Evidence-based Intellectual Property Policymaking

An Integrating Review of Methods and Conclusions

Jeremy de Beer

Working Paper 1
Published: 2 January 2017

Author

Jeremy de Beer
Full Professor, Faculty of Law, University of Ottawa
Senior Research Associate, Intellectual Property Unit, University of Cape Town
Co-Founder and Director, the Open African Innovation Research Network (Open AIR)

Abstract

Governments have long been interested in making intellectual property (IP) policy based on sound evidence. There is a large body of literature addressing the economic impacts of IP, but little of it is accessible to policymakers. This article aims to improve understanding of how IP contributes to the economic performance of a country's innovative sectors. A detailed literature review and meta-analysis identifies existing methodologies and analytical frameworks. The article organizes the literature and conclusions into four major archetypes, and explains the advantages/disadvantages of each approach. First, data for advocacy is used primarily by special-interest lobby groups. This literature is accessible to policy-makers, but rarely transparent, verified, or peer reviewed. Second, valuations of aggregate economic contributions of IP-related industries are influential worldwide. This literature usefully allows us to compare data internationally, but makes unfounded or misleading assumptions about the importance of IP to a particular industry. Third, innovation indices and rankings are increasingly used to assess comparative progress over time. This literature reports on a broad-base of IP and innovative activity, but risks turning into a statistical horserace. Fourth, the literature on scholarly theoretical and empirical research and modeling is extensive. This literature often relies on sound evidence, but tends to use the 'available information' – patent data – without explaining the context in which firms may or may not choose to use formal IPRs. It is also rarely accessible to policymakers in the format or timelines required. None of these frameworks alone are fully capable of providing complete, reliable information about the economic importance of intellectual property in any one particular country, and explain why. An approach that positions and integrates various frameworks, methods and data sources is, therefore, appropriate. The key challenge for the future is to connect empirical data and micro-economic analyses about firms' strategic responses to IP policy changes with statistics and macro-economic insights on overall economic performance or social welfare.

Keywords

open innovation, innovation, intellectual property, access to knowledge, evidence-based, policy, policymaking

Introduction

1. Calling for Evidence-Based IP Policymaking

Governments have long been interested in making IP policy based on sound evidence, but the concept of evidence-based IP policymaking has recently garnered increased attention. Such attention seems to correspond generally with a rise in the complexity of IP policy frameworks and the controversies associated with them.

A number of industry-sponsored studies have made claims about the benefits (or costs) of IP protection, ostensibly to justify self-interested policy revisions. Other business associations, civil society groups, and academic commentators have responded to such studies with harsh criticism or counterclaims of their own. There is a large body of scholarly literature addressing the economic impacts of IP, but little of it is accessible – in theory or practice – to policymakers. Governments have therefore struggled to implement an evidence-based approach to IP policymaking.

One notable catalyst for action towards this ideal was the "Hargreaves report," a high-level enquiry into IP's effectiveness commissioned in 2010 by the UK Prime Minister (Hargeaves, 2011). The report's first recommendation concerned evidence: "Government should ensure that development of the IP System is driven as far as possible by objective evidence." (Hargeaves, 2011, p. 8, 20, 98). This recommendation was subsequently implemented by the UK Intellectual Property Office (2013), which has issued a "Guide to Evidence for Policy,". The Guide explicitly aspires to solicit evidence that meets three criteria: "that it be clear, verifiable and able to be peer-reviewed," (p. 1).

The US has also undertaken efforts to promote evidence-based IP policymaking. When Congress passed legislation known as the *PRO-IP Act*, the US Government Accountability Office (US GAO) was directed to provide information on one particular IP issue: quantifying the impacts of counterfeit and pirated goods.[1] After careful study, the US GAO (2010) reported that "despite significant efforts, it is difficult, if not impossible, to quantify the net effect of counterfeiting and piracy on the economy as a whole," (p. 27). Indeed, on examination, the US Government could not substantiate its widely cited estimates of the economic impact of counterfeiting and piracy problems. The *PRO-IP Act* also mandated the office of an Intellectual Property Enforcement Coordinator (IPEC) to develop strategic policy.

[1] *Prioritizing Resources and Organization for Intellectual Property Act of 2008*, 15 USC (2008) [*PRO-IP Act*].

In doing so, the "IP Czar," as she was colloquially known, began with a public call for data and ways to measure IP infringement threats, promoted on the White House blog (Espinel, 2010, p. 66-68).

Policymakers in Australia, Canada, and at international organizations including the EPO and WIPO are also feeling the impetus for better evidence to shape IP policy (Global Advantage, 2014). Writing after the UK government accepted Hargreaves's recommendation for evidence-based policy, one IP policymaker (formerly the economic advisor to the UK IPO, now Chief Economist for IP Australia) summed up the problem and ideal solution like this:

> "[W]e are constrained to consider all submissions of evidence to a debate, and that usually includes a large swath of 'grey literature' which can take weeks to get through, leaving very little time to go looking for academic papers which may be relevant to the policy questions at hand. … For us, the Nirvana would be to have academics, industry, consumer groups and policy makers sitting in the same room, agreeing on what the underlying data looks like." (Mitra-Kahn, 2011)

Take Canada as one example. There, the Conference Board of Canada's reports have been among the most widely publicized studies of Canada's innovation performance. In 2010, the Conference Board gave the country a "D" grade (i.e. 14th out of 16 countries). A quarter of that grade was weighted on a quantitative count of Canada's IP outputs. For example, indicators included "patents by population" and "trademarks by population" (Conference Board of Canada, 2010). In 2013, the Board repeated the study and doubled its indicators. Canada remained 13th out of 16th countries. In that study, a fifth of the indicators measure quantitative IP outputs; and in each of these, Canada received a D (Conference Board of Canada, 2013a). The report expressly acknowledges the limits, for example, of counting patents as a measure of innovation. However, it then asserts these outputs "help indicate relative national innovative abilities and capacities" (Conference Board of Canada, 2013b). The Conference Board's 2015 update compares not only Canada and 15 peer countries, but also innovation at the sub-federal level in Canada's 10 provinces and 3 territories. Internationally, Canada's ranking increased to a "C", or 9th out of 16 countries (Conference Board of Canada, 2015). The new report reduced the number of indicators by half and included only one measuring IP output: patents by population. Did Canada actually become more innovative? Or did new metrics yield new results?

The core challenge is similar in various jurisdictions around the world. There is a need to make intellectual property policy which responds to verifiable interests and concerns amongst stakeholders. But how?

2. Scope and Methods

This article aims to improve understanding of how IP contributes to the economic performance of a country's innovative sectors. The purpose of this study is *not* to assess the contribution of IP to innovation or the economy. It is to help policymakers and researchers understand how such assessments have been or could be done.

Following this introduction, a detailed literature review identifies existing methodologies and analytical frameworks. I examine relevant research and analysis that relates to the question of how IP contributes to the performance of an economy across sectors. I adopt an integrative approach, combining collections of seminal and recent works from across disciplines including economics, management science, technology and innovation, science policy, and law. This article is the first of its kind to review and synthesize what we know across not only sectors and disciplines, but also domains of intellectual property, *i.e.* copyrights, trademarks, patents and related fields, and to connect those insights with our knowledge of innovation policy more generally.

To do so, I use a range of accepted literature review methods, including especially citation searching and bibliographic tracing (Hart, 2001; Machi & McEvoy, 2009; Fink, 2010). This method – which involves searching forward and/or backward from already known-sources – was most appropriate to ensure coverage not only of key scholarly materials, but also policy-relevant grey literature from commissioned experts, think tanks, and inter-governmental organizations. Although I did not use interviews, focus group workshops, or open consultations in my research, many of the studies that I review did use such methods to gather insights about evidence-based IP policymaking.

As a result, my meta-analysis identifies, synthesizes and analyzes the most relevant materials; including peer reviewed and policy-oriented national and international sources across a range of disciplines in all major fields of IP. I organize the existing methodologies and frameworks into four major themes:

- Data for advocacy, used primarily by special-interest lobby groups;
- Valuations of aggregate economic contributions of IP-related industries;
- Innovation indices, rankings, and policy reports; and
- Scholarly theoretical and empirical research and modeling.

I then provide an integrated summary of the frameworks, methodologies, data sources, and advantages/disadvantages of each of these approaches. I conclude that none alone are fully capable of providing complete, reliable information about the economic importance of intellectual property in any one particular country, and explain why. An approach that positions and integrates various frameworks, methods and data sources is, therefore, appropriate.

Based on my analysis of the literature, and identification of its gaps and deficiencies, I identify a potential solution to the challenges of assessing the economic impacts of IP. I explore the usefulness of an innovation process framework as a practical means to structure the analysis of the socio-economic implications of IP policy decisions for specific sectors and across the economy. The framework explains how firms' intellectual property management decisions at the microeconomic level are affected by IP policy decisions, and how firm level decisions relate to broader outcomes at the level of a particular industry or innovation system. Most importantly, this framework may help to shift the focus of policymaking from a firm-centric micro-economic perspective to a systemic macro-economic analysis. This is the crucial leap that few if any studies in the existing IP impact assessment literature have made. Such a framework could allow policy makers to investigate how the impacts of their decisions are likely to propagate through the economy, and who the winners and losers will be.

Literature Review

1. What is Reliable Evidence?

Before delving into the dominant frameworks, methods and data sources for assessing the impacts of intellectual property, it worth exploring the concept of reliable evidence in this area.

In late 2012, a group of renowned copyright scholars met to discuss the question: *What Constitutes Evidence for Copyright Policy* (Kretschmer & Towse, 2013). This symposium was a direct response to Hargreaves's report and its subsequent reception by the UK government. Contributors were asked to start with their disciplinary perspective on the meaning of the UK IPO's standards for evidence that is "clear, verifiable and able to be peer reviewed." Various participants noted different attitudes toward evidence. For example:

- Economists favour testing hypotheses against objectively selected quantitative data;
- Social scientists would also consider relevant norms and power structures; and
- Governments prefer participatory ways to interpret and weigh all kinds of information.

The contrasting perspectives of economists and lawyers are noteworthy. It has been suggested that the demand for evidence as understood by economists is especially difficult for lawyers, whose understanding of evidence is based on interpretation of cases and judgments about what works in their experience rather than on statistical data (Towse, 2013, p. 1189). I submit that the legal analytical approach is a judgmental exercise that considers both relevance and probative value in determining whether evidence is acceptable or not and, if so, what weight it should be given. While lawyers tend to base decisions on facts or analogies, economists are more comfortable with assumptions and models.

It is clear that economists, lawyers, political scientists, and others have differing disciplinary norms and perspectives on what constitutes reliable evidence, and this is relevant to policy-makers who have to respond to and consult with all of these different groups. Yet one point well-accepted across most disciplines concerns the recognition of qualitative data. Ethnographic studies based on close observation can certainly be valid evidence, while anecdotal evidence can be illustrative even if it is not generalizable. Kretschmer and Towse (2013), conveners of the symposium mentioned above and editors of the published proceedings, noted the inevitable tension between specificity and generality (p. 10).

Experts have also confronted the pragmatic aspects of an evidence-based policymaking agenda. Good quality evidence may in practice be very difficult or impossible to obtain. For one thing, governments have short timeframes that are not always amenable to rigorous scholarly standards. Commissioning research favours professional consultancies over academic investigators; therefore, there are likely to be biases in the data and evidence presented to policymakers. Organized and well-financed industry lobbyists are advantaged over disparate small business or consumers (Kretschmer & Towse, 2013, p. 11).

Another issue is that those who insist on evidence-based IP policy occasionally ignore their own ideals. "Policy making remains a political business with or without economic evidence," Towse (2013) explains in the *Cambridge Journal of Economics* in 2013 (p. 1188). This undermines stakeholders' confidence in a process of preparing and submitting evidence that may not matter anyways. Database protection in the EU has been cited as one example (Hargreaves, 2011, p. 19). Copyright term extension for sound recordings in the UK, to match protection in the European Union, is another (Hargreaves, 2011; Towse, 2013).

In 2006, the Institute for Information Law at the University of Amsterdam reported to the European Commission on the arguments in favour of several copyright reforms, including extending copyright terms for makers of sound recordings (Hugenhotlz *et al*, 2006). The report finds little benefit to term extension.[2] Subsequent studies in Canada and New Zealand also show little evidence to support extending copyright terms for sound recordings, because a longer term was unlikely to make any significant positive impact (Hollander, 2005; New Zealand Ministry of Foreign Affairs, 2015). In fact, the New Zealand report suggests that longer terms would lead to more money leaving the country, as most of its copyright protected music is imported rather than created domestically (New Zealand Ministry of Foreign Affairs, 2015, p. 1, 14). Nonetheless, international agreements like the Trans-Pacific Partnership establish longer terms and promise economic benefits for all Member States.

Such challenges make it appropriate to examine more closely various frameworks and methodologies for IP impact assessments, including their scope and data sources. Reviewing previous studies will help to demonstrate concerns, identify gaps and propose solutions. The next section of this article clusters existing approaches into four archetypes: (1) data for advocacy; (2) industry contributions; (3) indexes and rankings; and (4) empirical analyses. While some studies straddle the boundaries between categories, my original taxonomy helps capture the

[2] See also N. Helberger et al, (2008), Never forever : Why extending the term of protection for sound recordings is a bad idea, *European Intellectual Property Review*, 5, 174-181, retrieved from fordhamipconference.com/wp-content/uploads/2010/08/Bernt-Hugenholtz-Never_forever_EIPR.pdf.

essence of the various approaches currently available to assess the economic contributions of IP.

