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ENQUIRIES INTO INTELLECTUAL PROPERTY'S ECONOMIC IMPACT

CHAPTER 1. SYNTHESIS REPORT

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FOREWORD

"Enquiries into Intellectual Property's Economic Impact" is a result of the combined expertise and effort of six parts of the OECD (Consumer Policy, Digital Economy, Science & Technology, Industry and Entrepreneurship, Tax Policy, and Trade). A component of the multidisciplinary OECD Project *New Sources of Growth: Knowledge-based Capital, Phase 2*, this report has its roots in an earlier horizontal project called *The Innovation Strategy*, delivered in 2010 and currently being updated. That report identifies ways in which governments can promote innovation to capitalise on its power to drive productivity and income growth forward. In the midst of that work, the economy entered into its worst slowdown in 70 years, leading to a follow-on project, *New Sources of Growth: Knowledge-based Capital, Phase 1*, aimed at identifying new drivers of growth. Building on seminal work from the staff of the United States Federal Reserve Board[1], this study identified a new class of capital assets – "knowledge-based capital" (KBC) such as R&D, design, software, data and intellectual property like patents and copyright – which are difficult to measure but critical strategic investments for retaining and building competitiveness. As KBC becomes recognised as a driver of new sources of growth, and as the ownership of KBC becomes commonplace across all sectors of the economy, a number of policy challenges emerge, as analysed in Phase 1.

Amongst these are policies to nurture and protect intellectual property (IP). Hereto now, in some countries IP mainly affected specific sectors like pharmaceuticals and artistic content. Mobile phone wars, for example, are a new development, and a mobile phone may have as many as 3 000 different patents. In addition, the development of technologies like digitisation and the Internet has brought consumers into more direct and frequent contact with copyright laws than ever before by making it far easier, faster, and cheaper to create, duplicate, and disseminate content. The aim of this second phase of work is to examine how those developments have interacted with IP and to develop analytical tools and collect information that will facilitate insights and analysis. The goal is to recognise IP's growing importance and ensure that it is as valuable and helpful as it can be to OECD economies. Now, more than ever, policy makers need to harness drivers of growth like the creativity and ideas contained in intellectual property to stimulate economic growth and foster social well-being.

Given the multidisciplinary nature of the work on KBC and intellectual property, the chapters of this report were discussed and declassified by a variety of OECD Committees, including the Digital Economy Policy Committee, the Committee for Scientific and Technological Policy, the Committee on Industry, Innovation and Entrepreneurship, and the Trade Committee. The content and comments contributed by the delegates to these OECD official bodies are gratefully acknowledged.

Many OECD staff contributed to this report. Jeremy West wrote Chapter 1 (Synthesis). Chapter 2 (Measuring the Technological and Economic Value of Patents) was written by Mariagrazia Squicciarini, Hélène Dernis, and Chiara Criscuolo. Chapters 3 and 4 (Approaches to the Protection of Trade Secrets and An Empirical Assessment of Protection for Trade Secrets) were authored by Douglas Lippoldt and Mark Schultz. Piotr Stryszowski wrote Chapter 5 (Copyright in the Digital Era). Chapter 6 (Design and Design Frameworks: Investment in KBC and Economic Performance) was written by Christopher Tucci and Tilo Peters with comments from Mariagrazia Squicciarini. Lucie Guibault and Thomas Margoni wrote Chapter 7 (Legal Aspects of Open Access to Publicly Funded Research) with guidance from Mario Cervantes and Giulia Ajmone-Marsan. Niamh Dunne was the Rapporteur for the expert workshop and wrote Chapter 8

(Summary of the Expert Workshop). Chapter 9 (IP-Based Financing) was authored by Marco Antonielli with guidance from Jeremy West. Alistair Nolan, who managed the KBC Phase 1 project, provided valuable information and advice on the whole project. The assistance of Joshua Yeremiyew, who helped with several of the diagrams and charts in the synthesis chapter, is also greatly appreciated.

This report also benefited from the advice of a panel of delegates drawn from the participating committees. Many thanks to Maria Ludovica Agro, Heather Anderson, Suso Baleato, Maurizio Cerratti, Tony Clayton, Dave Dupuis, Stephanie Eshelman, Gregory Garramone, Rita Goldstein, Roger Higginson, Ali Karami-Ruiz, Konstantinos Komaitis, Thomas Nortvedt, Max Peterson, Filippos Pierros, Nicole Primmer, Michel Sabbagh, and Scott Smith. Comments from Brian Kahin and Matt Schruers were very informative, as well.

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CHAPTER 1. SYNTHESIS

This chapter provides the rationale and context for Enquiries into Intellectual Property's Economic Impact and highlights its most significant findings. In doing so, the chapter presents the major themes of the overall report, which are 1) the importance of various types of intellectual property as sources of growth and innovation in today's economies; and 2) the effects on IP systems and stakeholders of major developments such as content digitisation, the growth of the Internet, and globalisation.

EXECUTIVE SUMMARY

Key challenges

- Copyright appears to be the type of IP that has been attracting business investment at the highest growth rate and it is undergoing statutory review in many countries, yet there are fewer empirical studies about copyright than about patents. Encouraging and enabling the collection and availability of more data on copyright would facilitate data-driven copyright policy. In fact, robust evidence on the use of IP rights generally and on their economic and social impacts is essential for sound IP systems. Presently, however, relatively little concrete evidence is available to support the common assumption that IP rights encourage greater innovation and creativity. More economic evidence is needed.

- At the same time, the copyright system could benefit from review and analysis with a view towards clarifying its underlying principles, as well as clarifying the standards for delineating the exclusive rights and exceptions to those rights that are informed by the principles. Such reviews and analyses could make the use of copyrighted works more transparent, consistent, and predictable.

- Young innovative firms have the strongest track record for creating jobs, but it has become harder for them to find financing. Making it easier to use IP (in particular patents and design rights) to obtain financing would help some young firms to drive job growth and spur innovation.

- To leverage the economic benefits of patents, take steps to improve the diffusion of patent information after publication, consistent with international norms.

- Initial work on trade secrets in this report suggests a link between trade secret protection and innovation, pointing to an issue which merits continued study.

General points

- **Intellectual property rights are exclusive rights** held by the owners of a variety of knowledge-based assets that qualify for legal protection under applicable IP laws. The main types of IP rights are patents, copyrights, design rights, trademarks, and geographical indications. Trade secrets are sometimes considered to be IP rights, too, though many countries do not expressly define them as such.

- **IP rights support innovation by making it a more worthwhile investment and encouraging knowledge diffusion**. The economic rationale for IP rights is that it is in everyone's long-term interest for people and businesses that create knowledge to have well-defined, enforceable rights to exclude third parties from appropriating their ideas, or the expression of their ideas, without permission. Failing to put restrictions on appropriating others' inventions and creations would dilute the rewards for investing in innovation, thereby reducing the incentives for making such investments. In addition, both *i)* disclosure requirements and time limits for exclusivity that are

built into IP laws, and *ii)* IP rights' facilitation of licensing and other knowledge transfers, contribute to knowledge diffusion and thus to innovation.[2]

- **IP's overall role in economies has evolved** from a policy area that was mainly relevant to a handful of industries to a force that influences a wide swath of demand and sectors. Consequently, IP policy has become a more influential framework condition that affects not only innovation, but trade, competition, taxes, consumer protection, and other areas.

- Investment in IP-protected capital is growing faster than investment in tangible capital, and salaries in IP-intensive sectors are higher than in non-IP-intensive sectors. The available evidence on IP's aggregate role also shows that IP's economic importance has grown over time and that it remained resilient during the recent recession.

- **The context in which IP operates has been changing substantially**. IP frameworks and stakeholders have been and continue to be affected by a number of developments, including the rise of cloud computing, the growth of the Internet, digitisation, and globalisation. These have created both new challenges for IP, including the facilitation of piracy and industrial espionage, and new opportunities for it to stimulate inventions and creativity as well as to facilitate greater access to information and creative works. For example, new business models and research tools (based on, e.g., text/data mining, open access, and e-content) hold the promise of jobs, growth, and greater knowledge diffusion.

