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Lee Nari

Exclusion and coordination of fragmentation

– Five Essays Toward a Pluralistic Theory of Patent Right

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ABSTRACT

Technological advances have dramatically increased the types and quantity of intellectual and useful commercial innovations. The significance of intellectual creation and innovation leads to increasing claims for rights over the tangible values that they capture and generate. With the example of debates surrounding patents on information and communication technologies (ICT), five essays collected in this volume look into a particular coordination problem of fragmentation that the claims and right to patent held by many actors cause. In ICT industries, sheer number of rights and claim holders may fragment the rights and technology, and may discourage efficient use of innovation. Coordination of the fragmented claims, before, during and after the rights are granted, may ameliorate the negative impact. However, as exclusive rights influence incentives and coordination both negatively and positively, this research claims that provision of a governance mechanism is as important as exclusion provided by right.

The presence of fragmentation highlights the significance of a governance mechanism to continuously coordinate the interests of the multiple claim-holders and users in the process of innovation. Governance mechanism may be provided by various institutions - legislation, court, administrative agencies and private parties in the market. Thus, this dissertation claims that a solution to coordinate fragmented patent rights ultimately needs to first resolve a question of institutional choice. Regardless whether the solution is private ordering, utilizing the formal and informal creation of norms in the market, or public ordering, involving various institutions of the law, the judiciary, and administration, a single-institution centric solution inevitably downplays the role of alternative institutional arrangements that minimize the impact of fragmentation. In conclusion, the research calls for an institutional comparison on both positive and negative impacts of institutional arrangements, ultimately entrusting the institution at less imperfect position with a particular decision making competence.

Key words: Patent Law, Exclusion, Governance, Coordination, Fragmentation, Institutional Comparison.

ABSTRAKTI

Teknologinen kehitys on lisännyt voimakkaasti immateriaalisten ja kaupallisesti hyödyllisten innovaatioiden määrää ja lajeja. Innovaatioiden ja immateriaalisten luomusten merkittävä rooli johtaa lisääntyviin vaateisiin oikeuksista niiden tuottamaan ja hyödyntämään konkreettiseen arvoon. Käyttäen esimerkkinä informaatio- ja kommunikaatioteknologian patentteihin liittyviä kiistoja, viisi tähän teokseen koottua esseetä tarkastelee useiden toimijoiden hallussa olevien vaateiden ja oikeuksien aiheuttamaa erityistä koordinaatio-ongelmaa – sirpaloitumista (fragmentoitumista). Oikeuksien ja vaateiden haltijoiden suuri määrä voi IT-teollisuudessa pirstoa oikeuksia ja teknologiaa ja siten jarruttaa tehokasta innovaatioiden hyödyntämistä. Sirpaloituneiden vaateiden koordinointi voi oikeuksien myöntämistä ennen, sen aikana sekä sen jälkeen lievittää fragmentoitumisen kielteistä vaikutusta. Koska yksinoikeudet vaikuttavat kannustimiin ja koordinaatioon sekä kielteisesti että myönteisesti, hallintamekanismilla varautuminen on yhtä tärkeää kuin ulkopuolisten poissulkeminen. Fragmentoituminen lisää hallintamekanismien merkitystä monien vaateiden haltijoiden ja käyttäjien jatkuvassa koordinoinnissa innovaatioprosessin aikana. Hallintamekanismeja voivat tarjota erilaiset instituutiot – lainsäädäntö, tuomioistuimet, hallintoelimet sekä markkinoiden yksityiset toimijat. Siksi on koordinoitaessa fragmentoituneita patenttioikeuksia ensin tehtävä institutionaalinen valinta. Riippumatta siitä, onko ratkaisuna tukeutuminen markkinoiden muodollista ja epämuodollista sääntelyä hyödyntävään yksityisautonomiaan tai julkiseen sääntelyyn, joka hyödyntää erilaisia oikeudellisia instituutioita kuten lainsäädäntöä, oikeuslaitosta tai hallintoa, yhteen instituutioon keskittyvä ratkaisu vähättelee sirpaloitumisen vaikutusta vähentävien vaihtoehtoisten institutionaalisten ratkaisujen roolia. Lopuksi tutkimus peräänkuuluttaa institutionaalisten ratkaisujen myönteisten ja kielteisten vaikutusten vertailua ja mahdollisuutta antaa päätöksentekovalta sille elimelle tai toimijalle, joka parhaiten kykenee selvittämään parhaan mahdollisen ratkaisun.

Avainsanat: patenttioikeus, yksinoikeus, hallinta, koordinaatio, fragmentoituminen (sirpaloituminen), institutionaalinen vertailu

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Nari Lee
April, 2010

Contents

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FIGURES

Part I.
Overview and summary

1. Introduction

1.1. BACKGROUND OF THE STUDY

In the past few years, technological advances have dramatically increased the types and quantity of intellectual creation and useful commercial innovations. The significance of intellectual creation and innovation leads to increasing claims over the tangible values they capture and generate. In response to this, intellectual property laws in major industrialized countries have expanded the subject matter to include most human endeavors.[1] These expansionist changes in law have raised concerns about their potential negative impacts not only on the scientific and research communities but also on competition and innovation.

One impact of expansionist change in intellectual property is the emergence of multiple stake-holders surrounding a particular innovation or technology. In other words, a quantitative increase in the protectable subject matter has led to a quantitative increase in the claim-holders, before, during and after the right is granted or acquired. Subsequently, unless there is a proportional increase in the doctrines in law that allow access and provide exceptions to the users, the expansion unilaterally increases the quantity of the stake-holders in a right, either as licensee or as potential infringer.

Fragmentation is a result of a combination of changes in the legal context and increasingly global modularization of production and competition in the market place. The changes in laws and competition in the market place and the quantitative increase in claim-holders and users make fragmentation of rights covering one technological area nearly inevitable. In certain industries where research is cumulative and the development incremental, fragmentation of rights is believed to cause an underuse of intellectual works and technology.[2] Thus firms and private actors are required to devise various institutional measures to strategically manage and transfer valuable commercial information, without having to resort to the protection and enforcement of intellectual property.

Additionally, with the development of information and communication technology (hereinafter ICT), firms increasingly globalize their operations and modularize the production process, from product design to development and offering. Furthermore, as patent subject matter now includes various aspects of human endeavor and processes, the use of the invention is no longer limited to the firm-

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[1] See, among others, Lee, Nari (2005), *The Patent Subject Matter Reconfiguration and the Emergence of Proprietarian Norms - The Patent Eligibility of the Business Methods.* 45 IDEA, The Journal of Law and Technology 321.

[2] Details are elaborated in Publication 3 in this book. See also Heller Michael A. & Eisenberg, Rebecca. S. (1998). *Can Patents Deter Innovation? The Anticommons in Biomedical Research.* Science 280, 641-78; Shapiro, Carl (2001) *Navigating the Patent Thicket: Cross Licenses, Patent Pools and Standard Setting,* IN: Jaffee, Adam, Lerner, Josh, and Scott Stern eds. Innovation Policy and The Economy, Vol.1, National Bureau of Economic Research (NBER), MIT Press; 119-150.

based industrial exploitation. For example, in the case of computer program and business method related inventions,[3] the inventive process does not necessarily require high investment costs or production facilities. It may simply require an ingenious computer programmer who is skilled in the art. At the same time, innovation in this industry can be used regardless of the location of its tangible production facilities. Innovation in the ICT industry is produced, used and commercialized on a truly global scale. For example, any innovation utilizing the Internet or a communication network implies multiple geographical points where the users can be located. In this sense, the actual uses and exploitation of the innovation are increasingly fragmented.

To regulate the uses and exploitation and to settle disputes over the uses of exploitation, national legislative and judicial institutions are pressured to devise rules to pool these fragmented uses and exploitation of innovation into coordinated and governable right that can be adjudicated in a forum. In sum, fragmentation of rights and the uses brought forth by the recent changes in market practices and the law highlight the importance of coordination in the study of intellectual property. This study focuses on the interaction between the fragmentation caused by the expansion of exclusive rights and coordination of fragments.

1.2 OUTLINE OF THE STUDY

This dissertation consists of two parts. Part I, including this introduction, presents an overview of the research topic and the overall findings of the research. Part II consists of five essays discussing particular aspects of the research topic.

Part I is divided into three main sections. The first chapter, in Section 1.1, provides background and the starting point of the research. Section 1.3 identifies the gap in the previous research and provides motivation for the study. Section 1.4 sets out the research objectives. Section 1.5 describes the methodology generally used in intellectual property law research and the relevant methodology. Chapter 2 describes and summarizes individual essays. The final chapter, Chapter 3, incorporates the individual research findings of the essays and presents the theoretical and policy implications of the research. Additionally, limitations and further relevant research questions and oversights are discussed in Chapter 3, to suggest a research agenda for a follow-up study.

Part II is composed of five research papers published between 2005-2009, in different forums and publication series, examining different aspects of the research topic. Each essay is structured differently and the research motivation for each essay is different. However, they commonly study fragmentation of a patent right and the uses of the underlying innovation and how patent law treats the problem of fragmentation. In particular, fragmentation and coordination in patent law is studied from the point before the right is granted, *ex ante*, until the point where a patent right is granted and enforced, *ex post*.

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[3] *Supra* note 1. See also Shapiro (2001), *supra* note 2.

1.3. THEORETICAL BACKGROUND

1.3.1. Theories on Intellectual Property

Creative expression and invention, which are the core subject matter of intellectual property rights, are intangible. Furthermore, they often have what economists call the characteristics of public goods, such as air and public defense system. [4] This means that the use of knowledge is non-rival – use by one person does not preclude use by another. While production is costly, once it is produced, it does not require additional resources to reproduce them. For the society, maximum efficiency may thus be achieved by promoting sharing by the most.[5] However, the intangible and fluid nature of knowledge is such that once produced, it is difficult to exclude its uses by others. Without any means of exclusion or any means of recouping the costs of production, there will be free-riding of the benefits. This, in turn, decreases incentives to produce. In other words, externalities and the dissipation of the benefit would lead to underproduction of this type of goods. Thus, the market for knowledge will not be formed without institutional interference because of the lack of an incentive to produce and disclose.

The right of exclusion provided by the law of intellectual property is often explained as one such institutional arrangement which allows a market to be formed.[6] The exclusive right of intellectual property provides a legal means of exclusion that deals with the problem of incentives and dissipation of benefits due to free-riding.[7] This market-based solution through the exclusive right of property is deemed to be the least intrusive or a more efficient form of solving the problem of underproduction compared to such alternatives as public production, private patronage, public subsidy, and prizes.[8] The classic role of the intellectual property institution is understood as providing incentives to produce and transfer innovation and creation by grants of exclusive property rights. As such, it either complements other incentivizing mechanisms that exist in the market or creates incentives where such law-driven incentives are necessary to solve the problem of underproduction.

This economic explanation for having an intellectual property right often forms the foundation for the theorization and normative justification of the intellectual property law. However, the superiority and efficiency of the intellectual property law over other means of providing incentives have been repeatedly questioned by scholars. Scholars, both in law and economics, have repeatedly engaged in finding a general theory to explain and assess the efficacy of the intellectual property institution. As fully explained below, in Part II, this enquiry has generated volumes of work, but a generally applicable theory of intellectual

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[4] See for example, Scotchmer, Suzanne (2004) Innovation and Incentives, MIT Press at 31: Foray, Dominique (2004) Economics of Knowledge, MIT Press at 113-130.
[5] See Foray (2004), *supra* note 4 at 116.
[6] See Foray (2004), *supra* note 4 at 109, also at 131-164, Scotchmer (2004), *supra* note 4 at 31.
[7] See Tamura, Yoshiyuki (2006), Chitekizaisan Hou [Intellectual Property Law] 4th edition, Tokyo: Yuhikaku, explaining the system of intellectual property rights from the point of incentive.
[8] For a discussion of these alternatives, see Kingston William (1987) ed Direct Protection of Innovation. Dordrecht: Kluwer, and Foray (2004), *supra* note 4.

property either claiming or disclaiming its overall superiority over other institutional arrangements still does not exist.[9]

Regardless of the absence of a coherent uniform theory, the intellectual property has now become part of most countries' system of property rights, partially due to the WTO-TRIPs agreement obligating WTO member states to provide a minimum level of protection for seven types of intellectual property.[10] The absence of a general theory justifying the intellectual property rights despite the pervasive adoption of these rights begs the question of fundamental justification. Thus over the years, a majority of the legal research on intellectual property theory rightfully starts from the justification for and against general intellectual property protection.[11] However, as the laws of intellectual property are considered complex, more often the majority of the works have been written on a particular interpretation of a domestic intellectual property law and a positivistic description of the law and changes in it, and court decisions. Foreign case laws and legal concepts in foreign doctrines are introduced as a way to provide an alternative way of constructing a domestic concept that may later be used in describing domestic case laws.[12]

As interests surrounding intellectual property became more politicized, more commentaries started to acknowledge the global political dimension of the intellectual property law and critically assess the impact of exclusive rights in national and global economies. For example, researchers critically questioned the justification for introducing new types of subject matter for protection,[13] and for introducing new intellectual property-like rights.[14] Likewise, commentators were

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[9] See among others, Oddi, A. Samuel (1996) *Un-unified Economic Theories of Patents – the Not-Quite-Holy-Grail,* 71 NOTRE DAME L. REV. 267; Lemley, Mark A. and Burk, Dan L. (2003) *Policy Levers in Patent Law.* 89 VIRGINIA LAW REVIEW, 1575 at 1595-1630, discussing heterogeneous theories of intellectual property both in economics and law; and Mazzoleni Roberto and Nelson, Richard (1998) *The benefits and costs of strong patent protection: a contribution to the current debate*, 27 RESEARCH POLICY.273–284, reviewing four strands of economic theories. For details see Publication 1 in Part II of this book, below.

[10] WTO Agreement on Trade-Related Aspects of Intellectual Property Rights, art. 28, Apr. 15, 1994, 33 I.L.M. 81 (1994) [hereinafter TRIPs Agreement]. For a commentary on the TRIPs agreement, see Friedrich-Karl Beier, and Schricker Gerhard (ed.) (1996) FROM GATT TO TRIPS : THE AGREEMENT ON TRADE-RELATED ASPECTS OF INTELLECTUAL PROPERTY RIGHTS, IIC studies, Vol. 18 Weinheim: VCH Verlagsgesellschaft; and Gervais, Daniel (2008) THE TRIPS AGREEMENT, DRAFTING HISTORY AND ANALYSIS, 3rd Edition, Sweet & Maxwell.

[11] See Drahos, Peter (1996) A PHILOSOPHY OF INTELLECTUAL PROPERTY. Aldershot: Dartmouth; Merges, Robert P and Ginsburg Jane C. (2004) ed. FOUNDATIONS OF INTELLECTUAL PROPERTY: Foundation Press. Hettinger E.C. (1989) *Justifying Intellectual Property*. 18 PHILOSOPHY AND PUBLIC AFFAIRS 31.; Hughes J. (1988) *The Philosophy of Intellectual Property*. 77 GEORGETOWN LAW JOURNAL 287.; Lemley Mark (2004), *Ex Ante Versus Ex Post Justifications for Intellectual Property,* 71 U. CHI. L. REV. 129.