Existing Frameworks, Methodologies and Data Sources

1. Data for Advocacy

Some of the interest in reliable IP impact assessments and evidence-based IP policymaking is a response to a growing number of studies prepared or paid for by industry associations or lobbyists. “Data for advocacy” is one term that has been used to describe these statistics (Towse, 2013, p. 1190). Hargreaves (2011) was more direct in his report to the UK Government, calling the approach “lobbynomics,” (p. 18).

Rob Reid (2012), in a satirical TED Talk called “The $8 Billion iPod,” reviewed some popular statistics about the harms of copyright infringement.[3] He cited figures used by the Motion Picture Industry of America (MPAA) in its press release supporting the *Stop Online Piracy Act*:

- $58 billion lost to the US economy annually;
- 373,000 lost American jobs;
- $16 billion in lost employee earnings;
- $3 billion in federal, state and local governments’ tax revenue (Motion Picture Association of America, 2011).

These figures are found in a widely cited report from the Institute for Policy Innovation (Siwek, 2007a). The 2007 report on “the true cost of copyright industry piracy,” authored by Stephen Siwek (2006, 2007b), is one of a suite of similar works, also dealing specifically with sound recordings and motion pictures.

Another report presents estimates of losses due to piracy in the EU: €240 billion and 1.2 million jobs by 2015; that statistic is according to a TERA Consultants (2010) report commissioned by the International Chamber of Commerce’s (ICC) initiative, “Business Action to Stop Counterfeiting and Piracy (BASCAP).” On examination, the methods and data underlying the study were found to be highly

[3] Industry figures have also led to numerous critical media reports, including from the *New York Times*. See A. Chozick & J. Wortham, (2012, February 8), The Piracy Problem: How Broad? *New York Times*, p. B1(L), retrieved from go.galegroup.com/ps/i.do?id=GALE|A279426508&v=2.1&u=txshracd2598&it=r&p=AONE&sw=wLA-English; D. Kravets, (2010), Fiction or Fiction: 750,000 American Jobs Lost to IP Piracy, retrieved from Wired website <www.wired.com/2008/10/fiction-or-fict/; J. Sanchez, (2008), 750,000 lost jobs? The dodgy digits behind the war on piracy, retrieved from Ars Tech website arstechnica.com/tech-policy/2008/10/dodgy-digits-behind-the-war-on-piracy/1/>.

problematic. One government policymaker described how TERA, on behalf of the International Chamber of Commerce, used "the classic tricks of the trade," (Mitra-Kahn, 2011, p. 84).

The general criticisms are that such reports are not peer reviewed, do not disclose sources, or provide transparent data. More specifically, the methods used in the TERA study, and others like it, have been criticized for:

- relying on unverifiable data;
- making unspecified calculations and assumptions;
- double-counting important figures;
- explicitly but arbitrarily adjusting others;
- including formulaic or computational errors;
- and so on, (Mitra-Kahn, 2011).

Two further methodological problems concern assumptions about estimated substitution effects (*i.e.* whether one infringement equals one lost sale), and blindness to countervailing benefits (*i.e.* how money not spent on a CD is nevertheless spent elsewhere in the economy) (Karaganis, 2011, p. 13).

Both studies just cited are examples of impact assessments involving estimates of the costs of *not* protecting IP. The implied corollary is that these costs would be avoided with more IP protection. A related strain of reports couches a similar argument in positive terms, arguing more directly that IP protection "benefits the economy," "promotes innovation," "helps firms monetize their innovations and grow," "helps small and medium enterprises," and "benefits consumers and society."

A report sponsored by the ICC and BASCAP, titled "Intellectual Property: Powerhouse for Innovation and Economic Growth," mentions these virtues (Dixon, 2011). That report expands the analysis to make claims about the importance of not just copyright industries but also "patent-intensive" industries like pharmaceuticals, chemicals, aerospace, motor vehicles and electrical engineering, as well as "branded good" industries relying on trademarks (p 4). In doing so, it footnotes two earlier works (from 1987 and 1996) that have been difficult to obtain for verification, and several reports that are no longer accessible as cited (Raymond, 1966; McCarthy, 2010).[4]

[4] C. P. Raymond, (1996), *The economic importance of patents*. London: The Intellectual Property Institute. and J. T. Mccarthy, (2010), *The Economic Importance of G.I.s.* are not in print or available online, but archival copies were eventually obtained from the Bodleian Library at the University of Oxford. A reference in a McKinsey consulting report from German, Spanish and UK industry association reports, and a report from the UK IPO that could not be located.

Siwek (2014), who reported the $58 billion figure for the Institute for Policy Innovation, is also noted for his authorship or co-authorship of numerous periodic reports about copyright industries in the US economy. The International Intellectual Property Alliance (IIPA), a private sector coalition of trade associations representing U.S. copyright-based industries, commissioned 15 such reports up to 2013. The 2014 version asserts that the copyright industries in 2013 contributed $1.9 trillion (11.44%) to the US economy and employed 11.2 million workers (8.26% of all US employment).

The IPI, ICC/BASCAP, and IIPA work are just a few examples of a large body of grey literature about IP industry contributions to GDP and jobs.

In response, "user" industry associations have adopted the same methods to support their own interests. A series of studies funded by the Computer & Communications Industry Association (CCIA) looks at "The Economic Contribution of Industries Relying on Fair Use," (Rogers & Szamosszegi, 2007, 2010; Rogers et al, 2011). One study includes claims like: "[f]air-use industry value added in 2008 and 2009 averaged $2.4 trillion" and "[e]mployment in industries benefiting from fair use and related limitations and exceptions increased from 16.9 million in 2002 to 17.7 million in 2008," (Rogers *et al*, 2011, p. 6-7). The CCIA also funded a study of industries relying on exceptions and limitations to copyright in the EU, attributing to these industries €1.1 trillion or 9.3% of GDP and nearly 9 million jobs in 2007 (Akker *et al*, 2010). A methodologically similar study in Australia, funded by the Australian Digital Alliance, concludes that in 2010, all the industries relying on limitations and exceptions to copyright contributed 14% to Australia's GDP, or $182 billion, and employed 2.4 million people, which is 21% of Australia's paid workforce (Houghton & Gruen, 2012a, 2012b).

Many of the industries cited by proponents of more IP protection as being "IP-intensive" or "copyright-based" are the same industries other advocates cite to support more limitations and exceptions. One academic has critiqued just the latter group of studies, but in fact most of these studies suffer from the same conceptual difficulty. They provide interesting data about industrial contributions, but make unjustified assumptions and inferences about the relevance of IP (Baker, 2012).

Mitra-Kahn (2011) aptly explains why the grey literature of industry and government reports set the tone of debate (at least in copyright policy), despite empirical shortcomings. The reason is not because this work is inherently better than academic studies, "but because it is presented in a definite voice, accompanied by press statements, glossy front-pages and a concert effort to send short executive summaries to politicians and policy makers," (p. 77). He notes the "particular trick of telling the reader how big the copyright industry is," which is a "rhetorical device" used before moving on to make a case (p. 77).

2. "IP-industry" Contributions

Reports stating the cost of IP infringement or the contribution of IP industries to GDP or jobs often come from industry groups, especially the IIPA, ICC, or think tanks like the IPI. But many national governments and influential international organizations have also used these methods.

A report from the United States Patent and Trademark Office (USPTO, 2012) quantified the importance of "IP-intensive industries." Covering patents, copyrights, and trademarks, the USPTO concluded that IP-intensive industries "directly accounted for 27.1 million American jobs, or 18.5 percent of all employment in the economy in 2010," (vi-vii). Adding in 12.9 million "indirectly supported" supply chain jobs, the USPTO claimed 40 million jobs (27.7 percent of all jobs) were directly or indirectly attributable to the most-IP intensive industries. Further, according to the USPTO, these industries "accounted for about $5.06 trillion in value added, or 34.8 percent of U.S. gross domestic product in 2010," (vi-vii).

In 2013 the European Patent Office (EPO) and the Office for Harmonization in the Internal Market (OHIM) produced their own study: "Intellectual property rights intensive industries: contribution to economic performance and employment in the European Union." Because it was expressly intended to provide results comparable to the US economy, the methodology is closely related to the "pioneering study" by the USPTO. The headline conclusion is that "IPR-intensive industries contribute 26% of employment and 39% of GDP in the EU," (p. 6).

The USPTO's numbers may seem overstated to some readers. That is because they involve a subtle sleight of hand. Certain "industries" may indeed make gigantic contributions to employment or economic output. It is misleading, however, to label these "IP-intensive" industries. Such industries do use the IP system *more than other industries*. The methodology is generally robust to determine which industries those are.

But, in fact, we have little idea how IP is used *within* many of these industries, relative to other management strategies or policy levers. We know almost nothing about what would happen to these industries *without* IP. And what we do know about the impact of IP within these industries is not based on studies of this kind, but on methodologically different studies. Moreover, while the term "intensive" implies that IP is used a lot, one of two industries that hardly use IP at all can be more intensive than the other.

Basically, the fact that some industries are important does not support the proposition that IP is important, or any inferences about how important IP is. That does not mean IP is unimportant. It simply means that studies like the USPTO's do not answer questions about the economic impacts *of IP*.

Citing or, worse, conducting flawed studies presents a credibility concern for those that seek reliable evidence to inform policy. As noted, the US GAO's (2010) audit of the government's assertions about counterfeiting and piracy showed that figures coming from the Federal Bureau of Investigation (FBI), Customs and Border Protection (CBP), and Federal Trade Commission (FTC) "cannot be substantiated or traced back to an underlying data source or methodology," (p. 18). Despite internal instructions to stop citing the debunked numbers, they continue to be referenced by various industry and government sources (p. 19).

The methodological caveats apply also to studies about the size of specific industries perceived but not proven to be associated with IP. The United Kingdom Department of Media, Culture and Sport's (2010) reporting of economic estimates about "creative industries" is an example. Towse (2013) laments that now such "figures on the size and growth of the creative industries are monotonously repeated as the motivation for every enquiry into the efficacy of copyright in the United Kingdom, as though they provided evidence of its economic incentive value," (p. 1192).

Numerous international organizations also conduct and promote such studies. One illustration is a report by UNCTAD and UNDP (2008), which assessed the significance of "the creative economy." The report contains reliable data, sound methods, and interesting findings about creative/cultural industries in general. The empirical contribution of its only chapter on intellectual property, however, is derived from the work of the World Intellectual Property Organization (WIPO).

WIPO has been instrumental in dozens of country-level studies of the economic contributions of copyright-intensive industries. Its *Guide on Surveying the Economic Contribution of the Copyright-Based Industries* has become a gold standard for governments seeking numbers that may justify certain policy-making initiatives in this sector (WIPO, 2003). Its methodology is essentially based on the earlier lobbying work of the IIPA. But the techniques and standards were subsequently refined by an international group of well-respected experts, giving this approach the credibility it previously lacked.

The methodology characterizes various industries as "core," "interdependent," "partial," or "non-dedicated support," and then makes "copyright factor" weighted calculations of economic value added accordingly. According to WIPO's guide, for example, core copyright industries include press and literature; music and theatre; motion picture and video; and so on. Software and databases are a significant inclusion in this category, given the often very large economic contribution of this category. Computers and equipment are an example of an "interdependent" copyright-based industry, since their "function is wholly or primarily to facilitate the creation, production or use of works. "Paper" is an industry "partial[ly] interdependent" on copyright, while "furniture" is merely a "partial" copyright industry. "General trade and wholesaling," "general transportation," and "telephony and internet" are examples of "non-dedicated support" industries.

The guide establishes laudable standards for data collection, survey tools, and analytical techniques. Methodologically, the more serious concern is conceptual. Studies using this method may indeed yield useful data about many important industries. But it is a big leap to call these "copyright-based" industries, implying that copyright is the basis for these industries' success. Why, for example, are "advertising services" a "core" copyright-based industry, with 100% of their value based on copyright? The "radio and television" industries do indeed disseminate copyright-protected content, but are as much users as producers of this copyright. Companies in these industries, just like "computers and equipment," frequently argue *against* copyright protection, not for it.

The methodology underpinning WIPO's guidelines and similar studies sidesteps this point. The WIPO Guide does purport to avoid topics like, "the economic impact of copyright law itself, measuring the social effects of copyright, the valuation of copyright assets of enterprises or the assessment of the effects of copyright piracy," (p. 7). Unfortunately, this crucial disclaimer is almost never the headline, nor even part of the summary presented to busy readers and high-level decision makers. Instead, an express aim of such studies is to facilitate "a new level of awareness of the *economic significance of copyright protection*," [emphasis added] (p. 7).

Due partly to WIPO's resources, prestige and influence, and partly to a lack of viable methodological options, WIPO's guide has been implemented in 46 national studies as of 2014.[5] It is probably the most widely used and politically influential economic impact assessment method that exists.