- **IP-based financing deserves attention**. Young firms contribute disproportionately to job creation. Among the most important factors affecting their success is the ease of access to financing. Capital is often relatively difficult for young firms to obtain because they do not have long histories of consistently repaying loans and they tend to lack traditional collateral. But some young firms have untapped resources in the form of IP, which – if it can be properly valued and if markets for IP-based financing are functioning well – can be used to persuade lenders and investors to provide financing. Indeed, a substantial body of empirical work has found that young, high-growth firms with IP assets receive more funding than firms without IP. Nevertheless, IP-based finance is significantly under-used, especially by SMEs that are most in need of it. One reason is a lack of opportunities to sell IP in secondary markets. While open source models may not be predicated on enforcement, in some countries a lack of effective IP enforcement can be another barrier to obtaining financing. Policy makers are striving to support IP markets in several countries. Generally, their efforts fall into two categories: *i)* supporting greater transparency of IP ownership and transfer information via disclosure requirements or measures to foster greater clarity in patent claims; and *ii)* creating new IP market infrastructures. Another approach that governments can take is to help manage the risks associated with collateralising IP. Government agencies and development banks can do that through risk-sharing mechanisms.

Points about particular types of IP rights

- **IP rights involve more than just patents; copyright and trade secrets have a bigger role than some might have thought**. Indeed, they are the most economically significant forms of IP rights in some respects, yet they have benefited from relatively less research, mainly because there is much less data available on them than there is on patents. It is inherently difficult to obtain data on trade secrets due to the fact that they lose their legal protection if they are made public; however, more could be done to improve data availability with respect to copyright. One possibility is to implement more measures designed to encourage voluntary copyright registration. Other potential actions include funding research and surveys to estimate the benefits of more

registration, and changing the accounting rules that apply to creative industries to enable better data collection. This should be done while bearing in mind that under the Berne Convention registration is not mandatory.

- **Copyright's performance excels** in terms of the magnitude of investment it attracts, the growth rate of that investment, and job growth. Therefore, to the extent that this synthesis chapter devotes more space to copyright issues than to issues related to other types of IP rights, an important reason is that copyright's role in economies appears to be growing larger, faster. Note that, in much of the world, copyright protects a significant amount of software investment – sometimes more than in the rest of the 'creative industries'. Furthermore, although the report discusses the copyright intensive industries at some length, it is important to recognise that user generated content is now also a significant source of entertainment and information.

- **Several governments have embarked on a review of their copyright laws** to make sure they remain fit for the digital age, with the aim of ensuring that their legal frameworks maintain effective incentives for creators and all stakeholders in the value chain including intermediaries and to consider whether certain aspects of the copyright regimes need to be adapted to the 21st century. For example, such efforts have been undertaken in the United Kingdom, Ireland and Australia. The ways in which copyrighted material is being created, disseminated, and used have changed substantially due to digitisation and the Internet. As a result, a new dynamic amongst stakeholder interests has emerged, which has fuelled a debate about the effects of copyright law and particular provisions on the growth of a wide range of economic activities that depend upon digital networks and products.

- **Evidence that patents stimulate innovation is mixed**. Several surveys have shown that patents are not considered to be very effective in protecting innovations outside a small number of sectors. However, other reports indicate that growth in patent-intensive industries following the 2008-2009 recession outpaced growth in non-IP-intensive industries. In any event, studies still have not definitively concluded that stronger, broader patent rights are necessarily resulting in more innovation. Despite this mixed evidence, over the past 20 years or so patent rights have generally become broader and stronger, and there has been a surge in the number of patents granted.

- **Several ways to estimate the technological and economic value of patented inventions and the impact they may have on subsequent technological developments are provided** in this Report, making it possible to shed more light on the patent-innovation relationship. The Report proposes several indicators and illustrates what they can do with data from the European Patent Office. The illustrative results show that: *i*) the average technological and economic value of inventions protected by patents has eroded over time, at least through 2004, possibly reflecting application backlogs as well as strategic behaviours like defensive patent filings; *ii*) patented micro and nano technologies have the highest economic and technological value; and *iii*) Australia, Canada, Norway, South Africa, and the United Kingdom are the countries with the highest average technological and economic patent values.

- **Taking certain steps to improve disclosure and dissemination of the information contained in patent applications could boost the impact that patented inventions have on subsequent technological developments**. This would more fully achieve a primary purpose of the patent arrangement, namely to increase innovation and knowledge diffusion by granting exclusive rights. Countries can improve the quality of disclosures by more rigorously enforcing the disclosure laws that already exist. They can improve dissemination by encouraging and funding efforts by patent offices to digitise the application process and put databases of patent information online. In

addition, a peer review system might be helpful because it is difficult for any individual patent examiner to be skilled in every area. Another idea is to reduce the lag between the date of filing and the date of publication (which is when public disclosure actually occurs). Shortening the lag, at least in fast-moving technology fields, could make disclosures more useful by making it more likely that the information they contain is still relevant.

- **A link between trade secrets and innovation is suggested by new OECD work**. This report presents an indicator of the stringency of protection of trade secrets, which provides a way to study the relationship between the strength of trade secret protection in an economy and that economy's performance. The indicator is used to test the hypothesis that more stringent trade secrets protection is associated with greater innovation and diffusion. The results show that there is indeed a positive and statistically significant relationship between the stringency of trade secret protection and indicators of innovation inputs. While these results do not mean that ever stronger rights and remedies will yield similar results, the positive and statistically significant relationships identified do indicate that adequately protecting trade secrets may be an appropriate policy for strengthening certain aspects of economic performance.

- **Evidence on the importance of design rights is scarce and mixed**. The number of industrial designs contained in applications has been growing. However, one of the few studies that have been performed on design IP found that while design is a significant part of the business model for 85% of UK businesses, a mere four percent of them use registered designs; another four percent use unregistered designs. Nevertheless, earlier work indicated that companies that were "effective users of design" (but not necessarily design *rights*) outperformed the UK stock market by 200 percent between 1994 and 2004. That raises questions about the effectiveness of design rights for motivating investment in design-related KBC.

Introduction: The Context and Motivation for Knowledge-based Capital Phase 2

Knowledge-based Capital Phase 1

New Sources of Growth: Knowledge-based Capital is a strategic priority of the OECD, as recognised by the 2012, 2013 and 2104 Meetings of OECD Council at Ministerial-level[3] and the Secretary General's Strategic Orientations.[4] It has benefited from the involvement of multiple committees and OECD Directorates, thereby enabling a multi-disciplinary analysis.

New Sources of Growth: Knowledge-based Capital was born out of insights from the OECD's Innovation Strategy (2010). *New Sources of Growth* began in 2011. Phase 1 provided evidence of the economic value of knowledge-based capital (see Box 1.1) as a new source of growth and identified current and emerging policy challenges. It drew on expertise from across the OECD and from streams of work on competition, corporate reporting, the efficiency of resource allocation, global value chains, innovation, knowledge networks and markets, measurement and taxation. Phase 1's main findings are summarised in Annex 1.1 to this Chapter.

Box 1.1 Knowledge-based capital and IP rights

Knowledge-based capital comprises a range of assets. These assets create benefits for firms but, unlike machines, equipment, vehicles and structures, they have neither a physical nor a financial embodiment. This intangible form of capital is, increasingly, the largest form of business investment and a key contributor to growth in advanced economies. The term KBC, as defined and used in this report, can be used interchangeably with the term "intangible assets."

Some but not all KBC is protected by IP rights, which are exclusive rights held by the owners of assets that qualify for legal protection under applicable IP laws. A significant portion of KBC is effectively 'open' in the sense that it is not protected by IP rights.