[12] This seemingly pragmatic way of using a legal concept thus may fall short of what Coleman calls a pragmatic conceptualism, as it does not involve any conceptual analysis. Coleman Jules (2001) THE PRACTICE OF PRINCIPLES, IN DEFENCE OF A PRAGMATIC APPROACH TO LEGAL THEORY. Oxford University Press.

[13] See, for example, in patent, Lee (2005), *supra* note 1, Burk, Dan L. (2000) *Patenting Speech*, 79 Tex. L. Rev. 99; Bakardjieva-Engelbrekt, Antonina (forthcoming) *Jurisdictional and Institutional Aspects of Stem Cell Patenting in Europe (EC and EPO)*, In Torremans P. and Plomer A. (eds.) *Embryonic Stem Cell Patents: European Patent Law and Ethics* (Oxford, Oxford University Press, forthcoming), reviewing and discussing the controversy over patenting new aspects of human endeavor.

[14] See, for example, Lessig, Lawrence (2000). *Cyberspace and Privacy: A New Legal Paradigm*? 52 STAN. L. REV. 987, discussing privacy protection as intellectual property, and Reichman J.H. & Pamela Samuelson. (1997). *Intellectual Property Rights in Data*? 50 VAND. L. REV. 51, discussing intellectual property protection in data.

sceptical toward an extension of duration of existing rights,[15] which may or may not be normatively justified at the national or international level.[16]

Most intellectual property research is still involved in the task of theorizing the best means to achieve an optimal mix of incentives of exclusion and access to innovative knowledge and creation. In patent theorizing, scholars also increasingly started to use various concepts of economics and property theories, such as monopoly[17], patent prospects,[18] competitive innovation,[19] cumulative innovation,[20] anti-commons[21] and patent thickets,[22] to model the innovation process and analyze the impact of patent law on innovation, and *vice versa*.[23] On the other hand, the absence of a unifying theory may indicate that a general theory of intellectual property may be so general that only agreement on the goals of the intellectual property system can be made, and not the precise means to implement such goals.[24] This may explain why there are various heterogeneous theories to describe, justify, explain and sometimes propose to emulate exclusive rights of intellectual property.[25]

Another explanation for the heterogeneity of theories may be that institutional arrangements surrounding the uses of intangible resources require policy considerations beyond the incentive of exclusive right balanced against disclosure

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[15] In the discussion in the US, the term extension led to a dispute over the constitutionality of the particular legislation, Copyright Term Extension Act (CTEA), in *Eldred v. Ashcroft*, 537 U.S. 186 (2003); for commentary and discussion, see Samuelson, Pamela (2003) *The Constitutional Law of Intellectual Property After Eldred v. Ashcroft,* 50 J. Cop. Off. Soc'y 547. In Europe, similar debates started when the EU Commission introduced a proposed amendment on copyright term extension for performers' right in 2006, "*Proposal for a European Parliament and Council Directive amending Directive 2006/116/EC of the European Parliament and of the Council on the term of protection of copyright and related rights,* COM/2008/0464 Final / COD 2008/0157. This change was made despite impact studies warning against such extension. e.g. *The Recasting of Copyright & Related Rights for the Knowledge Economy* (2006), Institute for Information Law (IViR), University of Amsterdam for DG Internal Market, Text available online <http://www.ivir.nl/ publications/other/ IViR_Recast_Final_Report_ 2006.pdf>. This is an independent review commissioned by the European Commission (DG Internal Market). It sparked criticism across Europe. See, for example, Kretschmer, M. et al. (2008) *Creativity Stifled? A joint academic statement on the proposed copyright term extension for sound recordings.* European Intellectual Property Review (EIPR) 30(9): 341-347, which was signed by leading 50 European academics. At the time of writing, the European Parliament voted in favor of the proposal with a modified text of 70 years' term extension on the first reading and it is now at the Council of Ministers. <http://www.europarl.europa.eu/sides/getDoc.do?type=TA&language=EN&reference=P6-TA-2009-0282 > [cited on 26.4.2009].

[16] See for example, Yu, Peter K.,(2006) *TRIPs and Its Discontents*. 10 Marquette Intellectual Property Law Review 369, and Oddi, A. Samuel. (1996). *TRIPs – Natural Rights and a "Polite Form of Economic Imperialism?"* 29 vand. j. of transnat'l law. 425.

[17] Schumpeter, Joseph A.(1942) , Capitalism, Socialism And Democracy at 88 and 106 (Harper & Row, 3d ed, 1950)

[18] Kitch, Edmund W. (1977). *The Nature and Function of The Patent System*. 20 Journal of Law and Economics 265. On the criticism, see Publication 1 in this book, at 235-237. (original pagination).

[19] Arrow Kenneth J. Arrow, (1962) *Economic Welfare and the Allocation of Resources for Invention, in* The Rate And Direction Of Inventive Activity: Economic And Social Factors 609 (Richard R. Nelson ed., Princeton Univ. Press).

[20] Scotchmer, Suzanne (1991) *Standing on the Shoulders of Giants: Cumulative Research and the Patent Law,* 5 J.Econ. Perspectives 29, Merges, RP. & Richard R. Nelson, (1990) *On the Complex Economics of Patent Scope*, 90 Colum. L. Rev. 839.

[21] Heller and Eisenberg, (1998), *supra* note 2

[22] Shapiro, *supra* note 2.

[23] Lemley (2004), *supra* note 11

[24] Burk and Lemley, *supra* note 9, at 1577.

[25] *Ibid*. See also Publication 1, Part II of this book.

and access. Exclusive rights allow innovators or the producer of the knowledge to rely on the right to recoup the cost of investment. However, an efficient use of resources requires coordination of the uses of the resource or flow of such uses. Coordination is more crucial for the uses of intangible resources, because simultaneous and independent but duplicative production and use is not resolved by exclusive right alone. Exclusion may provide a system of production of the resources. However, exclusive rights alone may fail to provide order among conflicting and overlapping multiple claim-holders, and governing the uses of the resources and manage the flow of uses, i.e. *how such uses may be coordinated*, before, during and after the rights are claimed and granted.[26]

1.3.2. Exclusion and Coordination in Intellectual Property Theories

Fundamentally, intellectual property rights grant the right-holder the right to exclude others from engaging in certain types of conducts that are defined as infringement in law. In regards to patents, such conduct is harmonized to a degree under the TRIPs agreement[27] and harmonized remedies for infringement of intellectual property include both injunction and damages.[28] This right to exclude and the presence of injunctive relief characterizes the rules concerning patent right in particular, a property rule regime that requires permission prior to use, as opposed to a liability rule regime based the idea that the infringer pays a fee after the use and will not be enjoined from the use .[29]

In the tangibles, the boundary of the object of a right is mostly physically definable and the right-holders may show ownership by physically possessing the tangible object. Even in the case of a paper title being used, as in the case of ownership of an immovable such as land, specifying the boundary of the object is physically possible. In contrast, in intellectual property, the boundary of an abstract object is drawn based on the action of using a legally constructed intangible object (invention or expression) that is not limited by the tangible boundary of the medium (product, process or work).[30] The actual boundary is shown where one engages in some conduct that would require authorization from the right-holders. Thus, the right to exclude is specifically limited to those activities defined in law.

Furthermore, a right to exclude can be enforced in two ways. It may be enforced strictly under the property rule by enjoining the trespasser from such ac-

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[26] Hess Charlotte and Ostrom, Elinor (2003) *Ideas, Artifacts, And Facilities: Information As A Common-Pool Resource* 66 Law & Contemp. Probs. 111. See also discussion in Publication 3, in this book, Part II.
[27] TRIPs agreement, *supra* note 10, Article 28.
[28] TRIPs agreement, *supra* note 10 , Article 44-45, In Europe, EC Directive 2004/48/EC Article 11 and Article 13. *EC*. O.J. L 195, 2.6.2004 p. 16–25 [Hereinafter EC Enforcement Directive], obliging member states to make both injunctive relief and damages available. Similarly, in the US, 35 USC §283, §284, however, subject to *eBay, Inc. v. MercExchange*, L.L.C., 547 U.S. 388 (2006), and In Japan, Japanese Patent law, *infra* note 83, §100 and §102.
[29] In the context of property, this is explained as property rules versus liability rules. See Guido Calabresi & A. Douglas Melamed, (1972). *Property Rules, Liability Rules and Inalienability: One View of the Cathedral*, 85 Harv.L.Rev. 1089. As applied to intellectual property right, see Reichman J. (1994) *Legal Hybrids Between the Patent and Copyright Paradigms*, 94 Colum. L. Rev. 2432.
[30] See for example, Sherman Brad and Bently Lionel (1999) The Making of Modern Intellectual Property Law. Cambridge: Cambridge University Press at 47-50, comparing the pre-modern concept to the modern concept of intangible property, as an action to an object.

tion, thus forcing the user to enter into a license agreement with the right holder before every action. On the other hand, a right to exclude may be enforced under the liability rule by requesting the trespasser to pay a fee after such action has occurred. Currently, the enforcement of the intellectual property right is a mix of these two types of rules.

Moreover, the right to enjoin others is sometimes subject to judicial discretion. For example, the text of the United States statutes provides that the courts may grant injunctions and the discretion of the court has been highlighted in the *eBay* decision.[31] In Europe, a national patent law may incorporate different texts, but the text of the enforcement directive leaves room for discretion to the member state by informing member states that the judicial authorities may grant injunctions.[32] In contrast, the text of the Japanese patent law provides that the patent right-holder is entitled to an injunction as the right to request an injunction is part of the patent right and that the discretion of the court is limited.[33] However, case laws and academic opinions suggest the possibility of using the scope and the object of an injunction flexibly.[34]

This highlights that the right of exclusion provided by the intellectual property law is not complete and that the rules of intellectual property are a mixture of property rules and liability rules. Furthermore, this indicates that it is too simplistic to characterize intellectual property only from the perspective of exclusion. Since the object of a right is a combination of action over an abstract thing, the right not only excludes others from the specified abstract object, but also coordinates and governs the actions of users.

The governance or coordination perspectives are found in particular in the literature using the economic approach to property law, partly because economists view property right as a right governing particular uses of resources. This definition of property right has been adopted in some of the early American law and economics literature and they consider coordination in the discussion of property rights governing tangibles. For example, Demsetz initially observed that the emergence of property rights is to internalize the external beneficial and harmful effects.[35] This observation implicitly connects the emergence of intellectual property rights to coordination controlling the uses of resources, which otherwise could be held in common. However, coordination is studied as a justification for creating property rights to internationalize the externalities of benefits and disadvantages over the uses of commonly held tangible resources.

Closer connection of coordination to the exclusive right of intellectual property arises later in the work of Kitch.[36] While drawing an analogy between the mining

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[31] 35 USC §283, and *eBay, Inc. v. MercExchange, supra* note 29.
[32] EC Enforcement Directive, *supra* note 28, Article 11.
[33] Japanese Patent Law , *infra* note 83, §100.
[34] See for example, Electrodeposited Image Case, 1764 Hanrei Jihou 112 (Tokyo D. Ct., Sept. 20, 2001), and Tamura Yoshiyuki (2009), Tokkyohouno Riron (The Theory of Patent Law), at 335-368, Yuhikaku. Japan.
[35] Demsetz, Harold (1967) *Toward a Theory of Property Rights*, 57 The American Economic Review 2: 347-359.
[36] Kitch, *supra* note 18.

claim and the patent system, Kitch advanced the patent prospect theory favouring an early grant and broader patent right over a known technological possibility and argued that this is because the right-holder will be in an ideal position to "to coordinate the search for technological and market enhancement of the patent's value."[37] Landes and Posner extended this argument to copyright.[38] They observe that the exclusive right of property over creation prevents premature exhaustion of the values generated after the creation, and proposed a system of indefinitely renewable copyrights.[39] Other authors similarly explored the provision of property rights over intangible resources stating that this positively coordinated with the use of the resource from the standpoint of information costs. For example, focusing on the information cost of an innovative process, Long claimed that the informational aspects of patent signals further research and thus coordinates the innovation process.[40]

Similarly, Smith focuses on information cost and uses the concept of governance (rights of uses) versus exclusion as two alternative strategies.[41] He argues that the modularity provided by an exclusion strategy (i.e. property rules) manages coordination better than a governance strategy (i.e. liability rules), because it can mitigate high information costs.[42] Kieff goes one step further. Coordination is the central thesis in Kieff.[43] He connects the coordination of an individual's activities to the intellectual property, in the context of competition and access.[44] He compares coordination based on intellectual property to alternative institutional arrangements such as market-based individual transactions (i.e. contract) without a property right, norm communities, firms, government[45] and claims that the coordination of individual actions based on these institutional arrangement in the absence of an intellectual property right may lead to anti-competitive effects and decrease downstream access – a negative type of coordination.[46]

In the sense that they employed coordination as a central conceptual tool to analyze the institutional arrangement of intellectual property and that alternative institutional arrangements were compared, the above literature makes a valuable contribution to the discourse of intellectual property. Furthermore, the observation that intellectual property facilitates coordination may be true when the boundary of the property is clear and the rights are enforced.[47] However, whether the exclusive right of intellectual property is preferable to alterative arrangements

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[37] Kitch *supra* note 18 at 276.
[38] See Landes William and Posner Richard (2003) *Indefinitely Renewable Copyright* 70 U Chi L.Rev 471.
[39] Landes and Posner, *Ibid* at 475 and 485. For a detailed discussion, see Publication 3, Part II in this book at 18-20 (original pagination).
[40] Long, C. (2002) *Patent Signals*, 69 U. Chi. L.Rev..625.
[41] Smith, Henry E. (2007) *Intellectual Property as Property: Delineating Entitlements in Information,* 116 Yale Law Journal 1742.
[42] *Ibid. F*or a critique of using the modularity perspective, see Carrier, Michael A. (2007) *Why Modularity Does Not (and Should Not) Explain Intellectual Property*. 117 The Yale Law Journal Pocket Part 95.
[43] Kieff, F. Scott. (2006). *Coordination, Property and Intellectual Property: An Unconventional Approach to Anticompetitive Effects and Downstream Access*. 56 Emory Law Journal 327 at 354-379.
[44] *Ibid*.
[45] *Ibid* at 354-370.
[46] *Ibid* at 370.
[47] Lemley, Mark A. and Weiser, Phil, (2007) *Should Property or Liability Rules Govern Information?* 85 Texas Law Review 783.

must be examined by empirical evidence. Additionally, none of these alternative arrangements studied exist entirely without the underlying exclusive rights. In the studied examples, the alternative governance regimes never completely substitute intellectual property but rather complement the intellectual property regime as a means to adjust scope of rights. Thus the claim that intellectual property is preferable is not strongly supported by the evidences that they cite and their recommendation may not be so different from the recommendation from earlier law and economics property scholars advocating the creation of a strong property right. Ultimately, they advocate strong exclusive rights, because among others things, a strong exclusive would lead to a "good type of coordination."[48]

In sum, the property-centric coordination thesis boils down to two core normative recommendations. First, *exclusive rights with a broader scope and injunctive relief coordinate the uses of the resources better than the other alternatives*. Secondly, as a corollary, *the right to coordinate multiple uses after the grant of the first right should be concentrated in the right-holder*. In other words, they recommend existing rights broader in scope with a stronger form of remedy. Making existing rights stronger and broader is arguably one way to minimize the coordination problem because this will lead to relatively fewer rights and thus fewer transaction costs. However, it is questionable whether it would justify more rights. Furthermore, a property-based solution for positive coordination needs to meet the challenges of the observations claiming that exclusive rights cause a problem of coordination in certain situations – in particular, fragmentation of rights.