Take its influence in Canada as an example. A WIPO-guided 2004 study of Canada's "copyright-based" industries reported a total economic contribution in 2002 of $53 billion, 5.4 percent of GDP, and 900,000 employees (Wall Communication). Another study, stemming from an Industry-Canada-sponsored conference in 2001, calculated the contribution of Canada's copyright sector

---

[5] Argentina (2014); Australia (2011); Bhutan (2012); Brunei Darussalam (2012); Bulgaria (2008); Canada (2004); China (2011); Colombia (2010); Croatia (2010); Dominica (2014); Finland (2011); Grenada (2014); Hungary (2004); Indonesia (2014); Jamaica (2008); Jordan (2013); Kenya (2011); Latvia (2004); Lebanon (2008); Lithuania (2013); Malawi (2013); Malaysia (2008); Mexico (2008); Netherlands (2011); Pakistan (2011); Panama (2011); Peru (2011); Philippines (2008); Republic of Korea (2012); Romania (2010); Russian Federation (2010); Saint Kitts and Nevis (2014); Saint Lucia (2014); Saint Vincent and the Grenadines (2014); Serbia (2014); Singapore (2004); Slovenia (2011); South Africa (2012); Thailand (2012); Trinidad and Tobago (2013); Turkey (2014); Ukraine (2010); United Republic of Tanzania (2013); United States of America (2004, 2013); Organization of the East Caribbean States (2014).

slightly differently (Putnam, 2006). Before the WIPO guide had been published, Charles, McDougall and Tran used the classification of different kinds of works protected by the *Copyright Act* to ascertain “principal” and “peripheral” copyright industries. They then concluded that the GDP of the copyright sector reached $65.9 billion in 2000, or nearly 7.4 percent of Canada’s GDP (Charles, McDougall & Tran, 2006, chapter 2, p. 26). Using the same concept but a slightly different method (due to the availability of better data), they also found that the patent sector represents more than 17 percent of the Canadian GDP, or over $130 billion (chapter 2, p. 49). In 2000, according to this study, the gross domestic production of the trademark sector amounted to $313.5 billion, or 35.35 percent of total value added in Canada (chapter 2, p. 43).

As interesting as all these figures are, they simply beg the question of how exactly copyrights, patents, or trademarks contribute to the economic outcomes of putatively associated industries. Calling something an “IP-intensive” or “copyright-based” or “branded good” industry, or a “patent sector” or “trademark sector” implies that its economic contributions are attributable to IP. None of these studies, however, empirically support that proposition.

3. Innovation Indices and Rankings

The series of 46 WIPO-guided studies of contributions by copyright-based industries are indicative of a trend in IP impact assessment work globally. For many policymakers, it is not enough to believe that IP contributes billions or trillions to GDP. Governments want to know how they compare to other countries. Several methods are commonly used for international indices, rankings and comparisons.

An aim of the WIPO (2013) guidelines was to establish a basis for comparison of future surveys built on reliable data and common methodologies (p. 7). Its 2014 analysis of the numerous national studies demonstrates success in achieving this goal. While WIPO’s comparative analysis still cannot shed light on whether or how copyright actually impacts the “copyright-based” industries or the economy generally, it does contain interesting observations about relationships between copyright-based industries and other measures of policy success. WIPO analyzed how the contributions of copyright-based industries to GDP and jobs in various countries correlate to rankings in innovation, competitiveness, government effectiveness, and freedom from corruption. Strong positive correlations (though not causal relationships) were found in each case (WIPO, 2014a).

The “Global Innovation Index” and the “Global Competitiveness Index” are the two international ranking systems most relevant to IP policymaking. Each includes several IP-related indicators among a broad range of other variables, and each collects data using multiple reliable methods.

So far, six editions of the Global Innovation Index have been produced since 2007.[6] The 2015 report was co-published by WIPO, INSEAD and Cornell University (Dutta *et al*, 2015). Five "input pillars" of the index capture elements of the national economy that enable innovative activities: (1) institutions, (2) human capital and research, (3) infrastructure, (4) market sophistication, and (5) business sophistication. Two "output pillars" capture actual evidence of innovation outputs: (6) knowledge and technology outputs and (7) creative outputs. Sub-pillars are composed of individual indicators, which lead to weighted averages and scores to produce sub-indices and, ultimately, the overall index on which countries are ranked.

There are 79 indicators in the 2015 index, of which about 10% are based upon IP-related data (indicators with an * were given half-weight):

- Number of patent families filed by residents in at least three offices (per billion PPP$ GDP)*
- Royalty and license fees, payments (% of total trade)*
- Number of patent applications filed by residents at the national patent office (per billion PPP$ GDP)*
- Number of international patent applications filed by residents at the Patent Cooperation Treaty (per billion PPP$ GDP*
- Number of utility model applications filed by residents at the national patent office (per billion PPP$ GDP)
- Royalty and license fees, receipts (% of total trade)*
- Number of trademark applications issued to residents by the national office (per billion PPP$ GDP)
- Number of international trademark applications issued through the Madrid System by country of origin (per billion PPP$ GDP)*

The other indicators cover data on matters ranging from regulatory environments, to educational achievements, to ICT infrastructure, to available financing, and many more. To their great credit, the indexers have also integrated cutting-edge measures of creative output, including domain name registrations, Wikipedia edits, and YouTube video uploads. These new indicators supplement and dilute the impact of older studies that emphasized IP outputs as the most (or only) relevant indicator of innovation.

These and other creative industry output figures used in the index – such as cultural and creative services exports as a percent of total trade; national feature films per million of population; and global entertainment and media output per thousand of population – are not "IP-related" indicators *per se*. But the index's authors appropriately make no claims, inferences or assumptions about whether

[6] Available at www.globalinnovationindex.org.

or how IP influences the figures. The methodology of the Global Innovation Index stands in contrast, therefore, to the IP-industry contribution studies described above.

The Global Competitiveness Index covers 12 pillars, many of which are similar to the components of the Global Innovation Index: (1) institutions; (2) infrastructure; (3) macroeconomic environment; (4) health and primary education; (5) higher education; (6) goods market efficiency; (7) labour market efficiency; (8) financial markets; (9) technological readiness; (10) market size; (11) business sophistication; and (12) innovation. Statistical data for these pillars is obtained from internationally recognized agencies.

In this context the Global Competitive Index relies on a number of IP-related indicators (Schwab & Sala-i-Martin, 2014). Specifically, "intellectual property protection" counts for half of the weighting for "property rights," which is 20% of the value of "public institutions," which itself is 75% of the "institutions" pillar, which is 25% of the "basic requirements," which ranges from 20-60% of the total index score. IP protection and Patent Cooperation Treaty applications are two of the eight indicators that count for 50% of the score for the 12th pillar, "R&D innovation," which is 50% of "innovation and sophistication factors," which is 5-30% of the overall score. As one can see, the indexing formula is complex.

Notably, this index also uses data from the World Economic Forum's annual "executive opinion survey," (Schwab & Sala-i-Martin, 2014, p. 85-96). More than 14,000 "business leaders" were surveyed in 20 different languages. National-level partner institutes carried out the surveys. Guidelines specified the method of, first, listing potential executives from both small- and medium-sized enterprises and large companies; second, stratifying the pool based on size and sector; and choosing a random sample from the pool to survey. Surveys are administered a variety of formats, including face-to-face or telephone interviews with business executives, mailed paper forms, and online surveys. The data collected is then edited, aggregated and analyzed. The World Economic Forum has audited and aimed to improve its survey methods and analytical techniques on a regular basis.

Of particular interest is the question pertaining to intellectual property protection: "In your country, how strong is the protection of intellectual property, including anti-counterfeiting measures? [1 = extremely weak; 7 = extremely strong]." One fundamental problem with this question, from a methodological standpoint, is that different respondents may interpret the meaning of "strong" protection differently. While many respondents might believe that strong protection means *more* protection, some respondents may understand that strong protection means *more appropriate* protection, *i.e.* a healthier IP system.

Some industry associations have attempted to use "strong" IP as the only indicator in a scorecard or ranking system, which is essentially a self-interested appraisal of various countries' policy environments. An example is a February 2015 study by the Global Intellectual Property Center (GIPC, 2015), funded by the U.S. Chamber of Commerce, dramatically titled *UP: Unlimited Potential*. This is the third iteration in a series designed to promote stronger IP protections for the special interest groups who fund the work. Methodological criticisms include arbitrarily selecting or scoring indicators, disproportionately weighting pharmaceutical patents, making questionable correlations without confidence intervals, imposing subjective judgments about the law, encouraging baseless rhetoric, and more (Brooah, 2014; Basheer, 2015; Chawla, 2015). The report, for example, criticizes Canada's patent system as weak due to allegations that Canada's utility standard is out-of-line with international norms, an allegation Canada strongly disputes.[7] Other countries are criticized for protecting public health and safety, like enacting plain-packaging requirements for tobacco. More generally, the report rests on faulty premises derived from the authors' (or funders') subjective normative assessments of other countries' legal frameworks. It fails to meet the most basic standards of transparency or verifiability.

By ranking countries based on certain indicators, these reports are methodologically somewhat similar to the large-scale indices from WIPO or the World Economic Forum. But they lack the robustness or reliability of those other studies. Some are also conceptually contradictory. A study by the Business Software Alliance (BSA, 2013), for example, purports to assess various aspects of the strength of IP protection as a measure to determine whether a country satisfactorily supports cloud computing. But many of the computer and communications business actually involved in cloud computing are vocal advocates for *less* strict IP laws (See e.g. Rogers *et al*, 2011).

Although methodologically distinct, the large-scale international ranking reports (the Global Innovation Index and the Global Competitiveness Index) are useful because they recognize that IP is one among many factors that influence innovation and competitiveness. While increasing the number of IP outputs can have an impact on a country's ranking, these studies do not claim that IP causes innovation, let alone that IP is responsible for broader economic outcomes. Despite the sophistication of the international indexing studies, however, some organizations and commentators misinterpret the implications or misapply the methods. Policymakers cannot use them to determine whether IP protection is important or not, how important IP protection might be, or what might be the impact of any particular change to IP policy. These studies assume and assert, but do not establish, that IP is one of many factors that influences innovation and competitiveness.

---

[7] See *Eli Lilly and Company v. Canada* (2016), UNCT/14/2 (ICID) (Respondent's Statement of Defence at p. 9-11, 32-36), retrieved from Global Affairs Canada website: www.international.gc.ca/trade-agreements-accords-commerciaux/topics-domaines/disp-diff/eli.aspx?lang=engza.

4. Empirical Analyses

In contrast to the glossy reports and succinct summaries offered by special-interest groups, there is a vast body of comparatively technical but empirically rigorous scholarly literature that sheds light on the economic impacts of intellectual property. A full review of this literature is beyond the scope of this study, but a general overview of common frameworks and methodologies is warranted.

Figure 1 depicts a linear analytical framework that implicitly underpins many studies in this area: patents are used as an indicator of intellectual property rights, although other rights are also considered occasionally; intellectual property rights and/or surveys are used as indicators of innovation; and innovation or intellectual property rights are assumed to be proxies for/indicators of/correlated with economic outcomes. In other words, intellectual property is sometimes used as one of the key indicators or components of innovation, which is (accurately) presumed to be economically beneficial. Intellectual property is other times analyzed in more direct relation to economic outcomes, such as growth, trade or investment.

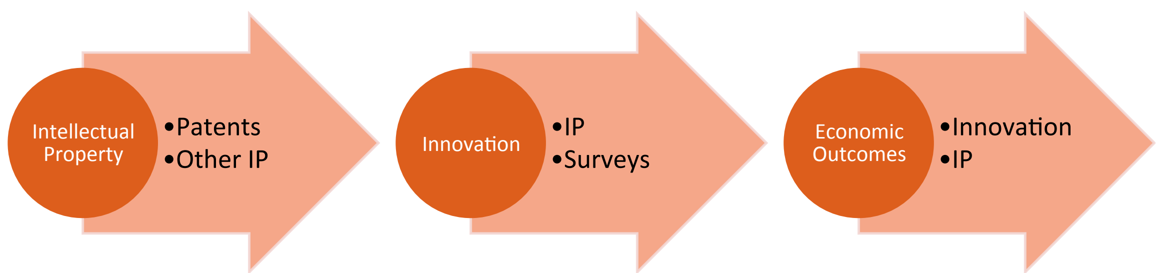

Figure 1: A common implicit but oversimplified linear model of IP, innovation, and economic outcomes.

This framework for studying intellectual property, innovation, and economic outcomes maps roughly onto the linear model of innovation itself, which depicts a process moving from basic research, to applied research, to development, to diffusion. A linear model is attractive because it is amenable to statistical analysis, which partly explains its popularity and longevity (Godin, 2006). Such an approach can sometimes be useful, but also has numerous shortcomings that a synthesis of the relevant literature reveals.

Intellectual Property and Innovation

Researchers use many different metrics to measure innovation, including intellectual property statistics. Patent statistics dominate in the context of innovation, science and technology, and research and development. The history of patent data as an indicator of innovation, research and development, and technological change is rooted in the seminal work of Jacob Schmookler (1966), and explained well in several literature reviews conducted over the past 30 years (Griliches *et al*, 1986; Basberg, 1987; Griliches, 1990, 1998).

One reason patent statistics are often relied upon is that patents were the most closely aligned with new technologies. While it remains true that copyrights are most closely associated with cultural industries, and trademarks with branding and goodwill, businesses in fact rely on all kinds of intellectual property rights to protect innovations of different sorts. A growing body of empirical research provides evidence regarding commonly used appropriation mechanisms, which range from formal patents to informal secrets and other mechanisms like product complexity (de Beer *et al*, 2013; Hall *et al*, 2014). The use of formal appropriation mechanisms such as patents is, by far, not the norm. That is especially true in developing countries, but also in developed countries (See e.g. de Beer *et al*, 2014a; de Beer *et al*, 2014b, p. 5-6; Ncube *et al*, 2014). 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, 2014). Also, many innovative firms and individual users adopt open innovation strategies that intentionally eschew patent protection (de Beer, 2015). This reality undermines studies that treat patents as the only, or even most important, intellectual property right relevant to innovation.

