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"Open" Innovation Policy Frameworks

Intellectual Property, Competition, Investment & Other Market Governance Issues

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I. Executive Summary

The central objective of this study is to explain what "open" innovation is and how policymakers might respond to it. More specifically, this study aims to:

1. Clarify the meaning of terms describing new forms of innovation, with examples.
2. Describe the relationship between open innovation and intellectual property (IP).
3. Recommend appropriate IP and other marketplace framework policy measures.

A. Open innovation happens by exchanging knowledge in networks.

An "innovation" is the implementation of a new a new or significantly improved product, process, marketing method, or organizational structure. Innovation and invention are distinct concepts. Many commercialized innovations are not patented inventions, and many patented inventions never become commercialized innovations. Innovation is affected by intellectual property rights other than patents, including trademarks, copyrights, trade secrets, and other informal appropriation mechanisms. Moreover, intellectual property is just one of many areas of marketplace framework policy relevant to innovation, which should be assessed and calibrated holistically.

"Open" is an umbrella term that has been applied to many related but separate ideas surrounding innovation. There is, however, a common thread across academic disciplines and policy debates about open innovation. The key concept is that "open" innovation is driven by networks not single firms, and by exchanging not excluding others from knowledge. Open innovation happens by exchanging knowledge throughout networks.

While it is well settled that innovation is good for the economy, there is no consensus and little evidence whether *open* or *closed* innovation models are better. Many current marketplace framework policies, especially IP policy, rest on the theoretical assumption that exclusive rights and proprietary incentives best promote innovation. There is, however, growing evidence and emerging consensus that, in the real world, open models are displacing closed ones. This study recognizes the clear trend toward more open innovation, but remains agnostic about the economic implications of open versus closed innovation. Indeed, this study recommends a neutral policy approach—favouring neither open nor closed approaches categorically—because the evidence supporting one model or another is highly contextual. Also, much depends on what one means by "open."

Some people define "*open innovation*" from an individual firm's perspective, meaning that innovation happens when knowledge flows into and out of the organization instead of being developed in-house. Others use terms like "*open collaborative innovation*," "*user innovation*," and "*peer production*," to describe a more fundamental change in the socio-economic systems that facilitate innovation. In the former context, open innovation is a business strategy. In the latter, open innovation is a systemic phenomenon. The word "open" is also sometimes associated with specific intellectual property licensing arrangements, such as "*open source*," or "*open access*." IP licensing is one strategy to facilitate open innovation; free revealing to the public domain is another.

The different ways that "open" is applied in the context of innovation and intellectual property is not just a matter of semantics or academic debate. It is crucial for

innovation policymakers to recognize that different stakeholders, advisors, and organizations may use the same or similar terms inconsistently. The solution is not as simple as choosing one definition and sticking with that. Caution is warranted to ensure clear understanding of the various connotations of "open" innovation and the consequences for intellectual property and other marketplace framework policy areas.

B. Intellectual property can facilitate and frustrate knowledge exchange.

How best to facilitate knowledge exchanges is an unsettled question. In terms of business strategy, some firms choose to reveal and share innovation while other firms find ways to appropriate. Evidence shows that firms that appropriate most often use informal mechanisms of protection, including first-mover advantage, product complexity, customer loyalty, and/or trade secrets. Firms may also choose to use formal IP protection mechanisms, such as patents, trademarks, copyrights, and/or designs.

No single sharing or appropriation, formal or informal strategy is likely to be adopted by every firm for every one of its innovations. A firm's innovation strategy will involve a mixture of approaches, depending on the context, competitors' behaviour, costs and benefits, and other variables. Firms also use various strategic IP management models to exploit innovation.

One model is acquisition toward commercialization. This is a closed strategy, in which formal IP rights are used to secure funding, limit competition, and/or raise prices. Its distinguishing feature from other management models is that the research, development, and commercialization process takes places mostly within a single

organization although potentially involving IP assignments or exclusive licensing arrangements.

A second model involves free revealing knowledge to the public domain. This strategy is used for commercial as well as non-commercial purposes. Commercial benefits include the cost savings and simplicity of avoiding formal IP protection. This strategy may also be used to solve collective problems, grow infant industries, exploit network effects, and/or sell complementary goods or services.

A third IP management model is collaboration through open licensing. Whereas the free revealing model sidesteps the IP system altogether, placing knowledge directly in the public domain, the strategy of open licensing depends upon and leverages the IP system. Using standard form licenses such as the Creative Commons, MIT, or GNU GPL licences, IP owners can exchange knowledge in a way that *requires* rather than *restricts* its further dissemination. Open collaborative licensing may also be facilitated through IP clearinghouses, information or license brokers, or even non-practicing entities (NPEs).

It is essential also to recognize defensive IP management strategies. These strategies are used by firms that do not hold a particular IP right themselves (they may own other IP rights), but instead are at risk of or threatened by the infringement of competitors' rights. Given the availability of IP protection to any firm, all other firms—including those practicing closed and open innovation models—require defensive strategies. The need for defensive strategies imposes costs even on open innovators that would prefer to adopt non-proprietary strategies.

C. Policies should reduce the costs of knowledge exchanges.

Whether IP facilitates or frustrates open innovation depends upon one's definitions. If open innovation is defined as a management strategy, from the perspective of the individual firm, there is no paradox between open innovation and IP. On this view, IP can be used strategically by the open innovator to facilitate the flow of knowledge into and out of the organization. However, if open innovation is understood as a broader and more systemic paradigm shift, IP rights pose greater challenges. From an open innovation ecosystems perspective, IP rights may increase transaction costs; frustrate cumulative, sequential, or collaborative innovation processes; and/or misdirect policy based on questionable indicators.

This study, therefore, makes three overarching recommendations for marketplace framework policymakers. These recommendations correspond to each of the three major objectives and analytical sections of this study. First, understand and use precise terminology. Second, revisit assumptions about prevalent appropriation and IP management practices. Third, neutralize marketplace framework policies to equally encourage and support open as well as proprietary innovation strategies.

Implementing the third recommendation—neutralizing marketplace framework policies supporting various models of innovation—may involve several steps. At least, policymakers should reduce the transaction costs of knowledge exchanges. This can be done by increasing the quality of formal IP rights, and by gathering and making available better IP-related data for private businesses and public policymakers to make decisions.

Somewhat more ambitiously, government policymakers could do more to specifically incentivize open, in addition to proprietary, innovation strategies. Policies and programs should be reviewed to determine whether they inherently favour proprietary business models over non-proprietary models. Neutral marketplace framework policies are important both because of the weak empirical evidence supporting theories about "closed" models of innovation, and the rapidly growing body of evidence showing the substantial economic potential of "open" innovation. In the absence of any clear and generalizable evidence in favour of open or closed models, marketplace policy frameworks should not preference one over the other.

Policymakers should also support the development and deployment of new metrics and indicators of innovation. Statistics Canada data about the proportion of firms that freely reveal ideas is one promising example of a new indicator for open innovation. Studies that rely heavily upon IP outputs as innovation indicators should be viewed cautiously, as they may be incomplete or potentially misleading.

Finally, if the trend toward "openness" in innovations continues and/or grows as expected, policymakers may need to revisit fundamental assumptions about the relationship between collaboration and competition in driving innovation and economic growth. There is a large body of evidence showing how collaboration, sometimes more than competition, drives innovation. Existing policies that presume competition is necessary and are skeptical of collaboration, such as laws pertaining to agreements among competitors, may eventually require revision.

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III. Introduction

A. Motivation for this Study

In an increasingly globally competitive world, businesses are looking for new models of innovation to spur growth while reducing risk and costs. Some businesses wish to continue working in a "closed" environment, relying on internal R&D to develop new products and processes. Meanwhile, many other businesses are becoming more "open."

Open, user, collaborative, and related innovation concepts imply strategies and systems where ideas and knowledge flow across firm boundaries. Intellectual property (IP), however, is designed to give businesses the right to exclude others from using such ideas and knowledge in certain circumstances. From one perspective, IP could be viewed as inconsistent with open innovation principles. From another, IP may be seen as a tool to enable open innovation. These contrasting perspectives highlight uncertainties about the way IP management strategies interact with open innovation business models in practice. And the implications of these emerging trends on IP and other marketplace framework policies are unclear.

The Marketplace Framework Policy Branch of the Government of Canada's Department of Industry, therefore, has sought expert analysis and advice. This study responds to key questions about open innovation policy frameworks, specifically IP policy but also competition, bankruptcy and insolvency, and financing and investment.

B. Questions and Objectives

The central objective of this study is to explain what "open" innovation is and how policymakers might respond to it. Examining types of open innovation is important to better understand how IP and related marketplace framework policies can assist Canadian businesses. More specifically, this study aims to:

1. Clarify the significance of terms used to describe new forms of "open" innovation. Which firms practice "open" innovation strategies, and why?
2. Describe the relationship between open innovation and IP. How do firms that practice "open" innovation use the IP system?
3. Recommend appropriate marketplace framework policy measures. What is the impact of "open" innovation trends on marketplace framework policies?

The purpose of this study is not to advocate for more open or more closed innovation. In that respect, the study is agnostic between modes of innovation. Similarly, the study highlights but does not resolve questions about whether either form of innovation is more or less effective in promoting economic growth or increasingly social welfare. This is not an impact assessment. The study, rather, acknowledges the expert consensus that new, "open" models of innovation are replacing conventional "closed" approaches. Therefore, the goal is to explain the emerging models in order to inform development of appropriate marketplace framework policies.

C. Structural Overview

Following this introduction, the study explains the meaning of key terms and concepts. It situates emerging trends in the context of scholarly literature, public policies, and business practices.

The study then describes several ways to appropriate returns on innovation. The appropriation methods that are described include but are not limited to formal IP rights. The study explores both formal and informal appropriation mechanisms, as well as techniques to enforce rights in different contexts.

Next, the study presents a business-oriented primer on the most common and relevant IP management strategies. The strategic choices that firms make are analyzed as either offensive or defensive decisions. In practice, almost every firm deploys both offensive and defensive IP management strategies at various times and for various purposes.

After addressing new terminology, innovation appropriation methods, and IP management strategies, the study deals with implications for marketplace framework policies. IP policies, especially patent, trademark, and copyright policies, are the study's primary focus. However, the study also considers briefly other areas, such as competition, insolvency, and finance and investment framework policies.

Specific cases mentioned throughout the study provide examples of the role that IP plays in open innovation at the level of the individual firm, industry sector, and Canadian economy. The study finally includes a list of key references for further reading, culled for convenience from a literature review of nearly 1000 sources.

IV. Key Terms and Concepts

A. Background and Assumptions

1. Innovation and Inventions

Innovation is a buzzword that many people use, but too few define. This study adopts a definition of innovation from the Organization for Economic Development and Cooperation (OECD). As defined by the OECD and Eurostat in the widely recognized *Oslo Manual*—containing guidelines for collecting and interpreting data on innovation in countries around the world—"An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations" (OECD, 2005, p.46)

> "Product innovations involve significant changes in the capabilities of goods or services. Both entirely new goods and services and significant improvements to existing products are included. Process innovations represent significant changes in production and delivery methods. Organisational innovations refer to the implementation of new organisational methods. These can be changes in business practices, in workplace organisation or in the firm's external relations. Marketing innovations involve the implementation of new marketing methods. These can include changes in product design and packaging, in product promotion and placement, and in methods for pricing goods and services."

Concept 1: Product, Process, Organizational, and Marketing Innovations (OECD, 2005, p.17)

It is important at the outset of this study on intellectual property and open innovation to confront a common misconception about the terms "innovation" and "invention". Innovations and inventions are often conflated, but they are not synonymous or even necessarily related. An invention, defined by patent laws globally,

must generally be new to the world, useful, and non-obvious. An innovation may be new to the world, new to a country, or merely new to a firm. An innovation may also be obvious, and/or not useful as that term is applied to patentable inventions. Inventions, therefore, are merely a subset of innovations. Moreover, not all inventions are or become innovations. Only inventions that are *implemented*—typically understood to mean brought to the market—are innovations. Patented inventions may never be put into commercial practice at all or be commercially successful. Figure 1 illustrates the conceptual relationship between commercialized innovations and patented inventions. While there is no generalizable evidence regarding the size or scale of this relationship, understanding the difference in principle between these concepts is important for developing innovation policy frameworks that support both open and proprietary innovation models.

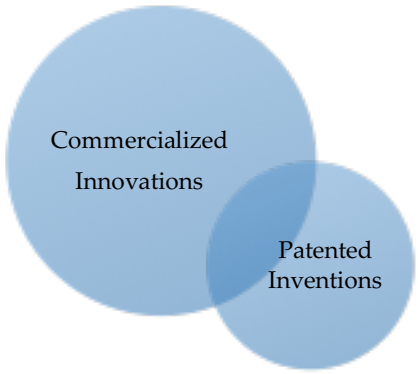

Figure 1: Innovations and Inventions

Innovation is influenced by marketplace framework policies other than patent policies. Other intellectual property rights, including copyrights, trademarks, trade secrets and many informal appropriation mechanisms, are also important. And intellectual property rights are merely part of an overall innovation policy framework. To understand intersections among open innovation and intellectual property policies, it helps to very briefly contextualize innovation policymaking generally. Although the OECD definition centres on innovations adopted by an individual firm, this study also contextualizes firm-level innovation within broader industrial, economic, political, and

social systems. Making the leap from micro to macro economic considerations helps to facilitate effective policymaking.

2. Outcomes of Innovation

This study takes as its starting point the notion that enabling innovation through marketplace framework policies is a desirable public policy objective. Innovation is desirable even though, as a consequence of innovation, some firms will succeed and others will fail. For individual firms, the "innovator's dilemma" is that change is necessary to catch new waves of innovation, but unappealing while a firm still benefits from old ways of doing business (Christensen 1997). Macroeconomic innovation policymaking is similarly difficult for governments because the goal is disrupting incumbent businesses, despite uncertainty about which new innovators will displace these incumbents and how. Yet, disruptive innovation is believed to increase overall social welfare.