1.3.3. Fragmentation Caused by Exclusion

In contrast to the above property-centric approach, a few influential studies on the impact of patent grants on new subject matter, particularly biotechnology and software, claim that exclusion cause the fragmentation of rights. In this context, *they imply that exclusive rights either negatively influence the coordinating use of resources, or at least create demands for a further governance mechanism that would coordinate the uses*.

Earlier, Heller claimed that where there are mutually exclusive rights over the same object of a property right, the core of the rights may become fragmented, resulting in underuse.[49] Using the example of the post-Soviet store front being underused during the transition period, Heller claimed that many rights with a mutually and equally exclusive effect make it difficult to pool the fragments into a usable bundle and results in the underuse of resources. He termed this underuse as anti-commons problem. Heller and Eisenberg applied the anti-commons problem to biotechnology inventions in the United States.[50] They claimed that the narrow yet mutually exclusive patent rights over upstream technology (i.e. DNA gene fragments) causes problems regarding the downstream commercial innovation that

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[48] *Id*. 435-436.
[49] Heller Michael (1998), *The Tragedy of the Anticommons: Property in the Transition from Marx to Markets,* 111 Harv. L.Rev 621. See also discussion Publication 3, Part II, *infra*, at 20-23 (original Pagination.)
[50] Heller and Eisenberg (1998), *supra* note 2.

has to use upstream technology since the multiple fragments of rights create accumulated costs. Similarly, Shapiro claimed that not only narrow scope but broad yet overlapping exclusive rights subject the SW industry to a patent thickets problem.[51]

Collectively, they documented that the *combined* impact of expansionist change in American patent law, leading to grants of multiple rights surrounding one technology or one innovative subject matter area, and cognitive bias in the right holders behaviours result in underuse of resources. In particular, this discouraged alternative institutions from emerging to govern problem of fragmentation.[52]

Broader and strong exclusions have been questioned earlier in the works of Scotchmer,[53] Mazzoleni and Nelson[54] and Nelson and Merges.[55] In particular, Shapiro, in a similar context, argued that even in the case of fewer and broader patents, when they overlap in one or a similar technological area, right-holders need to license from each other, clearing the overlapping area of technology.[56] This thicket of permissions may lead to the underuse of technology and unless a collective solution to manage the thicket emerges, exclusive right may lead to an underuse of the innovation. Thus, under these conditions, the exclusive right of patent is seen to hinder rather than promote innovation.

In particular, the concept of anti-commons that describes the negative impact on coordination caused by property rights has spurred much follow-on literature, both in law and economics. Additionally, anti-commons, as a "tragedy" of the under-utilization of resources caused by a rational choice, has stimulated empirical studies, regardless of whether the problem can be empirically verified or falsified.[57] In the United States property literature, anti-commons spurred semi-commons thesis to complete the spectrum of perspectives from commons, anti-commons, semi-commons and the private for property rights.[58] In particular, Smith develops the semi-commons theory including a mix of private rights and commons, which illustrates the case of intangible resources under current intellectual property protection.[59]

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[51] Shapiro (2001), *supra* note 2. See also Burk and Lemley (2003) *supra* note 9 at 1610-1615, that anti-commons and patent thickets are two of the problems cause by intellectual property due to complementarity problems.
[52] Heller and Eisenberg (1998) *supra* note 2.
[53] Scotchmer (1991), *supra* note 20.
[54] Mazzoleni and Nelson (1998), *supra* note 9.
[55] Merges and Nelson (1990), *supra* note 20.
[56] Shapiro (2001), *supra* note 2.
[57] See for example, Walsh, Arora and Cohen (2003), *Research Tool Patenting and Licensing and Biomedical Innovation*, IN W.M. Cohen and S. Merrill, eds. Patents in the Knowledge Based Economy. Washington, DC: National Academies Press at 285340.
[58] See Smith, Henry E. (2000) *Semicommon Property Rights and Scattering in the Open Fields*. 29 Journal of Legal Studies 131-169, introducing the concept of semicommons, and Loren, Lydia Pallas (2007) *Building a Reliable Semicommons of Creative Works: Enforcement of Creative Commons Licenses and Limited Abandonment of Copyright.* 14 Geo. Mason L. Rev. 271 (2007), applying the concept of semicommons to describe the creative commons project. Creative commons is a project that drafts and recommends a set of standardized copyright licensing terms, with a view to create relatively open norms for sharing the copyrighted works. The work was pioneered in the US, with Lawrence Lessig as a key person. See http://creativecommons.org/ for more information and see evaluation of Elkin-Koren, Niva (2005) *What Contracts Can't Do: The Limits of Private Ordering in Facilitating a Creative Commons*. 74 Fordham L. Rev. 375.
[59] Smith, (2000), *supra* note 58.

1.3.4. Theoretical Position of this Research

As reviewed above, there are growing literatures on the impact of exclusive rights on coordination, both in legal and economic research. However, the recommendations seem to be divided along the normative position on whether the exclusive right of intellectual property is beneficial or harmful to coordination and who or which institution is at the best position to promote or regulate coordination. Scholars seem to agree on the point that the rights and uses surrounding a specifiable intangible resource or technological prospect are increasingly becoming fragmented and that they require a governing mechanism for coordination. The disagreement seems be on the causes and solution to the fragmentation and how and if the intellectual property rights should be or can be calibrated in the face of fragmentation.

The division in normative positions may be partially due to the gap in law and practice. Innovation is a heterogeneous and multi-faceted process. As a continuous process, innovation is dynamic and the relationship surrounding and generated by this process is fluid, flexible and often complex. In contrast, when intellectual property is framed as a property, it is inevitably compared to the institution of property rights over tangibles based on the binary relationship between an object and the corresponding right, where the boundary of the right is physically clear. In intellectual property, especially in the context of patent, even where the rights are registered and based on a paper title, the scope of the object is never clear, until disputed and specified by the court. Viewed through the lens of property, intellectual property in the innovation process may be viewed as part of the available resources to be used, controlled and appropriated, while in fact it could very well be an action and a process. In short, both academically and practically, a substantial gap exists between perspectives on the production, use and transaction of innovation and the production, use and transaction of intellectual property.

In the context of patent, fragmentation resulting from multiple sources, multiple claim-holders and multiple uses seems to be one indication of the discrepancy between the binary model of innovation used in law and the actual underlying process of invention and creation. If an invention is derived from the action of a single actor, a so-called stand-alone invention, then it is plausible to coordinate uses of many others by concentrating the right to control all forms of uses to the single actor. This may also be easily justified because the invention could not exist without the input of the single actor. However, in practice, sources of an invention are plural and many actors may create the inventive concepts in no particular order, or may even use the same inventive concept simultaneously. Unless an invention is so unique and pioneering, it is natural that the initial entitlement to apply for a patent is fragmented, as there will be multiple claim-holders and contributors. After the grant of a right, an invention may be simultaneously used by the many with no particular physical spatial order or limitation. Thus, multiple uses of an invention after the grant of patent may fragment a right.

Previous research considers coordination by highlighting it in regard to post-grant coordination of multiple uses, including those of after-arising technologies

and improvements. However, as argued above, fragmentation in patent may be observed in other contexts as well, because multiple actors may participate in all stages of innovation, not simply in the use of the granted rights and inventions. In particular, there are at least three further types of fragmentation that may be observed in the context of patent, in which exclusive right as such does not provide positive coordination: *(1) fragmentation in the entitlement prior to the grant of right (2) fragmentation of the rights after the grant of right, (3) geographical fragmentation of the right during enforcement.* They need to be discussed in the context of coordination and exclusive right and this research will explore them.

(1) Fragmentation to the entitlement prior to the grant of right[60]

Innovation is becoming an increasingly open and collaborative process.[61] Even when firms engage in closed and in-house R&D, they may employ multiple researchers to participate in the project. When multiple actors participate in the process of innovation, the right to file for the patent itself could be fragmented. Thus even before the patent right is granted, there will be questions as to who has the right to file for patent concerning the innovation. The contribution of each party may vary in terms of its quality (i.e. financial input or mental inputs) and quantity.

The fragmentation in the entitlement calls for coordination before the grant of right, among the collaborators about who would file and manage the patent application as well as during the prosecution and enforcement of the right. This is because fragmentation in the entitlement for the patent often results in either joint proprietorship among the parties (joint inventorship, co-ownership) who collaborated or the sole right of the right-holder who manages the patent.[62] When only exclusion is emphasized, the interests of an inventor to use his own contribution to that invention may be ignored. When claimed as joint proprietorship, a strong exclusive right held by each joint owner fragments the right to the extent that assertion of the right against the third party may be prevented.

(2) Fragmentation of rights, post grant[63]

In earlier works on property rights, authors have used the metaphor of a bundle of rights to correctly describe the various aspects of rights and interests that are protected and regulated as property right under the law.[64] A similar description is also possible for intellectual property. The core of a patent right, for example, is the right to exclude others from engaging in certain types of activities, and thus it is possible to describe it as a bundle of exclusive rights. The right can be divided according to the particular uses that require authorization from the right-holder

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[60] See, Publication 5, Part II *infra*.
[61] Chesbrough, Henry (2003) Open Innovation: The New Imperative for Creating and Profiting from Technology, Boston: Harvard Business School Press.
[62] See, Publication 5, Part II *infra* at 82-83 (Original Pagination).
[63] See, Publication 2 and Publication 3, Part II, *infra.*
[64] For example, see the discussion in the US, Ellickson Robert C., Rose Carole M., and Ackerman Bruce A. ed. (1995). Perspectives on Property Law. Second Edition. Boston New York: Little Brown and Company; for the discussion of other metaphors, see Rose, Carol M. (1994) Property and Persuasion. Essays on the History, Theory and Rhetoric of Ownership. Westview Press: Boulder.

and thus, the right-holders may exercise their right by licensing particular fragments of uses. Field of use licenses are typical examples. As in the property right to tangibles, intellectual property rights may become subject to fragmentation. Such fragmentation has often been studied in the context of competition or antitrust law in particular, whether such fragmented licensing is pro-competitive or anti-competitive.[65]

In addition to this, after the grant of the right, fragmentation can exist in the *form of concurring multiple rights* held by multiple right-holders over a single core "object". This type of fragmentation is a direct result of the expansionist legal change involving new subjects of patent (i.e. software and biotechnology). Earlier literature sometimes discussed this as a problem of blocking or dependent patents (i.e. a right that overlaps in scope that cannot be used without permission of another right-holder).[66] However, when the scope of enquiry is expanded to a downstream product, it may be possible to see fragmentation that is not present in a single patented invention but in the cluster of patents covering a complex systems technology or a group of solutions and tools geared for a downstream product. An innovation in the product market, in this context, requires coordinating the fragments of rights or a clearance. Furthermore, to compete in the market for a complete product, firms need to coordinate the multiple fragmented uses. As reviewed above, the problem of anti-commons or patent thickets is a coordination problem due to concurrence of rights.[67]

(3) Geographical Fragmentation of Patents[68]

Geographic fragmentation is both factual and legal. A right may become fragmented as there is no uniform intellectual property law that has a universal effect. All rights are still national in origin and thus territorial in effect. Right-holders need to appropriate and enforce rights nationally. Multiple rights may be held in *parallel* by one right-holder, based on one invention. Fragmentation is a direct result of the territoriality principles of law and patent right and thus, the solution is seen to be more procedurally oriented.

Additionally, a right may become geographically fragmented by facts, when a right is *readily divisible into different uses* and can substantively be practiced in modules. As discussed above, an intellectual property right encompasses bundles of uses that may be decomposed into various actions. When certain action is regulated in one country as infringement, but not in others, the right and its enforcement may be fragmented geographically.

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[65] See, for example, Patterson, Mark R. (2008) *The competitive effects of patent field-of-use licenses* IN, Drexl, Josef. ed. (2008) Research Handbook on Intellectual Property and Competition Law, Edward Elgar Publishing, at 162-200.
[66] See, Merges and Nelson (1990), *supra* note 20.
[67] See text accompanying *supra* note 49 to 57.
[68] See Publication 4, Part II, *infra.*

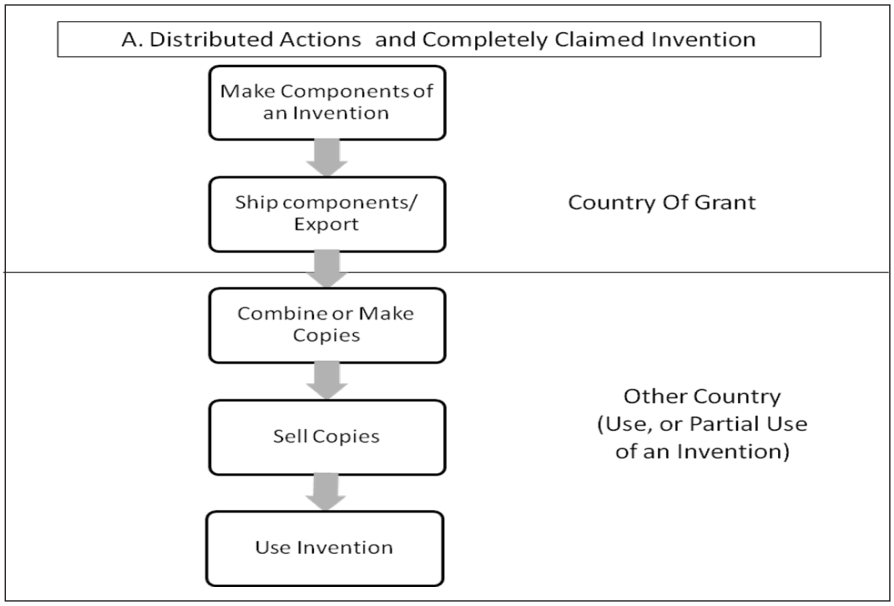

Figure 1. Distributed Act of Use and Geographical Fragmentation of a Right.

As Figure 1 illustrates in the context of a patent, the right-holder of a complete set of claims may yet choose to use the invention in a modular manner. A firm may typically produce a product that embodies the invention by manufacturing parts and components of that invention and ship them abroad to be combined. Firms often do this to exploit production factors such as labor and logistical costs for the distribution of the finished products. However, as the right of exclusion can be decomposed into different uses, shipping or exporting components may be regulated differently from the distribution or sale of a complete product.

Another example of the substantive geographical fragmentation of a right is so-called distributed claiming. Because the patent system is based on the textual description of functional subject matter, the text of the claims requires interpretation to enforce the right, in terms of the infringing technology.[69] However, in Internet-related inventions, patent claims may adopt the multiple perspectives of the users and be drafted in a distributed manner, as Figure 2 below illustrates. In such a case, if the invention is in the combination, the final complete set of claims may be used by the end-user, and not the intermediaries who may provide an instrumental device or services for such use. In these contexts, the rights are geographically fragmented and the actors who coordinate the actions and uses of the invention and the right-holder are not necessarily the same.

[69] Lee, Nari (2000) Technological Change and Regulatory Heterogeneity. Vaasa: Research Papers. Proceedings of the University of Vaasa at 67-144.