Another reason patent statistics dominate innovation discourse is because they are among the richest and most readily available sources of information. “In this desert of data, patent statistics loom up as a mirage of wonderful plentitude and objectivity,” (Griliches, 1990, p. 1661). Patents also present a unique opportunity for longitudinal analysis, given the availability of data over many decades. Despite these advantages, there are drawbacks. Many innovations are not patented. And many patents never lead to innovation. In short, patent data presents an incomplete and potentially misleading picture of innovation, as Figure 2 demonstrates. Patents are only available for novel, useful and non-obvious inventions. According to the most widely accepted definition from the Organization for Economic Cooperation and Development (OECD) and the Statistical Office of the European Communities (Eurostat), however, an “innovation” can be new to the world, new to a country, or new to a firm (OECD & Eurostat, 2005, p. 46). Moreover, patents only protect certain kinds of technical subject matter, while innovations might occur across a broad range of business functions. The existence of a patent does not indicate whether an invention is radical, minor, or irrelevant. It is also very difficult to attribute value to any particular patent, as opposed to aggregated portfolios of patents.

These inherent limitations make it risky to rely on patents as indicators of innovation. Nevertheless, doing so is common. For example, a Canadian report published by the C.D. Howe Institute purported to measure "domestically applied innovation" with patents (Brydon *et al*, 2014). The authors claimed the methodological innovation of using patents to shed light on "not only the inputs of the innovation process, such as research and development spending, but the outputs applied in Canada," (p 1). This approach misunderstands the relationship between inventions and innovations. Patented inventions are typically an *outcome* of the *research* process but an *input* into the *innovation* process. They do acknowledge the limitations of patent data, but nevertheless base conclusions and headlines about regional innovation on that data alone. Such studies would be more useful if focused more narrowly on patenting trends. It is interesting that the pharmaceutical and medical device sectors have a low share of Canadian inventors applying for patents in the Canadian market; but the relevance of that fact for innovation policymaking is unclear, and the economic implications even less so.

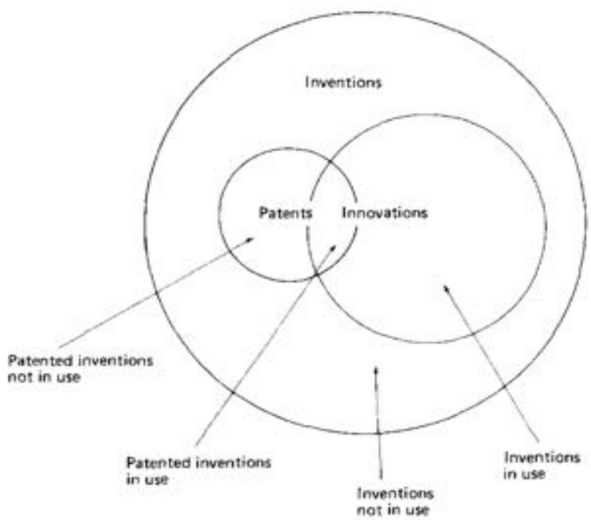

Figure 2: A generalized picture of the relationship between patenting, invention and innovation (Source: Basberg, 1987, pp.133)

That does not mean patent data should be ignored. The oft-cited conclusion about using patents to measure innovation is this insight first stated 50 years ago: "We have a choice of using patent data cautiously and learning what we can from them, or not using them and learning nothing about what they alone can teach us," (Schmookler, 1966).

The shortcomings of patent data as indicators of innovation contributed to the development of another technique: innovation surveys. In fact, some of the evidence of problems with reliance on patent data was collected using such surveys (Levin *et al*, 1987; Cohen *et al*, 2000). While there was sporadic data collection by some governments before the 1980s, innovation surveys did not become systemic until the 1990s (Godin, 2002). In the field of innovation, guidelines developed by the OECD and Eurostat (2005) – published in the Oslo Manual – are now the international standard for survey work. Various national governments, including the United States and Canada, also collect data on business innovation using surveys tailored to particular purposes work (Government of Canada, 2009a; Boroush, 2010; Statistics Canada, 2014). Some of these surveys focus specifically on intellectual property management, which is useful to better understand the behaviour of particular firms (Statistics Canada, 2008). Such surveys do not assume that patents indicate innovation; instead, they provide insights into why and how firms that innovate use the intellectual property system (Baldwin, 1997; Baldwin *et al,* 2000; Baldwin & Hanel, 2003). The major drawback of this method is expense. While patent data are produced consistently and available readily on a rolling basis, surveys are by their nature complex and periodic undertakings. We learn what we can from them when data are available.

Scholars have explained how both patent data and innovation surveys can be used in tandem to shed light on innovation, or more specifically technological change (Archibugi & Pianta, 1996). Numerous challenges remain however, which the existing literature on intellectual property and innovation has not yet solved, such as assessing:

- innovation with data on intellectual property rights other than patents;
- industry/economy-wide impacts of firms' intellectual property strategies; and
- macro-economic outcomes linked to particular intellectual property policy changes.

Intellectual Property and Economic Outcomes

The Ginarte-Park (GP) index is the most widely cited measure of patent protection by cross-country economic analyses of intellectual property and economic outcomes. It was introduced in an article by Juan Ginarte and Walter Park (1997) and updated in Park's subsequent work (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 are widely used for modeling relationships among intellectual property and innovation, R&D, GDP, trade, investment, technology transfer and other variables.

In theory, the exclusive rights protected by intellectual property are predominantly justified as an incentive to invest in innovation through research, development, and commercialization of new products and processes. The basic economic premise, well explained in the literature, is that without the guarantee of exclusivity that intellectual property provides, the world would have less creativity and fewer inventions (see, e.g. Gallini & Scotchmer, 2002; Landes & Posner, 2003; Scotchmer, 2004; Greenhalgh & Rogers, 2010b). 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. Economist Keith Maskus (2012) offers one of the most important, must-read reviews of econometric analyses of intellectual property's impact on innovation and/or technology transfer. It is not possible within the scope of this article to fully detail the vast body of literature on this topic. But Maskus summarizes it well: "There are no clear and universal relationships," he explains, "between policy reforms to strengthen IPRs and subsequent innovation or R&D investments," (p. 63).

While intellectual property can and does 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 intellectual property is more important to large firms in industries such as pharmaceuticals and semiconductors. In the semiconductor industry, large firms use intellectual property rights more to cross-license portfolios and defensively preserve freedom to operate than to incent or recoup R&D investments, while smaller firms use intellectual property mainly to signal commercialization potential to venture capitalists (Hall & Ziedonis, 2001). A global statistical and economic policy analysis by 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. Open innovation is causing scholars, businesses and policymakers to rethink many of the fundamental assumptions, management strategies and framework policies around intellectual property (de Beer, 2013).

In theory, intellectual property protection also leads to technology transfer, by reducing the threat of imitation in other countries, increasing the availability of technical information, and facilitating cross-border licensing transactions. Studies reviewed by Maskus show that patent reforms have positive effects on inward technology transfer, attract foreign patents, and expand the activities of multinationals through local sales, investment, R&D, and licensing. These effects, however, are generally only found in large and middle-income countries, not the smallest and poorest countries. Moreover, Maskus (2011) cautions, these international activities may threaten local firms or undermine learning from abroad through nonmarket channels; meaning that international technology may not increase overall welfare. Overall, however, "available economic evidence supports the claim that transparent and enforced IPRs facilitate international transactions in technology, at least among emerging-market countries. In turn, this enhanced access to global information materially contributes to domestic structural transformation and industrial growth in countries with conducive complementary economic and regulatory conditions," (Park & Lippoldt, 2008).

A series of works by Christian Handke (2010, 2011, 2012) contains authoritative literature reviews on the economic evidence pertaining specifically to copyrights, as opposed to patents. A literature review and plea for more empirical evidence by Ivan Png is also very useful (2006).

A summary of Handke's 2012 review is worth quoting fully: "There is initial evidence, for example, that the economic effects of digital copying vary between different industries, but these differences are not yet well understood. Most importantly, the empirical literature is unbalanced. The bulk of econometric research has focused on unauthorized copying and rights holder revenues. Little is known about the implications for user welfare, for the supply of copyright works, or about the costs of running a copyright system," (p. 47).

Towse similarly summarizes the empirical copyright literature: "Basically, empirical research has covered three areas: measuring losses from unauthorised use of copyright works (piracy), the contribution to national economies of copyright-based industries (reviewed earlier) and studies of creators' earnings from copyright works," (p. 1195). It is the last category where Towse notes we know the least. She observes that there are only indirect data about the incentive function of copyright, which is what Handke characterizes as the supply of copyright works. Moreover, Towse explains "what data there are strongly suggest that the industries, not the initial content creators (authors), benefit from copyright law," (p. 1195).

General Equilibrium Modeling

A number of studies have investigated the impact of innovation on economies using dynamic equilibrium modeling. Such models use economic data to estimate how an economy might react to changes in policy, technology or other external factors. They consist of equations describing the interactions among model variables and economic data presented as input-output tables. The equations tend to be neo-classical with assumptions about demand, labour mobility, competitive behaviour, and price adjustments.[8]

Heer and Maußne (2005) emphasize the popularity and reliability of this method in their introductory textbook to general equilibrium modeling. Specifically, the two authors note, "dynamic general equilibrium models have become the workhorses of modern macroeconomics," (p. V). Such models allow researchers to conceptualize, and as a result answer questions about, complex, constantly

[8] General equilibrium economic models are not the same as dynamic systems models. While both approaches are dynamic (i.e. consider how process change over time as a result of flows and feedbacks), they are philosophically very different. General equilibrium models have their origins in neo-classical economics and converge to a steady-state solution. Dynamic systems models have their origins in engineering systems and may frequently display chaotic (in the mathematical sense of the word) behaviour with no steady state outcome.

evolving modern economies over periods of time. The strength and value of dynamic general equilibrium modeling is further illustrated by the breadth of economic questions it can be used to answer. Heer and Maußne (2005) suggest that the themes of these questions are generally grouped into three primary categories: those relating to the transitional dynamics of economies; those that seek to understand how economies react to "supply and demand shocks;" and those concerned with "heterogeneous-agent economies" (p. V).

Some general equilibrium model studies illustrate the economic and public policy implications of new technologies. For example, Australian economists have developed the MONASH model. A dynamic general equilibrium model, MONASH can be applied to inform public policy in several ways, including: "estimating changes in tastes and technology…; explaining periods of economic history in terms of driving factors such as policy changes, changes in world commodity prices, and changes in tastes of technology…; generating forecasts for industrial, occupational and regional variables…; and calculating the deviations from explicit forecast paths for macro and micros variables which would be caused by the implementation of proposed policy changes," (Dixon & Rimmer, 2001, p. 37).

Similarly, Acemoglu et al. (2012) developed and applied a general equilibrium model in a study of new, innovative technologies and the standardization periods that often follow their introduction. That study yielded several potentially valuable insights for policy makers, such as: the idea that innovation-standardization cycles can be "an engine of economic growth, [or]… act as a barrier to growth by potentially slowing down innovation," and the prediction that "data on product and process innovation might be used to test the existence of a trade-off between innovation and standardization at an industry level" (p. 593). Jin has also developed and applied a general equilibrium model to better understand how domestically produced technologies have helped China combat climate change. He concluded that China has made significant advancements; however, further innovation and environment specific policies are required (p. 640). Leao (2003) fashioned a general equilibrium model that analyzes how the adoption of new technologies, referred to as 'technology shocks', may affect the US banking sector.

Other authors have used general equilibrium models to show that the effects of IP policy differ with the size of a country's economy. Shifting focus from patents to copyright, a doctoral thesis by Cheng (2004) examined the economic effects of extending copyright terms in developing countries with a general equilibrium model. Chu, Cozzi & Galli also utilized a general equilibrium model in their study of IP and innovation in the US market. They concluded in this study, "patent protection has asymmetric effects on different types of innovation that carry different chances of patent infringements, and hence, the traditional tradeoff of optimal patent protection needs to be modified to take into account these asymmetric effects of patent policy" (p. 742).

Through the construction of general equilibrium model, Helpman (1993) has also reached conclusions about IP protections, innovation, and economic growth. Chief amongst his conclusions is the finding that relaxed IP frameworks might benefit the global South, and in some cases may even benefit the North (1274-1275). Building on the work of Helpman, several other scholars have constructed dynamic models to study the effect of IP rights on economic growth and innovation (Bye *et al*, 2009; Azevedo *et al*, 2014; Shao, 2014). Indeed, numerous academics have indicated how dynamic models of IP rights and market structures might affect competition policymaking (Greenhalgh & Rogers, 2010). Finally, Pathak, Xavier-Oliveira and O'Laplume (2013) have partially relied on data from a general equilibrium model in their evaluation of how IP rights and foreign direct investment influence technological entrepreneurship (p. 2095).

The construction of economic models is a complex process in which researchers must recognize and include the factors that will ensure a model is appropriate and applicable to a specific context, so that it can answer specific questions. For instance, to properly analyze the relationship of IP and innovation in the Global North and South, Helpman included assumptions about wage rates and labour productivity in both regions, and assumptions about the broad availability of imitated products in the Global South (Helpman, 1993, p. 1252-1253).

While these studies have developed a broad range of models, each of which can be used to address specific policy questions, the economic relationship of IP and innovation remains far from being entirely understood. As Gans (2011) notes: "it is hoped that future research will be able to further untangle… the role of intellectual property protection in providing a separate instrument to stimulate innovation" (p. 73). Consequently, further studies, based on new, advanced dynamic systems models are likely needed if this field is to continue to yield valuable policy insights.