Dating back to the work of Adam Smith (1776), economists have tried to explain how competitive markets facilitate innovation. Neoclassical economists, such as Alfred Marshall, began in the 20th century to posit links between innovation and local economic development (Marshall 1920). But innovation was not a subject of specialized study until Joseph Schumpeter (1934, 1942) first suggested that abrupt and uneven adjustments in capitalist economies happen sporadically, displacing old equilibriums and creating radically new and more efficient socioeconomic conditions through "creative destruction."

By the late 1950s and early 1960s, economists were suggesting that technological development is the stimulus that pushes countries along the path of modernization

(Rostow 1960). A revolutionary growth model was presented, which focused on the role of technological development to explain economic growth that could not be accounted for by capital accumulation or labour productivity (Solow 1957). Such ideas informed economic development policy for decades following (see also Hirschman, 1958; Pred, 1965). Modernization theories informed by insights from sociology (Lipset 1959; Hoselitz 1960; Parsons 1966), psychology (McClelland 1961) and political science (Hagen 1962) helped to explain connections among industrialization, innovation, economic growth, and positive socio-cultural change. Economists, meanwhile, were theorizing about the factors driving innovation, such as fear of competition (Arrow 1962). Indeed, by the 1970s, researchers were relatively less interested in what innovation does than in how innovation happens.

B. Innovation Systems Policymaking

Neoclassical economists' preoccupation with profit maximization and market equilibrium overlooked the uncertainties of innovation and variety of institutions that support innovation across sectors. Accordingly, Richard Nelson and Sydney Winter (1977, 1982) developed an evolutionary theory of innovation modeled on biology. Other key scholars broadened the field of evolutionary economics later in the 1980s by explaining the importance of national systems of innovation (Freeman 1987; Lundvall 1992; Edquist 1997).

> "Systems approaches to innovation shift the focus of policy towards an emphasis on the interplay of institutions and the interactive processes at work in the creation of knowledge and in its diffusion and application."
>
> Concept 2: National Systems of Innovation (OECD, 2005, p. 15)

Many academic experts studying innovation management and strategy still focus on firms' behaviour at the microeconomic level. Governments, however, must connect micro and macroeconomic analyses to create innovation-friendly policy environments in which various kinds of social and economic activities can thrive. The *Oslo Manual* explains that examining "national systems of innovation" shifts the focus of policy to the interplay of institutions and processes. From this innovation systems perspective, any particular firm is far less important than the interactions between not just firms but all kinds of economic actors.

Open innovation, in particular, makes more sense in the context of innovation systems because it involves knowledge flows across firm boundaries. Information is exchanged among various actors in a system: businesses, customers, suppliers, competitors, governments, and so on. Shifting from a firm level analysis to a system wide view is, therefore, important to understand the policy implications of open, user, collaborative or related forms of innovation.

C. Similar Terms With Different Meanings

Numerous similar-seeming adjectives have been applied to the term innovation, with subtly but significantly different meanings. The most common phrase is "open innovation." The word "open," however, has different (and sometimes inconsistent) connotations in various other contexts, such as "open source" or "open access". Another common term is "user innovation," which has been affiliated with related forms of "open collaborative" innovation.

As with "innovation" and "invention," the differences among these terms are not merely semantic or academic. The inconsistent and often misunderstood vocabulary can

seriously impact policymaking. Marketplace framework policies that are consistent with one individual firm's "open innovation" strategy may be highly problematic for "user innovation" by another firm, or "open collaborative" innovation systems as a whole. For example, a firm such as a non-practicing entity (NPE, or "patent troll") might implement "open innovation" by acquiring and then licensing a vast portfolio of IP rights. This could create substantial legal and transaction costs for other firms that would prefer an "open and collaborative" system with fewer or no IP constraints. The less familiar policymakers or stakeholders are with the emerging trends and terminology, the greater the policymaking challenges become.

The solution is not as simple as choosing one definition over another. Nor can one adopt a common general understanding, since understanding varies so greatly. This is still an emerging area of business practice and academic research, let alone government policymaking. The best approach is to acknowledge, not avoid, the inevitable complexity. Caution is needed to ensure that policymakers can grasp stakeholder positions, expert analyses, and relevant research in this field. Failure to appreciate definitional and conceptual distinctions can lead to inappropriate policy recommendations or legal reforms. The following subsections, therefore, clarify and distinguish the relevant terminology.

1. Open Innovation

Any discussion of open innovation must begin by reference to the work of Henry Chesbrough

> "Open Innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively."

Concept 3: Open Innovation (Chesbrough, 2006, p. 1)

(2003, 2006). His first book on the topic, *Open Innovation: The New Imperative for Creating and Profiting From Technology*, argued that companies do better by strategically leveraging not just internal but also external ideas, and by commercializing knowledge through multiple paths to market (Chesbrough 2003). Several years after that was published, the term, "open innovation" had gained sufficient traction to spawn a new research framework. A collection by Chesbrough, Wim Vanhaverbeke, and Joel West

Labour mobility: Innovative people no longer spend an entire career working in one place. They move from firm to firm, and take their experiences and ideas with them.

Market institutions: Venture capital provides flexible new financing, IP facilitates new ways to exchange knowledge, and industry standards require cooperation.

Technology platforms: Information communications technologies, especially the internet, have made asynchronous collaboration across geographic space easier.

Product complexity: As products and services become more complex, cumulative, or integrated it is less likely that any one firm working in isolation can provide them.

Box 1: Trends Driving Open Innovation (Source: Author's synthesis of recent literature reviews)

set out a common definition: "Open Innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively (Chesbrough 2006, p.1)."

The old theory was that internal R&D departments created economies of scale to lower the cost of innovation, and that exchanging ideas outside of the firm would increase costs and benefit competitors. While using external ideas to supplement internal capabilities is not new, several major trends—labour mobility, market institutions, technology platforms, and product complexity—converged to help ideas move across boundaries, shown in Box 1.

Solving common problems beyond the capacity of any individual firm is another reason that firms choose to practice open innovation. Box 2 describes how Canada's Oil Sands Innovation Alliance (COSIA) was established for cleaner energy innovation.

Canada's Oil Sands Innovation Alliance (COSIA) links the personnel and R&D of 13 oil sands producers. These companies own shares in the COSIA Corporation, a separate legal entity with its own unanimous shareholders agreement. Under COSIA's charter, shareholders pledge "responsible and sustainable growth" in oil sands development and "accelerated improvement in environmental performance through collaborative action and innovation". Collaboration happens in four areas: tailings; water; land; and greenhouse gases. COSIA companies have reported sharing a total 560 technologies worth $900 million, as well as being engaged in a further 185 joint projects worth $500 million.

Members of the alliance chose to pursue open innovation realizing that the industry faces a crisis no firm can solve alone. The product each company produces is indistinguishable to consumers, and reaches the market mostly via common supply chains. As long as the industry as a whole is exacerbating the problem of climate change, all firms suffer the adverse consequences of consumer and regulatory reactions. Open innovation helps the industry address this problem collectively.

COSIA Corporation and its shareholding members practice open innovation in several respects. They have engaged in public-private partnerships, collective research and technology development, the creation of knowledge repositories, technology cross licensing among members, and "crowdsoucing" ideas from others.

The IP implications of COSIA are complex. Its "joint venture agreements" are not in fact patent pools, but rather are networks of technology cross licensing agreements. Contracts allow participating members to use shared technologies without fear of reprisal for infringing other members' IP. Competition law and policy has also been very important for COSIA. One the biggest risks of joint R&D initiatives is avoiding actions that are *per se* illegal (like price fixing) or that have anti-competitive effects (like reducing innovation). COSIA clearly believes that its collaboration will *increase* not *decrease* innovation. The IP, competition, and other marketplace framework policy implications of COSIA are explored below.

Box 2: Open Innovation to Develop Cleaner Technology in Canada's Oil Sands

Since Chesbrough's seminal works, there have been several thorough reviews of the open innovation research (Dahlander & Gann 2010; Lichtenthaler 2011; West et al. 2014; Giannopoulou et al. 2010; Huizingh 2011; Van de Vrande et al. 2010; West & Bogers 2014; Elmquist et al. 2009), summarized in Table 1. Research shows a gradual broadening of the concept of open innovation. Some authors encourage growth in the field (Van de Vrande et al. 2010), while others merely accept it. To prevent the term "open innovation" from becoming too generic and therefore meaningless, however, some concrete boundaries are needed. Chesbrough and Bogers' most recent re-definition of open innovation offers one way to ground the open innovation concept (West et al., 2014, p. 806). The revised definition better integrates pre-existing economics and innovation management literature. Specifically, the "distributed innovation process," alludes to systems-based concepts of innovation. This definition also allows for both pecuniary and non-pecuniary mechanisms to manage knowledge spill overs.

> Open innovation is "a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business model."

Concept 4: An Updated Definition of Open Innovation (West et al., 2014, p. 806)

The essential characteristic of Chesbrough's definition remains unchanged: Open innovation is understood and implemented as a business strategy. It emphasizes strategic management decisions that benefit the individual firm practicing open innovation. Chesbrough's paradigm does not purport to generate or even account for economy-wide impacts.

Table 1: Reviews of Open Innovation Literature 2009-2014 (Source: Author)

Authors	Date	Journal	Findings and Recommendations	Research Methods and Sources
Elmquist et. al.	2009	*European Journal of Innovation Management*	Synthesizes emerging research on open innovation; identifies key themes and emerging trends	Systematic literature search of management and innovation journals and books, up to 2007 (n=49); questioning leading researchers in field (n=15)
Dahlander & Gann	2010	*Research Policy*	Provides analytical frame of different definitions and forms of openness, and the associated advantages and disadvantages for each type	Literature review using ISI Web of Knowledge for articles listing 'open innovation' in the title, keyword, or abstract, up to 2009 (n=150)
Giannopoulou et. al.	2010	*Journal of Technology Management Innovation*	Refines classification scheme for relevant literature; considers managerial implications, including importance of IP strategy	Qualitative analysis of all English-language scientific literature from 2003-2009 (n=134)
Van de Vrande et. al.	2010	*International Journal of Technology Management*	Finds scholars agree open innovation is not a new phenomenon; suggests more research on how open innovation creates competitive advantage	Meta-analysis of management articles, in leading journals, in ISI Web of Knowledge, citing Chesbrough (2003) from 2004-2008 (n=88)
Huizingh	2011	*Technovation*	Explores the content of open innovation, its context dependency, and the process of open innovation	Method not specified
Lichtenthaler	2011	*Academy of Management Perspectives*	Provides framework for discussing open innovation processes and implications at organizational, project, and individual levels	Method not specified (review of "earlier research")
West & Bogers	2013	*Journal of Product Innovation Management*	Finds research has focused on process of obtaining innovations from external sources; considers how and why firms commercialize external sources of innovations	Review of articles, in top-25 innovation journals, on 'open innovation' or citing Chesbrough between 2003-2010, and frequently-cited business-related Google Scholar hits (n=291)
West et. al.	2014	*Research Policy*	New approaches to measure open innovation; firm choices for appropriability; integration of innovation, management, economics theories	Review of open innovation since 2003 and of nine articles published in a special issue of *Research Policy*, selected from 78 submissions

2. User and Open Collaborative Innovation

User innovation is distinct from open innovation, although the terms are often confused or conflated. The study of user innovation was pioneered through the work of Eric von Hippel, which began in the mid-1970s. In his 2005 book, *Democratizing Innovation*, he explains why and how, in his words, "users of products and services—both firms and individual consumers—are increasingly able to innovate for themselves" (von Hippel 2005, p.1). Von Hippel describes user innovation in "stark contrast" to the traditional innovation model, in which products and services are developed by manufacturers in a closed way, by using patents, copyrights, and other protections to prevent free riding.

> User innovation is innovation by "firms or individuals that expect to benefit from *using* a design, a product, or a service."

Concept 5: User Innovation Defined (Baldwin & von Hippel 2011, p.1400)

It is wrong to frame user innovation as a subset of open innovation. Despite von Hippel's contrast to "closed" innovation, user innovation is not merely a specific kind of open innovation; one in which a firm opens its boundaries to receive ideas from a specific constituency, *i.e.* its users. It is true that within Chesbrough's framework, a firm may be open to adopting innovation from users. But von Hippel's ideas go much further, challenging the notion that "the firm" should be the focus of attention. Rather, von Hippel's analysis highlights the fact that firms are not the only ones innovating; users are also innovating.

User innovation is not just innovation by *end* users. User innovation includes sequential or cumulative firm-level innovation as well. As Harvard Business School

professor Carliss Baldwin and von Hippel (2011, p. 1400) explain, quantitative studies show that "many of the most important and novel products and processes commercialized in a range of fields are developed by users for in-house use." There is, in fact, a common pathway in which user innovations become commercially successful products (Baldwin et al. 2006).

Both von Hippel/Baldwin and Chesbrough use the word "open," but in very different ways. For example, in describing what they call "open collaborative innovation," Baldwin & von Hippel (2011, p. 1400) use "open" to mean: "all information related to the innovation is a public good— nonrivalrous and nonexcludable." This, they explain, "differs fundamentally from the recent use of the term to refer to organizational permeability—an organization's "openness" to the acquisition of new ideas, patents, products, etc., from outside its boundaries, often via licensing protected intellectual property." While Chesbrough focuses on the openness of an organization, Baldwin and von Hippel focuses on the openness of information. This is an important distinction, with major implications for policymakers.

> "Since the time of Schumpeter, the preeminence of producer innovation as well as the need for intellectual property rights to enable producer innovators to protect their rents have gone largely unquestioned by scholars and policy makers alike. … Both assumptions are now challenged by the viability of the single-user and open collaborative innovation models … "
>
> Concept 6: Changing the Problem Field for Innovation Research, Policy, and Practice (Baldwin & von Hippel 2011, p.1413)

Evidence and analysis of user innovation tends to be described with much broader socio-economic welfare and public policy implications than the firm-centric framework of open innovation. Von Hippel is

emphatic, for example, about the need for neutral marketplace policy frameworks that level the field for manufacturer and user innovators. Although "beneficiaries of existing law and policy will resist change," he explains, "both fairness and social welfare considerations suggest that innovation-related policies should be made neutral with respect to the sources of innovation" (von Hippel 2005, p.12). He argues that a fair policy framework would favour no single kind of innovator over any other, and that the overarching policy concern should not be the interests of any particular constituency but rather social welfare as a whole. For these reasons, Von Hippel is critical of IP frameworks for favouring product manufacturers over individual users and user firms.