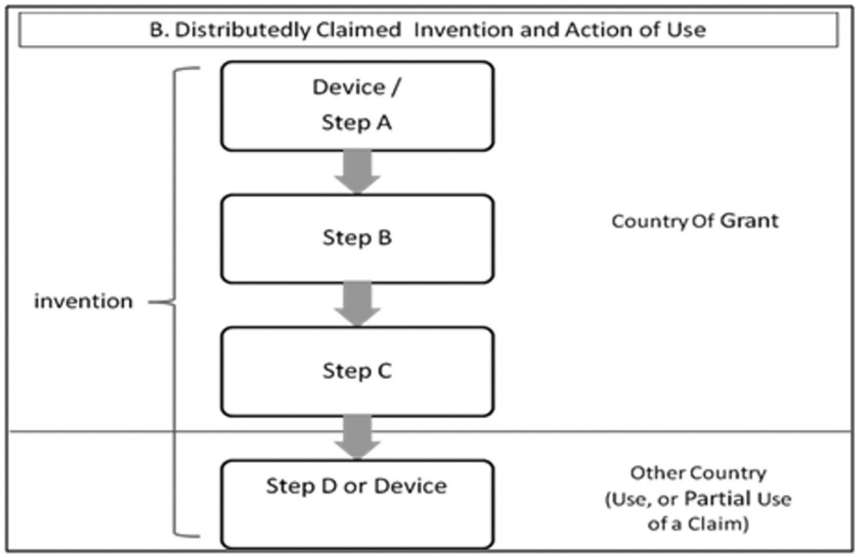

Figure 2. Distributed Claims of a Patent and Geographical Fragmentation.

1.4. RESEARCH OBJECTIVE

The purpose of this research is to bridge the gap in research by focusing on the aspects of fragmentation that have previously been under-researched and by re-examining the means of coordinating the fragmentation. In particular, the essays collected in this study together question *if the exclusive right of patent promotes or hinders coordination of fragmentation and, if so, what are the alternative institutional arrangements for coordination.*

The essays examine the fragmentation of the rights and use caused by grants of exclusive rights on new subject matter, in particular – modern information processing and computer program technology. They explore the impact of patent right on the innovation of these technologies and the impact of exclusion on coordination in the innovation process. Collectively, they aim to challenge the binary model of knowledge production and right, and explore the implication of coordination and fragmentation, in patent theories. In particular, they explore a pluralistic patent theory reflecting multiple focal points in the construction of the right, actors and institutional choices.

The essays focus in part ICT industry and computer program inventions. Coordination in the ICT industry is deemed to be of greater necessity because most of the today's end-user informational processing products are so-called complex systems products. In other words, a product often consists of various parts and modules that are independent products while at the same time generating synergistic commercial values as a system. Product complexity also means that the relationship governing one product and the entitlements related to it

becomes fragmented. Fragmentation makes the coordination of titles and rights essential, not only just for a specific process of product development, but also for overall innovation in the industry. Coordination to integrate the fragmented rights may have positive effect beyond the negative type of coordination with monopolistic inclination or may even be a necessary condition to compete in the complex systems product market.

Additionally, firms may manage the complexity of production modularly - by disintegrating some of its facilities in a modular way, to gain efficiency and outsource production, sometimes to multiple jurisdictions. Modular production means innovative technologies may be produced or used partially, and not in their entirety, and often under different legal settings and institutional arrangements. Further innovation may occur as a combination of one part of the product with that of others and in some cases innovative combination may be accomplished by the final end-users of the modules or system products.[70]

The above considerations imply plurality of actors and institutional arrangements. Thus the study aims to connect the exclusion provided by intellectual property, namely patent right, to the coordination of resources, and reviews various institutional arrangements surrounding patent rights, in order to overcome fragmentation. This study claims that when fragmentation is caused by changes in law that create additional right-holders, efficiency gains in the coordination by having a property right over that particular subject matter may be lost. Furthermore, by employing a *multi-institutional perspective*,[71] the study emphasizes that all institutions with coordination processes that clarify the fuzzy boundaries of rights, pool fragments and provide a governing hierarchy need to be considered in the proposals for solutions. In this context, the research argues that focusing only one means of promoting coordination may fail to correctly assess the alternative institutional arrangements.

The study aims to bring a pluralistic and process-oriented perspective to the theories of intellectual property and, in particular, to the discussion of patent right. The intangible knowledge that the right represents is non-rival in nature, and can be used simultaneously by many without reducing the value of each use. Patent right does not necessarily have a correlating binary subject matter of protection or a subject matter of use. For example, licensing of patent or copyrighted material presupposes that the scope of authorization is clear, and the relationship of the licensor and the licensee is clearly understood, analogous to that of buyer and seller of tangible goods. However, in the context of intangible innovation, a right does not necessarily cover a single discrete market product and function

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[70] See Strandburg, Katherine J. (2008) *Users as Innovators: Implications for Patent Doctrine*, 79 U. Colo. L. Rev. 467.

[71] See Bakardjieva-Engelbrekt, Antonina (2007) *Copyright from an institutional perspective : Actors, itnersts, stakes and the logic of participation.* 4 Review of Economic research on Copyright Issues 65; Rai, Arti (2003) *Engaging facts and policy: a multi-institutional approach to patent system reform* . 103 Colum. L. Rev. 1035, at 1039, highlighting the need to engage in comparative institutional analysis.; Tamura, Yoshiyuki (2008) *Towards the New Paradigm of Intellectual Property Law. The Law and Policy of Intellectual Property: Building a new framework*, 20 Intellectual Property Law and Policy Journal 1 (in Japanese, unpublished English translation on file with the author.)

as a single input to the final product.[72] Attributing intangible inputs to concrete outputs in information goods is extremely difficult.[73] As economists explain, intangible resources may be produced by multiple actors and used by multiple actors. Underlying knowledge governed partially by intellectual property may be produced by multiple actors and used as inputs into multi-component products or intermediate products. Furthermore, the difficulty of attribution is due to the very abstractness or intangibleness of the subject matter that the intellectual property right is based on. The binary relationship of an object and the exclusive right does not exist in the intellectual property right and the relationship between an "abstract object" and exclusive right is almost purely legal convention. Thus the attribution of the inputs to the output must also be based on legal convention.

Legal convention, in many senses, does not apply to the actual transaction of useful or creative knowledge and the expression. Trading of useful knowledge and creative expression requires communication beyond the transaction of formalized title to the property against payment. Binary transaction may be applicable when the goal of transaction is just for the sake of gaining the necessary permission to use a well-defined knowledge to avoid litigation. However, when the exchange is to learn and use the innovation, this assumption may collapse because the exchange has to be less transactional and more relational and continuous. This is because the knowledge specified and clearly governed by a right may often be insufficient to commercialize the innovation and the tacit knowledge transfer must be separately agreed, with or without the exclusive property rights. In this context, the study aims to highlight the *contradiction between legal convention and the actual practice of knowledge exchange*.

1.5. RESEARCH METHODOLOGY

1.5.1. Review of Jurisprudential Methodologies

The discussion of the research methodology in jurisprudence has various strands. A strict categorization of methodology for a general theory may not be as useful in intellectual property theory. However, it is still possible to broadly distinguish legal theories based on methods that are used in terms of the selection and treatment of sources and conceptual tools and the purposes of such selections and apply it to this research.

Debates on general legal research methods distinguish methods of legal research as analytical, ethical and sociological.[74] Further categorization may yield such general divisions as interpretative, conceptual analysis, empirical analysis, and normative advocacy. Generally, a survey of the debates on the methodology of legal theory leads to a division into two large category of methodology – descrip-

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[72] See, for example, Ullrich, Hanns (2008) *Patent pools - policy and problems*. IN: Drexl ed. (2008), *supra* note 65: 138-161, at 143.
[73] For an excellent account of an abstract object in the history of English patent law, seec Sherman and Bently (1999), *supra* note 30.
[74] Stone, Julius (1956) The Province and Function of Law, Harvard University Press.

tive and analytical methods.[75] In general, it is believed that the purpose of using descriptive methodology is to find a descriptive criterion to find and better understand "the law" among its many sources. Descriptive methodology often viewed as having a theoretical penchant for legal positivism, for its reliance on authoritative sources, in Dworkin's terminology "rules".[76] In contrast, the analytical method is used to build a theory for a normative argument. Because this method is used as a means of building an internal and interpretative analysis, relying on moral rules or standards, it is often associated with normative theories.[77]

There are countless books and articles on the debates defending each position as the proper methodology of jurisprudence, and this study will not recount these debates.[78] However, these methodology debates in legal research are tied to the philosophical debates on the nature of law and authority, and *they seem to indicate that the choice of a methodology may have meaning beyond the simple organization of the sources, and materials, but also the methodology may implicate substances of the research*.[79] In intellectual property, the selection of the methodology may thus mean a differing stance on the philosophical justification of the right and limitations to such rights.[80]

Furthermore, at close inspection, the boundaries of methodologies are quite often fuzzy and interlinked, and most legal research unavoidably adopts both descriptive and analytical methods. Conceptual analysis based on descriptive jurisprudence is necessary to emulate and justify normative changes.[81] Similarly, to a certain extent, most legal research utilizes all these methodologies - conceptual analysis, normative advocacy, interpretive and to an extent limited empirical analysis based on disputed cases and practices.

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[75] Compare the debates between Dworkin and Hart on descriptive and analytical jurisprudence, Dworkin, Ronald (1977) Taking rights seriously, Harvard University Press, and Dworkin, Ronald (1986) Law's Empire, Harvard University Press, and Hart, H.L.A. (1961) The Concept of Law. Claredonen - Oxford University Press. 2nd Edition with Postscript (1994), edited by Bullock, P.A. and Raz J.

[76] Dworkin, Ronald (1977) *supra* note 75 at 17-22, describing and criticizing the legal positivism of Austin and Hart. For a review of positivist legal theory in Europe, see Spaak, Torben (2003) *Legal Positivism, Law's Normativity and the Normative Force of Legal Justification*. 16 Ratio Juris 469 at 471-472.

[77] Dworkin, Ronald (1977) *supra* note at 22-31.

[78] See, for example, the follow-up and characterization of the debates, See Leiter, Brian (2003) *Beyond the Hart/ Dworkin Debate: The Methodology Problem in Jurisprudence, 48 American Journal of* Jurisprudence *17*, Raz, Joseph (1985) *Authority, Law, and Morality*, 68 The Monist 295 and Finnis, John (2000) *On the Incoherence of Legal Positivism*, 75 Notre Dame Law Review 1611. For a review of positivist legal theory in Europe, see Spaak, Torben (2003) *Legal Positivism, Law's Normativity and the Normative Force of Legal Justification*. 16 Ratio Juris 469 at 471-472. See also Halpin, Andrew (2006) The *Methodology of Jurisprudence: Thirty Years Off the Point.* 19 Canadian Journal of Law and Jurisprudence, 67-105.

[79] See Ratner Steven R, and Slaughter Anne-Marie (1999) *The Method is the Message*. 93 Am. J. Int'l L. 410.

[80] See Drahos, Peter (1996) A Philosophy of Intellectual Property. Dartmouth.

[81] For example, Dickson tries to offer a path between descriptive or normative methodology. Spaak argues that legal positivist can accept morality. Dickson J, (2004) *Methodology in Jurisprudence: A Critical Survey*. 10 Legal Theory 117. Spaak (2003), *supra* note 78. Similarly, Coleman's pragmatic conceptualism is a modification of positivism by using conceptual analysis in core legal concepts. Coleman (2001) , *supra* note 12.

1.5.2. Research Methodology of this Study

The methodology employed in the essays in this study involves conceptual analysis, interpretative dimension and normative advocacy across jurisdictions, and levels of ordering – both private and public ordering. This is inevitable for legal research in a global context.[82] While a systematic empirical analysis is not adopted as a method in this study, the practices in cases of dispute and patent examination practices as well as private ordering provide a limited glimpse into what an empirical study may reveal.

In the descriptive part of the research, the study uses the primary sources of law. Primary sources including statutes and case laws that have authority over patent right as well as administrative examination guidelines of the patent offices have been selected and studied in two jurisdictions of Japan[83] and the United States[84] and to a certain extent in Europe, by focusing on the European Patent Convention[85]and decisions of board of appeal at European Patent Office (EPO). Wherever relevant, primary sources in specific national jurisdictions in Europe have been selectively studied. International conventions that are related to the grant and assertion of patent rights, in particular the TRIPs agreement, are also reviewed.[86]

The secondary sources have been selected from multiple disciplines, including commentaries of law, economics and organizational research. This is because legal commentaries alone, either descriptive or interpretative, may offer little information on how fragmentation of rights may be coordinated. Fragmentation is a factually interdisciplinary phenomenon, caused or exacerbated by law or legal change, and demands organizational inputs from economic actors. Thus, one part of this study complements the knowledge of patent law with process-oriented insights from the organizational study of firm – a capability perspective.[87] An efficient use of intangible resources requires coordination of not only individuals with claims or entitlement to the resources but also coordination governing the measurement of use and how to manage the flow of intangible resources. Thus, not only the claim or right-holders of the resources, but also the act of measuring the intangible resources needs to be coordinated. The exchange of intangible innovation is multi-faceted and iterative and thus often requires a *continuous process of coordination* beyond the exchange of title and permission for specified use that is covered by intellectual property right. Utilizing the capability perspective, the study aims to include the process-oriented perspective in patent theories.

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[82] See Twining William (2005) *Have Concept, Will Travel: analytical jurisprudence in a global context.* 1 Int'l J. of law in Context 5 at 33-34.
[83] Patent Law of Japan, (1959) , as amended.
[84] United States Code Title 35, as revised.
[85] Convention On The Grant Of European Patents (2000). [European Patent Convention, hereinafter EPC] as revised.
[86] TRIPs Agreement, *supra* note 10.
[87] See for example, Williamson, Oliver E. (1999) *Strategy Research: Governance and Competence Perspectives,* 20 Strategic Management Journal 1087-1108; Lee, Nari (2008) *From Tangibles to Intangibles – Contracting Capabilities for Intangible Innovations*, IN: Corporate Contracting Capabilities (2008) edited by Soili Nystén-Haarala, University of Joensuu Publication, No.21.

In the analytical part of the study, the research seeks to go beyond the simple description and comparison of primary sources in a global context.[88] The study does not simply compare specific rules in the statutes, but approaches fragmentation as a phenomenon resulting from the grant of exclusive right in the form of patent, and reviews various levels of ordering that coordinate the fragmentation in alternative institutions in peer positions, in global context. While the descriptive part of each essay identifies relevant legal doctrines and compares the differences, the overall goal of the research is to compare alternative institutional arrangements to promote positive coordination.

Institutional choice theory instructs us to engage in comparative institutional analysis (or multiple institutional comparison) when formulating a new policy or law. Based on the strong observation that "what law is, can be, or ought to be is determined by the character of those institutions that make, interpret, and enforce law,"[89] Komesar proposes a framework for an institutional design focusing on participation cost. This comparative institutional insight is crucial in the articulation of laws and policies of intellectual property right. Consequently, the intellectual property "system", as a property institution, operates with multiple interdependent social institutions. For example, a patent right has an interdependent mixture of institutions that define, grant, evaluate and enforce the rights. Most countries that have a patent system now grant the patent right based on substantive examination, a process initiated by the claimant. After the grant, as long as the right-holder pays the fee, the nation-state maintains the right against the world, exercising the sovereign power of the executive branch. Right-holders privately enforce the rights, ultimately in the court, according to the rules laid down by the legislative branch of government.

