emerging technologies.[165] Inevitably, the practice of any claim under a patent derives some of the economic value of the patent, and this value is intangibly reflected in the manufacture and sale of the patented or infringing products.[166]

161. As Professor Robinson addressed, on determining the "control or direct" concept for determination divided infringement, patent case law always requires the third parties should be contractually obligated to or in an agency relationship with the infringer. *See* Robinson, *Economic Theory, Divided Infringement and Enforcing Interactive Patents*, *supra* note 111, at 2004 (footnote omitted). Following such the interpretation for the cases of multiple participants taking part in the same electronic transaction, it seems evitable to face the anticipated difficulties on whether one participant has really controlled or directed another's activities during the transaction, *id.* (footnote omitted).

162. *See* Petherbridge, *supra* note 22, at 218-19.

163. *See id.*

164. *See id.* at 219-20.

165. *See* NTP, Inc. v. Rsch. in Motion Ltd., 418 F.3d 1282, 1317-18 (Fed. Cir. 2005). *See e.g.*, Holbrook, *Extraterritoriality in U.S. Patent Law*, *supra* note 14, at 2154-56; Holbrook, *Method Patent Exceptionalism*, *supra* note 123, at 1043-44; Holbrook, *What Counts As Extraterritorial in Patent Law?*, *supra* note 96, at 309.

166. *See* Petherbridge, *supra* note 22, at 218-19.

When dealing with issues of divided patent infringement, it seems feasible to adopt the economic value to provide a distinctive interpretation for the all elements rule. Though multiple parties are involved, the party who initiates the scheme should primarily be responsible for patent infringement.[167] Furthermore, using the economic value of a patent reduces unnecessary speculation as to the relationship across all the participants.[168] In particular, the capitalized cash flow among the participants may help get past hurdles normally at issue in divided infringement.[169] Simultaneously, the concept of the economic value of a patent in the interpretation of the all elements rule strengthens the significant connection between the responsible party and other participants under divided infringement, while reducing the need for courts to ascertain the technical meaning of a claim to understand the causation.[170]

When dealing with patent economic value, we may accordingly develop a new perspective of the all elements rule to support traditional vicarious liability for issues related to divided infringement.[171] It is worth noting that the approach of patent economic value provides a constant concept, without any exception, which indicates that the necessary result of the practice of any claim produces a corresponding economic interest in the market.[172] This approach would implement the all elements rule through the view of economic interest as soon as the multi-parties participated transaction or activity is done. The concept of economic interest may unite the split activity by a given participant, by instead considering the entire economic interest of any claim resulting from the joint contributions made by all the participants in the transaction. Rather than probing into the existence of dominion or control produced by one party over other parties, the approach of economic interest objectively

167. *See* Holbrook, *Method Patent Exceptionalism*, *supra* note 123, at 1049 ("It is far from clear why a method claim could not be infringed under the same reasoning as a system claim—the method is 'used' when someone puts it into service by demonstrating control and beneficial use.").

168. *See id.*

169. *See* Karshtedt, *Divided Infringement, Economics, and the Common Law*, *supra* note 156, at 341-43 (relying on innocent agency to emphasize the substantial influence the defendant has over third parties and suggesting that such influence is equivalent to direct infringement).

170. *See id.*

171. *See also id.* at 332-33.

172. *See also* Robinson, *Economic Theory, Divided Infringement and Enforcing Interactive Patents*, *supra* note 111, at 1995 ("The economic theories of the patent system are a useful tool to explain patent law's impact on inventors, innovation, and the commercialization of new technology. . . . When patent law is consistent with economic theory, presumably the patent law is performing its economic function.").

traces and follows the development of any transaction to find out who began the transaction scheme.[173] Furthermore, it seems to be less costly for the court to review relevant evidence concerning the subject matter of the transaction when resolving a challenge based on the all elements rule than on the "directs or controls" doctrine developed by the United States' patent case law.[174]