Institutional Challenges

Prior to presenting discussion and conclusions that might be drawn from the literature reviewed above, there is one further point worth mentioning. It is that evidence-based policymaking is difficult in institutions without solid systems in place for tracking, sharing and integrating knowledge acquired over time. The Canadian experience is illustrative in this respect.

Several studies rely upon reports and indices to lament Canada's ostensibly poor performance in the area of innovation. But such studies and reports fail to really grapple with the existing evidence empirical impact of IP in this context, or if they are rejecting (as opposed to neglecting) existing evidence, to propose methods or metrics for studying the matter. For instance, an influential report on mobilizing science and technology in Canada identified IP as a major issue for attracting venture and intellectual capital, but failed to explain how (Government of Canada, 2007). Nine years later, little has been done. In a progress report after two years, the only mention of IP was the bare fact that Canada Foundation for Innovation (CFI) investments resulted in 1,750 rights (Government of Canada, 2009). The next year, a government strategy paper at least acknowledged the disruptive trend toward open innovation and IP sharing, but failed to integrate the concepts into its proposals (Science, Technology and Innovation Council, 2011). The Council of Canadian Academies' Expert Panel on Business Innovation in Canada (2009) issued an extensive and well-researched report on Canadian innovation, but offered only general remarks on the impact of IP, not methodological guidance or empirical priorities. Similarly, the high-profile Jenkins panel, which was a "call to action" on innovation in Canada, could only conclude about IP: "the government needs to explore this issue further," (Jenkins et al, 2011). Think tanks have echoed the plea for serious studies on this topic (Mazurkewich, 2011). While counting IP outputs is convenient (Corbin, 2011), good research and policymaking requires a radically new approach to studying these issues as more than a "statistical horserace" (Hawkins, 2012).

Yet, numerous specific impact assessment studies have been done. Take the context of copyright law reform. These include studies by respected academics and consultants on topics ranging from possible new performers' and producers' rights (Towse, 2003), to the impact of WIPO's internet treaties (Boyer, 2003), to changes to the private copying system (Hirshhorn, 2005), to economic effects of copyright reform on service providers (Chwelos, 2006), technology-enhanced learning (Hirshhorn, 2011), and select users and consumers (Hollander, 2005). There are also, in Canada, industry-sponsored or academic analyses of proposed legislative changes in other fields, which unlike most "data for advocacy" reports, do present transparent methods, verifiable data, and peer-reviewed findings. The impact of extended data protection terms on the pharmaceutical industry is one example (Grootendorst & Hollis, 2011).

The most relevant characteristic of these studies by Canadian government-commissioned or industry-sponsored researchers is their specifity of analysis. They do not purport to make broad claims about the size of IP industries, or cherry-pick statistics to support polemics. The narrower the study, the more likely it seems to provide evidence that relies on transparent methodologies, verifiable data, and peer reviewable conclusions. Yet, its own studies are not often cited when Canada makes purportedly justified changes in its IP policies. As in the UK and EU cases mentioned at the outset of this article, Canada is not alone with this pattern of behaviour.

Discussion and Conclusions

Each of the four frameworks described above is arguably useful to some extent, although each also has fundamental limitations in the context of broad questions about intellectual property's economic contributions. Table 1 summarizes the methodologies, data sources and limitations of each of these existing frameworks.

Even data for advocacy has the benefit of being accessible to policymakers, though the ease of access to reports that are not transparent, verifiable or peer reviewed is also part of the problem in this area. At least, however, such reports have increased the scrutiny to which putative evidence is held and driven the demand for more reliable studies.

Assessments of the contributions of IP-industries have the advantages of transparent, consistent methodologies and robust, reliable data sources. These studies also provide an opportunity for internationally comparative analyses. Their main drawback is the tendency for busy readers to believe or infer from headlines that the studies actually provide evidence of the relationship between IP and IP-related industries. They do not. The size of so-called "copyright industries," for example, says nothing about the economic impacts of copyright in general or any particular legal or policy reform.

Several global indices and ranking systems are based on sound methodologies and reliable data, despite the inevitable challenge of selecting appropriate indicators on which to base an analysis. The best of these studies include a large number of relevant indicators that reflect, for example, inputs to and outputs from the innovation process. The disadvantage is that as the indicators become more diverse and the analysis becomes more nuanced, the implications for IP policy become less clear. There is also a risk that innovation policymaking more broadly might devolve into a statistical horserace rather than an informed investigation. Having more IP outputs may increase a country's ranking but, as both theory and evidence clearly show, more IP does not mean more innovation and could, in fact, lead to less.

A large body of scholarly literature from multiple disciplines contains theoretical insights and empirical evidence about the importance of IP for innovation and/or other economic outcomes. Much of the literature developed over recent decades relies on patent data, because it is available, detailed, longitudinal, and comparable. Unfortunately, patent data is also incomplete and potentially misleading. We know for a fact (via innovation surveys and other approaches) that except in specific industries patents are not a widely popular appropriation strategy. More generally, open innovation is requiring us to rethink both research methods and policy approaches. There are few if any studies to inform policy based on statistical analyses of firms' uses of copyrights, trademarks, trade secrets or IP rights other than patents. The patent-based studies that do exist are also highly contextual, with results depending on the dynamics of the particular innovation, firm, industry, country or region in question.

It is impossible to generalize, based on methodologies and data in existing industry reports, government studies, academic scholarship or any other literature, about the economic importance of IP. None alone is fully capable of transparently, verifiably, and rigorously answering the core policy questions: what is the importance of IP to the economy, and what is the evidence of IP's impact?

The existing methodologies and frameworks demonstrate that intellectual property is one of many factors which influence the inner-workings of an economy on a macro (market-level) or micro (firm-level) scale. Intellectual property, through its rights and regimes, seeps into many market forces and firm activities; therefore, one must study the issue with a mind to the factors acting on it as much as its impact on the economy, market, industry, or firm. Intellectual property rights give innovators a monopoly over their creation, allowing the appropriation of a larger amount of resources from exploration to exploitation; but it also reduces spillovers by creating costs for other firms to use existing ideas. Changes to an intellectual property regime, therefore, will affect not only how a firm operates internally, but also how it interacts with external actors (*i.e.* civil society, investors, universities, etc.) on which it depends on. Measuring the treatment of intellectual property by a country, or conversely, the impact of an IP policy change on a country's economy, therefore requires a systemic approach.

In practical terms, this article asserts that policy-makers can better assess the state of intellectual property and its impacts by situating it within the larger context of economic forces which affect firm behaviour. Although a policy question may seem to address a niche IP issue, its ripple effects and influences, and therefore stakeholders, will often reach further. The key challenge for the future, therefore, is to connect empirical data and micro-economic analyses about firms' strategic responses to IP policy changes with statistics and macro-economic insights on overall economic performance or social welfare.

Table 1: Frameworks, methodologies, data sources and limitations of existing measurements of economic contributions of IP. (Source: Authors).

Framework	Methodology	Data	Limitations
Data for advocacy	Identify, select and report statistics that support conclusions favourable to particular industry groups or ideological perspectives on IP.	Secondary reports; industry figures; national accounts; subjective assessments; normative value judgments.	Often based more on hyperbole and rhetoric than sound data. Typically present imbalanced analysis, dependent on opinion. Lack the transparency, verifiability, and reliability of peer-reviewed studies.
Industry contributions	Measure aggregate economic and employment contributions of industries assumed to be related to one or more specific IP rights.	National accounts; input-output tables; census reports; assumed industry value-added/multiplier factor.	Robust methods and data on industry size, but reports provide no evidence of a relationship between IP and "IP-related" industries. Busy readers may be misled by headlines that imply the size of such industries is attributable to IP protection.
Indices and rankings	Collect statistics thought to indicate inputs/outputs of e.g. innovation, then rank and compare the performance of various countries.	National accounts; government statistics; patents; executive opinion surveys.	Widely variable in methods, data, and reliability. More robust reports including many indicators have limited relevance for IP policy specifically. Others focusing only on IP indicators are often data for advocacy in disguise.
Empirical analyses	Collect/analyze data on relatively discrete and specific IP issues, using results to inform legal, economic or public policy ideas.	National accounts, government statistics; patents; innovation surveys; case studies; qualitative data.	Specificity of analyses supports contextual findings but not generalizable conclusions. Publications in journals not widely accessible beyond academia. Volume/format of literature can be overwhelming for busy readers.

Bibliography

Acemoglu, D., Gancia, G. & Zilibotti, F. (2012). Competing engines of growth: Innovation and standardization" *Journal of Economic Theory,* 147(2), 570-601.

Acs, Z. J. & Sanders, M. (2008). Intellectual Property Rights and the Knowledge Spillover Theory of Entrepreneurship. (Tjallling C Koopmans Research Institute Discussion Paper Series No. 08-23). Utrecht, The Netherlands: Tjalling C. Koopmans Research Institute.

Akker, I., van der Noll, R., Poort, J. & Tewes, F. (2010). *Economic contribution of EU industries relying on exceptions and limitations to copyright* (Amsterdam: Computer & Communications Industry Association).

Almeida, A. & Teixeira, A. A. C. (2007). *Does Patenting Negatively Impact on R&D Investment? An International Panel Data Assessment* (FEP Working Papers No. 255). Porto, Portugal: Faculdade de Economia, Universidade do Porto.

——— (2008). *One Size Does Not Fit All. An Economic Development Perspective on the Asymmetric Impact of Patents on R&D* (FEP Working Papers No. 292). Porto, Portugal: Faculdade de Economia, Universidade do Porto.

Archibugi, D. & Pianta, M. (1996). Measuring technological change through patents and innovation surveys. *Technovation*, 16(9), 451-468

Arif, F. & Abbes, C. (2013). *Assessing the Effectiveness of the Patent System: A Literature Review Why Is an Evaluation of the Effectiveness of the Patent System Necessary?* Ottawa, ON: Industry Canada.

Azevedo, M. L, Afonso, Ó. & Silva, S. T. (2014). Endogenous growth and intellectual property rights: A north–south modeling proposal. *Economic Modeling*, 38, 112.

Baldwin, J. R. (1997). *Innovation and Intellectual Property*. Ottawa, ON: Industry Canada.

Baldwin, J. R. & Hanel P. (2003). The Use of Intellectual Property Rights. In J. R. Baldwin & P. Hanel (Eds.), *Innovation and Knowledge Creation in an Open Economy: Canadian Industry and International Implications* (p. 251-296). Cambridge, UK: Cambridge University Press.

Baldwin, J. R., Hanel, P. & Sabourin, D. (2000). *Determinants of Innovative Activity in Canadian Manufacturing Firms: The Role of Intellectual Property Rights.* Ottawa: Industry Canada. DOI:10.2139/ssrn.229792.

Barker, G. R. (2012). *Estimating the Economic Effects of Fair Use and Other Copyright Exceptions: A Critique of Recent Research in Australia, US, Europe and Singapore.* Sydney: Centre for Law and Economics Ltd.

Basberg, B. L. (1987). Patents and the Measurement of Technological Change: A Survey of the Literature. *Research Policy*, 16(2-4), 131-141.

Basheer, S. (2015, February 10) These rancid rankings. *The Indian Express.* Retrieved from http://indianexpress.com/article/opinion/columns/these-rancid-rankings/99/

Barooah, S. P. (2014, February 16) GIPC IP Index: Propagating imaginary IP norms. *SpicyIP.* Retrieved from http://spicyip.com/2014/02/gipc-ip-index-propagating-imaginary-ip-norms.html

Besen, S. M., and Raskind, L. J. (1991). An Introduction to the Law and Economics of Intellectual Property. *Journal of Economic Perspectives,* 5(1), 3–27.

Bessen, J. & Maski, E. (2009). "Sequential Innovation, Patents, and Imitation." *The RAND Journal of Economics,* 40(4), 611–635. DOI:10.1111/j.1756-2171.2009.00081.x.

Boldrin, M. & Levine, D. (2002). The Case Against Intellectual Property." *The American Economic Review* 92 (2): 209–212.

Boroush, M. (2010) NSF Releases New Statistics on Business Innovation. *InfoBrief*, 1-6

Boyer, Marcel. (2003). *Assessing the Economic Impact of Copyright Reform on Authors, Makers, Photographers and Publishers in Canada in Reference to Two New Copyright-Related Treaties: WIPO Copyright Treaty (WCT) and WIPO Performances and Phonograms Treaty (WPPT).* Ottawa, ON: Industry Canada.

Brydon, R., Chesterley, N., Dachis, B. & Jacobs, A. (2014). "Measuring Innovation in Canada: The Tale Told by Patent Applications." Toronto: C.D. Howe Institute.

Business Software Alliance (BSA), (2013) *2013 BSA Global Cloud Computing Scorecard: A Clear Path to Progress*. Washington, DC: BSA.

Bye, B., Fæhn, T., & Heggedal, T. (2009). Welfare and growth impacts of innovation policies in a small, open economy; an applied general equilibrium analysis. *Economic Modelling*, 26(5), 1075-1088.

Charles, S., McDougall G., & Tran, J. (2006). The Importance of Intellectual Property Industries in the Canadian Economy. In J. D. Putnam, (Ed.), *Intellectual Property and Innovation in the Knowledge-Based Economy* (p. 2-1-2-57). Ottawa, ON: Industry Canada.