Scholars have already identified the four types of institutions and actors that are in a peer position in the sense that they may be alternative forms of arrangement – the legislative and legislator, the administrative and the government, the judiciary and the court and the market and private actors.[90] Each institution that operates the patent system has important and separate functions, but at the same time they are closely interdependent.[91] The legislative shapes the context and frame for the interactions of all the institutions and private persons. Administrative agencies such as the patent office and competition authorities function to examine and maintain the "quality" of the patent system so that individual right claims are valid before the grant and granted rights do not unreasonably harm competition. In contrast, the judiciary and the court often are dispute-based and thus selected only after the rights are granted. Thus, the court can only function as an institution on *ex post* considerations either to perform judicial review over the administrative action or to validate or repudiate claims

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[88] Van Hoecke, Mark and Warrington, Mark (1998) Legal Cultures, Legal Paradigms And Legal Doctrine: Towards A New Model For Comparative Law, 47 Int'l & Comp. L. Quarterly 195.
[89] Komesar, Neil (2001) Law's limits- the rule of law and the supply and demand of rights. Cambridge University Press at 3.
[90] Tamura (2008), *supra* note 71, Bakardjieva-Engelbrekt (2007), *supra* note 71.
[91] Rai, Arti (2003), *supra* note 71 at 1039, highlighting the need to engage in comparative institutional analysis.

of private claim-holders. Finally, there are private individuals who operate in the market, producing, exchanging and using technologies and rights.

The task of analytical jurisprudence in a global context is thought to be engagement in jurisprudential enquiry dealing with generalization across jurisdictions.[92] In this context, institutional comparison is a useful tool because the comparison in itself does not give any normative advice, but only suggests which alternative may be less imperfect, based on institutional competences.[93] This does not mean that institutional choice would be context-independent and cannot give any normative advice. [94] Often the context in which an institutional choice is made is important in offering normative advice from the comparison, and such a context may be provided by adopting a historical perspective, and by highlighting the path dependency of a particular institutional arrangement.[95]

The usefulness of this institutional comparison in the context of patent right is evidenced by a budding literature of patent system reforms using multi-institutional analysis, both at the national and international levels. Tamura's thesis of a functional approach to the intellectual property system is an example.[96] He stresses the importance of the division of competence according to the role and functions of the four institutions, emphasizing the specialist role of the patent offices and suggests the policy decisions to be made by each competent institution, in Japan.[97] Similarly, the scholars such as Rai, who employ multi-institutional comparison in the discussion of patent system reform, emphasize the need to examine the administrative agency's role in the patent rule comparing it to the role of specialized courts with centralized jurisdictional competences.[98] Dreyfuss goes on to apply multi-institutional analysis at the global level and reformulates the global IP law, making it a case of administrative law reform.[99]

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[92] See *generally* Twining, (2005), *supra* note 82.

[93] See Komesar, Neil K. (1994) Imperfect Alternatives – Choosing Institutions in Law, economics and public policy. The University of Chicago Press.

[94] See Dworkin, (1977), *supra* note 75 at ix. See also Publication 1, Part II of this book at 223. (Original Pagination). This is addressed in Bakardjieva-Engelbrekt (2007), *supra* note 71 at 71, warning against an "abstract and ahistorical" application of the institutional choice perspective alone, which gives "unrealistic normative advice."

[95] See North, Douglass. (1990). Institutions, Institutional Change, and Economic Performance. New York : Cambridge University Press, See also Bakardjieva-Engelbrekt's application of North, Bakardjieva-Engelbrekt (2007) *supra* note 71

[96] Tamura, (2008), *supra* note 71.

[97] *Ibid*.

[98] See Rai, *supra* note 71. After the exercise of multi-institutional comparisons in the US, she highlights the role of an administrative agency, but given the current context, recommends judiciary-based reform. However, she later, with Benjamin, proposes the creation of an executive branch entity to oversee innovation policy in the US. See Benjamin Stuart Minor and Arti K. Rai. (2008) *Fixing Innovation Policy: A Structural Perspective*, Duke Law School Research Paper Series 218, Electronic copy available at: <http://ssrn.com/abstract=1259850.> [last visited on 10, January 2009]. See also Benjamin, Stuart Minor and Rai, Arti K. (2006), *Who's Afraid of the APA? What the Patent System Can Learn from Administrative Law*. 95 Geo. L.J. 269, proposing a theory of applying administrative law principles to the patent system.

[99] Dreyfuss, Rochelle Cooper. (2008) *Fostering Dynamic Innovation, Development and Trade: Intellectual Property as a Case Study in Global Administrative Law*, IILJ Working Paper 2008/4,(Global Administrative Law Series) Electronic copy available at: <http://ssrn.com/abstract=1316925>, [last visited on 10, January 2009].

In Europe, the institutional structure is more complex as it has to consist of four institutions in each EU member state plus the European institutions. At the same time, in the area of patent, there is a specialized administrative agency which is an intergovernmental organization – the European Patent Office (EPO). As such, the EPO is an administrative agency based on the exercise of each contracting state's executive power but subject to no national or supra-national review.[100] Commentaries on the EPO reform, which started to surface as a result of the interaction between the EU Directive and the EPO's administrative decisions, focus on these additional layers of institutional choices and their interaction.[101] In contrast to this, competition policy regulating the exercise of intellectual property has been harmonized through the implementation of now Articles 101 and 102 of Treaty on European Union.[102]

Thus, the essays collected in this book approach coordination and fragmentation in part through institutional choices theory, by examining solutions in patent law, court based litigation, administrative solutions as well as private ordering. Law and legislation may be revised so that the exclusive rights granted may be recalibrated. In turn, courts may coordinate the fragmented right in a particular context. Additionally, private parties may be encouraged to engage in private ordering in varying degree of formality in the market as well as instituting an internal process to manage fragmentation. Administrative agencies, such as competition authorities after the rights are granted and to a lesser degree the patent office in the initial grant of rights and as a depository of patent information, may also be involved in the coordination.

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[100] See EPO Decision (2008) G 0002/06 at 13-17, reiterating this principle.

[101] An exemplary study discussing the layers of institutions in European patent law-making is Bakardjieva-Engelbrekt, Antonina (Forthcoming) *Jurisdictional and Institutional Aspects of Stem Cell Patenting in Europe (EC and EPO)*, In: P. Torremans and A. Plomer (eds.) Embryonic Stem Cell Patents: European Patent Law and Ethics, Oxford, Oxford University Press, [on file with the author].

[102] Treaty on European Union, *Official Journal C115 of 9 May 2008*, amended by the Treaty of Lisbon, *Official Journal C306 of 17 December 2007*. Ex Article 81 and 82 of the Treaty Establishing the European Community[hereinafter EC treaty], *Official Journal C 325 of 24 December 2002*, On the complex relation of IP law and competition policy in Europe, see Drexl, Josef, (2008) *Is there a more economic approach to IP and competition law,* IN: Drexl (2008), *supra* note 65, at 27-53.

2. Overview of Publications

This dissertation consists of five publications assessing different institutional solutions to the problem of fragmentation in uses and in patent rights. The publications included in this study are selected and arranged to show the research process and how coordination has developed as the organizing concept. The essays discuss different aspects of patent rights where different institutions are called upon to present solutions to the problem of coordination and fragmentation. They critically review the role of exclusive right of patent and institutional arrangement to coordinate the use of intangible resources and overcome fragmentation. In cases where the topics of the essays are closely related, the scope and the direction are different, thus complementing each other.

The first publication provides a general theoretical framework for the entire study. Publications 2, 3 and 4, are a more detailed analysis of the problem of fragmentation in the use and enforcement of patent rights, as post-grant considerations, in particular related to standardized ICT. The last publication returns the focus of the coordination question to the pre-grant - before or during the collaborative innovation process. It also opens the scope of enquiry to include firm-internal organizational processes as one institutional arrangement.

The essays in part utilize institutional comparisons. Publication 1 utilizes analytical legal theory and partially assesses the singular institutional characterization of patent law as an institution of property that provides for exclusive rights. This may only partially explain the system of patent and lead to different and somewhat predictable normative advice. Publication 2, which explores the relationship between standardization and patent as an exclusive right of property, surveys practices and connects the private ordering to patent law. Thus it partially compares private ordering and legislation. Publication 3 carries the theme further by presenting the anti-commons problem as fragmentation, which was, in the absence of private ordering, created by the grant of patent right as equally exclusive over an identified technological area. Publication 3 utilizes analytical legal theory and compares the solutions in law, private ordering, and administrative institutions. Publication 4 examines a case where the invention can be practiced in fragments, and used in fragments. Coordination in this case is performed by the judiciary as this creates the need for courts in different jurisdictions to coordinate the different uses doctrinally. Publication 5 examines the case where fragmentation exists in the claims for a patent grant – joint and collaborative innovation, where coordination may occur predominantly through private ordering – commercial contracting. It indirectly compares the solutions and uncertainties

in law to the contract-based solution as an alternative institutional arrangement to overcome the problem of fragmentation.

2.1. TOWARD A PLURALISTIC THEORY ON EFFICACIOUS PATENT INSTITUTION

2.1.1. Overall Objectives of the Publication 1

This publication aims to present the theoretical position of the entire research by highlighting the division in the normative position on the nature of patent right in patent theories. The essay examines the efficacy of the patent law as an institution of exclusive rights and reviews theories focusing on the efficiency of patent law. This essay explores the predominant research methodologies in patent theory that seek a justification for granting exclusive rights from efficiency and starts by questioning the utility of this enquiry. Additionally, the essay seeks to place patent law and its institutions into a larger context. It argues that patent law itself is a socially constructed institution embedded with values, objectives and goals and that the institutions of patent right may be legal, including law, courts and administrative agencies but also interact with other institutions, such as market, firm and informal norms. As such, the efficacy of patent institutions cannot be based on the singular instance of efficiency.

This essay reviews several definitions of efficiency adopted in patent theories in both law and economics, and characterizes them largely into two categories – the proprietarian or property-centric theory and the instrumentalist, or policy-oriented, theory of patent law, and reviews how the efficacy of patent law from these positions are approached differently. This paper claims that proprietarian or property-centric theory relies greatly on a natural-rights-based justification for patent right. The basis of this argument is the view that the entitlement for patent right or intellectual property right precedes the recognition of such rights in law, as is the case for property right.[103] Therefore the legislation acknowledges the right by enacting statutes granting such rights. This is either based on Lockean labor property theory,[104] or reward theory. In this context, the law and right of patent has primary value, and efficiency in providing the right to exclude may become the goal of the institution.

In contrast, policy-oriented or instrumentalist theory characterizes patent law as utilitarian and instrumentalist legislation. Thus the rights are first created through legislation, and the grant of such rights serves specifically defined social policy goals. This right is closer to what Hohfeld classified as a privilege that may be revoked when certain conditions of grant, i.e. "duties", are not met.[105] It is thus

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[103] Hohfeldian classifications of rights and obligation are useful here. Hohfeld, Wesley Newcomb (1913) *Some Fundamental Legal Conceptions As Applied In Judicial Reasoning*, 23 Yale L. J. 16 .

[104] See Locke John, (1690) The Second Treatize Of Government, ch. 5, (1690), available at <http://www.gutenberg.org/dirs/etext05/trgov10.txt>. See also commentaries in Publication 1, Part II, at 230-235 (original pagination).

[105] Hohfeld, (1913) , *supra* note at 30 .

possible to view patent as a legally created monopoly whose use and abuse may be subject to the scrutiny of public authorities, or as a legally constructed incentive that supports market-based incentives for innovation and creation.

2.1.2. Findings and Main Contribution

This essay builds on the perspective that denies the existence of a uniform set of norms underlying patent institutions and finds no single theory focusing on efficiency to be generally applicable to the system of patent, either claiming or disclaiming the efficacy of the patent law over other institutional alternatives. The main contribution of this article to the theory of patent law is to point out that this absence is not an indication of the failure of jurisprudential efforts, but caused rather by the fact that a uniform efficiency applicable to the entire institution of patent law cannot be defined.

The essay concludes that a singular assessment of the patent institution is nearly impossible and suggests that the multi-faceted nature of the patent institution calls for a more pluralistic theory and research methodologies that may accommodate various seemingly inconsistent aspects of patent law and the patent system. While it is true that efficiency, as applied to specific cases, may be definable with the help of further normative criteria, the indeterminacy of the efficiency is so great that it cannot serve as a sole normative criterion. As there is no uniform theory of the patent institution, studying it should be pluralistic and functional, and application-specific and contextual. The focus of research should be then not on whether an institution is efficient, but why a certain definition of efficiency or which institution of patent should be more socially acceptable and efficacious in achieving a specifically defined goal.

A pluralistic perspective makes it possible to view patent right as both exclusive and coordinating, and the system of patent as having multiple institutions that may provide for exclusion or coordinate innovative activities. The essay points out different characterizations of patent right and patent law, either as a property right or policy instrument leading to different normative advices. This implies the impact of exclusive rights on coordination may also be approached differently, according to the normative inclination.

2.2. PROPRIETARY STANDARDS AND PATENT LAW

2.2.1. Overall Objectives of Publication 2

This essay aims to develop one of the themes identified in the first essay in greater detail – the interaction of patent law and alternative institutional arrangements in the market and the firm surrounding technological standards. Publication 2 discusses standardization in the ICT industry pertaining to interoperability and compatibility and how this relates to patent law. Technological standards enable modular productions to manage complexity in products. In this sense, standardization is a private ordering in the market to coordinate technical fragmentation in business and market practices.

This essay reviews the impact of exclusive right on standardization. Standards inherently require accessibility, while patent rights are inherently based on the possibility to exclude. If interface standards can be privately owned and controlled, exclusive right may transfer the very benefit of the standardization to the private right-holder, allowing the right-holder to collect a toll on the standards. The essay notes that the exclusive rights of patent may confer such power on the right-holder, subjecting the standard to a capture or hold-up by the assertion of the patent-holder. Furthermore, the essay identifies characteristics of patent right that may be inherently adverse to standardization. It asks whether a patent right is inherently in conflict with efficient development compatibility standards and aims to suggest institutional solutions that can be devised.

2.2.2. Findings and Main Contribution

The essay finds that in order to be functional and accessible, interface standards need to be public, non-discriminatory, and well understood. In contrast, patent rights are private, involve arbitrary decision-making by the right-holder and are often complex to understand. In order to overcome negative aspects of exclusive rights, a Standard Setting Organization (SSO) often institutes internal intellectual property policy that attempts to deal with strategic and opportunistic behaviors of the participants and right-holders. The rules often include such licensing principles as Fair and Reasonable And Non Discriminatory (FRAND or RAND) terms for essential patent disclosure or notification rules.