The value of KBC depends on how effectively it is used. The use of KBC that is protected by IP rights depends, in turn, on how effectively it is protected (so as to provide an incentive for creation and exploitation) as well as on ease of access and the level of transaction costs

The Purpose and Structure of Knowledge-based Capital Phase 2

Taking into account the outcomes of phase 1, phase 2 of the project focuses on three specific types of knowledge-based capital that need further explanation, hold the promise to generate growth and may warrant improved policy making: *i)* intellectual property; *ii)* data and data analytics; and *iii)* economic competencies (e.g. organisational capital, skills (human capital)).

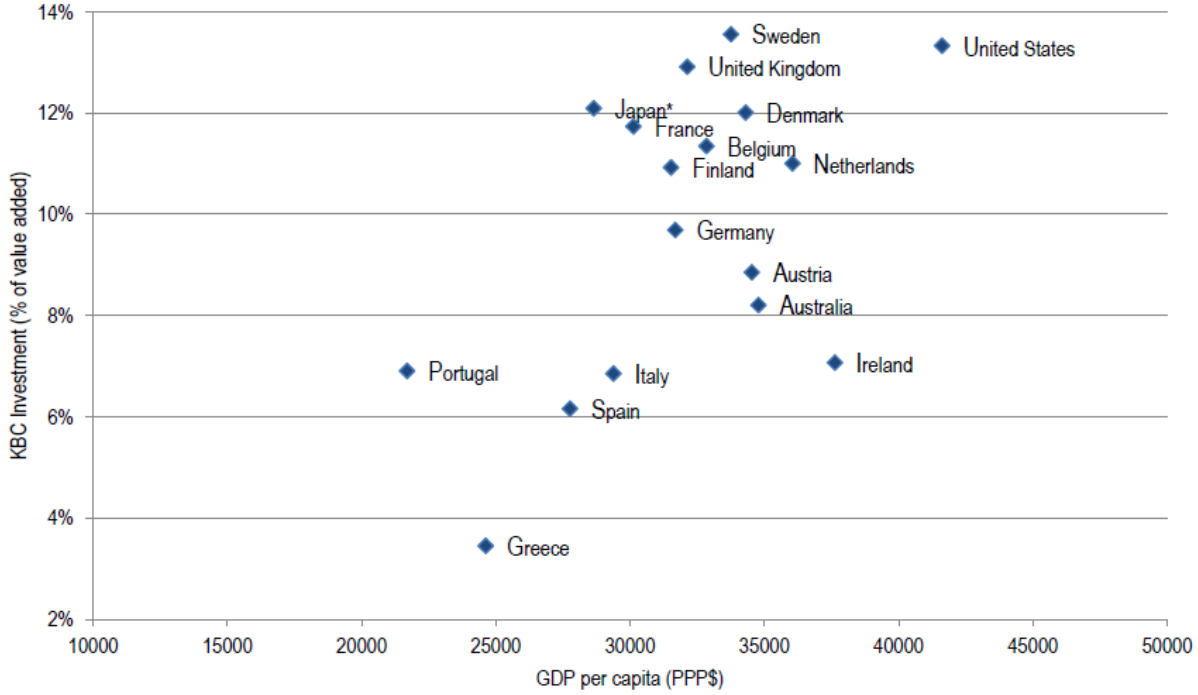
Phase 2 therefore encompasses three streams of work: *i)* Enquiries into Intellectual Property's Economic Impact; *ii)* Data-Driven Innovation – Unleashing Data for Growth and Well-Being; and *iii)* Economic Competencies. A stand-alone tax report, Taxation of Knowledge-based Capital: Non-R&D Investments, Average Effective Tax Rates, Internal vs. External KBC Development and Tax Limitations, has elements that relate to all three work streams.

Phase 2, conducted under the auspices of the Committee for Digital Economy Policy, involves seven other OECD Committees: the Committee on Fiscal Affairs, the Committee on Industry, Innovation and Entrepreneurship, the Committee on Consumer Policy, the Committee for Scientific and Technological Policy, the Health Committee, the Public Governance Committee, and the Trade Committee.

The context of phase 2's IP component: A changing landscape

One of phase 1's main findings was that business investment in knowledge-based capital is linked to growth and higher productivity. That link exists for two main reasons. First, in contrast to physical capital, once the initial cost of developing some types of knowledge is borne, the cost is not re-incurred when the knowledge is used again (in other words, KBC is "non-rivalrous"). That feature can create substantial economies of scale in production. Second, investments in many types of KBC create knowledge spillovers, which allow the benefits from an original investment to reverberate throughout multiple sectors of an economy. Studies have shown that business investment in KBC contributes 20 to 27 percent of average labour productivity growth in the European Union and the United States (OECD, 2013a at 6, 18, 20-22). As a share of GDP, the business sector in higher-income economies invests proportionally more in KBC. Figure 1.1, which is from the phase 1 report, illustrates that positive correlation (though it does not establish causality).

Figure 1.1. Business Investment in KBC and GDP per capita, average 2000-2010



Source: (OECD, 2013*a* at 16).

The two features underlying KBC's link to higher growth (non-rivalry and spillovers) contribute directly to another key finding of phase 1, which was that KBC has become more prevalent in OECD economies, not only spreading across many different industries but growing over time in the aggregate and developing into the largest form of business investment in an increasing number of countries (OECD, 2013*a* at 12, 13). Considering that KBC encompasses intangible assets like software, databases, R&D, worker training, market research, advertisement, and intellectual property, it is easy to see the point that KBC investment today is widespread. Furthermore, KBC is becoming a more tradable asset that is taking over the core of the global economy. Consider, for example, that most of the value in technology products and medicines is not in the physical materials with which those goods are made, but in the continuum of activities around the research, testing, and innovation required to develop them. Similarly, films, songs, and books are bought and sold not because of the form they take but because of the creativity they reflect. Even manufacturing staples like apparel can include substantial KBC, e.g. designs, in their value (Verdier, 2013.) As globalisation continues, the KBC inherent in those products is reaching, as well as emanating from, more and more markets. In countries such as the United Kingdom, Australia, Japan, the United States, and Canada, the significance of investment in KBC relative to investment in tangible capital has been growing for years (OECD, 2013*a* at 13).

Because so much KBC is protected by intellectual property rights, and given the findings that KBC is linked to growth and that it is becoming a more prevalent part of OECD economies, it is no surprise that IP-protected capital has taken on an increasingly prominent and extensive role in economic activity, as well. Whereas in some countries IP formerly had a smaller role and was considered relevant to a small number of sectors such as pharmaceuticals, information technology, music and books, IP's presence and influence are now economy-wide (OECD, 2013*a* at pp. 9, 47-48). Accordingly, IP is now a mainstream factor that has a substantial influence on economic performance in virtually every sector.

While IP's prominence has been growing, a number of developments have been significantly changing the way IP is created, disseminated, appropriated and used. Some of those developments, such as advances in digital technologies, have helped to make information more abundant, easier to access, and easier to store and copy. Those developments have also made it easier to obtain and distribute IP illegally. That accentuates the fact that IP rights are now more important than ever, as it is in everyone's long-term interest for stakeholders who create knowledge and artistic works to have well-defined, enforceable rights to exclude third parties from appropriating their ideas or the expression of their ideas without permission. This Report takes a closer look at IP's role in OECD economies while examining some of the most significant changes to the landscape in which it is operating. The Report targets several discrete areas rather than attempting to cover every possible issue.

This section begins with brief descriptions of the various types of IP rights and the incentives they provide. There is also a table that makes it easier to compare some of their important characteristics. These are followed by a description of the key developments that are affecting how IP systems are operating today.