4. How Patent Value to Help Case Law for Interpretation of Territoriality

As mentioned above, the issue of divided infringement naturally extends to cross-border transactions in the era of e-commerce transactions. Aside from possible interpretation disputes concerning the all elements rule, another issue emerges when applying the principles of territoriality. Although territoriality involves the choice of applicable law and jurisdiction, I merely address the role of the jurisdiction for evaluation of patent infringement. Here, jurisdiction may be implicated when an act of direct infringement occurs, thereby entitling the patentee to further remedies.[175]

Consider again a previously described hypothetical of an online transaction platform.[176] Patent holder Y owns a patent for an online transaction platform and a related payment system, in which the patent is correspondingly and respectively registered in jurisdictions J1, J2, and J3. The patent claims three steps: S1, S2, and S3. S1 concerns the establishment and operation of the online transaction platform. S2 facilitates a transaction between parties when using the platform and system. Finally, S3 supports the payment system for any transaction in the platform by a financial entity. When party A implements the patent-protected online transaction platform, party A is practicing S1. Meanwhile, when parties C and D engage in a transaction on the platform, they necessarily invoke S2 of the patent. Lastly, when any party uses party B's payment system, such actions would implicate S3. During these

173. *See also id.*

174. *See* Muniauction, Inc. v. Thomson Corp., 532 F.3d 1318, 1330 (Fed. Cir. 2008) ("Under *BMC Resources*, the control or direction standard is satisfied in situations where the law would traditionally hold the accused direct infringer liable for the acts committed by another party that are required to complete performance of a claimed method.").

175. The following scenario is based upon such an assumption to develop for further discussion of the cross-border divided patent infringement.

176. The hypothetical is as follows: An online transaction platform established by A where C and D, users of the platform, make a digital transaction. B, meanwhile, works with A to facilitate payment services for any transaction.

events, parties A and B are located in J1, while parties C and D are respectively located in J2 and J3. This hypothetical illustrates the complexities of infringement in a cross-border transaction, whereby multiple, unique jurisdictions are implicated for the practice of only parts of a patent.[177] Though helpful as a starting point, the concepts of territoriality and the all elements rule are pushed to the edge when dealing with such scenarios of infringement. To overcome a blockage produced by traditional interpretations, some scholars and courts have proposed devise workarounds to deal with the issue of territoriality and the all elements rule.[178]

a. The Essentiality-Oriented Approach and Cross-Border Infringement

There are at least three possible theoretical approaches to resolving issues related to the interpretation of territoriality. First, the essentiality-oriented approach looks at the technical feature behind the claim, evaluating whether a patent holder Y may assert their exclusive rights, requesting remedies against an infringer in a case of multi-participant and cross-border divided infringement.[179] Under the essentiality-oriented approach, courts evaluate, using principles of claim construction, which step in the claim, e.g., S1, S2 or S3, is the most "essential" among the three steps.[180] For example, if after construing the claim, the most essential step of the patent occurs during S1, then patent holder Y would bring a lawsuit in jurisdiction J1 against party A for infringement.[181]

As support for this approach, the value of the patent is premised on the technical feature present in S1, entitling patent holder Y to the entire lost value occurring from infringement of the patent. However, this is rebutted by the two inherent problems impacting the applicability of the essentiality-oriented approach. First, claim construction is usually

177. *See generally* Holbrook, *Extraterritoriality in U.S. Patent Law*, *supra* note 14, at 2154-56.

178. *See* Michael Brody et al., *Extraterritorial Application of U.S. Patent Laws*, 18 SEDONA CONF. J. 187 (2017); *see* Bernard Chao, *Patent Imperialism*, 109 NW. U. L. REV. ONLINE 77 (2014).

179. *See* Romandini & Klicznik, *supra* note 103, at 532 (referring to "the 'essential elements' approach").

180. *See id.*

181. To determine whether an element of step is essential to a claim, it seems inevitable to probe into its technical contribution beyond prior art in the view of patentability. *See* Holbrook, *Extraterritoriality in U.S. Patent Law*, *supra* note 14, at 2159-60 (suggesting that the test for whether a step is essential to a claim requires a probe into its technical contribution, or "the patentably distinctive test") (footnote omitted).

analyzed in relation to a patentability requirement or during patent infringement cases.[182] For example, claim construction allows courts to compare the proposed invention with relevant prior art to determine if such an invention is patentable. Similarly, in the context of infringement, claim construction allows for the court to compare the accused product to that of the patented invention. Rarely, there is any occasion where the court wishes to compare and evaluate all the elements or steps to determine which is the "most" essential in terms of their technical features.[183] Moreover, every foreign jurisdiction has developed its own approach to claim construction and claim construction has yet to be harmonized across differing jurisdictions.