Two technological trends—falling design and communication costs and increasingly modular design architectures—are making single-user and collaborative innovation more widely viable (Baldwin & von Hippel 2011, p.1402). While it may not entirely replace producer innovation, it is expected to grow in importance in most sectors of the economy. Box 3 shows two key factors driving the paradigm shift.

Design and communication costs: Powerful personal computers and standard design languages, and tools reduce costs of design and communication.

Modular design architectures: Systems in which decisions, tasks, or components are independent can be worked on in parallel isolation but function together.

Box 3: Factors Supporting User Innovation (Source: Author, based on Baldwin & von Hippel, 2011, pp. 1402, 1410)

3. Other Terminology and Practical Examples

The term "open" is used to describe different ideas in innovation research, policy, and practice. Conversely, many different terms are often used interchangeably. Table 2 shows some of the most frequently used terms and their definitions.

Table 2: Various Terms Describing "Open" Innovation Concepts (Source: Author's synthesis)

Concept	Meaning	Key Sources
Open innovation	Distributed innovation via purposively managed knowledge flows across organization boundaries.	(Chesbrough 2003; Chesbrough 2006)
User innovation	Innovation by single individual user or user firm, in order to use that innovation.	(von Hippel 2005)
Sequential innovation	Innovation that builds in an essential way upon earlier innovation. Also called cumulative innovation.	(Scotchmer 1991; Bessen & Maskin 2009)
Open collaborative innovation	Innovation by a group of contributors who share the work of generating a design and reveal outputs openly.	(Baldwin & von Hippel 2011)
Peer production	Decentralized, collaborative, nonproprietary production by widely distributed, loosely connected peers.	(Given 2007)
Crowd-sourcing	A central actor outsourcing tasks to an undefined network of people in the form of an open call.	(Howe 2006; Howe 2008)
Open source	Computer software licensed on terms that meet criteria for redistribution, source code, derivative works, etc.	(Raymond 1999; Perens 1999)
Open access	Knowledge or publications that are digital, online, free of charge, and free of most copyright restrictions.	(Suber 2012; Harnad et al. 2004)
Creative Commons	A nonprofit organization providing standardized legal tools (licences) that enable sharing and use.	creativecommons.org
Knowledge commons	A complex ecosystem of information resources shared by a group of people subject to social dilemmas.	(Hess & Ostrom 2006)
Public domain	Material that is not covered by, and can be spread without, intellectual property rights.	(Boyle 2008)

"Hybrid innovation" models involve elements of single-user, producer, and collaborative innovation. According to Baldwin and von Hippel (2011, p. 1412), Facebook and YouTube are examples of producer-built and producer-owned platforms on which primarily individual users generate and distribute creative content. Crowdsourcing is another example of hybrid innovation, where a producer innovator poses a problem and solicits and selects solutions from others, *i.e.* the crowd. In this model, the sponsor typically owns outputs. Contributors have no rights to others' submissions nor, in some situations, even their own contributions. Hybrid innovation models segue into other terminology used to describe similar phenomenon.

One of the most common terms used in conjunction with the concepts of open innovation and user innovation is "peer production," a term popularized by Yochai Benkler in his book, *The Wealth of Networks* (Benkler, 2006). Peer production, however, is much more closely aligned with von Hippel's work on "user innovation" and "open collaborative innovation" than on Chesbrough's work on "open innovation." Benkler and von Hippel's concepts converge particularly well over the problematic role of IP rights as impediments to user/peer innovation, and the challenges posed by current IP policy frameworks. The main difference between Benkler and von Hippel is that Benkler mostly avoids the term "innovation." Instead of innovation, which has its own particular meaning, Benkler describes how hierarchical industrial modes of knowledge "production" are changing. Benkler's idea of peer production—decentralized, collaborative, nonproprietary production by widely distributed and loosely connected individuals—is also related to the concept of crowdsourcing.

"Crowdsourcing" was a term first coined by Jeff Howe (2006, 2008), initially in an article for *Wired* magazine, and two years later in his book, *Crowdsourcing: Why the Power of the Crowd is Driving the Future of Business*. Crowdsourcing has been used in association both with user innovation/peer production and with open innovation.

Sometimes, the term crowdsourcing may be used to describe *decentralized* peer production, open collaborative innovation, or user innovation, as conceived by Benkler or von Hippel. Wikipedia is a good example of the decentralized user/peer sort of crowdsourcing. This example is harder to fit with Chesbrough's firm-centric framework. That is because the innovation happens not by managing knowledge flows across a firm's boundaries, but rather, without any conventional firm at all. Knowledge is instead produced organically by open collaborating groups of users/peers.

The term crowdsourcing, however, is most commonly used as a verb when a central actor solicits input from or outsources tasks to a large and generally undefined network of people in the form of an open call—a quintessential open innovation strategy. A specific example is campaigns where food and beverage producers openly call for suggestions for new flavours of products or advertising slogans. Another example is open invitations to invest funds in new ventures, discussed in Box 4 on "crowdfunding".

Crowdfunding applies the logic of crowdsourcing to finance, investment, and venture capitalism. Anyone who has an idea but requires capital to implement it can use crowdfunding platforms to raise money. Crowdfunding can also connect large, disconnected, and decentralized groups of investors with opportunities. Some platforms allow donations, some enable loans, and some facilitate equity exchanges.

American firms Kickstarter, Indiegogo and Kiva are arguably the most famous crowdfunding companies. But Forbes recently ranked Canada's project crowdfunding portal FundRazr as one of the six best platforms. Other notable Canadian examples include Optimize Capital Markets, which connects not the general public but rather accredited and institutional investors, as well as MetroFunder and Open Avenue, which allow crowd investing in real estate. According to a 2014 Globe and Mail article, the top 10 Canadian projects on Kickstarter and Indiegogo at the time had collectively raised approximately $5 million. Kickstarter notes its users have pledged $1 billion to 71,000 projects since 2009. The National Crowdfunding Association of Canada also offers more examples.

These crowdfunding companies themselves are not the most interesting example of open/user innovation in practice. They use new technologies for innovative business models, but are essentially intermediaries that facilitate open innovation by others. More interesting are the clients and investors that utilize these new platforms and services. While open innovation is typically associated with in/outflows of knowledge and technology, crowdfunding enables firms to source another valuable resource—financial capital—in a much more open, collaborative, and decentralized way than was previously possible. Crowdfunding might also connect to user innovation. Although users themselves are not innovating, goods or services most desired by users may attract more funding from "the crowd".

The marketplace framework policy challenges of crowdfunding relate mostly to the regulation of securities markets and related financial systems. Yet crowdfunding also calls into question some fundamental assumptions underlying intellectual property policy. Specifically, crowdfunding could be an alternative to conventional venture capitalism, for which strong intellectual property rights were seen as an important incentive. Proof that investors would put money into a project or enterprise without guaranteed returns forces us to re-evaluate assumptions.

Box 4: Crowdfunding as Open Innovation in Finance, Investment, and Venture Capitalism

Open sourcing is not the same thing as crowdsourcing. "Open source" is a term most commonly used in the context of computer software. It refers to software licensed on terms that meet criteria for free redistribution, source code availability, the ability to create derivative works, and so on (Perens 1999). The first author to describe the open source software movement is Eric Raymond (1999) in his book, *The Cathedral and the Bazaar*. The open source software movement—sometimes called "free and open source software" (FOSS)—is generally credited with inspiring mainstream acceptance of open innovation in practice, and spawning an new field of innovation and IP research.

Red Hat, Inc. is renowned for providing open source enterprise software solutions to some of the world's largest companies (i.e. Adobe, Intuit, Sprint, Bayer Business Services). Headquartered in North Carolina, with Canadian offices in Ottawa, Toronto and Montreal, Red Hat has been a strong advocate for open source software. It embraces open source innovation, and its principles of transparency and collaboration are reflected even in their corporate structure (e.g. Red Hat is a relatively "flat organization" that practices meritocratic decision-making).

As a member of open source consortiums like The Linux Foundation and the Fedora Project, Red Hat believes that open source communities are more efficient and advantageous for creating environments that foster innovation than traditional internal R&D labs. To prove this commitment to open source, Red Hat builds open source communities, contributes to open source projects and curates and tests open source technologies.

While it has received much criticism throughout the years, in 2012 Red Hat became the world's first open source company to reach the billion-dollar milestone (in annual revenue), making it an open source software success story and showcasing the promise of open source software. As explained later in this study, Red Hat does have a large patent portfolio, which it views as a "necessary evil" in order to protect its freedom to operate and the ability of its user community to innovate.

Box 5: Red Hat Inc. – Open Innovation's First Billion Dollar Company

The process of creating open source software is an excellent example of open collaborative/peer produced innovation at work. Decentralized and loosely connected groups of programmers collaborate organically to produce open source software, without hierarchical coordination or direct pecuniary remuneration. The knowledge that is created is kept "open" through the clever use of standard form licences that require, not restrict, sharing.

Open source software is also an example of open innovation, within Chesbrough's framework. From this perspective, the innovating firm basically outsources (or crowdsources) software development without paying for it. However, purchasing a license to use the proprietary software of a third party vendor would also fit perfectly with Chesbrough's definition of open innovation. Acquiring software from anywhere outside of the firm—whether open source or proprietary—instead of developing it in-house would constitute open innovation in the narrow sense. This realization helps to demonstrate the importance of definitional clarity. It is unlikely that the founders of the open source software movement or most software programmers would consider the purchase of proprietary software an example of "open" innovation, yet that is precisely what Chesbrough's firm-centric definition contemplates. In this respect, the open source software community is more aligned with the non-proprietary ideologies of open collaborative/peer produced innovation of von Hippel and Benkler.

Three-dimensional (3D) printing, or additive manufacturing as it is technically known, has the real potential to fundamentally alter the concept of manufacturing. It puts the power to create, design, and modify physical objects into the hands of ordinary people. With this technology, the practice of "user innovation," could have radical implications for business.

The industry leader and standard-setter, arguably, is Makerbot. During the companies first few years in business, its founders and executives pursued an open source strategy. Since designs for the company's printers were made openly accessible on its design-sharing website, Thingiverse, users could quite literally print copies of the printers the company itself was in the business of selling. Makerbot's IP strategy changed significantly as it became an acquisition target. Acquired by Stratasys for USD 403 million in 2013, its designs are no longer open. One of Makerbots main competitors, Ultimaker, has maintained an open source approach. And there remains a strong connection between 3D printing and the ethos of "openness" that characterizes user innovators and the open source community.

As some industry players have shifted away from the open source ideology, litigation over 3D printing patents has increased. Much controversy was stirred when Intellectual Ventures, the non-practicing entity discussed later in this study, acquired a patent covering a method to prevent unauthorized printing. Like technological protection measures and corresponding copyright laws, there is the potential for IP rights to alter the industry, and perhaps suppress user innovation.

Box 6: User Innovation Through Three-Dimensional Printing and Open Source Hardware and Designs

"Open access" is yet another term that is commonly used, but not to be conflated with the concepts above. It is most frequently used in the context of scholarly publications or other creative content. Open access refers to content that is digital, online, free of charge, and free of most copyright restrictions. Steven Hanard, Canada Research Chair at the Université du Québec à Montréal (UQAM), is one of the world's leading experts in this field. Among the best book-length introductions to the topic is titled, simply, *Open Access*, by Suber (2012). Just as open source is expanding in scope,

open access is increasingly being used beyond the scholarly research community. It is now used to sometimes refer to the accessibility of other kinds of cultural and creative works, such as music and video content.

There are various levels of openness in respect of both software and scholarship, and several legal and technical mechanisms to facilitate such arrangements. The General Public Licence (GPL), developed and promoted by a computer programmer named Richard Stallman, is the most commonly used license to support open source software. Similarly, the Creative Commons offers a suite of standard licenses to facilitate sharing of cultural works, such as publications, images, music, and video.

Information and knowledge that is openly available to a group of people is part of the knowledge commons. However, the "knowledge commons is not synonymous with open access," explain the authors who first coined the term describing this concept (Hess & Ostrom 2006, p.13). Some information may be available without any IP restrictions to the world at large, in which case it is said to be in the "public domain" (Boyle 2008). Other information, however, is more commonly governed by a complex system of social and technical (rather than legal) norms about access and use.

Disciplinary boundaries seem partly to blame for definitional and conceptual inconsistencies. While management scholars are perhaps the most active writers about innovation, lawyers and legal scholars heavily influence IP and other marketplace policy frameworks. Among IP lawyers and legal researchers, Chesbrough's work on "open innovation" seems less influential than the concepts of "open and collaborative innovation," "user innovation," and "peer production" articulated by Baldwin and von

Hippel and Benkler respectively. For example, a workshop hosted at NYU law school, convening many leading IP scholars, on the topic of "User and Open Innovation" did not even mention Chesbrough's seminal work on a list of recommended background readings. The most influential *legal* scholarship in this area tends to focus on user innovation, as demonstrated by recent works from Fisher (2010) and Strandburg (2008; 2009a; 2009b). Often, the underlying concepts are applied to IP and related legal issues in particular fields of technology, such as biotechnology (Burk 2002; Burk & Boettiger 2004; Torrance 2009). Legal scholars have also introduced new terminology, such as "social innovation," which is described as a kind of innovation operating completely outside of the patent system (Lee 2014). There is a small but growing body of legal literature on governing the knowledge commons, emerging in response to the concern that "the amorphous idea of 'openness' might become the new one-size-fits-all panacean approach…" (Frischmann et al. 2014, p.11).