Chawla, Kartik. (2015, February 18) Comments on the GIPC Index 2015, Part I – Misleading Links. *Spicy IP.* Retrieved from http://spicyip.com/2015/02/comments-on-the-gipc-index-part-i-misleading-links.html>

Chen, Y, Pan S., & Zhang, T. (2014). (When) Do stronger patents increase continual innovation? *Journal of Economic Behavior & Organization*, 98, 115-124.

Cheng, X. (2004). Intellectual Property Rights, Innovation in Developing Countries, and Copyright Term Extension. *University of Hawai'i* [unpublished].

Chozick, A., & Wortham, J. (2012, February 8). The Piracy Problem: How Broad? *New York Times*, p. B1(L).

Chu, A. C, Cozzi, G., & Galli S. (2012). Does intellectual monopoly stimulate or stifle innovation? *European Economic Review*, 56(4), 727-746.

Chwelos, P. (2006). *Assessing the Economic Impacts of Copyright Reform on Internet Service Providers.* Ottawa: Industry Canada.

Cohen, W. M. & Levinthal, D.A. (1989). Innovation and learning: The two faces of R&D – implications for the analysis of R&D investments. *Economic Journal*, 99, 569-596.

Cohen, W. M., Nelson, R. R. & Walsh J. P. (2000) Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not) (NBER Working Paper No. 7552) Cambridge, MA: National Bureau of Economic Research.

Collette, J. E. (2012). Essays on Intellectual Property: Innovation, Growth and Strategies. *Carleton University* [unpublished].

Conference Board of Canada (2010) *How Canada* Performs. Ottawa, ON: Conference Board of Canada.

——— (2013a) *How Canada Performs: International Ranking.* Retrieved from http://www.conferenceboard.ca/hcp/details/innovation.aspx.

——— (2013b) *How Canada Performs: International Ranking - Patents Index.* Ottawa, ON: Conference Board of Canada. Retrieved from <www.conferenceboard.ca/hcp/details/innovation/patents-index.aspx>.

——— (2015). *How Canada Performs: Provincial and Territorial Ranking*. Ottawa, ON: Conference Board of Canada. Retrieved from http://www.conferenceboard.ca/hcp/provincial/innovation.aspx.

Corbin, R. M. (2010). *Intellectual Property in the 21st Century*. Ottawa, ON: Conference Board of Canada.

de Beer, J. (2015) *"Open" Innovation Policy Frameworks*. Ottawa, ON: Industry Canada.

de Beer, J., Fu, K. & Wunsch-Vincent, S. (2013). The Informal Economy, Innovation and Intellectual Property – Concepts, Metrics and Policy Considerations (World Intellectual Property Organization Working Paper No. 10). Retrieved from http://www.wipo.int/edocs/pubdocs/en/wipo_pub_econstat_wp_10.pdf.

de Beer, J., Oguamanam, C. & Schonwetter, T. (2014) Innovation, Intellectual Property and Development Narratives in Africa. In J. de Beer, C. Armstrong, C. Oguamanam & T. Schonwetter (Eds.), *Innovation and Intellectual Property: Collaborative Dynamics in Africa* (p. 1-31). Cape Town: UCT Press. Retrieved from Open African Innovation and Research Network (Open AIR) http://www.openair.org.za/publications/innovation-intellectual-property-collaborative-dynamics-in-africa/.

de Beer, J., Armstrong, C., Oguamanam C. & Schonwetter, T. (2014) Current Realities of Collaborative Intellectual Property in Africa. In J. de Beer, C. Armstrong, C. Oguamanam & T. Schonwetter (Eds.), *Innovation and Intellectual Property: Collaborative Dynamics in Africa* (p. 373-394). Cape Town: UCT Press. Retrieved from Open African Innovation and Research Network (Open AIR) http://www.openair.org.za/publications/innovation-intellectual-property-collaborative-dynamics-in-africa/.

Dixon, A. N. (2011). *Intellectual Property: Powerhouse for Innovation and Economic Growth*. London, UK: International Chamber of Commerce (ICC) and Business Action to Stop Counterfeiting and Piracy (BASCAP).

Dixon, P. B. & Rimmer, M. T. (2001). An Illustrative Application of MONASH: the Australian Motor Vehicle Industry from 1987 to 2016. In P. B. Dixon & M. T. Rimmer (Ed.), *Dynamic General Equilibrium Modelling for Forecasting and Policy: A Practical Guide and Documentation of MONASH (Contributions to Economic Analysis, Volume 256)* (p. 137-232). Emerald Group Publishing Limited.

Doern, B., & Sharaput, M. (2000). *Canadian Intellectual Property: The Politics of Innovating Institutions and Interests*. Toronto: University of Toronto Press.

Dosi, G. (1988). The Nature of the Innovative Process." In G. Dosi, C. Freeman, R. Nelson, G. Silverberg & L. L. Soete (Eds.), *Technical Change and Economic Theory* (p. 221-238). London: Pinter.

Dosi, G., Freeman, C., Nelson, R., Silverberg, G. & Soete, L. L. (Eds.). (1988). *Technical Change and Economic Theory*. London: Pinter.

Dutta, S. & Lanvin, B. (2013). (Eds.). *The Global Innovation Index 2013: The Local Dynamics of Innovation.* Geneva: Cornell University, INSEAD & WIPO.

Dutta, S., Lanvin, B. & Wunch-Vincent, S. (Eds.). (2014). *The Global Innovation Index 2014: The Human Factor in Innovation.* Geneva: Cornell University, INSEAD & WIPO.

——— (2015). *The Global Innovation Index 2015: Effective Innovation Policies for Development*. Geneva: Cornell University, INSEAD & WIPO.

Edquist, C. (1997). *Systems of Innovation: Technologies, Institutions, and Organizations*. *Science Technology and the International Political Economy Series No. 107*. New York: Pinter.

Eli Lilly and Company v. Canada. (2016). UNCT/14/2 (ICID) (Respondent's Statement of Defence, p. 9-11, 32-36). Retrieved from Global Affairs Canada http://www.international.gc.ca/trade-agreements-accords-commerciaux/topics-domaines/disp-diff/eli.aspx?lang=engza.

Ely, A. & Bell, M. (2009). The Original 'Sussex Manifesto': Its Past and Future Relevance. *STEPS Centre*. Brighton: STEPS Centre.

Encaoua, D., Guellec, D. & Martínez, C. (2006). Patent Systems for Encouraging Innovation: Lessons from Economic Analysis. *Research Policy,* 35(9), 1423–1440. DOI:10.1016/j.respol.2006.07.004.

Espinel, V. (2010, February 23) Intellectual Property and Risks to the Public. *The White House Blog.* Retrieved from www.whitehouse.gov/blog/2010/02/23/intellectual-property-and-risks-public>.

European Patent Office (EPO) & Office for Harmonization in the Internal Market (OHIM). (2013). *Intellectual property rights intesive industries: contribution to economic performance and employment in the European Union.* Munich: EPO & OHIM.

Etzkowitz, H. (2008). *The Triple Helix: Industry, University, and Government in Innovation*. Taylor & Francis.

Expert Panel on Business Innovation in Canada. (2009). *Innovation and Business Strategy: Why Canada Falls Short*. Ottawa: Council of Canadian Academies.

Expert Panel on Science Performance and Research Funding. (2012). *Informing Research Choices: Indicators and Judgement*. Ottawa: Council of Canadian Academies.

Fagerberg, J. (2003). *Innovation : A Guide to the Literature*. Olso: Centre for Technology, Innovation, Culture, University of Oslo.

Falvey, R., Foster, N. & Greenaway, D. (2006). Intellectual Property Rights and Economic Growth. *Review of Development Economics*, 10(4), 700–719.

Farooqui, S., Goodridge, P. & Haskel, J. (2011). The Role of Intellectual Property Rights in the UK Market Sector. London: United Kingdom Intellectual Property Office (UK IPO).

Fink, A. (2010). *Conducting Research Literature Reviews: From the Internet to Paper* (3rd ed.). Thousand Oaks, CA: Sage.

Fink, C. & Maskus, K. E. (Eds.). (2005). *Intellectual Property and Development: Lessons from Recent Economic Research*. Washington: World Bank & Oxford University Press. DOI:10.1111/j.1467-9396.2006.00601.x.

Fisher, W. W. (2002). Intellectual Property and Innovation: Theoretical, Empirical and Historical Perspectives. In G. Ybema (Ed.), *Industrial Property, Innovation, and the Knowledge-Based Economy, Beleidsstudies Technologie Economie* (p. 47-72). Den Haag: Directoraat-Generaal Innovatie, Ministerie van Economische Zaken.

Forrester, J. W. (1981). Innovation and Economic Change. *Futures*, 13(4), 323-331.

Freeman, C. (1987). *Technology Policy and Economic Performance: Lessons from Japan*. *Society*. London: Pinter.

Gallini, N., & Scotchmer, S. (2002). Intellectual Property: When is it the Best Incentive System? In A. B. Jaffe, J. Lerner, & S. Stern (Eds.), *Innovation Policy and the Economy, Volume 2* (p. 51-78). Cambridge: MIT Press.

Gallini, N. T. (2002). The Economics of Patents: Lessons from Recent U.S. Patent Reform. *Journal of Economic Perspectives,* 16(2), 131–154. DOI:10.1257/0895330027292.

Gans, J. S. (2011). When is Static Analysis a Sufficient Proxy for Dynamic Considerations? Reconsidering Antitrust and Innovation. In J. Lerner & S.Stern (Eds.), *Innovation Policy and the Economy, Volume 11* (p. 55-78). Chicago: University of Chicago Press.

Gault, F. (2010). *Innovation Strategies for a Global Economy*. *Development, Implementation, Measurement and Management*. Ottawa: International Development Research Centre.

Ginarte, J. C. & Park, W. G. (1997). Determinants of Patent Rights: A Cross-National Study *Research Policy,* 26(3), 283-301

Gilbert, R. & Shapiro C. (2012). Optimal Patent Length and Breadth. *The RAND Journal of Economics,* 21(1), 106–112.

Global Advantage. (2014) *International Benchmarking to Support IP Policy Decision-Making.* Ottawa: Global Advantage Consulting Group.

Global Intellectual Property Center (GIPC). (2014). *Charting the Course: GIPC International IP Index*. Washington, D.C.: GIPC.

——— (2015). *UP: Unlimited Potential*. Washington, D.C.: GIPC.

——— (2015). *TRIPS: Floor Versus Ceiling?* Washington, D.C.: GIPC.

Godin, B. (2006). The Linear Model of Innovation. *Science, Technology, & Human Values,* 31 639-667.

——— (2002). The Rise of Innovation Surveys: Measuring a Funny Concept (Project on the History and Sociology of STI Statistics Working Paper No 16). Montreal: Institut National de la Recherche Scientifique.

Gold, E. R., Adams, W., Bubela, T., Cassivi, L., Castle, D., Cleret de Langavant, G., … Smith, P. J. (2008). *Toward a New Era of Intellectual Property: From Confrontation to Negotiation*. Montreal: International Expert Group on Biotechnology, Innovation and Intellectual Property: The Innovation Partnership.

Gould, D. M. & Gruben, W. C. (1996). The Role of Intellectual Property Rights in Economic Growth. *Journal of Development Economics,* 48(2), 323–350. DOI:10.1016/0304-3878(95)00039-9.

Government of Canada. (2007) *Mobilizing Science and Technology to Canada's Advantage*. Ottawa, ON: Government of Canada.

——— (2009a) *Business Innovation and Strategy: A Canadian Perspective*. Ottawa, ON: Government of Canada

——— (2009b). *Mobilizing Science and Technology to Canada's Advantage: Progress Report*. Ottawa, ON: Government of Canada.

Greenhalgh, C. & Dixon, P. (2002. The Economics of Intellectual Property: A Review to Identify Themes for Future Research (Univeristy of Oxford, Department of Economics Discussion Paper Series No. 135). Oxford: University of Oxford, Department of Economics

Greenhalgh, C. & Rogers, M. (Eds.). (2010a). *Innovation, Intellectual Property, and Economic Growth* (Princeton University Press.

——— (2010b). The Nature and Importance of Innovation. In C. Greenhalgh & M. Rogers (Eds.), *Innovation, Intellectual Property, and Economic Growth* (p. 3-31), Princeton, NJ: Princeton University Press.

Griliches, Z. (1990). Patent Statistics Indicators as Economic Indicators: A Survey. *Journal of Economic Literature,* 28(4), 1661-1707.

——— (1998). Patent Statistics as Economic Indicators: A Survey. In Z. Griliches (Ed.), *R&D and Productivity: The Econometric Evidence* (p. 287-343). Chicago: University of Chicago Press.

Griliches, Z., Pakes A., & Hall, B. H., (1986). The Value of Patents as Indicators of Inventive Activity (NBER Working Paper No 2083). Cambridge, MA: National Bureau of Economic Research.

Grootendorst, P. & Hollis, A. (2011). "The 2011 Canada-European Union Comprehensive Economic and Trade Agreement: An Economic Impact Assessment of the EU's Proposed

Pharmaceutical Intellectual Property Provisions." *Journal of Generic Medicines: The Business Journal for the Generic Medicines Sector*, 8(2), 81–103. DOI:10.1177/1741134311408275.

Grootendorst, P. & Di Matteo, L. (2007). The Effect of Pharmaceutical Patent Term Length on Research and Development and Drug Expenditures in Canada. *Healthcare Policy,* 2(3), 63-84.

Grossman, G. M. & Lai, E. L. C. (2004). International Protection of Intellectual Property. *The American Economic Review,* 94(5), 1635–1653. DOI:10.3386/w8704.