Thus, consider, for example, if a court in jurisdiction J1 does not recognize S1 as the most essential step in the claim, while simultaneously a court in jurisdiction J2 rejects S2 as the most essential step. Meanwhile, a court in jurisdiction J3 doesn't accept S3 to be the most essential step. Under this circumstance, the patent holder Y will be unable to seek remedies for infringement in all the jurisdictions of J1, J2, and J3. By contrast, consider if a court in the jurisdiction J1 recognizes S1 as the most essential step in the claim, while a court in the jurisdiction J2 interprets S2 as the most essential claim. Yet, a court in the jurisdiction J3 concludes S3 to be the most essential step. In such a situation, the patent holder Y may successfully assert its exclusive rights against the practice of S1, S2, and S3 in the respective jurisdictions J1, J2, and J3.[184] Here, a serious problem emerges when courts in various jurisdictions interpret the most essential component portion of a claim differently.

Second, even when a court determines what is the most essential step in a claim, there continues to be a conceptual gap to support an ultimate finding of patent infringement. As addressed earlier in this Article, a patent awarded for a given invention implies that the invention has an independent, technical value that goes beyond relevant prior art.[185] However, patent jurisprudence has never directly addressed the role of sub-contributions of an element to a given step.[186] Likewise, patent law

182. *See id.*

183. *See id.* at 2160.

184. *See id.* ("Indeed, there could be multiple aspects of the invention that distinguish it from the prior art. This test provides no answer as to which law governs if those two aspects are in different countries.").

185. *See generally* 35 U.S.C. §§ 101, 102, 103, 112.

186. *See* Holbrook, *Extraterritoriality in U.S. Patent Law*, *supra* note 14, at 2160 ("The entire concept of a particular 'patentably distinctive' aspect of an invention harkens back to the rejected concept of the 'heart' or 'gist' of the invention. There need not be a singular, defining

has never definitively established that a party practicing the most essential element or step is entitled to the total damages resulting from infringement, eschewing any rights or value afforded to less essential sub-elements or steps.[187]

Ultimately, a court's interpretation of the essentiality of an element may contravene future development of patent law. Although bound by established doctrines and statutes related to novelty, courts are unlikely to ignore the technical contributions made by other elements or steps in the same claim, or the functional synergy when all the elements or steps work together.[188] Likewise, courts have always emphasized the evaluation of the whole claim to probe whether the invention would satisfy the requirement of non-obviousness without giving differential weight to an individual element or step.[189]

b. The Server-Oriented Approach and Cross-Border Infringement

The "server-oriented approach" looks to the entity initially engaging the online transaction system and considers that entity's activity as the most significant in the completion of any online transactions.[190] This approach relies upon where the server hosted by the entity is located, i.e., the relevant jurisdiction, to decide the liability of the entity for the divided patent infringement.[191] For example, party A establishes the online transaction platform and invites cooperation from party B, while facilitating an online transaction between parties C and D. Here, party A plays the primary role in the whole online transaction system, even though the transaction occurred across many borders and jurisdictions, e.g., J1, J2 and J3, and included multi-party activities. To determine if party A should bear responsibility for the resultant divided patent infringement in J1, a court's core inquiry would be to ask whether the server hosted by party A is located in J1. If the answer is affirmative, party A's liability for divided patent infringement is justified.

feature of an invention that is key to its patentability, which renders this test difficult, if not impossible, to apply.") (footnote omitted).

187. *See, e.g.*, Timothy R. Holbrook, *Extraterritoriality and Proximate Cause After WesternGeco*, 21 YALE J. L. & TECH. 189, 225 (2019) (commenting on the approach adopted by the U.S. Supreme Court for resolution of the dispute on the cross-border patent damages).