The essay also discusses the interplay of market practices after the grant of patent right and legal changes. It notes that while patent law and market are alternative institutions, the order created in these institutions may be in direct conflict with each other, thus the benefit of private ordering or the benefit of having the exclusive right of property may be cancelled out by the costs imposed by each institutional arrangement. The essay also points out that other institutional solutions are a possibility. Using administrative agencies such as competition or antitrust administration authorities, interfacing the patent law and patent administration with competition policy is possible. Enforcing private ordering documents such as the patent policy of a standard setting organizing is another solution. The essay, however, *highlights the solution of recalibration through interpretation of patent law*. There are areas of patent law where interpretative or conceptual analysis may be necessary to ameliorate this conflict of legislation and private ordering in the market; this essay also reiterates the need to craft doctrine in law to accommodate standardization.

To recalibrate the right, it is necessary to identify those aspects in patent law that permit incremental changes by the court. The main contribution of this paper is that it identifies three aspects of patent right and the process of patent prosecution that may hinder the development of functioning and accessible standards.

First, the scope of a patent is complex and the textual disclosure required in the patent law is a poor fit to ICT subject matter. As a result, it is difficult to predict if a patent claim can read on a technical standard in advance. Secondly, the lag in the timing of patent publication and the adoption of the related standard subjects

the disclosure and licensing of the patents on interface standard to opportunism. If it is possible to avoid publishing the patent application until grant, the right-holder may delay disclosure during the patent prosecution process. At the same time, complexity in patent claims may make it difficult to predict which aspect of a standard would be covered by the disclosed patent applications. As a result, objectively identifying essential patents against the adopted standard may become so difficult that the right-holders may selectively disclose relevant patents that may be subject to the rules of standard setting. Thirdly, as patent right-holders may restrict field of uses. Field of use restriction forms the core of the patent right and is often used in a license agreement.[106] Coupled with the injunctive relief, the field of use restriction can be used to deny access to the patented part of the standard.

In conclusion, this paper argues that as a consequence of expansionary changes in patent law, patents over technical standards are present as a matter of fact. Presence of patent right over the technical specification of a standard may create problems over the standard adoption process. Assertion of rights after the adoption standard likewise creates concerns. The paper suggests that a solution to the problematic behaviors of the right-holders should be sought within patent law through interpretative doctrines recalibrating the strength of property right in a more flexible manner.

2.3. PATENTED STANDARDS AND THE TRAGEDY OF ANTI-COMMONS

2.3.1. Overall Objectives

This paper develops the findings of Publication 2 from a more theoretical perspective. It applies theories of property to patent law, in the context of patented standards in the ICT industry. As shown in the Publication 1, different views towards the nature of patent law and the patent institution, either as a property institution or a policy instrument, lead to different normative advices on IP law. In fact, the policy recommendation of one application could differ so greatly from another that they could be said to recommend opposite positions. The application of property theories to IP is not uniformly negative or positive. This is partly because, as the modern property discourse itself has diversified from an outright property absolutism to an extreme denunciation of property, different uses of property theories result in different policy recommendations for intellectual property.

This article first places patented standards into the debates on property theories and then evaluates the application of four strands of property theory that have been influential in IP literature. In particular, this paper asks if the lessons of property theories, such as anti-commons theory, can be transferred to understanding problems surrounding standardization in the ICT industry. It asks if the changed context for creating and adopting standards are direct results of the propertization of IP, and which theory would be useful to limit the negative effects of fragmentation. In particular, this article discusses whether it would help to explain

[106] This is evident again in the recent US Supreme court decision on *Quanta Computer, Inc, v. LG electronics* (2008). 128 S. Ct. 2109,; 170 L. Ed. 2d 996, 2008 U.S. LEXIS 4702; 76 U.S.L.W. 4375.

whether rational choices could lead to an irrational outcome, thus resulting in a tragedy that calls for an institutional interference.

Property-centric theory emphasizing only similarity of IP and property right may treat the subject matter of IP which is in its essence non-rival information, in the same manner as the tangible and rival goods that are the subject of property right. Treating these two fundamental different goods in the same manner leads to further confusion. Use of congestion externalities i.e. over-use in the identified product market created by the intellectual property to justify why more rights need to be granted is based on the confusion over the fundamental nature of the right, which is non-rival. In contrast, the anti-commons theory emphasizes the failure of transaction and fragmentation which arises. Applying anti-commons theory to patent seems to be more useful because it does not require the resources to be rival, but simply the rights to be equally exclusive to dictate certain pattern of behavior in the right holders.

2.3.2. Findings and Main Contribution

Coordination of fragments is central in anti-commons theory. In this regard, the main contribution of this paper is that it identifies a theoretical space for a coordination-based approach to patent law. The paper points out that strong property rules with multiple claim-holders in a specific technological area may create a coordination problem by fragmenting the core of the rights. At the same time the paper suggests that solutions to this problem may be found in three different institutions – law, administration and market.

This paper identifies and assesses three types of institutional arrangements as solutions - by not granting such property rights (i.e. an administrative and legislative solution), by recalibrating the rights at the use and enforcement stage (a judicial solution) and by encouraging the emergence of norms for coordination to emerge (a market-based solution).

The first solution would in practice mean rejecting a patent on ICT standards. This solution cannot be implemented by the administrative agency because an industry-specific exclusion of patent-eligible subject matter, in most jurisdictions, no longer exists in the law. Not granting ICT standard patents on useful and essential information processing is impossible under the current laws of Japan, the United States and the EPC, and would be contrary to TRIPs obligations. Furthermore, even if a legislative solution were sought and patents laws were to be revised so as not to grant such patents, it would not eliminate the problems of already granted patents. Moreover, patent offices may lack the competence to engage in an identification of patents on standards prior to their grant, and it may not be desirable for patent offices to selectively discriminate in this manner. Thus, prevention at the grant level is neither possible nor desirable. However, if a legislative solution is sought, it may be better regulated through more behavior-specific regulations directly related to a specific use restriction and not through a blanket rejection of patent application. This may take the form of competition law or anti-trust or monopoly law against misuses, or through flexible uses of such patent law doctrines of secondary infringement liability.

A second solution is a recalibration of the right when it is enforced. At the enforcement stage, the scope of a patent right described in the claim text gets specified against the accused infringing conduct and products implementing inventive idea. In this sense, courts do have a room to calibrate the specific scope of a patent right, utilizing interpretative doctrines in patent law. One example that is more relevant to fragmentation is partial infringement theory which would allow assertion of a patent right by a partial use. The court may refuse to enforce fragmented assertion of a right by rejecting such doctrinal theory. A partial infringement theory or the element protection doctrine may allow the division of a patent right into fragments of claims. Rejection of partial infringement theory, courts discourage further fragmentations of essential patents into essential elements.

Thirdly, formation of an institution with enforceable rules of behavior to manage fragments either formally, as in the cases of patent pools and SSOs, or informally, such as in the case of a norm community, has been suggested. However, both formal or informal institutions do have limited usefulness. Patent pools may involve problems concerning the entry of the non-right holder, thus may be promoting a negative type of coordination. Additionally, SSOs rule may not apply to non-members who have valid patents over key standards and thus has limited application. Another probable and socially desirable policy would be to encourage the development of user community norms, regulating licensing practices. In a close-knit community group, the presence of norms may encourage the access and use of standards that would otherwise be anti-commons property. The creation of norms may encourage right-holders not to assert their rights on essential patents and in fragments. Informal norms, however, are difficult to form and the process of how the norms are formed is often not so transparent and difficult to monitor. Enforcement is also a problem as often the enforcement may be voluntary.

2.4. FRAGMENTED INFRINGEMENT OF COMPUTER PROGRAM PATENTS IN THE GLOBAL ECONOMY

2.4.1. Overall Objectives

This essay follows and develops a court-based solution to ameliorate the negative impact of fragmentation and expands the scope of discussion to include multi-jurisdictional fragmentation – the geographic fragmentation of a right. As observed in Publication 2 and 3, when an invention is readily divisible, the uses of that invention may become fragmented under certain conditions. The two Publications also predicted that if the right-holders are allowed to assert their right in fragments, the problems of coordination would worsen.

In this context, this publication aims to identify which doctrines developed by the judiciary may be used by the right-holders to divide the invention in fragments. Computer program and Internet-related patents bring this question to the fore. This is partly because the practices of the computer programming industry are becoming increasingly cumulative, incremental and distributive. Patents on such subject matters tend to reflect their modular characteristics. This is seen to

increase the possibility of partial or incomplete infringement. Furthermore, in today's global economy, modular production of computer program products often involves cross-border production and distribution, using various production factors. Thus the use of the invention can be modular and may involve multiple actors. In contrast, patent rights need to be enforced and asserted territorially, based on a model of use by a single complete action taking place in one territory.

This paper seeks to review how computer program and Internet-related patents challenge the model of a single infringer within one territory performing one complete action. The paper explores judicial doctrines and interpretative principles surrounding partial uses and aims at identifying which of these doctrines may allow right-holders to rely on fragmented uses to assert their rights. In other words, it examines if patent infringement may arise based on partial uses in the patent law and cases law of Japan, the United States and Europe.

2.4.2. Findings and Main Contribution

The publication finds two types of partial uses whereby the right-holder may divide the patent right. First, right-holders may restrict directly the conduct of partial uses. This would be the case when users engage in some but not all aspects of carrying out the invention, as shown in Figure 1. Right-holders, for example, can partially authorize some types of conduct and reject others. In all the jurisdictions reviewed, this selective authorization seems to be allowed. However, as the legislations often refers to "making, selling and using" as working of the inventions, this paper finds that the courts have some discretion to interpret whether a certain conduct, for example, combining, repairing or modification of a computer program and program codes, falls within the list of conducts that inherently belong to the right-holder, which may give rise to direct or indirect patent infringement liability.

The second type of partial use occurs when the claims of a patent right include modules of the invention that may be divided and practiced in parts, as shown in the Figure 2 above. The essay finds in this case, partial infringement theory may allow assertion of a right when some elements of claims that are comprised of several steps are used but not the others. In this context, the essay finds that there are two types of fragmentation in the assertion of a patent right – one is the case of procedural fragmentation and the other is the case of substantive fragmentation. A procedural fragmentation occurs when there are parallel patents are held by one person over the same subject matter in different jurisdictions that have to be enforced in a consolidated manner. This type of fragmentation is in a sense unavoidable because patent rights have territorial effect, based on national grants exercising sovereign authority. Procedural fragmentation may be avoided through international conventions seeking uniform or at least harmonized rules of procedure.[107] In contrast, a single patent may be substantively fragmented when there is a partial use distributed in multiple jurisdictions, as in the Figure 2. Enforcement in this case is fragmented by each geographic jurisdiction and the courts need to

[107] On the future direction of international convention, see Drexl Josef and Annette Kur (2005) ed. Intellectual Property and Private International Law: Heading for the Future. IIC Studies. Hart Publishing.

find relevant patent doctrines to consolidate fragmented uses either to enforce or to reject enforcement of rights.

The paper finds that patent laws of the United States, Japan and to some extent in Europe, have doctrines related to liability arising out on partial use of a patented invention. While, the courts are reluctant to enforce partial assertion of a right under a direct and literal infringement liability, courts may allow partial assertion of a right under indirect infringement liability or under the doctrine of equivalents, depending on the type of claims. If there are patents on standards, a code duplication to achieve interoperability of computer programs often results in a partial use of the invention, as it would necessarily duplicate part of the codes or program functions that cover the interface. In this sense, nearly all computer program products adopting an interface standard need to duplicate the standardized codes or functions to achieve interoperability, and this would likely be a cause of action for indirect infringement liability, if the right-holders were to assert their rights.

However, the paper finds that at least in multi-jurisdictional substantive fragmentation, courts are reluctant to consolidate fragments that are located outside the territory of the country of the patent grants, and to allow coordination in court to reach the level of element protection. As seen above, while partial uses are regulated under some patent laws, the liability of multiple users in multiple territories raises complex questions about whether their conduct or actions may be combined or consolidated. The paper concludes that courts may have to make policy choices – a broad finding of liability in the use of components of inventions beyond the granting territory may be an over-protection and finding no liability may promote modular production and may create markets in products and services.

The main contribution of this paper is that it assesses a court-based solution to the problem of fragmentation. Furthermore, it identifies a policy space for the judiciary in the enforcement of the patent. This is because regulating one act as direct or indirect infringement requires a normative policy choice that balances the exclusive rights of the patentee and the rights of the users of the patented innovation. Fragmentation here is more strongly determined because it deals with factual fragmentation, where the invention can be practiced in modules and be located in a distributed manner. Coordination in practice would require the use in its entirety of the patented invention. However, when the fragments are distributed in different jurisdictions, coordination of the fragments of the invention is in practice accomplished by the end-users. In this context, the enforcement of the rights over the coordination of the users presents particular doctrinal and interpretative challenges to the courts, as patent law tends to hold only direct and complete uses as infringement.

Coordination in this case may also be carried out by the firms that exploit different production factors to achieve global economies of scale. While the courts seem reluctant to include the coordination of fragments at the end-users as an infringing conduct, they appear to regulate the conduct of firms that act as intermediaries to allow end-users to combine their acts toward direct infringement, under the indirect patent infringement liability. In this manner, the judiciary seems to take coordination into consideration.

2.5. EXCLUSION AND COORDINATION IN COLLABORATIVE INNOVATION AND PATENT LAW

2.5.1. Overall Objective

Publication 5 addresses the contradiction of exclusion of intellectual property rights, with the example of patent right, and the need to coordinate resources in collaboration. The paper aims to apply insight from organizational research to broaden the concept of private ordering as an alternative institutional arrangement to manage fragmentation.

Intellectual property law has been criticized for an over-arching scope of protection and, at the same time, insufficient protection. This seeming contradiction may stem from the discrepancies between the actual innovation practice and process and the models adopted in law. This paper illustrates this contradiction in the treatment of collaborative innovators in patent laws. This study, in particular, examines how the participation of multiple innovators at the initial stage of the innovation is regulated under the patent laws in the United States, Japan and, to some extent, in Europe. A single entity perspective and the concurrent closed invention model implied in law create legal uncertainties for collaborative innovators. Uncertainties in collaboration highlights the significance of organizational capability providing an inter- and intra-firm governance structure over the innovative process and the uses of innovation in managing the uncertainties before, during and after collaboration. Organizational capability seems to play a central role in addressing the seeming contradiction.

2.5.2. Findings and Main Contribution

This paper reviews a case where multiple actors are involved in the creation of inventions and what aspects of their actions leading to different claims to patent proprietorship. An increasingly iterative and collaborative innovation process highlights the importance of having a governance mechanism to provide coordination over the uses or resources, collaborative outcome, with clear rules of sharing and rules for claiming proprietorship in advance. The paper finds that where there are no clear norms or rules, an *ex ante* contractual arrangement and a firm-internal process are the next best solution for coordinating the use of right.

The paper distinguishes a closed and concurrent inventive process concerning collaborative innovation. The concurrent inventive process deals with two or more separate entities working on different paths toward the same innovative technology, and competing with each other. The process of concurrent invention is a simultaneous but closed one. In contrast, a collaborative innovation process follows a path that may be pursued jointly and simultaneously by multiple innovators and identifies collaborative innovation as an area where *ex ante* coordination over sharing the results of collaboration as well as the appropriation becomes crucially important.

This paper identifies in most patent laws, the process of innovation and invention is presumed to be concurrent and closed. The rights are granted based on the first connection thesis- only the first person who connects and act according

to the process of acquiring the right is granted an exclusive right over all others who may have engaged in the same inventive efforts. If patent system aims to encourage disclosure of the invention through the grant of the exclusive right, the disclosure that is encouraged by the model of closed innovation that current patent law adopts is only the disclosure at the patent filing, at the earliest. To the contrary, the patent law in its current shape actively discourages disclosure before the patent filing.