With few exceptions, such as Torrance & von Hippel's work on "innovation wetlands," (Torrance & Hippel 2013), or Fisher & Oberholzer-Gee's work on IP management strategy (2013), legal and management scholars tend rarely to integrate concepts and terminology. The inconsistent use of similar terms, contrasting research methods and disparate analytical frameworks across disciplines create challenges for policymakers, who must decipher and apply sometimes-conflicting findings. This problem is especially acute because, as described in Box 3, the various terms and concepts can all be applied to the same platform, with different connotations and management or public policy implications. The foregoing overview of key terminology

is intended to help avoid that risk and facilitate more nuanced and accurate analysis across sectors and disciplinary boundaries.

All of the terms and concepts related to "open" innovation often converge around the same platform. YouTube offers a good example. For Google Inc., the owner of YouTube, the platform is an example of open innovation. It integrates innovation from beyond its own firm boundaries directly into its business model, by using external content to generate its own revenue. This could also be seen as an example of crowdsourcing. Yet YouTube also illustrates the principles of user innovation and peer production, where large and loosely connected groups of people create and share their own content as a means of cultural expression. This content is not merely non-commercial. Much of the material is generated by users is clearly of a commercial nature, which shows the economic as well as social value of user innovation. Some of the software used to develop this platform is almost certainly open source, likely available through a version of the GPL or similar licence. Content available on YouTube can be fully open access, or it can be licensed on several kinds of standard terms via Creative Commons licenses. Some of the material on YouTube may be in the public domain, because intellectual property rights have expired, never existed in the first place, or protection is limited. Open access or public domain material forms part of the knowledge commons, which can then be integrated into single-user, collaborative, or open innovation models.

Box 7: YouTube exemplifies how "open" innovation concepts converge

V. Intellectual Property Management Strategies

To appreciate the IP implications of "open" innovation, it is necessary to first explain how the benefits of innovation may or may not be appropriated.

A. Strategically Revealing or Appropriating Innovation

The importance of inventors' rights to appropriate returns to their inventions—for example via exclusive IP rights—was recently identified as a main "fault line" between open innovation and user innovation (West et al. 2014, p.808). This means that different experts on open, collaborative, user and related kinds of innovation do not agree on the importance of exclusive IP rights as a strategy to appropriate returns on investment. Within Chesbrough's firm-centric paradigm of "open innovation," which focuses on the openness an organization to outside ideas, IP rights are seen as one possible mechanism to facilitate knowledge exchange between firms. Within the "open and collaborative" or "user innovation" systemic paradigm shifts identified by Baldwin and von Hippel, Benkler and others, however, IP rights are seen as a possible impediment to innovation, especially cumulative or collaborative innovation.

Understanding whether and how innovators appropriate returns is nearly not as simple as dividing commercial and non-commercial contexts. Extensive research shows that commercial benefits can be realized without IP protection, as with Red Hat's billion-dollar-a-year open source software business.

Teece (1986) argued almost 30 years ago that the most important determinants of an innovator's ability to capture profits generated by an innovation are the nature of the technology and the efficacy of legal mechanisms of protection. These so-called appropriation mechanisms reduce the risk of copying by competitors. This provides the firm with an incentive (although not the only incentive) to invest in innovation.

Strong appropriability—which means the acquisition and enforcement of IP rights by firms, not necessarily strict IP laws—has been understood as important for firms practicing open innovation under Chesbrough's paradigm. Open innovation did not, in this view, substantially change firms' decision to obtain IP rights. Instead, open innovation changed the way firms' used these rights.

> "With outbound open innovation being effectively defined by Chesbrough as out-licensing patented IP, during its first decade open innovation was (not unfairly) associated with strong appropriability."

Concept 7: Open Innovation with Appropriability (West et al. 2014, p.808)

A 2008 report by the Organization for Economic Cooperation and Development (OECD, 2008, pp. 43–44) suggested that with a closed innovation approach, IP was mainly created and used internally, and protection of intellectual property was used to block competition. With an "open innovation" strategy, companies are licensing in technology from external parties, and also creating value by licensing unused technologies or by selling the patents. There is scholarship on open innovation that, for example, considers how some firms choose to strategically share IP and appropriate value in other ways, using open source software as an example (West & Gallagher 2006). The key point is that this strategy of open innovation influences the firms' ability to protect and then manage IP via various licensing strategies.

Firms that embrace "user" or "open collaborative" innovation, however, are understood to have much different attitudes toward IP. Von Hippel explains how, often, these innovators do not need or want IP protection as an incentive to create or commercialize ideas. Anand & Galetovic (2004) cite two particularly noteworthy

surveys of over 600 managers in 45 different industries to conclude: "patents were generally rated as the least effective of the mechanisms of appropriation" (p. 272). They then showed how other strategies that firms use are both rich and varied, and that firms can and do often capture economic value by relying on market incentives rather than legal ones. Other studies also suggest that formal intellectual property rights may not be the best or most popular mechanism to appropriate benefits from innovation (B. Hall & Ziedonis 2001; Hall et al. 2014). This realization leads to deeper discussion of both formal and informal appropriation mechanisms.

> "It is now very clear that individual users and user firms—and sometimes manufacturers—often freely reveal detailed information about their innovations."
>
> Concept 8: Free Revealing by Users and Firms (von Hippel 2005, p.9)

B. Formal and Informal Appropriation Mechanisms

Among the subset of firms that practice open innovation through appropriation, rather than free revealing, appropriation strategies usually involve more than formal IP rights. Different firms use diverse and evolving strategies to appropriate returns from innovation (World Intellectual Property Organization 2011). A growing body of empirical research provides evidence regarding appropriation mechanisms used in the formal sector in high-income countries, ranging from formal patents to informal secrets and other mechanisms like product complexity (Hall et al. 2014). The use of formal appropriation mechanisms such as patents is, by far, not the norm. Innovation surveys show that only a small fraction of all firms in all sectors in high-income countries such as the United States consider formal IP rights important. Lead-time over competitors

and customer sales/service activities are more important appropriation mechanisms. Among firms that consider IP important, trademarks are considered most important, on average, followed by trade secrets, copyright, industrial designs, and lastly patents (Jankowski 2012).

For many firms, it does not make business sense to apply for and enforce formal IP rights; either other appropriation means are more appropriate or firms have no invention to protect in the first place. In some circumstances, these firms might benefit from filing for formal IP rights, but they lack awareness of the potential benefits and practicalities. On the other hand, small firms' ability to use the IP system can be constrained by various factors, including financial and other resources, and enforcement challenges on a global level (Kotala et al. 2010; Leiponen & Byma 2009).

Firms that face shorter product life cycles tend to patent less. Data also reveal that process innovators rely less on patents and more on secrecy than product innovators do. Accordingly, firms in the service industry use less formal IP; and when they do use IP, trademarks are particularly important. However, as firms' R&D intensity and collaboration with public research institutions increases, patent protection becomes relatively more important. In particular, the production of "discrete" technologies like pharmaceuticals and chemicals relies heavily on patents. The propensity to patent rises with firm size, other things being equal. It is rare that small firms rely on patents as appropriation mechanisms. When small firms innovate, they often rely on secrecy, lead-time or confidentiality agreements (Arundel 2001; Leiponen 2006; Organisation for Economic Cooperation and Development 2011; Kotala et al. 2010). SMEs that cooperate in innovation with horizontal partners, or significantly

depend on vertical partners, tend to prefer appropriation via lead-time. Process innovators with modest R&D investments or few cooperative R&D activities display a preference for trade secrets (Leiponen 2006; Leiponen & Byma 2009). Some research-intensive SMEs that harbor specialized knowledge, however, heavily rely on the patent system (Helmers 2011). This formal IP provides them with a reputation effect, access to finance and other benefits (World Intellectual Property Organization 2004; Organisation for Economic Cooperation and Development 2011). Small firms also use other forms of IP such as trademarks.

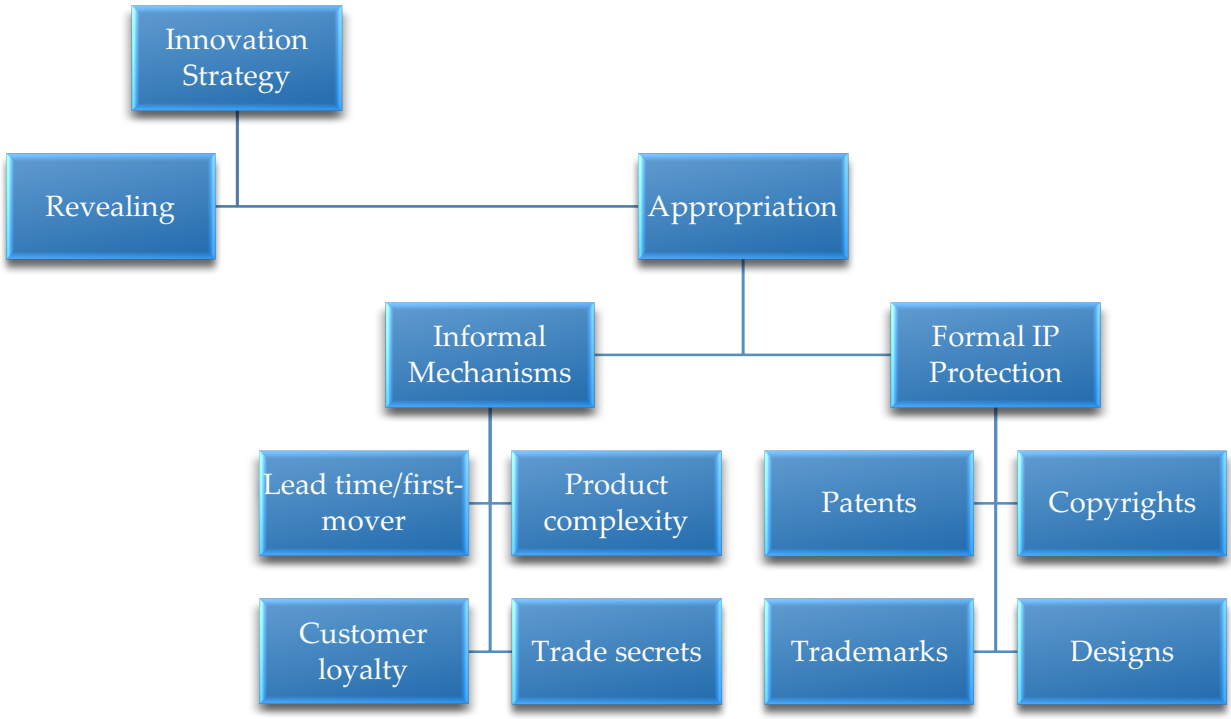

Figure 2: Innovation Appropriation and IP Strategy Roadmap (Source: Author)

Among the subset of firms that choose to appropriate instead of reveal, there is a further subset of firms that choose to appropriate via formal IP protection instead of informal mechanisms. Firms that obtain IP rights then face a further choice, which is to use those rights to collaborate or compete. While both strategies involve acquisition of IP rights, they do so as means to different ends. Figure 2 depicts these decisions that businesses might make when implementing IP-related aspects of an innovation strategy. There are also other ways to conceive of overlapping IP management strategies.

In a recent analysis of IP management strategies, de Beer, Gold, & Guaranga (2011) explained a model of three basic IP-based business models: (1) acquisition toward commercialization; (2) free revealing to the public domain, and (3) collaboration through open licensing. This study builds upon those models in the specific context of open, user or collaborative innovation. These models are not mutually exclusive. Few if any firms would implement one strategy for all circumstances. Firms may use different IP management models for their technology versus their brand (*e.g.*

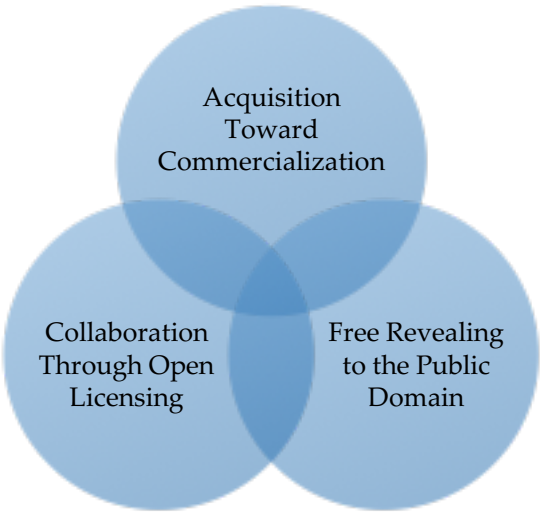

Figure 3: IP Management Models (de Beer et al. 2011)

foregoing patents but protecting trademarks). Firms may offer a non-exclusive license to one competitor, but sue another. Diverse and dynamic IP management tactics parallel hybrid innovation strategies, which can be open in some respects and closed in others.

> "Different resources in different industries involving different collaborators and different intellectual property rights can be managed using a mixture of approaches."

Concept 9: Mixed IP Management Models (de Beer et al. 2011, p.1)

For any strategy a firm chooses, it will be necessary to determine which IP rights to obtain, how, and where. In many cases, this decision is constrained by legal frameworks. As an example, some valuable intangible assets are simply not patentable subject matter. Business methods, software, or higher life forms may not be patentable, depending on the legal jurisdiction where protection is sought. In other circumstances, the IP management decision is influenced by financial or strategic considerations. Patent protection is initially more expensive to obtain than trade secrecy. But trade secrecy requires ongoing monitoring and compliance costs of employee confidentiality and non-disclosure agreements. Both options have their own have strategic strengths and weaknesses, depending for example on a technology's susceptibility to reverse engineering. And both can be prohibitively expensive to enforce, particularly if it requires protracted litigation, in which case neither kind of protection may have been a sensible business strategy. Choices may also be required between copyrights or patents or both, between registered or unregistered trademark protection, or among a range of other strategic options. Box 8 elaborates on two cases involving mixed IP strategies.

Most companies have carefully implemented strategies that adopt and incorporate a mix of open and closed approaches. Two Canadian success stories, Shopify and Desire2Learn, illustrate how certain e-marketplace platforms and solutions vendors rely on a "hybrid" approach to compete in the e-commerce platform and learning management solutions (LMS) industries, respectively.