188. *See* Mark A. Lemley, *Point of Novelty*, 105 NW. U. L. REV. 1253, 1259-60 (2011).

189. *See id*.

190. *See* Romandini & Klicznik, *supra* note 103, at 532-33 (describing the "claims-based approach," which is preferred by the courts in the United Kingdom).

191. *See id.*

On the surface, this approach seems more pragmatic, compared with other approaches, for determining the responsible party under divided infringement as the server hosted in the jurisdiction provides core evidence to make a conclusion of liability.[192] However, after careful review of the approach, two questions remain concerning the viability of such an approach in cases of cross-border divided infringement. First, the location of the server provides more information about patent infringement within the jurisdiction than is usually addressed in the choice of applicable law and jurisdiction.[193] There is little basis in patent jurisprudence as to why the server's host in a given jurisdiction should be considered the initiating infringer in a cross-border and multi-participant online transaction.[194] Merely resting upon the server to decide the infringer under such a complicated circumstance of divided infringement is substantially weak and formalistic, lacking a firm theoretical basis for such an inference.[195] Second, when touching upon the technical view in the cross-border and multi-participation online transaction, it is not rare to encounter a situation where there is more than one server in a given system.[196] Thus, this approach falls into the predicament the first approach faced in the evaluation of essentiality among all the servers.

c. The Market-Oriented Approach and Cross-Border Infringement

i. The Market-Oriented Approach and Economic Interest

The "market-oriented approach," representing the more popular approach, shifts the analysis to the economic impact of practicing a claim in a given market.[197] There are two characteristics that make the approach distinctive. First, this approach prefers an assessment based on the economic value of the patent, rather than the patent's technical value.[198] Importantly, this approach does not concern itself with claim construction

192. *See id.*

193. *See* PAUL GOLDSTEIN & MARKETA TRIMBLE, INT'L INTELL. PROP. L. 69-70 (5th ed. 2019).

194. *See* Romandini & Klicznik, *supra* note 103, at 533-34.

195. *See* Akami Techs., Inc. v. Limelight Networks, Inc., 797 F.3d 1020, 1022 (Fed. Cir. 2015) (en banc).

196. *See* Romandini & Klicznik, *supra* note 103, at 533-34.

197. *See id.* (describing "an economic-prescriptive approach"); *see also* PATENT LAW: A HANDBOOK ON EUROPEAN AND GERMAN PATENT LAW, *supra* note 40, at 757-58.

198. *See* PATENT LAW: A HANDBOOK ON EUROPEAN AND GERMAN PATENT LAW, *supra* note 40, at 765.

such as to ask which step is the most essential element.[199] Rather, this approach derives the economic value from the practice of a patent as the benchmark to determine in which jurisdiction such value occurs.[200] If the jurisdiction is the one where the patent is registered, the patentee may bring suit for infringement against the party practicing the patent in the same jurisdiction. Therefore, this approach averts the traditional issues caused by multiple participants engaging in cross-border activities. Second, this approach relies upon a patent's economic value as derived from the benefit accrued by a customer in a given market, thereby recognizing divided infringement occurring across borders, yet still ascertaining the culpable party.[201]

However, consider for example, if it is proven that party A operates the online transaction platform and party A's customers (parties C and D) enjoyed the patent's value in J1. Party A will be held liable for cross-border divided infringement.[202] Interestingly, there may be instances where customers C and D received economic value from the patent in their own countries, and party A merely receives economic value via a service agreement with parties C and D. Here, it is worth questioning the role of party B, the online payment mechanism supplier, has played in facilitating infringement. Under this approach, it may be difficult to ascertain whether party B would be considered a joint infringer or merely party A's customer. This scenario highlights the issues of this approach. By focusing on the illegal exploitation of the patent in a given domestic market, the approach neglects to assess the relationships between all the participants in a given online transaction.

ii. Patent Value to Extend Application of Market-Oriented Approach

The approach I propose in this Article, assessing infringement based upon the economic value of a patent, shares the merits of both "the server-oriented approach" and "the market-oriented approach," yet addresses the issues raised by critics on territoriality during cross-border divided infringement.[203] Rather than focusing upon the location of the server to

199. *Id.* at 751-53.