Hall, B. H. & Harhoff, D. (2012a). Recent Research on the Economics of Patents. *Annual Review of Economics,* 4(1), 541–565. DOI:10.1146/annurev-economics-080511-111008.

——— (2012b). Recent Research on the Economics of Patents (NBER Working Paper Series No. 17773). Cambridge, Massachusetts: National Bureau of Economic Research. DOI:10.1146/annurev-economics-080511-111008.

Hall, B., Helmers, C., Rogers, M., & Sena, V. (2012). The Choice between Formal and Informal Intellectual Property : A Literature Review. (NBER Working Paper Series No. 17983). Cambridge, Massachusetts: National Bureau of Economic Research.

——— (2014). The Choice Between Formal and Informal Intellectual Property: A Review. *Journal of Economic Literature*, 52(2), 375-423.

Hall, B., Helmers, C., Von Greevenitz, G. & Rosazza-Bondibene, C. (2012). A Study of Patent Thickets (NIESC Discussion Paper No. 41). London: UK IPO.

Hall, B., & Ziedonis, R. H. (2001). The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry, 1979-1995. *RAND Journal of Economics*, 32(1), 101-128. DOI:10.2307/2696400.

Handke, C. (2010). *The Economics of Copyright and Digitisation: A Report on the Literature and the Need for Further Research*. London: Strategic Advisory Board or Intellectual Property.

——— (2011, April). *Economic Effects of Copyright: The Empirical Evience so Far*. Rotterdam: The Committee on the Impact of Copyright Policy on Innovation in the Digital Era.

——— (2012). A taxonomy of empirical research on copyright – how do we inform policy?" *Review of Economic Research on Copyright Issues,* 9(1), 47-92.

Hart, C. (2001). *Doing a Literature Search: A Comprehensive Guide for the Social Sciences.* London: Sage.

Hargreaves, Ian. (2011). *Digital Opportunity: A Review of Intellectual Property and Growth.* London: UK Government. Retrieived from http://gov.uk/government/uploads/system/uploads/attachment_data/file/32563/ipreview-finalreport.pdf.

Hawkins, R. (2012). *Looking at Innovation from a Uniquely Canadian Perspective: The Case for a New Alliance of Practice, Policy and Scholarship*. Ottawa: Institute for Science, Society and Policy.

Heer, B., & Maußne, A. (2005) *Dynamic General Equilibrium Modelling: Computational Methods and Applications*. Heidelberg: Springer.

Heller, M. A. (1998). The Tragedy of the Anticommons: Property in the Transition from Marx to Markets. *Harvard Law Review,* 111(3), 621–688.

——— (2008). *Gridlock Economy*. New York, NY: Basic Books.

Heller, M. A. & Eisenberg, R. S. (1998). Can Patents Deter Innovation? The Anticommons in Biomedical Research. *Science* 280(5364), 698–701.

Helpman, E. (1993). "Innovation, Imitation, and Intellectual Property Rights." *Econometrica,* 61(6): 1247–1280.

Henry, C. & Stiglitz, J. (2010). Intellectual Property, Dissemination of Innovation and Sustainable Development. *Global Policy*, 1(3), 237-251.

Hirshhorn, R. (2005). *Economic Impact of Options for Reforming the Private Copying Regime*. Ottawa: Industry Canada.

——— (2011). *Assessing the Economic Impact of Copyright Reform in the Area of Technology-Enhanced Learning.* Ottawa: Industry Canada.

Hollander, A. (2005). *Assessing Economic Impacts of Copyright Reform on Selected Users and Consumers.* Ottawa: Industry Canada

Houghton, J. & Gruen N. (2012a) *Exceptional Industries: The economic contribution to Australia of industries relying on limitations and exceptions to copyright*. Victoria, Australia: Lateral Economics.

——— (2012b) *Excepting the Future: Internet intermediary activities and the case for flexible copyright exceptions and extended safe harbour provisions.* Victoria, Australia: Lateral Economics.

Hudson, J. & Minea, A. (2013). Innovation, Intellectual Property Rights, and Economic Development: A Unified Empirical Investigation. *World Development,* 46, 66–78. DOI:10.1016/j.worlddev.2013.01.023.

Hunt, R. M. (1999). Nonobviousness and the Incentive to Innovate: An Economic Analysis of Intellectual Property Reform (Federal Reserve Bank of Philadelphia Working Paper No. 99-3). Philadelphia, PA: Federal Reserve Bank of Philadelphia.

——— (2004). Patentability, Industry Structure, and Innovation. *The Journal of Industrial Economics,* LII(3), 401–425.

Idris, K. (2003). *Intellectual Property: A Power Tool for Economic Growth* (2nd ed.). Geneva: World Intellectual Property Organization.

Jaffe, A. B. & Lerner, J. (2004). *Innovation and Its Discontents: How Our Broken Patent System Is Endangering Innovation and Progress, and What To Do About It*. Princeton: Princeton University Press.

Jaffe, A. B., Lerner, J. & Stern S. (2005). *Innovation Policy and the Economy*. Cambridge: MIT Press.

Jankowski, J. E. (2012). Business Use of Intellectual Property Protection Documented in NSF Survey. *InfoBrief*. Retrieved from http://www.nsf.gov/statistics/infbrief/nsf12307/nsf12307.pdf.

Jenkins, T., Gupta, A., Naylor, D., Robinson, N., Leroux M., & Dahlby, B. (2011). *Innovation Canada: A Call to Action*. Ottawa, ON: Government of CanadaLandes, W. M., & Posner, R. A. (2003). *The Economic Structure of Intellectual Property Law*. Ottawa, ON: Government of Canada.

Jin, W. (2012). Can technological innovation help China take on its climate responsibility? An intertemporal general equilibrium analysis. Energy Policy, 49, 629

Joly, Y. &. Dove, E. S. (2012). Moving Beyond Commercialization: Strategies to Maximize the Economic and Social Impact of Genomics Research (Genome Canada Policy Brief No. 5). Retrieved from http://www.genomecanada.ca/medias/pdf/en/GPS-Policy-brief-April2012.pdf.

Karaganis, J. (Ed.). (2011) *Media Piracy in Emerging Economies*. Ottawa: Social Science Research Council.

Kieff, F. S. (2011). Removing Property from Intellectual Property and (Intended?) Pernicious Impacts on Innovation and Competition (Stanford University Law School: Law & Olin Research Paper Series No. 411). Stanford, CA: Stanford University.

Kim, Y. K., Lee, K., Park, W. G. & Choo, K. (2012). Appropriate Intellectual Property Protection and Economic Growth in Countries at Different Levels of Development. *Research Policy,* 41(2), 358–375. DOI:10.1016/j.respol.2011.09.003.

Kravets, D. (2010). Fiction or Fiction: 750,000 American Jobs Lost to IP Piracy. *Wired* Retreived from http://www.wired.com/2008/10/fiction-or-fict/.

Kretschmer, M. & Towse, R. (2013). *What Constitutes Evidence for Copyright Policy?* Bournemouth: CREATe.

Laforgia, F., Montobbio F. & Orsenigo, L. (2007). IPRs, Technological and Industrial Development and Growth: The Case of the Pharmaceutical Industry (Centro di Ricerca sui Processi di Innovazione e Internazionalizzazione Working Paper No 206). Milan: Università Commerciale "Luigi Boccini".

Landes, W. M. & Posner, R. A. (2003). *The Economic Structure of Intellectual Property Law*. Cambridge: Harvard University Press.

Lanjouw, J. O. & Lerner J. (1998). The Enforcement of Intellectual Property Rights : A Survey of the Empirical Literature. *Annales d'Économie et de Statistique,* 49, 223–246.

Leao, E. R. (2003) A Dynamic General Equilibrium Model with Technological Innovations in the Banking Sector. *Journal of Economics,* 79(2), 145-185.

Lerner J. (2000). 150 Years of Patent Protection (NBER Working Paper Series No. 7478). Cambridge, MA: National Bureau of Economic Research.

——— (2002a). Patent Protection and Innovation Over 150 Years (NBER Working Paper Series No. 8977). Cambridge, MA: National Bureau of Economic Research.

——— (2002b). The Economics of Technology and Innovation. 150 Years of Patent Protection. *AEA Papers and Proceedings,* 92(2): 221–225.

——— (2009). "The Empirical Impact of Intellectual Property Rights on Innovation: Puzzles and Clues. *The American Economic Review,* 99(2), 343–348. DOI:10.1257/aer.99.2.343.

Levin, R. C., Klevorick, A. K., Nelson, R. R, Winter, Sidney G., Gilbert R. & Griliches, Z. (1987). Appropriating the Returns from Industrial Research and Development. Brookings Papers on Economic Activity, 1987(3) Special Issue On Microeconomics, 783-831.

Lundvall, B. (Ed.). (2010). *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*. The Anthem Other Canon Series. London: Anthem Press.

MacCormack, A., Forbath, T., Brooks, P. & Kalaher, P. (2007). Innovation Through Global Collaboration: A New Source of Competitive Advantage." Boston: Harvard Business School.

Machi, L. A., & McEvoy, B. T. (2009). *The Literature Review.* Thousand Oaks, CA: Sage.

Manley, J. & Williams R. (2011, April 14). Enhancing Trade by Protecting Intellectual Property. *National Post*.

Marengo, Luigi, Corrado Pasquali, Marco Valente, and Giovanni Dosi. 2009. "Appropriability, Patents, and Rates of Innovation in Complex Products Industries." 5. 2009.

Maskus, Keith. (1998). "The Role of Intellectual Property Rights in Encouraging Foreign Direct Investment and Technology Transfer." *Duke Journal of Comparative and International Law*.

———. (2012). *Private Rights and Public Problems: The Global Economics of Intellectual Property in the 21st Century*. Washington, D.C.: Peterson Institute for International Economics.

Maskus, Keith E, and Mohan Penubartib. (1995). "How Trade-Related Are Intellectual Property Rights?" *Journal of International Economics* 39: 227–248.

Mazurkewich, K. (2011). *Rights and Rents: Why Canada Must Harness Its Intellectual Property Resources*. Toronto: Canadian International Council.

Menrad, K. (2004 April 8 to 10). The Regulatory Regime and Its Impact on Innovation Activities in Agro-Food Biotechnology in the EU and USA. Paper presented at Seeds of Change: Intellectual Property Protection for Agricultural Biotechnology Urbana-Champaign, IL: University of Illinois at Urbana-Champaign.

Merges, R. P & Nelson R. R. (1990). On the Complex Economics of Patent Scope. *Columbia Law Review,* 90(4): 839–916.

Motion Picture Assocaiton of America (MPAA). (2011). *Statement on Strong Showing of Support for Stop Online Piracy Act.* Retrieved from https://www.scribd.com/doc/85454091/MPAA-Press-Release-Dec-16-2011

Mitra-Kahn, B. H. (2011). Copyright, Evidence and Lobbynomics: The World After the UK's Hargreaves Review. *Review of Economic Research on Copyright Issues* 8(2), 65-100.

Ncube, C., Abrahams, L. & Akinsanmi, T. (2014) Effects of the South African IP Regime on Generating Value from Publicly Funded Research: An Exploratory Study of Two Universities. In J. de Beer, C. Armstrong, C. Oguamanam & T. Schonwetter (Eds.), *Innovation and Intellectual Property: Collaborative Dynamics in Africa* (p. 282-315). Cape Town: UCT Press. Retrieved from Open African Innovation and Research Network (Open AIR) http://www.openair.org.za/publications/innovation-intellectual-property-collaborative-dynamics-in-africa/.

Nelson, R. R & Winter, S. G. (1977). In Search of Useful Theory of Innovation. *Research Policy,* 6(1), 36–76. DOI:10.1016/0048-7333(77)90029-4.

———. (2009). *An Evolutionary Theory of Economic Change*. Boston: Harvard University Press. DOI:10.2307/2232409.

Nelson, R. R. & Rosenberg N. (1993). "Technical Innovation and National Systems." In R. R. Nelson (Ed.), *National Innovation Systems: A Comparative Analysis* (p. 3-22). New York: Oxford University Press.

Nordhaus, W. D. (1969a). *Invention, Growth, and Welfare: A Theoretical Treatment of Technological Change.* Cambridge, Massachusetts: M.I.T. Press.

———. (1969b). An Economic Theory of Technological Change. *The American Economic Review,* 59(2), 18–28.

———. (1972). The Optimum Life of a Patent: Reply. *The American Economic Review,* 62(3), 428–431.

O'Donoghue, T. (1998). A Patentability Requirement for Sequential Innovation. *RAND Journal of Economics,* 29(4), 654–679.

O'Donoghue, T. & Zweimuller, J. (2004). Patents in a Model of Endogenous Growth. *Journal of Economic Growth,* 9, 81–123.

Organization for Economic Cooperation and Development (OECD). (1997). *Oslo Manual: Proposed Guidelines for Collecting and Interpreting Technological Innovation Data*. *Proposed Guidelines for Collecting and Interpreting Technological Innovation Data* (2nd ed.). Paris: OECD.

———. (2010). *Measuring Innovation: A New Perspective*. Paris: OECD.

OECD & Statistical Office of the European Communities (Eurostat). (2005). *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data* (3rd ed.). Paris: OECD & Eurostat.

Park, W. G. (2008a). Intellectual Property Rights and International Innovation. In K. Maskus (Ed.), *Intellectual Property, Growth and Trade (Frontiers of Economics and Globalization, Volume 2)* (p. 289–327) Elsevier Science. DOI:10.1016/S1574-8715(07)00009-7.