In practice, however, innovation processes are less and less likely to be based on a closed action of a single actor. Especially in the industry where the life cycle of the innovation is short, the competition is high, or the product is complex, more of the innovation may be based on open and collaborative exchanges among plural entities and actors. To interface the innovation practice of collaboration with the requirements in law, firms utilize various private ordering measures and manage the degree of openness. Using the example of collaborative benefit sharing and joint ownership of patent, this paper shows when the intellectual property based protection is weak, uncertain and incomplete, the capabilities of a firm to coordinate the exclusion and exchange surrounding the innovation may make differences in the firms' performances.

The main contribution of this paper is to review the interaction of patent law and the market and highlight the fact that efficient management of intellectual property needs to take into account the existence of alternative incentives in the market, as well as the governance mechanisms in the market which manage the uses of the intangible innovations. Thus, this paper broadens the concept of private ordering mechanism. The paper identifies informal norms, contractual arrangement and firm-internal organizational process as the governance mechanisms administrating the uses of a collaborative outcome, in addition to intellectual property rights. Studies on governance as a private ordering have so far focused more on cases where fragmented rights are pooled into a usable package, after the rights are granted. Private ordering of this kind is based on the intellectual property rights with norms or contractual arrangement as a governance means. This paper adds to this the internal governance structure or an organization's coordination process that is used instead of, or complementing the protection of intellectual property.

In particular, the paper applies process-oriented insights from organizational research to the collaborative innovation process and joint ownership, where claims of entitlement to the right can be fragmented even before the right is acquired. Fragmentation in this case is caused by multiple entitlement-holders to a right to patent before the grant of the right. By emphasizing contractual arrangement and organizational process before and during the innovation, this paper reveals the details of a market-based institutional arrangement to deal with the problem of fragmentation.

	Publication 1	Publication 2	Publication 3	Publication 4	Publication 5
Title	Toward a Pluralistic Theory on Efficacious Patent Institution.	Proprietary Standards and Patent Law.	Patented Standards and the Tragedy of the Anti-commons.	Fragmented Infringement of Computer Program Patents in Global Economy.	Exclusion and Coordination in Collaborative Innovation and Patent Law.
Publication year and Notes	2007 *John Marshall Law Review* Vol 6, Issue 2. 220-249. Also selected by *Berkeley Center for Law and Technology. Law & Technology Scholarship,* Paper 35.	2005 *Intellectual Property Beyond Rights.* 159-184. IPR University Center, WSOY, Finland.	2006 *Teollisoikeudellisia Kirjoituksia VII.* 1-34 (2006 University of Turku, Faculty of Law Publication.	2008 *IDEA, The Journal of Law and Technology,* USA, Vol. 48: 345-379.	2009 *International Journal of Intellectual Property Management*, Vol. 3, No. 1, 79–93.
Author's Contribution	Sole Author	Sole Author	Sole Author	Sole Author	Sole Author
Objective	To provide a critical review of the theoretical literature on the efficacy of patent and to suggest that singular efficacy assessment of patent system is nearly impossible.	To provide a review of a particular mode of private ordering and identify relevant legal principles in the patent laws.	To provide a typology of property theories and anti-commons theory.	To review international rules on infringement of one patent practiced by multiple parties.	To apply a process oriented insights from organizational research to the collaborative innovation process and joint ownership.
Approach	Analytical Legal theory, Theoretical Literature Review.	Legal, Comparative Laws, Practice Survey, and Institutional Comparison.	Legal theory, Theoretical Literature Review, and Institutional comparison.	Comparison of Positivistic Law and Case Practice Review.	Theoretical Interdisciplinary approach, Law and Organizational & Strategy Research, Application of Findings in Organizational Research to Legal Research.
Methodology/ Institution reviewed	General Patent Systems and the concept of "efficiency".	Interaction between the law (legislative) and the market (private ordering).	Interaction between "law" (legislative change) and the market .	Single institutional analysis but interaction between the market and the Judiciary are discussed.	Interaction among the market (firm, contract) and the legislative.
Main Contribution	Critically assesses one dimensional approach of law and economics based on economic efficiency and identifies a need for a more pluralistic approach to the understanding of patent law.	Propose patent law doctrines need to take into account one particular mode of private ordering i.e. private standard setting activities .	Identifies a theoretical space for a governance based approach to intellectual property law, by pointing out the coordination problems associated with strong property rules in cases where there are many right-holder claims.	Overview of cases where the multiple-party involvement in the uses of the inventions leads to fragmented act of infringement, and discusses the doctrinal difficulties (direct and indirect patent infringement) to abridge the fragments at national judiciaries .	Overview of a case where multiple parties are involved in the creation of inventions, and reviews the different rules of joint proprietorship of patent and highlights the importance of utilizing contractual arrangement and the firm-internal process to coordinate the use of rights.

3. Summary and Conclusions

3.1. SUMMARY

The study first explored the general underpinnings of the patent system, and claimed that a pluralistic perspective needs to be adopted in the theories of patent law and intellectual property. This was followed by essays exploring fragmentation in a particular context – in the law and the market surrounding the ICT industry and how the rights and underlying innovation are used and enforced. Based on the patent laws and practices in Japan, the United States and in Europe, this study examined if fragmentation calls for a revision in the roles for the institutions of the patent system – namely the legislation, the administrative agencies, the court and the market. Finally, the research revisited the initial stage of innovation and considered the phase where the initial claim to the right itself can be fragmented by the involvement of multiple parties. The nature of the fragmentation at this stage differs because multiple parties participating in the collaborative innovation process require coordination *ex ante*, while the fragmentation in rights and uses after the grant requires coordination *ex post*.

The first essay explores the general underpinnings of the patent system, and argues a case for adopting a pluralistic perspective on the efficacy of the patent institution. When a pluralistic perspective is adopted, the impact of exclusive rights on coordination can be approached from a variety of angles including property-centric and instrumentalist one, allowing partial explanation. Property-centric theory reviewed in the essay seems to view the question of coordination as secondary to the primary concern of exclusion. Property-centric theory treats the *coordinating impact of a right over the use of the tangible resources* before the invention, in the sense that knowing exclusive right will be granted allows inventors to engage in the inventive process and disclosure their invention. Thus before the right is granted, the rights would provide incentive to efficiently use resources. On the other hand, once the right has been granted, exclusion from the right coordinates the uses of the resources indirectly in the sense that knowledge of exclusive right indirectly discourages duplicative research effort. However, the *coordination on how the rights may be used* is not actively considered. Implicitly, it may be extrapolated that any use of innovation, after the grant, may be concentrated in the first actor (inventor, or creator), who invested and coordinated the tangible resources for the production of that innovation. In contrast, instrumentalist theory, which views patent right as a means to achieve a socially desirable goal, considers

positive coordination primarily as either incentives for production or as a means to provide orderly or pro-competitive development of the innovation. In other words, how the rights may be used after the grant is one of the primary concerns. From this point of view, not only the impact of rights on the uses of resources, but also how the rights and the assertion of rights may be coordination, and the cost of this coordination of rights are considered as determinants of policy.

This is followed by three essays exploring fragmentation in a particular context. Fragmentation over the use of resources and in a granted right is a typically coordination problem. The essays explore the extent of fragmentation in the use and the enforcement of patent rights under the laws of Japan, the United States and in Europe. Collectively they examine multiple institutional solutions, namely the legislative institution (in patent law), the administrative agencies (patent offices and competition authorities), the court and the market (self-regulation or private ordering) and how they treat the problem of fragmentation.

In particular, the second essay discusses standardization and claims that patents seem to cause problems for standardization, which is a private ordering solution to technological complexity. This was largely due to the core characteristic of a patent right as private property with the possibility of private *exclusion and restriction of uses*. It claims that while the other institutional solutions are possible, solutions may be found in the recalibration of this aspect of patent right in the court.

The third essay strengthens this finding by examining the coordination problem in more detail. The essay found that a solution to fragmentation using patent law and not granting patent right (i.e. relying on patentability rule in law) is unfeasible, while using a more behaviour-specific regulation either in patent law (i.e. indirect or direct infringement liability over a particular conduct) or competition law to encourage positive coordination is possible. Private ordering such as a standard setting organization and a patent pool to coordinate fragmented uses is viewed positively. However, private ordering may suffer from opportunistic and strategic behaviour such as hold-up, as argued in the second essay. Similarly, a norm community surrounding the fragmented rights and resources is encouraged, but norms are difficult to develop and enforce. Together, *the second and the third essays recommend court-based solutions that recalibrate the scope and strength of a right and that may influence enforceability of a specific use restriction in a licensing agreement*. The fourth essay, in particular, explores court-based solutions concerning fragmentation of a right in the form of the enforcement of partial uses of an invention.

In contrast, the final essay considers a fragmentation in the initial phase, where the claim for the entitlement may be fragmented. In the particular context of collective and collaborative innovation, the final essay indicates that the participation of multiple parties in the innovative process highlights the contractual arrangement as an *ex ante private ordering* and the firm-internal processes and routines (i.e. organizational capabilities) that manage the flow of knowledge exchange during the initial phase of collaboration.

3.2. CONCLUSIONS

This research contributes to patent law theories by clarifying some of the key concepts used in the theoretical discussion of patent rights and by applying a multi-institutional analysis to the regulation of fragmentation of rights. The research clarifies the concepts of coordination, exclusion and fragmentation, in the context of intellectual property theories and identifies legal doctrines or conventions in patent law that may widen the gap between innovation practices and the model implicitly used in law. In particular, the research finds that the singular identity perspective adopted in patent law based on the tangible property right maintains the gap.

3.2.1. Fragmentation of Patent Right

Innovation requires both the incentives of exclusion and the means to coordinate the tangible or intangible resources as input and outcome to this process. The five essays collected in this volume discuss the aspects of governance and exclusion provided by patent protections. In conclusion, the research claims that a single entity and a single institution perspective in the construction of the patent system inevitably fails to take into account the fragmentation of rights and uses, and this may further underplay the importance of coordination.

Taken together, the essays explore different institutional solutions to the problem of fragmentation. The research identified three types of fragmentation of patent right and explored the causes and solutions differently - (1) fragmentation in entitlement to a right, *ex ante*, (2) fragmentation of rights, post grant, and (3) geographical fragmentation.

Fragmentation is caused by an interrelated combination of factual and legal elements. Factual elements here range from industry structures, economic factors that encourage modular production and management of complexity, and the technical difficulty to precisely claim the abstract object of a patent right. Legal elements of fragmentation include the concurrent and overlapping scope of patent rights, the territorial effect of domestic law and the legal convention of concentrating a property right in a single entity. Different factual and legal elements suggest that coordination of these fragments be specifically tailored to each type of fragmentation. At the extreme, no coordination of factual fragmentation may be necessary and coordination may even lead to anti-competitive collusion.[108] In contrast, some fragmentations seem to be tied to legal convention and expansionist changes in law. In this manner, when a legal convention or a legal change has a direct consequence on how the uses of an invention may be coordinated, institutional interference may be necessary.

3.2.2. Coordination of Fragments and Patent Theory

While previous literature generally used the concept of coordination to mean coordinating the behavior of the actors, this research further elaborated the concept

[108] Kieff, *supra* note 43

of coordination to include coordination over the allocation and uses of resources, entitlement and rights. The research found that coordination of uses of resources as well as the rights may be carried out by private individuals in the market, and institutions may encourage or discourage coordination. The institutional arrangements for coordination include not only private ordering activities of stakeholders and firms, but also public ordering by the judiciary and administrative agencies such as patent offices and competition authorities.

Despite the significance of coordination, aspects of coordination have previously been under-researched, in contrast to aspects of exclusion and incentive. Both positivist and normative research focuses on exclusive rights, the institutional arrangement surrounding those rights and the impact on incentives for creation or disclosure. In particular, the concept of coordination needs to be framed according to the type of fragmentation identified in the literature. As seen above, fragmentation could roughly be present at three levels - in the entitlement of rights, the use of rights, and in enforcement. Accordingly, *coordination* is thus *required in terms of the use of resources* necessary for innovative activities, in the *uses of rights over the innovative outcome* (including license and exchange, commercialization) and in the *assertion of right.*

(1) Coordinating fragmentation in the pre-grant entitlement to a right

Patent law, by entitling the right to file for patent to the inventor, coordinates the question of pre-grant and pre-filing uses of resources. In particular, patent law uses the first connection thesis as a way of coordinating the fragmentation in the entitlements. The first connection thesis artificially constructs a binary relationship between the object and the claim-holder to the entitlement[109] and of the claim-holders with the right to file for invention, only a single entity is granted the right of patent, based on the first connection thesis.

This initial grant of right based on first connection thesis seemed to be downplayed in a property centric law and economics literature.[110] This is due to the fact that when the transaction cost is zero, the initial allocation of property rights would not matter because the parties will efficiently exchange them according to the optimal preference maximization.[111] Who gets the initial entitlement would not matter as long as the trading of such initial entitlement can be done without further costs. Indeed, in most countries, the right to file for patent is transferable and assignable.[112] From this standpoint, it is recommended that intellectual property law reforms and policy proposals should analogously strive to approximate the conditions of zero transaction cost.

As in the case of tangible properties, this means that the boundary of the property must be clear, and that the protection and the enforcement of right, i.e. the exclusivity, must be nearly perfect. Imperfect or incomplete property with in-

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[109] See *infra,* Publication 5, Part II, at 82-83 (original pagination).
[110] See for example, Epstein, Richard A (2006) *The Structural Unity of Real and Intellectual Property,* The Progress & Freedom Foundation. Available on line. <http://www.pff.org/issues-pubs/pops/pop13.24 RAE_9_26.pdf>, [Last Visted on 10, March 2009]
[111] Coase, R. (1960). *The Problem of Social Cost*. 3 The Journal of Law and Economics 1-44.
[112] See *infra,* Publication 5, Part II, at 82-83 (original pagination).

adequate enforcement, in contrast, increases the transaction cost, as it would lead to a situation where the entitlement to a right itself will be disputed and contested. In this regard, we can make an intuitive conclusion that an incomplete property does not lead to an efficient transaction, and may lead to an inefficient outcome and allocation of resources.

Furthermore, alternative institutional arrangements are often viewed negatively by the property-centric perspective, because it may further distribute titles or create information costs of having to determine what aspects are subject to these other institutional arrangements. In other words, this exclusion-centric approach may assess the alternative means of coordination in the absence of the property right negatively.[113] This includes private ordering such as coordination by contracts, community norms or informal ordering or organizational routines or processes that may directly coordinate the use of the resources within a firm.

From this perspective, the task of intellectual property law reform and competition policy would become that of reducing the uncertainty or incompleteness of the entitlement. Perfecting the incomplete right would then be viewed as the policy goals of intellectual property law reform. Thus it would recommend changes in law that make the scope of right clear and enforcement easy. Moreover, a concentration of the right in a small number of right-holders, even trans-territorially, would be recommended, since it would reduce the transaction costs due to the coordination problem.