200. *See* Holbrook, *Extraterritoriality in U.S. Patent Law*, *supra* note 14, at 2154-56.

201. *See id.*

202. Based upon the concept of the market-oriented approach, since the payment of C and D for the online transaction service offered by A is expected to flow into J1 under the control of A, the economic value of the patent in-suit embedded in the service will be shown in the aforesaid payment and recognized by patent law in the J1.

203. *See also* Romandini & Klicznik, *supra* note 103, at 532-33 (footnote omitted).

solve the problem of territoriality, my proposed approach interprets territoriality as a determination of divided infringement, following the direction of the entire economic interest produced by practicing any claim of a patent.[204] If the economic value is directed predominately to the jurisdiction where the patentee holds the original patent, the patentee may seek remedies for infringement.[205] Thus, as soon as the related jurisdiction is determined, whoever established the patented online transaction system may be thought of as the starter and assignor of the corresponding patent economic interest in the market. According to such an interpretation, a patent's economic value will hold the party establishing the patented system as liable for cross-border, multi-participant patent infringement.[206]

Additionally, this approach builds upon "the market-oriented approach" when dealing with an issue of territoriality.[207] The market-oriented approach is concerned with the patent's economic value in a market, yet fails to evaluate sub-elements being practiced elsewhere, which may bring economic value to a different market. When the party orchestrates the patented system to invite corporations from other parties while facilitating the users for the online transaction, such a party has unrightfully earned the economic interest derived from the patent value in the jurisdiction it is located. Even though the party starting such a system substantially assigns part of the economic interest to other parties, including the users, it cannot be denied that the economic interest results from the practice of the patent in the market in the jurisdiction. According to the approach of patent economic value, the economic interest is an embodiment of the patent's value, which was transferred to the party who illegally practiced any claim in the patent.[208] As a consequence, when the entire economic interest for the patent value is confined to a single jurisdiction, it is justified for a patentee to bring suit for infringement.[209]

For example, under party A's online transaction platform, the patent protected subject matter is practiced in J1 where both is located and where the patent is registered. Through parties B, C, and D share the patent's economic value by virtue of their agreements with party A, J1 remains the relevant jurisdiction when dealing with infringement. Thus, patent holder

204. *See* Keyhani, *supra* note 87, at 303.

205. *See* Holbrook, *Extraterritoriality in U.S. Patent Law*, *supra* note 14, at 2160 ("More importantly, nearly all of these effects-based tests focus exclusively on the impact on U.S. markets and ignore the intellectual property policies of the relevant foreign countries.").

206. *See id.*

207. *See* Romandini & Klicznik, *supra* note 103, at 532-33.

208. *See id.*

209. *See id.*

Y may assert infringement against party A caused by an online transaction between parties C and D in J1. Therefore, I adopt the approach of using a patent's economic value, in conjunction with the traditional market-oriented approach, to resolve issues related to territoriality.

VI. CONCLUSION

Traditionally, in litigating patent infringement, courts tend to interpret the all elements rule and the territoriality principle in accordance with their views of a patent's technical features of the technical feature of the patent. However, with emerging technologies, the application of the all elements rule and the territoriality principle has generated unpredictable challenges that constitute a serious threat to the innovation-driven legislative goal of patent law. Although focusing on the claim construction of a patent's technical features may delimit the patent's scope, the patent's technical features remain vulnerable to interpretation when considering future applications of the technology. As the Article explored, there is continued disputes related to interpretation of the all elements rule and the territoriality principle that remain worthwhile to address. For example, multi-participants participating in an online transaction across borders presents questions related to infringement. There, the problem is whether and how we could hold such transactions and platforms liable for the resulting infringement.

This Article attempts to adopt the approach of patent economic value to break through the difficulty of the traditional interpretation of the all elements rule and the territoriality principle. Rather than relying on the technical aspects of a patent, this Article posits another method based upon the economic interest produced by the practice of the patent in the market. By analyzing the how the assignment of derived economic interest impacts a patent, this Article provides a new interpretation to the all elements rule and the territoriality principle.