———. (2008b). International Patent Protection: 1960–2005. *Research Policy,* 37(4), 761–766. DOI:10.1016/j.respol.2008.01.006.

Park, W. G. & Lippoldt, D. (2005). International Licensing and the Strengthening of Intellectual Property Rights in Developing Countries During the 1990s (OECD Economic Studies No 40 2005/1). OECD Publishing

———. (2008) Technology Transfer and the Economic Implications of the Strengthening of Intellectual Property Rights in Developing Countries (OECD Trade Policy Working Papers, No. 62). OECD Publishing. DOI:10.1787/244764462745.

Pathak, S., Xavier-Oliveira, E. & Laplume, André O. (2013). Influence of intellectual property, foreign investment, and technological adoption on technology entrepreneurship. *Journal of Business Research*, 66(10), 2090-2101.

Penrose, E. T. (1951). *The Economics of the International Patent System*. Baltimore, MD: Johns Hopkins Press.

Pham, N. D. (2010). The Impact of Innovation and the Role of Intellectual Property Rights on U.S. Productivity, Competitiveness, Jobs, Wages, and Exports. Ndp Consulting.

Png, I. P. L. (2006) Copyright: a plea for empirical research. Review of Economic Research on Copyright Issues, 3(2), 3-13.

Prioritizing Resources and Organization for Intellectual Property Act of 2008. (2008). Washington, D.C.

Putnam, J. D. (Ed.). (2006). *Intellectual Property and Innovation in the Knowledge-Based Economy*. Ottawa: Industry Canada.

Rafiquzzaman, M. & Ghosh S. (2006). The Importance of Patents, Trade-Marks and Copyright for Innovation and Economic Performance: Developing a Research Agenda for Canadian Policy. In J. D. Putnam (Ed.), *Intellectual Property and Innovation in the Knowledge-Based Economy* (p. 1-50). Ottawa: Industry Canada.

Rafiquzzaman, M. & Whewell, L. (1998). Recent Jumps in Patenting Activities: Comparative Innovative Performance of Major Industrial Countries, Patterns and Explanations (Industry Canada Research Publications Program Working Paper No 27). Ottawa: Industry Canada.

Rapp, R. T. & Rozek, R. P. (1990). Benefits and Costs of Intellectual Property Protection in Developing Countries. *Journal of World Trade*, 7, 75–102.

Raymond, C. P. (1996). *The economic importance of patents*. London: The Intellectual Property Institute.

Rob Reid, (2012) Rob Reid: The $8 billion iPod. *TED.* Retreived from http://www.ted.com/talks/rob_reid_the_8_billion_ipod.

Reynolds, G. J. (2013). The Precautionary Principle and Its Application in the Intellectual Property Context: Towards a Public Domain Impact Assessment. In B. C. Doagoo, M. Goudreau, M. Saginur, & T. Scassa (Eds.), *Intellectual Property for the 21st Century: Interdisciplinary Approaches* (p. 95–113). Toronto: Irwin Law.

Reynolds, T. W. (2003) *Quantifying the evolution of copyright and trademark law.* Washington, D.C.: American University [unpublished].

Rogers, T. & Szamosszegi, A. (2007) *Fair Use in the U.S. Economy: Economic Contribution of Industries Relying on Fair Use*. Washington, D.C.: Computer & Communications Industry Association.

———. (2010). *Fair Use in the U.S. Economy: Economic Contribution of Industries Relying on Fair Use*. Washington, D.C.: Computer & Communications Industry Association.

Rogers, T., Szamosszegi, A. & Capital Trade Inc. (2011). *Fair Use in the U.S. Economy: Economic Contribution of Industries Relying on Fair Use*. Washington, D.C.: Computer & Communications Industry Association. Retrieved from http://www.ccianet.org/CCIA/files/ccLibraryFiles/Filename/000000000526/CCIA-FairUseintheUSEconomy-2011.pdf.

Romer, P. M. (1992). *Two Strategies for Economic Development : Using Ideas and Producing Ideas*. Paper Presented to Proceedings of The World Bank Annual Conference on Development Economics. World Bank.

———. (2002). When Should We Use Intellectual Property Rights ? *The American Economic Review,* 92(2), 213–216.

Sakakibara, M. & Branstetter, L. (1999). Do Stronger Patents Induce More Innovation? Evidence from the 1998 Japanese Patent Law Reforms (NBER Working Paper Series No. 7066). Cambridge, MA: National Bureau of Economic Research.

———. (2001). Do Stronger Patents Induce More Innovation? Evidence from the 1988 Japanese Patent Law Reform. *RAND Journal of Economics,* 32(1), 77–100.

Sanchez, J. (2008, October) 750,000 lost jobs? The dodgy digits behind the war on piracy. Ars Tech. Retrieved from http://arstechnica.com/tech-policy/2008/10/dodgy-digits-behind-the-war-on-piracy/1/.

Sampath, P. G. (2006). Breaking the Fence: Patent Rights and Biomedical Innovation in 'Technology Followers' (United Nations University, UNU Merit Working Paper Series No 006-008). Maastricht, The Netherlands: United Nations University.

Schmitz Jr, J. A. (1989). Imitation, Entrepreneurship, and Long-Run Growth. *Journal of Political Economy,* 97(3), 721–739. DOI:10.1086/261624.

Schmookler, J. (1966). *Invention and Economic Growth*. Cambridge, MA: Harvard University Press.

Schneider, P. H. (2005). International Trade, Economic Growth and Intellectual Property Rights: A Panel Data Study of Developed and Developing Countries. *Journal of Development Economics*, 78(2), 529–547. DOI:10.1016/j.jdeveco.2004.09.001.

Schroeder, H. (2007). Commentary: Do Patent Terms Impact Domestic R&D Spending in the Pharmaceutical Industry? *Healthcare Policy,* 2(3), 90–94. DOI:10.12927/hcpol.2007.18704.

Schumpeter, J. A. (1934). *The Theory of Economic Development*. *Entrepreneurship Style and Vision, Vol. 1*. Cambridge: Harvard University Press. DOI:10.1080/03085140802357927.

———. (1942). *Capitalism, Socialism and Democracy*. *Economica*. *Vol. 11*. London: George, Allen & Unwin. DOI:10.2307/2549943.

Schwab, K. & Sala-i-Martín, X. (2014). *The Global Competitiveness Report 2014-2015*. Geneva: World Economic Forum.

Science Technology and Innovation Council. (2011). *Imagination to Innovation: Building Canadian Paths to Prosperity*. Ottawa: Science, Technology and Innovation Council.

Scotchmer, S. (1991). Standing on the Shoulders of Giants: Cumulative Research and the Patent Law. *Journal of Economic Perspectives* 5(1), 29–41. DOI:10.1257/jep.5.1.29.

———. (2004) *Innovation and Incentives*. Cambridge, MA: MIT Press.

Scotchmer, S. & Green J. (2007). Novelty and Disclosure in Patent Law. *The RAND Journal of Economics,* 21(1), 131–146.

Seyoum, B. (1996). The Impact of Intellectual Property Rights on Foreign Direct Investment. *The Columbia Journal of World Business,* 31(1), 50–59. DOI:10.1016/S0022-5428(96)90006-X.

Shapiro, C. (2001). Navigating the Patent Thicket: Cross Licences, Patent Pools and Standard Setting BT – Innovation Policy and the Economy. In A. B. Jaffe, J. Lerner, & S. Stern (Eds.), *Innovation Policy and the Economy, Volume 2* (p. 119–150). Cambridge: MIT Press.

Shavell, S. & Van Ypersele, T. (2001). Rewards Versus Intellectual Property Rights. *Journal of Law and Economics,* 44, 525–547. DOI:10.3386/w6956.

Shao, Y. (2014). *Product Cycle Dynamics and Intellectual Property Rights: Theory and Evidence* University of Colorado [unpublished].

Sherwood, R. M. (1997). Intellectual Property Systems and Investment Stimulation: The Rating of Systems in Eighteen Developing Countries. *IDEA: The Journal of Law and Technology,* 37(2), 261–370.

Sinha, U. B. (2001). Patent Protection, Innovation Rate and Welfare. (National University of Singapore Working Paper No. 0106). Singapore: National University of Singapore.

Silberston, A. (1987). *The Economic Importance of Patents*. London: The Common Law Institute of Intellectual Property.

Siwek, S. E. (2006). The True Cost of Motion Picture Piracy to the U.S. Economy (Institute for Policy Innovation Policy Report No. 186). Irving, TX: Institute for Policy Innovation.

———. (2007a). *The True Cost of Copyright Industry Piracy to the U.S. Economy* (Institute for Policy Innovation Policy Report No. 189). Irving, TX: Institute for Policy Innovation.

———. (2007b). *The True Cost of Sound Recording Piracy to the U.S. Economy* (2007)

———. (2014). Copyright Industries in the U.S. Economy: The 2014 Report. Washington, D.C.: International Intellectual Property Alliance.

Squicciarini, M., Dernis, H. & Criscuolo, C. (2013). Measuring Patent Quality: Indicators of Technological and Economic Value (OECD Science, Technology and Industry Working Papers No. 2013/03). OECD Publishing.

Statistics Canada. (2012) *Intellectual property management in selected industries , 2010.* Ottawa, ON: Statistics Canada.

———. (2014) *Survey of Innovation and Business Strategy , 2012.* Ottawa, ON: Statistics Canada.

Strandburg, K. J. (2009). Evolving Innovation Paradigms and the Global Intellectual Property Regime. *Connecticut Law Review,* 41(3), 861-920.

Taylor Wessing LLP. (2013). *Global Intellectual Property Index: The 4th Report.* Retreived from http://www.taylorwessing.com/ipindex/index.html.

Teece, D. J. (1986). Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy. *Research Policy,* 15, 285–305.

TERA Consultants. (2010). *Building a Digital Economy: The Importance of Saving Jobs in the EU's Creative Industries.* Washington, D.C.: TERA Consultants.

Thompson, M. A. & Rushing, F.W. (1999). An Empirical Analysis of the Impact of Patent Protection on Economic Growth: An Extension. *Journal of Economic Development,* 24(1), 67–76.

Torstensson, J. (1994). Property Rights and Economic Growth: An Empirical Study. *Kyklos,* 47(2), 231–247. DOI:10.1111/j.1467-6435.1994.tb02257.x.

Towse, Ruth. (2003). "Assessing the Economic Impacts of Copyright Reform on Performers and Producers of Sound Recordings in Canada." Ottawa, Canada.

———. (2013). The quest for evidence on the economic effects of copyright law. *Cambridge Journal of Economics*, 37, 1187-1202.

United Kingdom Department or Culture, Media, and Sports (UK DMC). (2011). *Creative Industries Economic Estimates*. Retreived from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/77959/Creative-Industries-Economic-Estimates-Report-2011-update.pdf.

United Kingdom Intellectual Property Office (UK IPO). (2013). *Guide to Evidence for Policy: Update 2013.* Retrieved from United Kingdom Government http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/388238/consult-2011-copyright-evidence.pdf.

United Nations. (2008). *Creative Economy Report 2008. The Challenge of Assessing the Creative Economy: Towards Informed Policy Making.* Geneva: UNCTAD and UNDP.

United States Government Accountability Office. (2010). *Observations on Efforts to Quantify the Economic Effects of Counterfeit and Pirated Goods* Washington, D.C: United States Government Accountability Office.

United States Patent and Trademark Office (USPTO). (2012). *Intellectual Property and the U.S. Economy: Industries in Focus*. Washington, D.C: USPTO.

Wall Communications. (2004) The Economic Contribution of Copyright-Based Industries in Canada (World Intellectual Property Organization (WIPO) Creative Industries Series No. 1). Ottawa: WIPO & Canadian Heritage.

Watters, D. B. (2014). International Benchmarking to Support IP Policy Decision-Making. Ottawa.

Williams, H. L. (2013). “Intellectual Property Rights and Innovation: Evidence from the Human Genome.” *Journal of Political Economy,* 121(1), 1–27. DOI:10.1086/669706.

World Intellectual Property Organization (WIPO). (2003). *Guide on Surveying the Economic Contribution of the Copyright-Based Industries.* Geneva: WIPO.

———. (2011). *World Intellectual Property Report: The Changing Face of Innovation.* Geneva: WIPO.

———. (2014a). *WIPO Studies on the Economic Contribution of the Copyright Industries.* Geneva: WIPO.

———. (2014b). *World Intellectual Property Indicators.* Geneva: WIPO.

Yasuda, F. & Kato, H. (2007). *Impact of the Intellectual Property System on Economic Growth*. Geneva: WIPO & UNU

Recognizing Africa's role in the global knowledge economy.
www.openair.org.za

Open AIR
Open African Innovation Research (Open AIR) is a unique collaborative network of researchers investigating how intellectual property (IP) systems can be harnessed in open, participatory ways that have the potential to maximise knowledge access, innovation, and the sharing of benefits from innovation inclusively.

For more Information about Open AIR, please visit our website: www.openair.org.za
or contact one of our Program Managers:
ottawa@openair.org,za
capetown@openair.org.za

This work was carried out by Open AIR with the aid of a grant from
the International Development Research Centre, Ottawa, Canada
the Social Sciences and Humanities Research Council of Canada, and
in cooperation with the International Centre for Trade and Sustainable Development and
the Department for International Development.

IDRC | CRDI
International Development Research Centre

Canada

Social Sciences and Humanities Research Council of Canada
Conseil de recherches en sciences humaines du Canada

Canada

ICTSD
International Centre for Trade and Sustainable Development

Department for International Development