Shopify, one of the Ottawa area's most successful technology companies, provides accessible and customizable e-commerce platforms for online business. While its founders opted not to make the service open source, Shopify still maintains an open source software design to a degree. Along with the applications and pre-made web-design themes found on the Shopify website, Shopify also works closely with GitHub, a collaborative open source software network. As of today, Shopify has over 150 open source software projects. An "app store," theme design, and set up services also engage the Shopify community allowing user innovators to make money at the same time as shop owners. This open innovation strategy creates a secondary market eco-system to support Shopify's platforms.

Desire2Learn, based out of Kitchener, Ontario, uses proprietary software while importing the value of open, collaborative approaches through their online portal, Brightspace Community. Brightspace Community is a place where Desire2Learn's "1100+ clients, 13+ million users, 100+ partners and 300+ developers" collaborate on projects that improve the user experience. In a highly competitive industry where larger companies (*i.e.* BlackBoard) have been known to actively enforce their patent rights, Desire2Learn has invested in a comprehensive patent portfolio spanning across multiple jurisdictions including the US, Canada, Singapore and Australia. Through this hybrid approach, Desire2Learn's proprietary software overcomes scale limitation issues that other open source competitors face (*i.e.* Moodle) while harnessing the collective intellect of the community and reacting to the needs of their users through the Brightspace Community.

Box 8: Hybrid Appropriation Models in Canada's Electronic Marketplace

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C. Acquisition Toward Commercialization

A closed innovation model means businesses obtain formal IP rights to stop competitors from using or imitating protected assets. Sometimes a strong portfolio of IP rights can also help secure financing (Hsu & Ziedonis 2013). A signal to potential investors or creditors that the firm has power to limit or prevent competition, can indicate potential to control markets and raise prices. In principle, the time-limited monopoly rights that businesses obtain ought to provide financial incentives and support to commercialize new technologies, provide services, or distribute content.

In practice, however, evidence also suggests that many IP-protected assets fail to generate commercial value for their owners. An OECD report reviewed multiple empirical studies that illustrate the trend: "Most patents do not directly generate revenue for patent owners via their incorporation into products, processes and services or through licensing revenues" (Organisation for Economic Cooperation and Development 2008, p.43).

Before considering IP licensing, sales, or other strategies, it is worthwhile mentioning the potential costs of IP protection. These costs can include more than just the legal and administrative costs of obtaining the rights. Fisher & Oberholzer-Gee (2013) explain how acquiring IP protection can have several adverse and sometimes unintended consequences for an IP owner.

A firm's IP acquisition can also create incentives for its rivals to innovate, leaving the IP-owning firm at a competitive disadvantage. In addition, a firm's IP can inhibit growth in the market for complementary products or services. An illustration is the

importance of applications that run on smartphones. The more tightly a platform is controlled, the less likely a thriving market for applications is to develop. The smaller the applications market is, the smaller the platform market. The contrasting closed and open approaches of BlackBerry and Android starkly illustrate the effects of this strategic choice. Understanding the strategic drawbacks of a closed innovation and IP management model helps explain why other IP strategies are becoming more attractive.

In the summer of 2014 Tesla's co-founder and CEO, Elon Musk, announced the company was opening up its patent portfolio. Tesla will not enforce patents against other companies—even competitors—acting in good faith to advance the development of electric vehicles. In a blog posting, Musk wrote: "Yesterday, there was a wall of Tesla patents in the lobby of our Palo Alto headquarters. That is no longer the case. They have been removed, in the spirit of the open source movement, for the advancement of electric vehicle technology." Patents may be used for defensive purposes, but not to stifle further innovation based on Tesla's technology.

The reasons for Tesla's decision to "open" its patent portfolio are varied. Tesla understood that its patents were "intellectual property landmines" inhibiting development of the market for hybrid-electric vehicles. Tesla's new open source ideology may help grow the market and recruit talent. In this industry, Tesla judged, people not patents drive innovation. Notably, however, Tesla has not undertaken to share trade secrets. And Tesla has defended its trademarks in the United States and internationally. Its selective sharing and appropriation strategies demonstrate the complexities of open innovation strategies in practice.

Tesla's patent tactics contrast with recent statements from other electric vehicle manufacturers, including Zenn (Zero Emissions No Noise) Motor Company. After restructuring to avoid bankruptcy, the Toronto-based firm that had designed and manufactured a small electric vehicle seems to have to shifted strategies. According to Zenn, "The Company's current business strategy is being recalibrated to focus on licensing and partnership opportunities across a broad spectrum of industries and applications." This language seems to suggest an IP management strategy similar to WiLAN, Mosaid, Rockstar and other NPEs.

Box 9: Tesla Motors Opens Up Its Patent Portfolio

Amassing large patent portfolios can also change the competitive landscape of an industry, reducing the overall size of a market. Consequently, the IP-owning firm may have a large market share, even a monopoly, but in a very small market. The case of open source automotive engineering, highlighted in Box 9, shows how this problem led Tesla to denounce its previous strategy of patent acquisition and enforcement.

In sum, the consensus among those who study or practice IP management is that the strategy of protecting IP rights solely to research, develop and commercialize innovation internally is becoming less common. Many firms now recognize the importance of having networks, partners, and receptors to successfully commercialize new ideas (thus turn inventions into innovations). The evidence canvassed throughout this study suggests that inventors, companies, or institutions like universities that acquire IP rights without a clear understanding of what to do, or who to collaborate with and how, next may be wasting their own time and money, and creating additional costs for other actors in the innovation ecosystem. Indeed, realizing the value of collaboration and partnership, and the corresponding shift in IP management strategy, is a basic premise of open innovation. The more complex issue is which strategies are emerging to replace the closed IP management model.

D. Free Revealing to the Public Domain

The strategy of free revealing should not be confused with open licensing. Open licensing, discussed below, is premised on the protection and strategic exploitation of IP. It moves beyond mere acquisition toward commercialization by contemplating various management strategies. But these strategies do depend on IP protection to

work. Free revealing is different. It sidesteps the intellectual property system altogether, generating economic value through alternative innovation strategies.

> "The free-revealing approach is distinct because it sidesteps the intellectual property system altogether."

Concept 10: Free Revealing (de Beer et al. 2011, p.5)

Free revealing is most commonly associated with von Hippel's concept of user innovation: "When we say that an innovator freely reveals information about a product or service it has developed, we mean that all intellectual property rights to that information are voluntarily given up by the innovator, and all interested parties are given access to it—the information becomes a public good" (von Hippel 2005, p.9).

> "Evidence has now accumulated that innovators who elect to freely reveal their innovations can gain significant private benefits—and also avoid some private costs."

Concept 11: The Benefits of Free Revealing (Baldwin & von Hippel 2011, p.1401)

It is wrong to assume that free revealing is suitable only or mainly for non-commercial activities. This may be the "least intuitive" business strategy, but increasingly it works, for example to reduce the risks of future IP holdups. (Fisher & Oberholzer-Gee 2013). Box 10 on the next page describes two examples of free revealing for open innovation in the development and commercialization of genomics and biomedical innovation.

While the strategy of free revealing can bring substantial commercial benefits to individual businesses, if promoted by policymakers and adopted on a wider scale and, it may also lead to increased welfare at the macroeconomic level. The more firms that free reveal, the more economic opportunities there are for ideas to interact, and for

knowledge to combine in unexpected ways. More efficient knowledge networks and clusters should lead to more sequential and cumulative innovation, as well as more radical breakthroughs and disruptive innovation. Implications are discussed in more details in the marketplace framework policy section below.

The Structural Genomics Consortium (SRC) is a public-private partnership between numerous innovator pharmaceutical companies and the Universities of Toronto and Oxford that supports the discovery of new medicines through open access research (Edwards 2008). Agreements prohibit its affiliated scientists or collaborators from seeking patents that would grant exclusive rights over research outputs. The Consortium also encourages funders from government, industry or civil society to similarly forego patent rights. A free revealing model has also been used by the BioBricks Foundation to create a public domain platform of standard biological parts at the Massachusetts Institute of Technology (MIT) (Rai & Boyle 2007). Synthetic biology researchers and for-profit companies can build upon this free revealing strategy in a wide variety of ways.

Box 10: Free Revealing as Open Genomics and Biomedical Innovation

E. Collaboration through Open Licensing

There are a wide variety of options for licensing IP rights to facilitate collaboration. The common thread among open licences is that they provide a way to facilitate multilateral (not just bilateral) IP transactions. Open licenses allow collaboration between one firm and multiple others, among limited groups of collaborators, or among large and loosely connected communities.

Two kinds of IP transactions—assignments and exclusive licenses—would qualify as open innovation under the Chesbrough framework, but would not be defined as "open" according to the vast majority of scholars studying innovation through other

lenses. Selling or exclusively licensing IP-protected assets would, technically, constitute open innovation, because it involves an outbound flow of knowledge across the firm boundaries. In this respect, assignments and exclusive licenses are distinct from a strategy of acquiring IP rights in order to suppress competition and develop innovation in-house. They are, as such, examples of open innovation.

Open licensing, however, is a much different concept. Open licensing is more closely aligned with practices involving open source software, open access publishing, and collaborative innovation communities. There are at least three sorts of organizational structures that facilitate open licensing: standard term templates like the GPL or Creative Commons; clearinghouses and IP brokers; or centralized clusters such as patent pools. Among all of these, the defining feature of open licensing is non-exclusivity. Non-exclusivity of licenses facilitates multilateral transactions that do not merely enable open innovation beyond one firm's boundaries, but also create commons-based knowledge networks and dynamic innovation systems.

1. Standard Term Licensing Systems

One of the original and still most popular standard-term licensing mechanisms is the GNU GPL, pioneered for free and open source software. The central principles underlying the GPL are beginning to influence hardware licensing practices as well. Another well-known approach is the Creative Commons system of open licences used to facilitate varying degrees of control over copyright-protected content. Its spin-off, Science Commons, promotes open access to scientific literature as well as research data. What each of these systems has in common are standard terms from which licensors can

choose, governing key points such as attribution of authorship or source, the need to maintain the integrity of the work or the right to modify it, and the ability or inability to redistribute derivative works on like terms. Although it is possible under most open licensing systems to waive all IP rights (hence free revealing the knowledge into the public domain), it is more common in practice to license some but not all uses. This is the so-called "some rights reserved" model. Fundamentally, a some-rights-reserved system of open licensing only works if there are IP rights to license in the first place.

2. IP Clearinghouses, Brokers and Other Non-Practicing Entities

Clearinghouses act as agents through which IP transactions can be simplified. In principle these entities help reduce transaction costs and makes IP markets more efficient. Some clearinghouses do not offer licences, but rather provide the IP-related information needed to determine whether a licence is needed, and if so, where a prospective licensor might start to look. One example was created by an organization called Cambia. Its "Patent Lens" is "a web-based platform that allows such data aggregation, analysis and visualization in an open, shareable facility" (Jefferson et al. 2013). This freely available resource complements "patent landscaping" services offered by private firms (Bubela et al. 2013).

Other clearinghouses do provide IP licences, in which cases they are commonly called "non-practicing entities" (NPEs). The emergence of NPEs is among the most controversial issues

> "What we're really trying to do is create a capital market for inventions akin to the venture capital market that supports start-ups and the private equity market that revitalizes inefficient companies."
>
> Concept 12: A Capital Market for Inventions (Myhrvold 2010, p.1)

currently facing IP and innovation policymakers. One of the earliest and most widely known examples is Intellectual Ventures. Its cofounder and CEO, Nathan Myhrvold, says the company is really trying to create a capital market for inventions (Myhrvold 2010).

The seminal work on NPEs is an article by Chien (2011), a surprisingly recent publication that has spawned enormous interest in the topic. A burgeoning body of scholarly commentary and policy advice is now available on the topic of NPEs. Some empirical evidence has been collected, most of which portrays NPEs in a negative light (Bessen et al. 2014; Bessen & Meurer 2014; Tucker 2014; Yeh 2013). A full review of that research is beyond the scope of this study. NPE's are part of the innovation marketplace, and intersect with debates over open innovation in several ways.

Viewed through von Hippel's lens of open and collaborative innovation, NPEs are problematic. They force firms that would prefer to avoid the IP system altogether to take costly defensive measures due to threats of litigation. While the litigation strategy against an ordinary competitor may involve counterclaims settled by cross-licensing agreements, this is not possible with firms whose only business is asserting patents. Within the narrower, firm-centric paradigm promoted by Chesbrough, however, NPEs might be seen to facilitate open innovation. Due to the emergence of NPE's there is now a marketplace in which firms can more easily in/out source patented inventions. It is no longer necessary to do all R&D in-house, since firms can instead acquire licenses from NPEs acting as brokers or clearinghouses. Similarly, firms need not develop ideas through the entire commercialization process, since there is now a market for these.

Both Conversant (formerly Mosaid) and Wi-LAN started out as manufacturing companies, but strategically decided it was more profitable to sell patents instead of products. Conversant began by specializing in semiconductor and dynamic memory chips, and the privately held company now boasts a portfolio of over 12,500 patents and annual revenue of USD 100 million. Wi-LAN, a publicly traded company, started business as a developer of high-speed networking technology. Its portfolio of more than 4000 patents generated USD 88 million in 2013. Rockstar was created solely to acquire and assert roughly 6000 patents acquired from Nortel in bankruptcy proceedings. The company is a spin-off of the consortium of technology firms—including Apple, Ericsson, EMC, Microsoft, BlackBerry, and Sony—that outbid Google with its $4.5 billion offer for Nortel's portfolio. While each member of the consortium is manufacturer of products, Rockstar itself is an NPE. After distributing some of the 6000 ex-Nortel patents to Rockstar's backers, the remainder were recently sold to the "Rational Patent Exchange" (RPX), another kind of IP clearinghouse discussed later in this study.