Box 1.2 Intellectual Property Rights and the Incentives They Provide

IP rights are exclusive rights held by the owners of a variety of knowledge-based assets that qualify for legal protection under applicable IP laws. IP rights foster innovation, creativity, entrepreneurship, investment in knowledge-based assets, and growth. Types of IP and the incentives they bring about include:

- **Patents and utility models**, which mainly protect new technology-based inventions, i.e. products or processes that provide new ways of doing something or that offer new technical solutions to problems. Patents stimulate innovation by assuring inventors that qualifying inventions will not be used or sold legally without their permission, thereby enabling them (potentially) to recoup their investments and profit from them. Patents can also facilitate financing for start-ups by signalling that a firm has valuable assets. To obtain a patent, one must disclose the technical knowledge behind the invention, and patents eventually expire (generally 20 years after the filing date). Patents can enable further technological developments through the information they disclose. They also provide the security that can be necessary for licensing inventions.
- **Copyrights**, which protect and reward literary, artistic and scientific works, whatever may be the mode or form of their expression, including those in the form of computer programs and, in some jurisdictions, databases.[5] Note, however, that copyrights provide protection only against identical copies and non-original works, whereas industrial property rights (patents, design rights, and trademarks) provide wider protection that works against similar inventions or creations, too. Copyright laws also provide for certain exceptions and limitations. Their protections typically last 50-70 years after the death of the creator (and shorter periods for works whose term of protection is based on the date of fixation or communication to the public). Copyrights stimulate creativity by assuring individuals and businesses, large and small, that the original, expressive material they create will not be reproduced, adapted, communicated to the public, displayed, distributed or performed without their permission or otherwise used in a manner that violates the exclusive rights of the copyright owners. Copyright laws provide a foundation for and protect the opportunity of authors to obtain compensation, profit from, and take credit for the material that they create.
- **Design rights**, which protect new and/or original ornamental or aesthetic aspects of articles rather than their technical features. Designs render objects more appealing to consumers and increase their marketability or commercial value. By providing a measure of protection against unlicensed imitations, design rights promote investments in proprietary designs that create value for both consumers and businesses. Registered designs are generally valid for up to 15 years, but in some jurisdictions they are renewable up to a maximum of 25 years.
- **Trade secrets**, which encompass confidential business and technical information and know-how that a firm makes reasonable efforts to keep secret and that has economic value as a result.[6] Trade secrets do not have a fixed duration and can potentially last indefinitely. By offering a measure of protection for valuable information and relieving businesses of the need to invest in more costly security measures, some trade secret laws may encourage businesses to invest in the development of such information. Other trade secret laws focus solely on the prevention of misappropriation of trade secrets. Trade secret laws may also encourage businesses to engage in wider, though limited, dissemination of information than they otherwise would, such as by sharing sensitive information (subject to confidentiality agreements) with business partners. In that manner, trade secret laws can increase the likelihood of knowledge spill-overs.
- **Trademarks**, i.e. distinctive words, symbols and brand names that help customers identify and purchase products or services that meet their needs and expectations, e.g. in terms of quality or price. By protecting such words and symbols, trademark laws encourage businesses to invest not only in developing brand names, but in building strong reputations associated with those brands. Trademarks can be renewed indefinitely.

Geographical indications, which are signs used on goods having specific geographical origins and possessing qualities or reputations that are essentially attributable to the place of origin. Geographical indications differ from other types of IP rights in that they are a collective right rather than a unique right held by a particular individual or business. Geographical indication protection can be renewed indefinitely

Table 1.1. Characteristics of Different Forms of IP

IPR / Trait	Patent	Trade Secret	Copyright	Design Right	Trademark
Duration	Usually 20 years	Indefinite	Usually 50-70 years after creator's death	Not more than 25 years in most jurisdictions	Indefinite
Owner must disclose information	√			√ (if registered)	√
Protects against independent discovery	√				√
Protects against unauthorised production based on reverse engineering	√				
Protects work in progress		√	√		
Must be new or original	√		√	√	√
Must be useful	√	√			
Must be nonobvious	√				
Must be secret		√			
Must have value		√			
Registration fee	√		√ (if registered)	√ (if registered)	√ (if registered)
Legal enforcement cost	Expensive	Expensive	Expensive	Less expensive	Less expensive

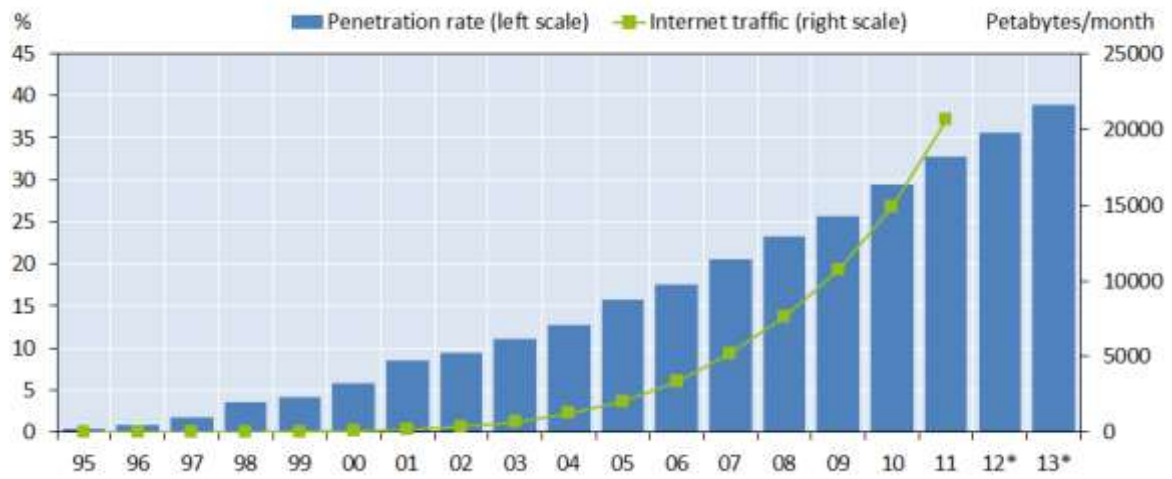
The developments that have affected – and continue to affect – the generation, accumulation and exploitation of IP include:

Internet and Information and Communication Technologies (ICT). The growth of the Internet, including the mobile Internet, and advances in ICT capabilities have enhanced the interconnectedness of economic agents worldwide, facilitated information flows within and across countries, and fostered the development of the digital economy.[7] The Internet has enabled and encouraged innovation, new services and applications, and brought them to a global user base. As a result, the Internet has fundamentally altered the way people, businesses and governments interact. It is now an essential part of life in developed

countries, as well as in many developing countries. At the same time, however, the Internet has provided opportunities for some to engage in unlawful conduct, including IP infringement.

The Internet's growth is depicted in Figure 1.2, which shows that almost 40 percent of the world's population today is connected to the Internet, whereas 15 years ago less than five percent was connected. Internet traffic has expanded even faster, reflecting higher volumes of data flow per user.

Figure 1.2. Worldwide Internet Users and Traffic, 1995 to 2013



Note: The Internet penetration rate is the number of people using the Internet as a share of the world population.

* Estimate.

Source: OECD (2014*a*), p.5 (citing International Telecommunication Union (ITU), Cisco VNI).

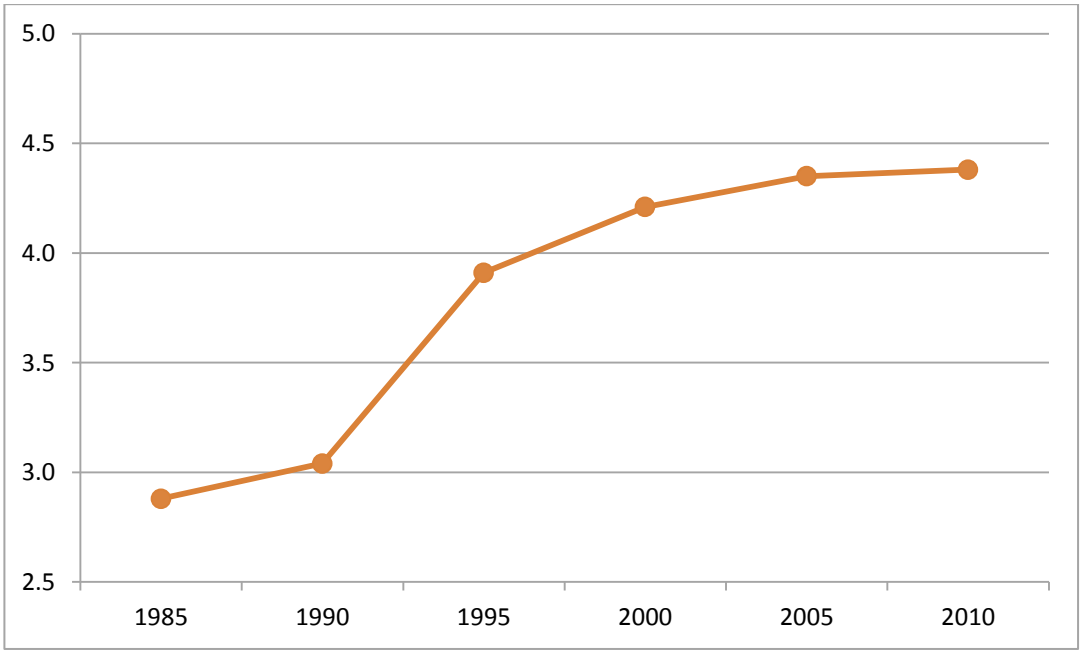
Meanwhile, advances in storage technology have enabled consumers to store more and more content, including on their mobile devices, enabling shifts in how, when, and where people consume, create, and share content that is, for the most part, protected by copyright.