Likewise, if coordination of fragmentation only serves for orderly development of the technology and innovation process, the policy recommendation of patent prospect theory would be the solution to fragmentation. As reviewed in Publication 1, Kitch's theory of patent prospect inevitably advocates a strong and broad patent right. This view would also be supported by the property-centric theory. However, as shown above, fragmentation may be caused by the conventions adopted by the law themselves. Particularly in the ICT industry, overlapping and concurrent scope is caused by a lack of precise boundary definition and exclusion without governance. Thus, broadly recalibrating the scope of the right in court may not provide a solution, while timing of the grant of right, however, may provide a solution by coordinating the entitlement to a right earlier. However, uncertainty on how technological prospect may develop, the optimal timing is hard to predict precisely.

This research claimed that the private ordering minimizing transaction costs may be beneficial in the management of the pre-grant entitlement to patent. As long as patent law adopts the first connection thesis as the basis for granting the right, it is difficult to use patent law to regulate the relationship of the collaborator. The court does have a limited role in coordination, because it can review private ordering practice, either in the interpretation of patent law defence such as prior-user defence or in the interpretation of the contractual arrangement to protect

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[113] See, for example, Merges, R.P. (2005) *A Transactional View of Property Rights*, Berkeley Center for Law and Technology, Law and Technology Scholarship (selected by the Berkeley Center for Law & Technology), paper 8, available on the Internet. <http://repositories.cdlib.org/ bclt/lts/8> [Last visited on 19 January, 2008], arguing that property rights provide better enforcement means.

the interests of the collaborators in continuing the use of their own share of the contribution. However, the courts may only intervene when there are clear dispute and thus may only limitedly influence the coordination, *ex post*. In contrast, patent offices as an administrative agency may not be equipped to find factual information on the collaborative contribution of the parties, as part of the patent prosecution. Furthermore, collaborating parties have the best information on the ratio of the collaborative contribution. Thus, in case where there are clearly identifiable collaborators and actors, *the Publication 5 advocated contracts and firm internal organizational routines as solutions* that provides a governance mechanism over pre-grant entitlement, because they may *ex ante,* concentrate the right to one entity (either firm, one of the inventors or a third party), and may specify the order and hierarchy of uses.

(2) Post-grant Coordination of Fragments of Multiple Uses

Coordination in intellectual property theory literature is found in the works of the scholars who approached coordination by drawing analogies between tangible property and intellectual property[114] or highlight the transaction costs that property rights may cause.[115] As reviewed in Publication 2 and 3, exclusive right may coordinate particular types of fragmentation of the multiple uses that arise after the invention and the grant of rights. However, as seen in Publication 2 and 3, the exclusive rights of patent over technological standards seem to create rather than alleviate a particular coordination problem. A proposal for good coordination based on a perfectly defined, strong and enforceable property right may fail to take into account that the exchanges in intangible resources cannot be analogous to exchanges in the tangibles. The binary relationship of right and use that allows the transaction of the right attached to the single subject matter of protection cannot be formed in the intangible resources. Therefore even if theoretically, a boundary of an object of intellectual property may be drawn, the right by itself cannot resolve the coordination problem created by the plurality in the relationship among the objects of exchange, use and the right surrounding the intangible subject matters of right.

Technical difficulty to precisely define and to claim the abstract object of patent is further exacerbated to the gap between the legal convention and practice. The legal convention of textual claim leads to granting of rights that may be overlapping in scope. Currently, patent law in most countries adopts the legal convention of patent claims that require the patent applicant to describe the technology in textual forms.[116] In a sense, the text of claims is equivalent to the text of contract, where society grants rights and obligations to the patent right-holder and the public, who need to respect the right of the patentee based on the text of the claims. At the same time, the legal convention defining the scope of a right is

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[114] See, for example, Landes and Posner (2003), *supra* note 38.
[115] See, for example, Heller and Eisenberg (1998), *supra* note 2, review in Publication 3, Part II of this book.
[116] See Publication 2, Part II *infra*, at 10-11. See also Thomas, John R. (1998) *Of Text, Technique, And The Tangible: Drafting Patent Claims Around Patent Rules* 17 J. Marshall J. Computer & Info. L. 219, and Lee (2000), *supra* note 69.

analogous to title deeds to an immovable object of real property. However, unlike the paper title, the description of the patent claim often is a poor fit to the functional technology and thus the actual and precise boundary of a patent's exclusive right is difficult to define, until it is disputed. Given this difficulty of clearly defining the scope of right, an overlapping right in a core technology or over a single systems product is nearly unavoidable.

Furthermore, the patent law's adoption of a closed innovation model results in concurrent rights - multiple rights with a narrow scope, with an equally exclusive effect over a same object. As a result, each right-holder may exclude one another equally and when there is no further hierarchy that prioritize the uses, fragmentation occurs, as seen in Publication 2 and 3. The closed innovation model encourages this, because it encourages innovators to keep the path of invention secret to preserve the novelty. In the industry where innovation is incremental such as ICT, this would result in multiple patents of narrow scope covering a promising patent prospect.

Private ordering is often suggested as the solution to the coordination problem. The property-centric position recommends that if the boundary of the rights is clear and enforceable, the parties will privately trade the right. Collective rights management, patent pools, and cross-licensing platforms are typical examples of private ordering that manages multiple uses and multiple rights-holders where private parties pool the fragmented multiple uses into a usable bundle after the grant of right. Standard setting can also be framed as a private ordering to manage the complexity of the technologies through modular production, and thus manage fragmentation in the technology. While patent pools are private ordering means to manage the rights, standard setting itself is not a private ordering to manage the fragmentation of multiple uses but rather dictated by the drive for having standard. As patent pools and standardization are subject to negative opportunism such as hold-up or capture by the right-holders, and hold-out, they may not present a categorical solution to coordination problem.

Furthermore, exclusion over the fragmented technology is shown to frustrate the benefit of standardization. While private ordering at various levels is viewed positively, the patent policies or licensing rules of these private ordering institutions need to be enforceable. Informal norms is difficult to intentionally set, develop and equally difficult to manage, and cognitive biases could exist that prevent these private ordering institutions to emerge. Both alternatives also suffer from the applicability of the rules of the private ordering institutions to non-members.

Based on these observations, the research recommends a recalibration of the *scope and strength of a right and the validity of the specific use restriction in licensing agreement* at the judiciary to promote coordination.

(3) Post-grant Coordination of Geographically Fragmented Right

As reviewed in Publication 4, a type of geographical fragmentation may be caused by the territorial effect of a patent right. The existence of parallel rights is unavoidable as long as the patent law and legal systems are based on domestic laws. In the

absence of a uniform supranational patent law, a geographical fragmentation in the sense of parallel patent is inevitable. However, concentrating the right to a single entity, based on a first connection thesis, contributes to this type of fragmentation. International conventions have progressively harmonized the patent laws globally to the extent that the right is now uniformly granted to the first entity that acts on the invention,[117] under the priority rules.[118] As the rights may be claimed by one entity, but have to be claimed and exercised nationally, parallel patent applications in countries where the rights are sought are inevitable. Consequently, one invention may be the basis of multiple parallel rights by a single entity. When the parallel rights are viewed as the basis of a right that should have been uniformly enforced by the first actor, then the right can be said to be fragmented. Coordinated assertion of the parallel rights is more procedural than substantive.

In contrast, a right may become fragmented because of the nature of the underlying technology, such as Internet, or because of the global and modular production. Coordination in this substantive fragmentation of a technology may be done by the intermediate user of the technology, or by the end-user of the product embodying the technology. Substantive fragmentation presents peculiar challenge to the assertion of a patent right and as Publication 4 noted, courts sometimes coordinate fragmented uses when enforcing the right, through various doctrinal theories on non-complete uses i.e. indirect infringement liability.

Coordination in the assertion of right is closely tied to the degree and strength of the property rights regime over the intangible resources. The research finds that the positive coordination resulting from the property right depends on the clarity and the enforceability of the rights. This finding coincides with the claims of Lemley and Weiser, who argued in the context of American patent law that the ability to define and enforce property rights effectively justifies the protection through property rules.[119] A closer look reveals that the strength of the exclusive right indirectly coordinates how the rights are to be used through their calibration at the judiciary in regard to enforcement. In patent law, calibration of right means how the liabilities surrounding the infringement are structured and which types of remedies are used to enforce the right – either injunctive relief or damages. In Civil law literature, the right to enjoin infringing parities from engaging in the particular conduct, as opposed to the right to demand compensatory remuneration or damages, is often deemed one of the defining characteristics of a property right. In American law and economics literature, the distinction is termed as property rules versus liability rules. [120] When the courts have discretion to choose the means of enforcing the patent right, they may recalibrate the exclusion with by the degree of the remedy, with or without injunction and/or damages. Given this discretion, the judiciary may play a role in promoting positive or negative coordination.

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[117] At the time of this writing, the first to invent principle of the US is slated to be overhauled by the Patent Reform Act of 2009 (S. 515/S. 610/H.R. 1260).
[118] Paris Convention, Art. 4, and also by virtue of TRIPs Agreement Art.2.1.
[119] See Lemley and Weiser (2007), *supra* note 47 at 784.
[120] The question was raised in connection to non-practicing entities in patent litigations, on when to grant injunctive relief for patent infringement, in the US Supreme Court case, *eBay, Inc. v. MercExchange*, (2008) *surpa* note 28 at 393–394.

3.2.3. Multi-Institutional Comparison for Coordination of Fragments

Intuitive observation suggests the following division of roles in each of the institutions based on the competences of the institutions to find the necessary information to make decisions: Patent offices seem to have a superior competence on technical fact-finding, while the judiciary is superior in finding laws and calibration of rights. Articulation of law and policy is traditionally the domain of the legislative institution, while the practical implementation of law is closely tied to market, which has superior information over the value of the right. However, the simplistic picture cannot be maintained due to the diversity of the interests that are reflected in the process as well as the structural impediments and lack of accurate information that provide predictability in the decision-making.

Employing a multi-institutional comparison, this research suggests that a single-institution-based solution to the coordination problem caused by fragmentation may not be useful. In this context, depending on the type of a fragmentation, a less imperfect choice seems to be a recalibration of right through the judiciary, complemented by various private ordering means, including norm communities, contract and the firm-internal process. Recalibration of a right is more pragmatic and is preferred to a broad legal reform, either to uniformly concentrate the right in a few right-holders or to retroactively remove the intellectual property rights altogether. As a theory, a pluralistic approach is preferred to take the alternative institutional solutions into account. This study provided an example of how this may be framed in the context of fragmented patent rights and coordination.

Each institutional alternative has multiple instruments that may be employed to promote positive coordination. For example, if a law reform is considered, coordination of the fragmented rights may be achieved, for example, through recalibrating subject matter, the term, scope, and enforcement of an exclusive right. Similarly, private parties may formally engage in coordination as a group, such as a firm, patent pools and other collective rights management organizations, or informally, by participating in norm communities. Courts may interpret intellectual property laws to recalibrate the rights, pool fragmented rights and give legal meaning to various private ordering documents such as contracts, licenses and rules of association in the disputes. Administrative agencies such as the patent office may be initially involved in the coordination by granting the rights and managing the register of patent claims and right-holders after the grant. A competition authority may be more active in distinguishing pro-competitive coordination from anti-competitive coordination or collusion by market participants, whether they are based on exclusive rights or not.

Whether the coordination mechanism is provided by the legislation, the court, the administrative agency or by private ordering in the market, is ultimately a question of institutional choice. A multi-institutional comparison thus should be a part of the pluralistic theory of intellectual property rights. In this context, this research compared different institutional solutions to the problem of fragmentation.

3.3. LIMITATIONS AND FUTURE RESEARCH

Critically, this study did not use some of the parameters that are advocated in multiple institutional comparisons. For example, Komesar's framework for institutional design takes the cost of participation for the actors into account – information and organization costs.[121] The cost of participation may reflect the direct costs of organization (e.g. those required to organize dispersed majority interests) or procedural participation in the administrative or judicial processes. (e.g. opposition cost, patent application fee or attorney costs). At the same time there may be indirect costs (e.g. information costs) related to participation.

However, as costs are closely tied to the value of gains, and as long as the value of the gains is unknown, all costs are relatively difficult to quantify. Furthermore, as the right encompasses both the public and private value and gain, there are externalities related to any participation and the resulting policy choices. In particular, proposing market, with multiple functions but no clear mandates or rules, as a regulatory institution of patent creates a further problem in terms of participation "costs." For example, market could mean a market for invention, a market for patent, a market for end-user products, or a market for the idea. Since market is a private institution, the costs/gains of the participation in the market institution are often private costs/gains. In other words, gains or participation in the market require further specifications. Even when the function of the market has been specified, for example, as a market for the exchange of patents, it is unclear whether the cost of participation in such market means the gains of non-participation or a need to be broader, including all the transaction costs.

Additionally, private-public aspects of intellectual property question whether the cost of participation should be measured based on private costs or the public costs of participation. While the private cost of an invention may in a certain subject matter be known in advance, the market value of a patent right is notoriously difficult to calculate.[122] Sometimes the value can be specified after the right is used in the market, in the license to practice an underlying invention, or assigned, in deducing the administrative cost of maintaining such a right. Sometimes, the cost of inventing round the patent may be the basis for the market value of the right. However, when the patent is neither licensed nor assigned, the value would only be known after it has been litigated on the basis of the cost of infringement, and most patents are not litigated. At the same time, as a public good with externalities, social value and social cost the right is impossible to calculate in advance. Given the uncertainties, the parameters of "participation costs" to market may be too difficult to be useful and therefore discarded.

Furthermore, several private ordering institutions are left out side the scope of this research. For example, standard setting organization's internal rule as a governance mechanism deserves further attention. While the research focused

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[121] See Komesar (1994), *supra* note 93 at 8.
[122] See for example, Troy, Irene and Raymund Werle (2008) *Uncertainty and the Market for Patents*, MPIfG Working Paper 08 / 2.

mainly on patent law specific principles only, the internal rules of standard setting organisation over the uses of assertion of patents, how they are implemented in practice and how they affect the behaviour of the related actors in the given industry sectors needs to be studied further. Likewise, norm communities' internal rules on assertion as well as collective rights management organisations internal rules' may deserve separate chapter as alternative institutional governance mechanisms. Further research is called for if the effectiveness of these alternatives is empirically proven or if they indicate paradigm shifts in the ways these organisations are viewed in law and policy of innovation.

The essays have been written over a period of five years and during this process there have been some changes in the interpretation of law in the courts in all jurisdictions and in the administrative agencies as well. These changes, however, do not affect the positions that have been taken by the study, partly because the directions of the research were such that the descriptive part of the research was to serve as a framework rather than an end in itself. However, updates in the descriptive part reflecting some of the changes may improve the research. In particular, court-based recalibration of property rights can be approached further by exploring recalibration based on the types of remedies available – such as injunctive relief or just compensatory relief, in comparative jurisdictions.

The distinction of the courts regarding the coordination of the fragments by the end-users and the intermediary firms in the findings of indirect infringement liability may influence user innovation models and collaborative innovation.[123] Further exploration would transform the findings of the research into a more practical policy recommendation. A future research area could be the empirical claims that may support some of the findings of this research. For example, claims made that the organizational capability is the reason for the over-protection or under-protection resulting from changes in law, which influence firms differently, would benefit from empirical studies.[124]

[123] Strandburg, (2008), *supra* note 70.
[124] For a preliminary criterion for this, see Lee, Nari (2008), *supra* note 87.

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