The licensing practices of NPEs have led to some anti-trust criticism or scrutiny, such as Nokia's patent-transfer and revenue-sharing agreement with Conversant (Mosaid at the time), and the Rockstar consortium's acquisition of Nortel's patents (American Antitrust Institute 2014). Rockstar's purchase of Nortel also raised questions about Canada's bankruptcy and insolvency laws, since control over IP developed with the benefit of Canadian government support—most notably via R&D tax credits—was acquired by US companies. Notable commentators like BlackBerry co-founder Jim Balsilie have gone so far to suggest that a "sovereign patent pool" could be an appropriate mechanism to acquire and manage such IP for the benefit of other Canadian companies (Balsillie 2014).

But the most interesting aspect of NPEs for the purpose of this study is their role in turning patented inventions into liquid assets. NPEs create liquidity for IP assets by offering licences to firms that want (or need) to secure external IP instead of conducting in-house R&D. They also provide a vehicle through which firms can realize value through selling or out-licensing IP, either as a going concern or in bankruptcy and insolvency proceedings. At the same time, the rapid growth of the NPE business model raises marketplace framework policy issues that require careful attention. The impact of NPEs on the cost of doing business, especially defending lawsuits, cannot be ignored.

Box 11: A Canadian Cluster of High-Tech Companies Illustrates Arguments about NPEs and Open Innovation

High-tech companies, for example, used to amass portfolios of IP rights in a patent "arms race" to deter litigation against one another. Emerging NPEs have created a new kind of patent "marketplace" that fundamentally changes litigation risk assessments, IP portfolio valuations, and patent policy priorities. Box 11 presents the case of a computer and communications technology patent licensing cluster. The practices of three companies illustrates conflicting arguments about whether non-practicing entities (NPEs) facilitate or frustrate open innovation.

An more intricate example of an IP broker is the Intellectual Property Exchange International (IPXI), which bills itself as "the world's first financial exchange that facilitates non-exclusive licensing and trading of intellectual property (IP) rights with market-based pricing and standardized terms." The concept is complex, but boils down to aggregating bundles of IP rights pertaining to certain technologies, creating "units" of derivative contractual use-rights, and then setting up a secondary market exchange-trading system for these derivative units. The value of the units fluctuates based on information about how the underlying technologies are being used in the relevant industry. Among IPXI's most recent offerings is, for example, a portfolio of 194 U.S. and foreign patents that cover technologies used in wireless chipsets that comply with the IEEE 802.11n Standard.

Another market-based IP clearinghouse, the Rational Patent Exchange (RPX) works on nearly the opposite premise of IPXI. Using subscription fees charged to its members, RPX buys up "dangerous" patents so they cannot be used against the members. The idea is, basically, to create a defense against IP infringement threats from non-practicing entities, by purchasing the IP rights might pose such a threat. The irony

is that RPX is itself a non-practicing entity, although one that claims a moral high ground by using its patent portfolio only to defend its members, never suing others.

An analogy might be drawn between the patent clearinghouses just described and the agents or administrators that collectively manage copyrights (see generally Gervais, 2010). Copyright collective societies were a response to the logistical challenges faced by large and disparate groups of copyright owners and copyright users trying to transact with one another. It was as difficult for copyright owners to monitor and enforce their rights against users as it was for users to obtain licenses from all the copyright owners whose works were used. The link between collective copyright management and open innovation is unexplored, but potentially interesting given the role collective societies play in structuring markets for IP rights (Gallini 2011).

3. Cross-Licensing and Patent Pools

Shapiro (2001) is credited with coining the term "patent thickets," which he described as "a dense web of overlapping intellectual property rights that a company must hack its way through in order to actually commercialize a new technology" (p. 120). As a solution to this problem, Shapiro suggested cross-licensing and patent pools. Both models enable firms to collaborate instead of compete, at least in respect of the licensed or pooled IP. While cross-licensing may involve only two firms, patent pooling is often capable of facilitating many-to-many licensing models. This feature is especially important to facilitate cumulative innovation resulting from the stacking of many necessary and overlapping technological components.

Some of the clearinghouse structures described above could also be fairly described as patent pools. But the history of patent pooling is much longer. Patent pools were widespread across many industries—from aviation to sewing machines—around the turn of the twentieth century. One reason for their popularity was the avoidance of antitrust regulations that applied to other forms of cooperation between competitors. Patent pools are common where industry standards require firms to comply with certain technical criteria or regulatory protocols, such as in the telecommunications and computer industries. In the context of so-called "standard essential patents," competition law requires IP be licensed to any entity on FRAND terms, which are Fair, Reasonable, and Non-Discriminatory. Pools or "pseudo-pools" can help to facilitate this kind of open licensing (Contreras 2013).

> Patent pools are "formal or informal organizations where owners of intellectual property share patent rights with each other and third parties."
>
> Concept 13: Patent Pools (Lerner & Tirole 2008, p.157)

Another noteworthy development is the "Defensive Patent License," which a group of scholars established as a mechanism to support what they call "open innovation communities" (Schultz & Urban 2012). The licence involves a pledge to forgo patent litigation against other licensors, in exchange for a royalty-free licence back to their portfolio. The concept of a "pledge" not to sue users of patented inventions has begun to be applied in the real world, as demonstrated through examples in Box 12.

Canada's Oil Sands Innovation Alliance (COSIA), described in Box 2 above, facilitates open innovation through joint venture agreements. Separate agreements facilitate collaboration for cleaner technology innovation to address problems with tailings, water, land, and greenhouse gases. Instead of creating a patent pool, parties to these contracts agree to share each others' technologies in exchange for "non-suit" clauses immunizing their collaborators from the threat of litigation.

Tesla made public statements promising not to sue anyone who uses its patented technology in good faith to advance hybrid-electric vehicle technology, described in Box 9 above. Its remarks reflect a similar business strategy, but with far less legal certainty. In the absence of binding contracts like COSIA's joint venture agreements, it remains to be seen precisely how the company will keep its promise.

Box 12: Open Innovation Via Promises Not to Sue for Patent Infringement

F. Offensive and Defensive Strategies

The management models just described are mainly strategies for firms that already own IP rights. With some of the strategies, there are mutual benefits for firms that both own rights and use others rights. However, IP issues are increasingly—sometimes equally or more—important for firms that do *not* own IP rights (or a particular right to an intangible asset in question) as for firms that do. In business terms of strengths, weaknesses, opportunities, and threats (a SWOT analysis), IP rights are often an opportunity and/or a threat.

Two Harvard professors, from the business school and the law school, recently published an article suggesting ways that lawyers and managers can work together on an integrated approach to strategic management of IP (Fisher & Oberholzer-Gee 2013). The framework they suggested for managerial decision-making begins by separating offensive and defensive IP strategies. Organizing IP management models in this way

provides useful advice for firms seeking opportunities to exploit their own IP, or firms threatened by others' IP.

Offensive Strategies	Defensive Strategies
Suppress competition	Challenge validity or scope
Assign rights	Develop an alternative
License rights	Secure a licence
Structure collaborations	Build a deterring portfolio
Give rights away	Deploy despite the threat

Box 14: Strategies for Managing IP (Fisher & Oberholzer-Gee 2013)

In 2009, Desire2Learn was involved in serious patent litigation with competitor BlackBoard. BlackBoard tried to enforce US Patent No. 6,988,138, which covers an online-based educational environment. Although a jury initially found Desire2Learn to be infringing upon certain claims of this patent, the Federal Circuit ultimately overturned the decision and held that Claims 1 - 38 are invalid as it is anticipated by existing prior art. Although considered a victory for Desire2Learn in the end, before the Federal Circuit's judgment, this lawsuit threatened Desire2Learn's operations in the United States. It was reported by the companies that BlackBoard and Desire2Learn reached a settlement involving a cross-license agreement, details of which were not disclosed. To remain competitive in the industry and to protect itself against potential threats, since then, Desire2Learn has invested in a comprehensive patent portfolio that spans across multiple jurisdictions including the US, Canada, Singapore and Australia, as shown by Espacenet data maintained by the European Patent Office. Desire2Learn explicitly outlines IP restrictions or activities that it deems as infringing or harming their intellectual property and proprietary rights.

Box 13: Desire2Learn's Patent Portfolio -- A Strategic Response to Threats

All of the offensive strategies they canvass fall within the scope of the three overarching business strategies described above, although this study's tripartite taxonomy is more specifically tailored to open, user, and collaborative innovation models than management strategy generally. The defensive strategies that Fisher & Oberholzer-Gee outline might also be relevant to an open or user innovation framework. Firms' open inbound innovation practices might be influenced by such strategies. Similarly, user innovation by end users or firms might require adopting one or more of defensive strategies.

As a major proponent of open source software, it is no surprise that Red Hat has taken the strong stance that patent portfolios, particularly large portfolios amassed by large enterprises, "impede innovation and are inconsistent with open source/free software" (Red Hat, n.d.). Having said this, Red Hat applies for patent protection, and as shown by USPTO data, manages an extensive patent portfolio of its own. Although reluctant, Red Hat notes that it is a necessary evil it must undertake in order to defend itself against other companies' patent portfolio misuse and to consistently promote and protect the open source community. Red Hat however, in reaffirming its commitment to open source software, has made a promise that it will "refrain from enforcing the infringed patent" against parties who are exercising the patent right with respect to open source software. In terms of respecting other individuals' IP rights, Red Hat has implemented due diligence and intellectual property review procedures wherein each project begins with a survey of existing, published prior art and great care is taken to avoid contamination.

Box 15: Red Hat Inc.'s Approach to Patents -- A Necessary Evil

The value of an analysis that highlights defensive strategies is to reveal how firms practicing user or open collaborative innovation—firms avoiding IP as much as

possible—are nonetheless impacted by the IP framework. The IP system is not merely neutral; it is not something that can simply be ignored by firms that choose not to use it. Business models based on user, open collaborative, or peer produced innovation are affected whether or not they wish to be, and must accordingly bear the additional costs of defensive IP strategies.

VI. Marketplace Framework Policies

A. Intellectual Property

Despite the widespread recognition that IP influences innovation policymaking, published research on IP in innovation management journals is surprisingly scarce (Candelin-Palmqvist et al. 2012). Much research on IP and innovation is published in the disciplines of economics and/or law, with growing interest from communications, political economy, public policy and related fields. This study, therefore, fills a gap in the analysis by providing a unique interdisciplinary analysis. The trends of open, user, or collaborative innovation have major implications for IP policy as (i) an *indicator* of innovation, (ii) an *incentive* for innovation, and/or (iii) an *impediment* to innovation.

1. Collaborative Innovation and IP Indicators

Researchers use many different metrics to measure innovation, including intellectual property statistics. In this context, patent statistics dominate, partly because they are among the most readily available data, and partly because of the orthodox view that they are the form of protection most relevant or important for innovation. By far the most widely cited measure of patent protection in cross-country economic

analyses of intellectual property is the Ginarte-Park (GP) index, introduced in an article by Juan Ginarte and Walter Park (1997) and updated in Park's subsequent work (Park 2008). It measures select aspects of the strength of countries' patent legislation in five-year intervals between 1960 and 2005. Similar indexes were developed to measure copyright and trademark protection (Park & Lippoldt 2005; Reynolds 2003). These indexes, though incomplete, are used for modeling relationships among intellectual property and innovation, R&D, GDP, technology transfer and other variables.

Intellectual property indicators are not only a tool for econometric analyses, they are also influential in various organizations' rankings of innovation performance, by country and by firm. The two most notable indexes are the Global Innovation Index (GII), jointly produced by Cornell University, INSEAD, and the World Intellectual Property Organization (Dutta & Lanvin 2013), and the innovation sub-index of the Global Competitiveness Report, produced by the World Economic Forum (Schwab 2012). Such indices consider intellectual property rights, specifically certain kinds of patents and trademarks, as outputs of the process of innovation. These are weighted with other outputs, such as scientific publications, as well as inputs, like R&D expenditures, to create a consolidated measure of countries' innovative activity.

For example, the Conference Board of Canada (2010) released a widely publicized assessment of Canadian innovation, giving the country a "D" grade. Unfortunately, a full quarter of that grade was weighted simply on a quantitative count of Canada's IP outputs. Some authors suggest that counting IP outputs is tempting because it is convenient (Corbin 2010).

The problem with counting outputs is that mere acquisition of patent rights indicates almost nothing about whether or how open, user, or collaborative innovation is happening. Indeed, as discussed above, counting "inventions" is not necessarily even a proxy for "innovations." Many patented inventions never become innovations, and many innovations are never patented. At best, even within Chesbrough's open innovation paradigm of outbound IP licensing, knowing how many patents were registered is an irrelevant indicator. But the consequences are not merely neutral. Worse, as discussed below, there is growing consensus that IP rights can often be an impediment to innovation, especially sequential and cumulative innovation. Yet policymakers and advisors continue using IP rights as a metric for assessing innovation performance. Indeed, it is clear that many government policies actively encourage and even subsidize the acquisition of more IP rights.

> "You get what you measure. Right now, we measure the wrong things about IP …"

Box 16: You get what you measure (Gold 2008, p.7)

Admittedly, the absence of any better metrics or indicators is a major problem. Supporting the identification, development, and implementation of new indicators is, therefore, among the priority recommendations made below as a result of this study. Some leading experts have suggested better metrics—such as the proportion of firms free revealing, as an example—and praised Statistics Canada specifically for piloting one such indicator an innovation survey of manufacturing plants (Gault & von Hippel 2009). Survey results showed that a significant proportion of Canadian manufacturers are user innovators, and that they freely reveal these innovations to other firms.

Yet, on a systemic level, the experts conclude: "Statistical indicators used in official surveys of innovation activities have not addressed this new understanding of the central role of users in the innovation process. New indicators must be created to provide a clearer picture. This is especially important as research shows that user innovation is becoming steadily more important …" (Gault & von Hippel 2009, p.3).