The digitisation of content protected by copyright. Advances in ICT have also led to a world in which most commercial content, such as music, print media, and motion pictures, is digitised. The combination of digitisation and Internet growth has made production and distribution faster and cheaper, enabled new, innovative and successful businesses, and empowered the public to become creators and disseminators of countless new creative works and sources of information and entertainment. Great strides have already been made toward fulfilling the promise of digital technologies for creating, delivering, and consuming content legally. However, it has also made illegal copying and misappropriation of some creative works easier, instantaneous, free of charge, often profitable, and frequently without legal repercussions. The ease of misappropriation has led copyright owners to take new measures designed to strengthen and better protect their rights. They contend that, as a result of those measures, legitimate services are delivering a wide variety of works in a wide variety of formats to consumers. Other stakeholders argue that the measures have gone too far and are undermining legitimate exceptions for personal use and (in some jurisdictions) fair use, and are interfering with innovation. Meanwhile, the growth of digital content has also been accompanied by some confusion and frustration regarding the rules and terms of service in the online marketplace among consumers who may expect the same rights over digital copies that they have over physical copies (OECD, 2013*d*; Forbrukerrådet, 2007). Consumers would benefit from greater clarity about their rights and obligations under copyright laws and licensing terms found under terms of service and about how they can use digital products legally, safely and responsibly.

Stronger IP rights. While it is not universally a recent trend, IP rights have generally been growing stronger over the last 25 years. More types of inventions and creations have become eligible for protection (e.g. synthetically produced genetic material and computer software can be patented in certain countries, copyright protection has been extended to temporary copies in some jurisdictions, trademark scope has expanded to include "non-traditional" marks such as smells, colours, aural marks, and motion marks), the duration of copyright protection has generally been lengthened, some core and neighbouring rights have been added (e.g. with respect to copyright, a right of communication to the public/making available, digital performance rights, protection for technological protection measures, obligations concerning rights management information), as have measures designed to improve enforcement and legal remedies (e.g. border measures and ex officio powers for customs officers, pre-established/statutory damages, the creation of an Office of the United States Intellectual Property Enforcement Coordinator in the White House in 2013).[8] Some of these developments have resulted from obligations found in international agreements, such as TRIPS, the WIPO Copyright Treaty and the WIPO Performances and Phonogram Treaty.

The trend with respect to patent rights, for example, is expressed in Figure 1.3, using the OECD average of a well-known patent rights index.

Figure 1.3. Patent Rights Index, OECD Average Score*, 1985-2010



Source: Chart generated with data from Park (2008) (and subsequent updates).

*The OECD average was compiled with a data set including 32 of the 34 countries that are OECD Members as of 2014 (data for Estonia and Slovenia are not available; 1985 data for the Czech Republic, Hungary, and Poland, as well as 1990 data for the Czech Republic, are also unavailable and therefore are not included in the average).

The numbers on the Y axis estimate the strength of a country's patent protection regime on a scale of 1 to 5.The chart shows that the average strength of patent rights protection in OECD countries grew considerably through 2005 and then levelled off during the next five years.

To some extent, the enhancement of IP rights is a reaction to the other two broad changes that have been mentioned, Internet growth and digitisation. In other words, IP rights affect technology, and technology also affects IP rights. A recent report by The United States Department of Commerce (2013, p.

10), for example, identifies a list of "adjustments to copyright rights in the digital space" that have been implemented to enable IP owners to "exploit their rights effectively":

> *In the United States, the most notable adjustments to copyright rights in the digital space have been the creation of a digital performance right for sound recordings; the application of the reproduction right to temporary digital copies; and the establishment of legal regimes regarding technological adjuncts to copyright, namely technological protection measures (TPMs) and rights management information (RMI). At the international level, there has also been explicit recognition of a "making available" right — i.e., the right to control making works available on demand to members of the public. Each of these adjustments represented an attempt to ensure that copyright owners retain the ability to exploit their rights effectively in the digital environment.*

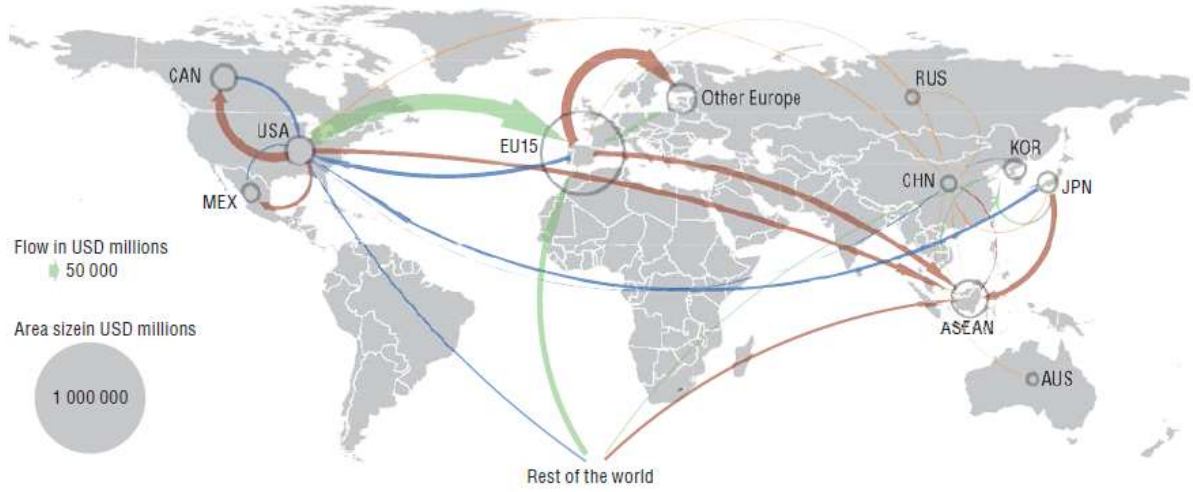
The point of mentioning these changes to IP frameworks is that broader and stronger IP rights may encourage more IP to be generated, or greater creativity to develop[9], and that leads to certain questions that could interest policy makers: How much of that IP is translating into more innovation, jobs, creativity, and productivity? Are IP rights currently calibrated to maximise innovation and growth? If not, how can they be amended to achieve that goal? Alternatively, IP rights may still be too weak to keep pace with the disruptive changes that have affected some industries, e.g. those in the creative economy. The questions for policy makers remain the same in that case, though. Are IP rights currently maximising innovation and growth? If not, how can they be adjusted to achieve that goal? This Report does not attempt to answer such questions, but it does provide some tools and information that can help to develop answers.

The arrival of "big data". Another effect of advances in ICT is that huge volumes of data and text from many sources can be more efficiently collected, sifted, analysed and reassembled into new forms to obtain a wide array of information and knowledge, and to identify correlations among different components of the text and data sets. ICT and big data have changed the way in which knowledge is created and, most importantly, appropriated and transferred. IP policies should balance the need to encourage further development of data analytics technologies, the need to preserve incentives for content creators and inventors, and the need for appropriate exceptions, such as for researchers under some circumstances.[10,11]

Globalisation. With trade liberalisation, greater trade flows, and more interdependence among economies, many business processes have been fragmented along global value chains (GVCs). Figures 1.4 and 1.5 illustrate how much GVC's evolved between 1995 and 2009. The size of the circles represents the total amount of foreign value added embodied in an economy's or a region's total exports of goods and services for final demand (household and capital consumption). The arrows show the origin of the imported content and their thickness corresponds to the volume of the size of the flow they represent. Note that the arrows thicken substantially between 1995 and 2009, indicating countries' greater dependence on imports.

Figure 1.4. Foreign Value Added Content of Exports, 1995

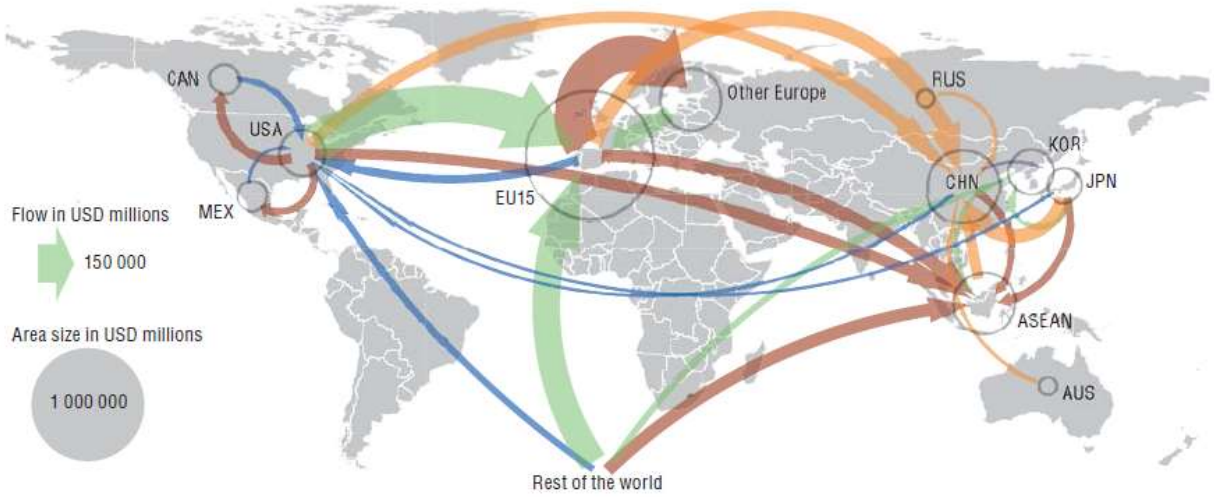
Selected flows, by source country/region, USD millions, at current prices



Source: OECD, 2013c, p. 40.

Figure 1.5. Foreign Value Added Content of Exports, 2009

Selected flows, by source country/region, USD millions, at current prices



Source: OECD, 2013c, p. 41. See also ibid at pp. 250-251.

A consequence of globalisation is that different "parts" of a product may be subject to different IP regimes in different countries. This development calls for IP systems that are able to accommodate the more geographically diverse processes that businesses use to develop, manufacture, and distribute their products. In addition, globalisation has encouraged more companies that sell globally to file for IP protection in multiple jurisdictions. This is true not only for companies based in OECD countries, but for companies that are based in developing countries. As these companies strive to protect their KBC in the jurisdictions where they sell, they rely more and more on the capacity of IP systems in OECD countries.

Furthermore, at least with respect to copyright, the larger the number of separate territories in which a creative work is protected, the higher the transactions costs are for procuring global licenses (though collective rights management can mitigate this problem). Consumer frustration may arise when terms and conditions under which they access certain content do not permit the transmission of such content outside the licensed territory. Finally, globalisation and interconnectedness have raised the profitability of businesses that intentionally locate themselves in countries with weak IP protections so that they can execute business models that would be considered to be based on IP infringement in OECD countries.

Convergence in science and technology, as well as the rise of open access, are leading to greater intermingling of IP and more joint inventions. New technologies have been emerging out of the cross-fertilisation of different technological and scientific fields. As the work of biologists, engineers, physicists and people in many other fields becomes more integrated, scientists and entrepreneurs are finding themselves immersed in multiple IP disciplines. Synthetic biology is a good example. It involves silica modelling of DNA structures that are then created using real biological "parts" following a computer-aided design approach. Consequently, elements of biology (typically protected by patents) and computer programming (typically protected by copyright) are intermingled. In addition, phenomena such as open access[12] and open innovation have increased the frequency of joint inventions and authorships. It may not always be obvious how best to use IP frameworks to protect new hybrid technologies.

*Greater complexity at a fast rate***.** Today, products often rely on multiple inventions. An example is smart phones, which feature thousands of components, many of which are individually protected by IP rights, especially patents and registered designs. This fragmentation of IP rights may exacerbate problems like information asymmetries and hold-up, harming innovation and consumer welfare. Moreover, while products are growing more complex, technology is also changing quickly and that has implications for IP. Some industries have recently experienced a sharp acceleration in the pace at which innovation takes place and have adopted partitioning strategies to protect their inventions.[13] These lead to shorter product life cycles and possibly to patent congestion.[14]

In contrast, some firms use the pace of technological change as an alternative to heavy reliance on patent and registered design protection, staying ahead of competitors by innovating faster and making previous inventions obsolete quickly. Note that those firms are likely relying on trade secrets protection to some degree. The significance of that approach is reflected in some European innovation surveys that show patents and registered designs are not necessarily viewed as the most effective way to protect innovation. Instead, they reveal that most firms systematically consider lead time and secrecy to be more effective in protecting innovation (e.g. Arundel, 2001; Hall, et al., 2012).

Moreover, some innovators avoid heavy reliance on IP because they are concerned that it could slow innovation down. In their view, most innovation is incremental and if IP rights are too strong or too widely used, IP will retard progress by planting landmines and erecting tollbooths for subsequent inventors. This perspective originated with certain software hackers and academics and eventually helped to shape the development of open-software platforms like Linux, Android and Chrome OS.

Furthermore, the pace of innovation in some industries is raising doubts in the minds of some stakeholders about the universal suitability of IP systems for helping to solve major global challenges such as climate change. This was illustrated by the decision of Tesla Motors to open its patent portfolio, which Tesla said was a result of its disappointment with the slow pace of adoption of electric motor technology.[15]

Knowledge Networks and Markets. Knowledge networks and markets (KNMs) comprise the wide array of mechanisms and institutions facilitating the creation, exchange, dissemination and utilisation of knowledge in its multiple forms. The common defining feature of these mechanisms is that they provide critical services to actors in the innovation system throughout the process of exchanging knowledge and

associated rights. These services range from searching and matching to relevant counterparties and knowledge objects, to evaluating, executing and enforcing agreements. Unprecedented levels of investment in KBC and information have driven the emergence of new KNMs for financing innovation and licensing IP, making it easier for start-up firms to secure the funding they need to develop their ideas (OECD, 2013b). For example, investment in KBC is encouraging new platforms (such as digital copyright exchanges[16]) that can make it easier, faster, and less expensive for firms, organisations and individuals to exchange knowledge and associated IP rights.

IP policy challenges (identified in phase 1 and elsewhere) that are addressed in phase 2/IP

The number and speed of the changes affecting innovative products and processes pose challenges to IP regimes. The phase 1 report identified many of those challenges. Other mainstream economic and policy dialogues have revealed several more. A subset of those challenges motivated the specific work undertaken in phase 2/IP.[17] That subset includes:

Estimating the economic significance of IP rights. Phase 1 showed that knowledge-based capital in general is an increasingly important component of today's OECD economies. But how much of that KBC takes the form of IP, and what can we do to improve our understanding of the relationship of IP systems for patent, copyright, design rights, and trade secrets to the performance of OECD economies? These questions are addressed in Chapter 2, Measuring the Technological and Economic Value of Patents, Chapter 4, An Empirical Assessment of the Economic Implications of Protection for Trade Secrets, Chapter 5, Copyright in the Digital Era: Country Studies, and Chapter 6, Design and Design Frameworks.