2. Collaborative Innovation and IP Incentives

As a matter of public policy, the exclusive rights protected by IP are predominantly justified as an incentive to invest in innovation through research, development, and commercialization of new products and processes. The basic economic theory, well explained by Greenhalgh & Rogers (2010), Landes & Posner (2003), and Scotchmer (2004) for example, is that without the guarantee of exclusivity that IP provides, the world would have less creativity and fewer inventions. Because knowledge and ideas are intangible, one person cannot physically exclude another from the possession of ideas, as one could with land or goods. As Brownywn Hall et al. (2012) explain: "Appropriability is a concern for inventors since one of the outputs of inventive and innovative activity is often knowledge, an intangible asset, hence it is difficult to exclude others from using this knowledge at a fraction of the initial cost of the invention development." Formal intellectual property rights are one way to address this concern, but not the only way. IP rights create artificial scarcity through laws establishing the temporal, geographic, and substantive boundaries of exclusivity. The promise of even temporary market exclusivity should motivate firms to invest in the inherently uncertain activity of innovation.

Empirical evidence proving this theory in practice, however, is scarce. And economic arguments have evolved considerably over the past several decades. Certainly many successful commercialized innovations through the decades (including those which have created new industries) have benefitted from patent protection, and changes to IP legislation have impacted on patent filing behaviours and indeed industries. The evidentiary problem is that we know little or nothing about what would have happened in the absence of patent protection or any particular legal reform.

A review of the vast theoretical and empirical literature on the economic importance of IP is beyond the scope of this study. For every study that concludes IP is important or not, there is another that contradicts it. In large part, policy remains guided by the observation made by economist Fritz Machlup (1958, pp.79–80) more than 50 years ago: "No economist, on the basis of present knowledge, could possibly state with certainty that the patent system, as it now operates, confers a net benefit or a net loss upon society. … If we did not have a patent system, it would be irresponsible, on the basis of our present knowledge of its economic consequences, to recommend instituting one. But since we have had a patent system for a long time, it would be irresponsible, on the basis of our present knowledge, to recommend abolishing it."

Maskus (2012) offers among the most recent and authoritative reviews of econometric analyses of intellectual property's impact on innovation and/or technology transfer. "[T]here are no clear and universal relationships," he explains (2012, p.63), "between policy reforms to strengthen IPRs and subsequent innovation or R&D investments."

While IP can stimulate activity in advanced markets, especially by multinational firms, patent law reforms have little if any impact on domestic innovation in poor countries. Also, even in developed countries, almost every economic study Maskus reviews fails to resolve the reverse causality problem: Patent reforms could increase R&D and innovation, or innovative countries might simply introduce more patent reforms.

Evidence also suggests that IP is more important to large firms in industries such as pharmaceuticals and semiconductors. In the semiconductor industry, large firms use IP rights more to cross-license portfolios and defensively preserve freedom to operate than to incent or recoup R&D investments, while smaller firms use IP mainly to signal commercialization potential to venture capitalists (see e.g. Hall & Ziedonis, 2001).

> "The characteristics of present-day intellectual property regimes as actually experienced by innovators are far from the expectations of theorists and policy makers."
>
> Concept 14: Disconnect Between IP Policy and Practice (von Hippel 2005, p.112)

The central policy challenge arising due to user innovation and peer production (more than open innovation) is that empirical evidence shows that considerable innovation happens *despite* IP, not *because of* IP. This evidence has profound implications for policymakers. The most significant implication is that current IP laws and policies are skewed to favour one particular model of innovation over another.

The recommendation consistently made by experts in this field is ensure that policy frameworks are at least neutral toward the source of innovation. That means instituting marketplace framework policies that do not directly or indirectly favour

producer or user innovation, open or closed innovation models, proprietary or non-proprietary strategies. Achieving that objective in practice is difficult, because arguably the premise of IP protection is itself not a neutral position. Establishing and promoting the use of an IP system may work well for companies that wish to use proprietary strategies. But this marketplace policy framework creates substantial additional costs for companies that would prefer non-proprietary models. Such open innovators must develop expensive defensive strategies (such as amassing their own IP portfolios) or create workarounds to leverage IP rights into tools that promote openness (such as the GPL or Creative Commons licence). In theory, instead of reducing levels of policy support for closed innovation strategies, officials could increase investments in mechanisms that support open innovation. Policymakers should at the very least be aware of the implications of IP policy for open, user, and collaborative innovation, and attempt to mitigate the adverse impacts of any measures on certain classes of innovators.

3. Collaborative Innovation and IP Impediments

A recent global statistical and economic policy analysis by WIPO (WIPO, 2011) explains how economists have refined their view of IP systems, especially the patent system, to pay greater attention to cumulative innovation and collaboration as opposed to market exclusivity. In a report on open innovation by the OECD, concerns were also raised about the potential of emerging patent thickets, especially in ICT and biotechnology industries, to constrain collaboration (OECD, 2008, p. 44).

Exclusive IP rights can sometimes frustrate rather than facilitate the flow of knowledge. Too much IP protection can be a problem, especially for sequential innovations that build upon earlier technologies (Bessen & Maskin 2009) and especially if rights are fragmented among multiple owners (Heller & Eisenberg 1998). Issues include market hold-ups, where one owner of an essential technology is unwilling to license it to others, and transaction costs, which increase the more complex the intellectual property landscape becomes. The resulting gridlock has been called a "tragedy of the anti-commons" by the theory's leading proponent (Heller 1998; Heller 2008), mirroring seminal work on the "tragedy of the commons" that posits private property as a solution to underinvestment in public goods (Hardin 1968). Later, Shapiro (2001) coined the term "thickets" to describe the phenomenon of overlapping intellectual property rights that may impede, not induce, innovation.

Clear and universal econometric evidence of the thicket theory operating in practice is, however, not widely available. Brownwyn Hall and her coauthors (2012) usefully summarize the limited empirical evidence regarding thickets and R&D investments. Existing studies do show that thicket exists in specific technology areas, and patent density is associated with reduced entry into those areas. And overall, the economic evidence and conceptual research canvassed above tend to support the view of von Hippel, Benkler, and other researchers working on user innovation and peer production: Current IP laws are a problem, and existing policy approaches do not optimize economic efficiency and social welfare.

> "New IP is the emerging era of IP in which IP is understood within the entire context of innovation. It stresses sharing and collaboration instead of increased protection, leading not only to greater levels of innovation, but better access to new products and services."

Concept 15: Defining a "New IP" Era (Gold 2008, p.8)

The key implication for policymakers is to focus on efficient knowledge networks and markets. This has shifted the emphasis from the protection of IP to the mobilization of knowledge. Improving the efficiency of the IP system, as well as supporting non-IP mechanisms to promote the flow of knowledge, has emerged as a key area of focus for organizations such as the OECD, for example (Organisation for Economic Cooperation and Development 2013). Canadian policy has yet to move clearly in this direction. It should.

Another way to improve efficiency is through better IP data. Improving IP data collection, standardization, and accessibility should be among the top policy priorities. Governments should not only facilitate access to IP data, they should also enable its direct correlation with other relevant business information. With this information, businesses and their advisors will be better able to navigate the complexities of the IP landscape. Such policies would increase transparency, lower transaction costs, and facilitate market exchanges—are all integral aspects of a vibrant open innovation ecosystem.

B. Other Framework Policies

Open, user, or collaborative innovation practices also have implications for other marketplace framework laws and policies. These include competition, bankruptcy and insolvency, and investment and finance.

1. Competition

Competition policy is perhaps the most notable area in tension with open innovation. Many of the policy solutions proposed to take advantage of open or user innovation opportunities depend on collaboration. However, an implicit or sometimes explicit suspicion of collaboration among competitors is firmly rooted in competition policy frameworks developed over nearly a century.

There are ebbs and flows in specific regulatory approaches, like law and policy makers' attitude toward patent pooling for example. Early court decisions in the United States held that competition laws did not apply the same way to patent pools. But during the middle of the century, regulators reversed course. As legal scrutiny increased, patent pools became less popular. In 1995, the United States Department of Justice issued updated antitrust guidelines on the licensing of intellectual property, noting that cross-licensing and patent pooling can provide pro-competitive benefits. Pools have since seen resurgence in popularity.

Shapiro, who coined the term "patent thickets " and proposed cross-licensing and patent pooling as a solution, was most concerned about competition law issues. Noting that antitrust laws are inherently suspicious of cooperation between direct competitors, he sought to explain why policymakers should be sensitive to the

problems IP can cause. Unless competition policymakers understand why cross-licensing and patent pooling may be necessary, overzealous antitrust enforcement "can have the perverse effect of slowing down the commercialization of new discoveries and ultimately retarding innovation" (Shapiro 2001, p.122).

Recent updates to the Competition Bureau's Intellectual Property Enforcement Guidelines (IPEGs) in 2014 provide some guidance on patent pooling (Competition Bureau 2014). While recognizing that such arrangements could have pro-competitive benefits, the IPEGs suggest that, where a patent pool does not result in the clearing of blocking patents, it could be challenged as being a conspiracy to prevent price competition.

The Competition Bureau recognizes that a patent pooling arrangement may provide pro-competitive benefits by, among other things, clearing blocking patents, avoiding costly infringement litigation, integrating complementary technologies and reducing transaction costs. However, patent pools can raise several competitive concerns such as distortion of competition due to competing patents being held in a patent pool, anti-competitive and grant-back provisions, and conspiracy (World Intellectual Property Organization 2014, p.12). In order to reduce and eliminate these anti-competitive concerns, the Competition Bureau would examine patent pools under section 45, the conspiracy provision, of the Competition Act. The Bureau's analysis includes assessing the validity of the patent pool and whether non-patent holders could "invent around" the patents in the pool.

Corresponding guidelines in the United States recognize that patent pooling may be a form of tying arrangement if the licensing of one product is conditioned upon the acceptance of a license of another, separate product. The U.S. Guidelines also recognize that patent pooling can be efficiency enhancing, and state that the antitrust authorities will evaluate its competitive effects in the same manner as for other tying arrangements. In the U.S., courts have held that, if the patent pool creates market power and the patents are potentially competing patents, the pool is likely to be anti-competitive. On the other hand, if the patent pool does not foreclose competition for a viable product, permits licensees to obtain licenses for individual patents within the pool, and does not create exclusive licenses, anti-competitive concerns are not likely to arise (Corley et al. 2006).

Standard-essential patents (SEPs) are an area where pools are especially important, and while the example of a refusal to licence IP related to a standard is discussed in Canada's 2014 Guidelines, SEPs are not specifically analyzed. The European Commission and United States have now begun to explore these issues (Directorate-General for Competition 2014; DOJ & USPTO 2013).

SEPs can confer significant market power on their holders. Once a standard has been agreed and industry players have invested heavily in standard-compliant products, the market is *de facto* locked into both the standard and the relevant SEPs. This gives companies the potential to behave in anti-competitive ways, for example by "holding up" users after the adoption of the standard by excluding competitors from the market, extracting excessive royalty fees, setting cross-licence terms which the licensee would not otherwise agree to, or forcing the licensee to give up their invalidity

or non-infringement claims against SEPs. To alleviate these competition concerns and to ensure that the benefits of standardization are promulgated, companies owning patents that are essential to implement a standard are required by many SSOs to commit to licensing their SEPs on FRAND terms, discussed briefly early in this study.

The Competition Bureau in Canada has indicated that SEPs, as well as the related matter of non-practicing entities (NPEs), are priority issues for its future phases of consultation and revision. Such policy discussion should be tied to broader open innovation trends regarding IP clearinghouses and other market exchange mechanisms discussed in this study.

2. Bankruptcy and Insolvency

IP and insolvency issues were thrust into the policy spotlight with Nortel's recent bankruptcy, and the ensuing acquisition of its IP portfolio by the Rockstar consortium. These issues are elaborated upon in Box 11, above.

Industry Canada's recent review of applicable bankruptcy and insolvency laws acknowledged that the current legislation could use amendments to improve the treatment of IP licenses in insolvency proceedings (Industry Canada 2014). The primary goal would be to create an economic framework that considers the diverse stakeholders of IP and bankruptcy and insolvency laws, to "promote innovation and marketplace integrity by mitigating entrepreneurial risk."

Amendments in 2009 changed the way IP licenses were handled in insolvency (Duggan & Siebrasse 2014a). Prior to legislative amendments in 2009, debtors were able to "disclaim" contracts as part of the restructuring process. Aside from provisions on

commercial leasing, however, these acts were silent on the precise implications of disclaiming certain kinds of contracts. Disclaiming IP licensing agreements, for example, raises distinct legal and policy challenges. The aims of the 2009 amendments were to reduce uncertainty surrounding IP, and address licensee concerns when a licensor undergoes restructuring. Parliament, therefore, expressly allowed debtors to disclaim all contracts in a restructuring, including licenses, but permitted continued use of a license provided that the licensee performs its obligations under the agreement.

While the 2009 legislative amendments advanced licensee protection, much ambiguity still remains in the treatment of IP licenses in the general insolvency context. Remaining issues include the lack of a definition of IP, inconsistencies with other insolvency proceedings, the complexities of service level agreements, and third-party sales of licensed IP. Also, current legal provisions regarding IP licenses apply only to restructuring proceedings, not bankruptcies and receiverships.

These outstanding issues are all important in the context of open innovation. The reason is, basically, that in an open innovation framework, firms increasingly rely on the marketplace to buy or sell IP. It is likely that more firms will obtain IP through bankruptcy and insolvency proceedings. The experience of the Rockstar consortium that acquired Nortel's patent portfolio highlights emerging issues in this area (Duggan & Siebrasse 2014b). Another excellent example, outside of the Canadian context, concerns the sale of Kodak's patents in bankruptcy (Harris 2014).

3. Investment and Finance

Yet another marketplace framework policy issue triggered by open innovation is how investment and finance regulations should respond to trends like crowdfunding.

One locus of debate is how securities legislation ought to be amended to allow crowdfunding. Based on empirical data, researchers from York University found the three most obvious stakeholders—start-ups, investors and the portals that would be mediators between the two—each seek different regulatory outcomes (Cumming & Johan 2013). Start-ups seek to reduce limits on the amount of capital they may raise. With a similar tilt towards less regulation, portals seek simple reporting and disclosure requirements. However, investors seek a more highly regulated environment for their own protection. There are a range of open questions around crowdfunding in Canada, including (Thring 2012):

- The voting rights, anti-dilution protections, participation rights on sale, restrictions, and repurchase rights attaching to shares.
- The application of administrative obligations regarding shareholder lists, meetings, and reporting.
- The implications of cross-border (or inter-provincial) subscriptions and investments, and corresponding conflicts of laws or regulatory requirements.