Developing tools to identify the prospective economic and technological value of inventions protected by patents. The challenge being addressed here is not so much a matter of estimating patents' financial value (although that problem requires attention, too), but rather their contributions to innovation. How can we determine whether that type of value has, on average, increased, decreased, or stayed the same over time? What methods are available to identify which sectors and countries tend to produce the most technologically valuable patents? These questions are addressed in Chapter 2, Measuring the Technological and Economic Value of Patents.

Identifying possible changes in society's net gain from IP systems and what, if anything, to do about them. IP rights effectively operate as an exchange between society and inventors/creators, rewarding innovative and creative work while giving society the benefits of greater technological and creative diffusion.[18] For example, governments award exclusive rights in the form of patents in exchange for the disclosure of the technology in the patent filing and the ability to use the invention freely after 20 years in most cases. Regarding copyrights, laws provide a framework that enables the author or copyright owner to prohibit unauthorised copying and dissemination, thereby encouraging the author or owner to create and to publish her creative work, and after a finite period the copyright expires and enters the public domain. Furthermore, the IP exchange may be affected by broad changes that have been taking place in OECD economies, such as the growth of the Internet, the proliferation of mobile devices, globalisation, the digitisation of content, and the growing importance of IP both to society and to rights holders. How does society benefit from existing IP regimes? How well does another form of KBC protection – trade secrets – perform in terms of spurring knowledge diffusion and growth? Do any policy adjustments need to be made to maximise IP's contribution as an ongoing source of growth in OECD countries? These questions were addressed by a group of 17 stakeholders who participated in a two-day Expert Workshop held in May 2014 as part of the phase 2/IP project. The discussions that took place at the Workshop are summarised in Chapter 8.[19]

Studying the mixed effects that IP systems may have on entry and innovation with respect to text and data mining. Although they may encourage innovation, creativity, and diffusion, IP systems today may

occasionally obstruct those dynamics, as well. In an era of routine copying of digital text, data and images, some stakeholders are concerned that copyright law can hinder the emergence of certain types of Internet-based firms, e.g. businesses based on data or text mining. Likewise, some are concerned that copyrights and to some extent patents may impede scientists and other researchers who wish to use text and data mining techniques. Other stakeholders assert that any such problems are being addressed through innovative licensing strategies and market-based solutions or are already resolved through limitations such as enumerated exceptions or the fair use doctrine. These issues are addressed in Chapter 5, Copyright in the Digital Era: Country Studies, Chapter 7, Legal Aspects of Open Access to Publicly Funded Research, and Chapter 8, Summary of the Expert Workshop.

Determining how copyright regimes can continue to reward creativity and innovation as well as promote access by consumers and new businesses. Most commercial content is now legally available in a digital format. That development, paired with the worldwide growth of Internet usage, has made copying, distributing, and redistributing easier while making it harder to deter and prevent infringement. As a result, commercial content is often accessed and appropriated illegally. Ideally, copyright policies and Internet policies will work harmoniously and complementarily to promote creativity as well as innovation in the digital economy. Ensuring that they do is, in the words of United States Secretary of Commerce Penny Pritzker, "a critical and challenging task" (United States Department of Commerce Internet Policy Task Force, 2013, p. ii).

Indeed, a variety of stakeholders have expressed concern that copyright laws have not kept pace with evolving technology, and consequently several governments have conducted reviews of their copyright laws. In the United States, the Register of Copyrights testified before a Congressional subcommittee last year that although the United States' copyright law is widely regarded as the most balanced in the world, it "is showing the strain of its age and requires [Congress'] attention".[20] The Chairman of the House Judiciary Committee supports the idea of re-examining the law: "[I]t is my belief that a wide review of our nation's copyright laws and related enforcement mechanisms is overdue. . . [T]here is wide agreement that the digital age has challenged our copyright laws in ways never imagined."[21] Similarly, the EU's Commissioner for Digital Economy and Society has noted that while there continues to be a need to protect intellectual property, copyright legislation also needs to be adapted to the digital era (Oettinger, 2015).[22]

Some academics have weighed in, as well, agreeing that copyright laws need to be reformed. For example, Gracz and di Filippi (2014) contend that copyright law has not adapted to the new reality of the Internet and digital technologies, resulting in the loss of its ability to regulate social dynamics concerning production, dissemination and access to creative works. "While copyright law has been, for many years, an effective body of law, constantly evolving to adapt to on-going technological advances and social or organisational changes, today, the copyright regime seems to have entered into a crisis, as the original rationale of the law has progressively been disrupted by the advent of Internet and digital technologies, and the radical change in contingencies that came along them" (ibid at 31).

Furthermore, a recent policy brief from the Lisbon Council states that "[c]opyright law is struggling to adapt to the dynamic of digital technologies" (Hargreaves & Hugenholtz, 2013, at 1). It elaborates that some researchers claim that copyright interferes with their work by obstructing text and data mining, cultural organisations are not sure how to make their archives legally available for digital public use, consumers have difficulty accessing content that should be available to them, creative industries cite the financial effects of Internet-based infringements, authors say they are not being paid, some firms contend it is too difficult to get cross-border licenses in Europe, and judges need more guidance on how to apply copyright laws in the digital, online world.

Others agree that changes are necessary but focus more on the need for better enforcement. For example, in a piece supporting proposed legislation to combat online piracy, Castro (2010) argues that

more robust copyright enforcement in the digital realm would not only be desirable for content creators, but it would make consumers better off. A recent report by the United States Department of Commerce Internet Policy Task Force (2013, p. 41) takes a balanced approach, noting that "there are a number of respects in which the existing array of tools against infringement has become insufficient" and that "[t]he tools for protecting and enforcing rights must keep pace – as with rights and exceptions, they need regular updating."

Still other commenters believe the current laws are sufficiently flexible to enable adaptation to the digital age, at least within the EU. See, for example, Depreeuw & Hubin (2014) and Charles River Associates (2014). Indeed, there are academics and stakeholders who believe that copyright is not an obstacle either to the development of business on the Internet or to access to science and culture. Instead, they contend that most of the identified roadblocks are linked to other issues such as cultural traditions and linguistic differences, as well as certain commercial practices by IT companies themselves, differences regarding the level of taxation, or cross-border payment difficulties.

Thus digital technologies have presented new opportunities for creative industries and consumers but have also brought a host of complex legal and other challenges for creators, consumers, and policy makers. The resulting discussion too often has been characterised as a clash of two extreme positions. That is an oversimplification because the choices are not binary and, in reality, there are multiple positions. One of them is that digitisation and the growth of the Internet diminished copyright protection and effective enforcement, thereby harming incentives to fund, create, and distribute new artistic material. Another view is that copyright is impeding innovation, creativity, free expression, and emerging businesses, and limiting consumer access to and use of creative works, so there should be more exceptions. But there are multiple gradations of thought between those two poles. Moreover, value may be found in innovation outside of policy making or through voluntary activities in the private sector. Accordingly, there are also stakeholders who argue that new licensing strategies and access control technologies, for example, are overcoming the problems associated with digitisation and the Internet while providing consumers with access to a wider range of content than they have ever had. Recently, the debate appears to be shifting toward a thoughtful assessment of the current balance of rights, exceptions, and responsibilities in the copyright system, taking into account the interests of all stakeholders.