The Ontario Securities Commission has proposed regulatory amendments to create a crowdfunding exemption that may address some of these questions. The OSC's proposal introduces "investment limits, portal registration [and] standardized disclosure [requirements]", as well as "rights of withdrawal and resale restrictions" (Anand 2014, p.230). Provincial regulators are not proceeding uniformly, however. Jurisdictional peculiarities in securities legislation are likely to exist.

Promoting crowdfunding may spur inventive activity. Since pledge amounts in crowdfunding are small compared to traditional venture capitalism, crowdfunding allows more investors to participate in the market. This may lead to a greater number of inventive start-ups overcoming financial hurdles through relying on crowdfunding.

Securities regulations are most strongly implicated by equity crowdfunding. Provincial regulators are contemplating changes to securities regulation that would allow equity crowdfunding. Relatedly, how upon dissolution or bankruptcy a firm's assets will be divided to pay off investors who purchased shares via crowdfunding portals may need to be addressed.

Time limits on filing IP protection, particularly patents, may hamper start-up enterprises using crowdfunding. O'Connor (2014) notes that start-ups, which are often disruptive enterprises, rely on surprise to displace incumbents. Potentially, start-ups widely advertising or describing their technology or ideas to attract donors may unknowingly trigger filing deadlines in IP legislation. This may result in start-ups actually losing their IP assets. O'Connor also notes the entrepreneurs mostly likely to use crowdfunding may not be experienced enough to grasp the costs of developing a strong IP portfolio. He notes the expense of building and defending an IP portfolio—particularly patent litigation— is often overlooked and "cash-strapped" start-ups do not budget for such expenses.

Box 17: Marketplace Framework Policy Implications of Crowdfunding

Concerns have been expressed that regulatory approaches putting public disclosure requirements on crowdfunding firms will hurt startups' IP portfolios (O'Connor 2014). Some firms may accidentally disclose patentable inventions or accelerate plans to procure IP rights, sometimes prematurely. O'Connor is one of the few IP scholars to have suggested ways for startups to manage IP portfolios in light of unsophisticated investors and emerging disclosure requirements applicable under crowdfunding. It is not yet clear, however, what the policy implications of this trend will be. Policymakers are advised, meanwhile, to monitor developments.

VII. Conclusions and Recommendations

Scholars such as Hall (2010) have concluded there is no paradox between IP and "open innovation," specifically Chesbrough's firm-centric framework. This particular concept of open innovation—meaning simply inward and outward flows of knowledge across the firm boundaries—is consistent with strategic appropriation and exploitation of IP. Hall is correct that attention to IP has helped individual companies implement open innovation strategies. From the point of view of a single firm's management strategy, IP is not irreconcilable with open innovation but rather, with the right licensing strategy, can be a means to achieve open innovation.

> "As we look more closely at the open innovation process, we see that there is no paradox—in fact the increased attention paid to IP management and the increased skill with which it is managed by companies has assisted them in developing open innovation strategies."

Concept 16: IP Management for Open Innovation (B. Hall, 2010, p. 3)

There is tension and conflict, however, between IP and "open collaborative innovation," "user innovation," and "peer production," from the public policy and innovation systems perspective of von Hippel, Baldwin, Benkler, and many others. IP rights can create substantial additional costs, acting as an impediment for firms that would prefer non-proprietary strategies. Complexities around IP-related transactions can also impede processes of cumulative or sequential innovation, and provide disincentives for collaborative and user innovation. Finally, IP-focused indicators of innovation can skew perceptions of a firm, industry, or country's performance. Overreliance on IP metrics could encourage the mere accumulation of IP outputs, which are convenient to measure but tell policymakers little or nothing about the health of an open innovation ecosystem.

> "Today, essentially all national governments support costly intellectual property rights infrastructures to support inventors who wish to restrict access to their innovations. At the same time, governments have done very little to create an infrastructure to support inventors and innovators who may wish to practice open innovation. The result is that 'open' innovators are forced to operate within an framework of intellectual property rights designed for closed innovators".

Concept 17: Skewed Policy Frameworks Support Closed Over Open Innovation (Baldwin & von Hippel 2011, p.1414)

It is clear from the analysis, therefore, that the answer to a question at the heart of this study—whether there is a paradox between IP and open innovation—depends largely on one's definition and understanding of what "open" innovation is. From the point of view of a single firm, perhaps there is no conflict. From an innovation systems perspective, the tensions are much greater.

This study, therefore, makes three key recommendations for policymakers:

A. Understand and use precise terminology.
B. Revisit assumptions about appropriation and IP strategies.
C. Neutralize marketplace framework policies.

A. Understand and Use Precise Terminology

There is an unambiguous trend toward new models of innovation across industrial and economic sectors. Economists, lawyers, management strategists, and other scholars from an array of academic disciplines have recognized that various forms of "openness" are replacing closed innovation strategies. Some of the research—especially from the disciplines of business, technology management and related fields—conceives of open innovation primarily as a strategic decision from the perspective of the firm. Other research—especially in law, economics, engineering, political economy, and others—conceives of open innovation as a broader, systemic phenomenon. The common thread in the academic scholarship, policy analysis, and practical examples is that "open" innovation happens by exchanging knowledge in networks.

Government policymakers should take this cue from experts, and explicitly acknowledge the new realities of innovation policymaking. Policy debates can then shift from asking whether this happening to determining how to respond. However, policymakers across government should aim to better understand the meaning of key terminology, including "open innovation," "user innovation," "collaborative innovation," "crowdsourcing," "open source," "open access," and so on. Conceptual and definitional clarity is not merely an academic debate or issue of semantics. Failure

to appreciate the different meaning these terms might convey or their connotation to policy stakeholders can lead to mistaken conclusions or the adoption of inappropriate policy measures. Be cautious, therefore, of analyses or arguments that conflate these related but distinct concepts. Prompt stakeholders to clarify or illustrate their positions, and encourage clearer and more consistent use of terminology in communications within and from government.

B. Revisit Assumptions About Appropriation and IP Strategies

While the appropriation of value from intangible assets is important to all businesses, there are many ways in which firms realize this value. Firms may strategically reveal and share certain things, while using various appropriation strategies to protect other aspects of the business. The formal IP system of patents, copyright, trademarks, and designs is only one aspect of a firm's innovation strategy. Informal appropriation mechanisms are far more widely used, and include lead-time, product complexity, customer loyalty, product complexity, and trade secrets.

With these formal and informal appropriation strategies in mind, policymakers can better understand the business models that firms may use to manage IP. Some firms acquire as many IP rights as possible, with a view to using such rights to attract venture capital, exclude competitors, raise prices, or implement other "closed" innovation strategies. But firms are increasingly choosing to freely reveal their innovations to the public domain. Free revealing can save costs, grow industries, exploit network effects, drive demand for complements, and yield a host of other benefits. Many firms implement a hybrid model of collaboration through open licensing. This can be done

via standard term licensing, through IP clearinghouses or brokers, or using cross-licences and patent pools.

The more government policymakers recognize the broad range of formal and informal appropriation strategies that businesses rely upon to innovate, the more responsive marketplace framework policies can be. At the very least, policymakers should recognize that fewer firms than ever are simply acquiring and enforcing IP rights in pursuit of a closed innovation strategy. Orthodox assumptions about the policy role of IP as primarily an incentive to invest in R&D or commercialization ought to be questioned and revisited. Rather, more emphasis should be placed on the role of IP in facilitating or frustrating knowledge exchanges, whether through market transactions or other mechanisms.

C. Neutralize Marketplace Framework Policies

Third, and most importantly, government policies should not focus disproportionately on proprietary models of innovation. Neutral marketplace policy frameworks should provide equal support for businesses based upon peer-produced, user, or open collaborative innovation.

1. Reduce IP-Related Transaction Costs

At a minimum, from the firm-centric view of open innovation, neutralizing policy frameworks requires reducing transaction costs. Reducing the costs of IP transactions would lessen the extent to which IP acts as a potential impediment to innovation. It would help to facilitate the knowledge networks and exchanges that drive open innovation.

One way to reduce transaction costs is to increase the quality of the rights that are granted (*i.e.* tightening application criteria or registration procedures, raising the standards to acquire protection, adjusting the burden of proving that protection is necessary, etc.). Formal IP rights that are granted would then be less prone to attack, reducing uncertainty and the corresponding costs of legal advice or litigation. The elimination of "weak" patents and other IP rights would help to create a "stronger" and healthier IP system. In other words, IP protection that covers broader subject matter, lasts longer, provides more rights, or is subject to fewer exceptions is *not* the appropriate measure of the strength of protection. Providing *more* IP protection would only assist firms practicing closed not open innovation. IP protection that is more predictable and reliable, but not necessarily broader or longer, would however benefit all businesses and the public in general.

Another way to reduce transaction costs is to improve the quality of IP-related information. Data should be standardized and openly accessible insofar as possible. WIPO has taken positive steps toward patent landscaping in certain fields and industries, which Canada could emulate in a domestic context. Initiatives could include not just patent-related data, but also data regarding other IP rights, such as copyrights. While international law may prevent the imposition of certain formalities in that regard, there are numerous initiatives underway to nevertheless create registries of works protected by copyright or in the public domain. Information about IP transactions, including assignments and licenses, would also be useful to track. So too would correlations with other business-related data, such as corporate details or securities

filings. Government policymakers should explore various mechanisms to collect and disseminate such information.

2. Provide Incentives for Openness

More ambitiously, government policies can be created to provide the same level of support for user, open, collaborative and other innovation models as currently exist for proprietary models. This would expand the range of incentives for innovation beyond the formal IP rights currently assumed to motivate most businesses.

Some steps have been taken to promote the open accessibility of results of publicly funded research. But there are few if any policies and programs designed to encourage the use of non-proprietary business strategies in the private sector, such as free revealing to the public domain or collaboration through open licensing.

Many government policies and programs are currently aimed at encouraging firms—especially small and medium-sized businesses—to acquire IP protection. Seldom are policies designed to advise business why they might want *not* to adopt proprietary models and management strategies. Little emphasis tends to be placed on the costs of proprietary strategies, whether to the acquiring firm, to other firms or individuals, or throughout innovation systems more generally. Some work has begun, for instance to assess the impact of NPEs in the United States, but there is little or no empirical research in Canada. Policymakers should consider a comprehensive audit of the public and private costs of maintaining the IP system, including establishing and administering registration systems and also litigation and other enforcement mechanisms.

Also, if policies were to fully recognize the value of user innovation, the concept of "user rights" would take a more prominent place not just in the jurisprudence but also in legislative frameworks. While the Supreme Court has emphasized the importance of user rights in copyright law, and fair dealing provisions were recently expanded, other legislative amendments have created legal barriers to user innovation. Prohibitions on adapting or modifying software or devices protected with technological protection measures are one concrete example of legal policy measures that may inhibit user innovation and its positive economic impacts.

3. Measure and Value Openness

In many studies of Canada's innovation performance, too much reliance is currently placed upon IP-related outputs, such as patent filings per capita or international trademark registrations, as indicators of innovation. At best, these metrics indicate strategic decisions to seek formal proprietary protection. IP-focused indicators typically conflate the distinct concepts of invention and innovation, which may overlap but may also be unrelated in many circumstances. They provide no indication whatsoever of levels of innovation by the vast numbers of firms that rely upon informal appropriation strategies, such as trade secrets or first-mover advantage. Output-oriented IP indicators also fail to capture the systematic aspects of innovation, including the degree to which information flows across firm boundaries throughout knowledge networks. Most problematically, measuring IP outputs is likely to lead to policies designed to increase what is measured, *i.e.* IP. As demonstrated in this study, more IP outputs may or may not correlate with, let alone cause, more innovation. More IP outputs will almost certainly not correlate with or cause more *open* innovation.

Measuring IP outputs may be convenient, and is often done because data is readily available and no other reliable sources exist. The recommendation to improve IP-related data can help somewhat to alleviate this problem. But also, government policymakers should encourage the development and deployment of new metrics. Experts have praised one of the methods and indicators pioneered by Statistics Canada—surveying businesses to determine whether and how firms freely reveal innovation— as an example other countries should follow. Canadian policymakers should invest in efforts to identify even more and better indicators of open innovation.

4. Promote More Collaboration

Government policymakers should prepare to question, and perhaps revise, fundamental assumptions about the relative roles of competition versus collaboration in promoting innovation and economic growth generally. For nearly 75 years, economic theory and innovation policy has been designed to promote competition and limit collaboration. The ideology that competition is the best way to promote innovation implicitly underpins not only IP but also competition and other marketplace framework policies.

A core assumption at the root of IP policy is that firms will not invest in innovation unless protected from competition by limited monopoly rights. Evidence now shows this assumption to be oversimplified and not generalizable; many users and firms will innovate without IP rights. Competition policy, at its heart, is inherently skeptical of collaboration. Collaboration among competitors is sometimes permitted, but as an exception to general prohibitions.

If the recent trend toward open, user, collaborative innovation and peer production continues to transform not just business strategy but also innovation systems and socio-economic structures, it may become necessary for marketplace framework policymakers to invert orthodox assumptions. In an "open" innovation paradigm, it should be assumed that firms would innovate without IP rights unless there is empirical evidence to the contrary. It should be assumed that collaboration would produce greater benefits than competition. This trend could also disrupt policies around finance and investment, bankruptcy and insolvency. Indeed, it is possible that user innovation, open collaborative models, and peer production could call into question the longstanding notion of "the firm" as the central stakeholder in innovation and economic policymaking.

The implications of such transformations could be profound. This study does not recommend radical or immediate action to completely reorient marketplace framework policies. It is, however, recommended, that policymakers make themselves aware of this shift toward "openness," anticipate that the trend will continue and likely grow, and evaluate existing and proposed policy measures accordingly.

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