In particular, several governments have completed or initiated comprehensive reviews of their copyright laws. That group includes the following, among others:

- The United Kingdom's Prime Minister commissioned the Hargreaves Report, which looked into ways that the copyright regime might be reformed to work more effectively in the digital era (Hargreaves, 2011). The government implemented several of those reforms in 2014, including new exceptions for text and data mining for non-commercial research (Intellectual Property Office & Viscount Younger of Leckie , 2014), and for personal copying for private use and parody, character and pastiche, and an extended exception for quotation (Intellectual Property Office, 2014).
- In the United States, the Department of Commerce's Internet Policy Task Force observed in a July 2013 report that while "[d]igital distribution and a proliferation of consumer-friendly devices have given American consumers more choices than ever in how they access and enjoy copyrighted works . . . we face a renewed challenge to assure that copyright law continues to strike the right balance between protecting creative works and maintaining the benefits of the free flow of information."[23] As noted, the House of Representatives' Judiciary Committee is conducting a wide review of United States copyright laws and enforcement mechanisms to determine whether they need updating in the digital age.

- The European Commission (2012) is undertaking a process to modernise the copyright framework to make it suitable for the digital age.
- The Australia Law Reform Commission (2014) conducted an inquiry on copyright exceptions in the digital economy.
- The Dutch Ministry of Economic Affairs commissioned a law and economics research report exploring the possibility of introducing more flexibility into the system of exceptions and limitations in Dutch copyright law (Van der Noll, et al., 2012).
- Canada reformed its copyright law in 2012 to better account for the impact of the Internet and digitisation.[24]
- In 2013, Ireland's Copyright Review Commission released a report weighing the possibility of modernising the copyright law (Copyright Review Commission (Ireland), 2013).

The public debate involves several difficult policy questions. The Internet has enabled the development of a vastly improved digital marketplace of creative works and more of them are becoming available to more people in new and diverse platforms. Still, more work remains to reach the full potential of the digital marketplace. How can governments provide an appropriate level of protection – one that will encourage creative expression and foster new, innovative firms whose legitimate business models depend on copyrighted digital content? At the same time, what can governments do to facilitate consumers' lawful access to the broadest possible array of digital content? How have enhanced enforcement remedies actually affected creative content generation, consumption, dissemination, and innovation in the digital era? Should they be complemented by other measures (e.g. consumer education, more efficient markets for licensing digital content)? Are current statutory exceptions to copyright protection still adequate? How do those exceptions affect copyright owners, creative output, and social welfare? While those broad questions cannot be definitively answered anywhere, including in this Report, information that is helpful in addressing them appears in the Chapter 5, Copyright in the Digital Era: Country Studies, and Chapter 8, Summary of the Expert Workshop.

Are IP systems meshing well with open access initiatives? Internet growth, content digitisation, and expanding "big data" and data analytics capabilities have also affected the ways in which publicly funded research results are accessed, disseminated and used. It has become increasingly easy to share and process such information. Generally speaking, "open access" refers to greater access to scientific articles and data produced from publicly funded research, which can lead to more collaboration, greater dissemination of results, and increased engagement with society.[25]

Open access raises a number of IP policy questions, though, such as how to delimit research exceptions to copyright. Both the benefits and the risks of greater openness in science should be well understood, but the optimal degree of openness with respect to public research is not obvious. For example, competition drives excellence in science and innovation, but making all aspects of every researcher's work publicly available would be detrimental to incentives to compete and therefore to the quality of the results. Researchers want to disseminate their papers widely and gain prestige, but they usually do not want to give away their underlying data for others to use.

How does IP affect the efficiency of research systems and the speed of knowledge diffusion? Other IP-related open access questions include how to define research exemptions, how to optimise licensing schemes for all stakeholders, data use and re-use, and IP rights for large datasets that are automatically generated by machines. These topics are discussed in Chapter 7, Legal Aspects of Open Science and Open Data and Chapter 8, Summary of the Expert Workshop.

Aims of Phase 2/IP

The main objectives for phase 2's IP project, in responding to the policy challenges set out above, may be summarised as:

- To identify better measurement techniques, statistics and indicators to underpin the analysis of IP's relationship to economic performance, innovation, productivity and growth

- To improve understanding of the role of IP in economic performance, innovation, productivity and growth

- To improve understanding of how digitisation, globalisation and the growth of the Internet are affecting IP use, enforcement, system effectiveness[26], and policy

The following section sets out the report's key findings in support of those objectives.

Key Findings

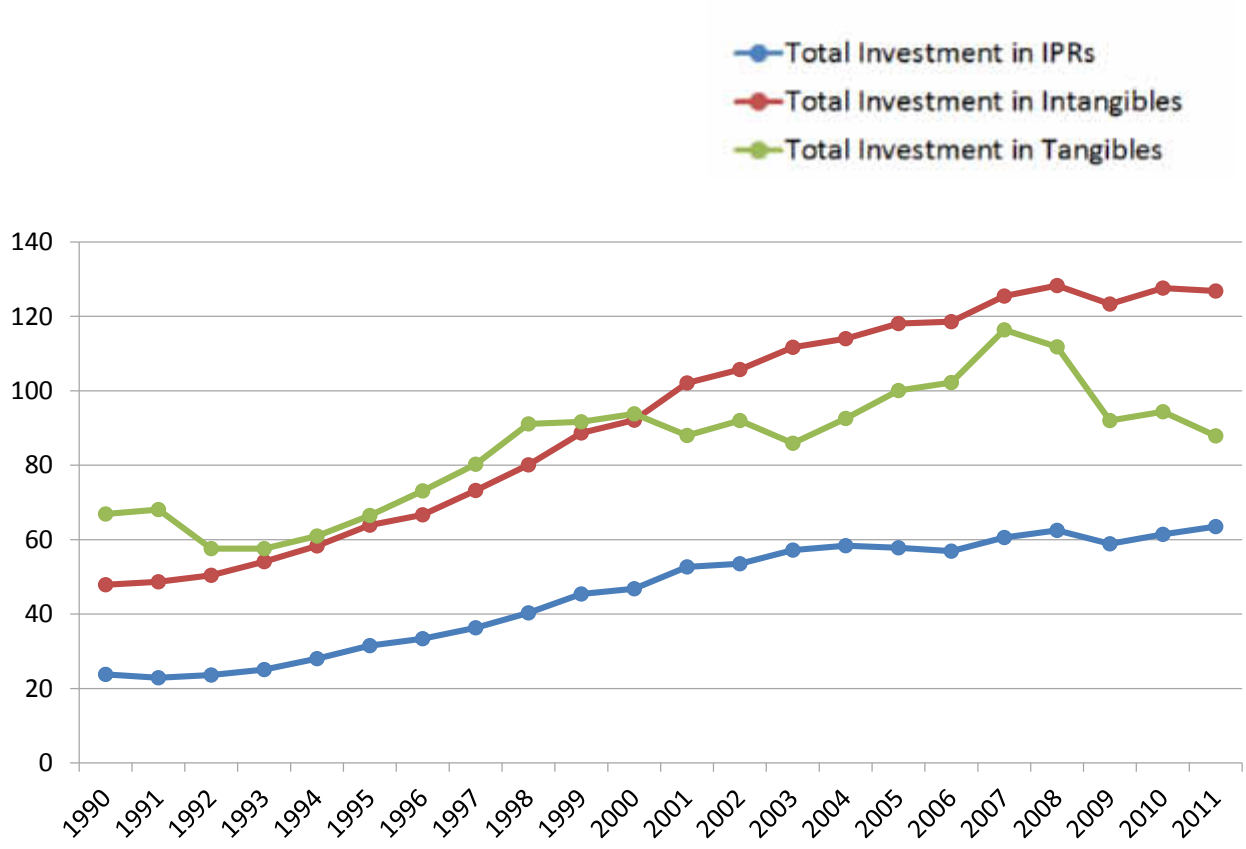
The Importance of IP to OECD Economies

Whether it is appraised in terms of its connection with investment in KBC, salaries, exports, or value added, intellectual property's economic impact is significant and has grown considerably over the past 25 years. Expanding not only in overall magnitude but across sectors, IP-protected capital has become an increasingly important component of advanced economies. Among the various types of IP, copyright stands out for the growth in and level of the investment it attracts, as well as its connection to job growth, according to the available data.

Looking at evidence on IP's aggregate role, three main points emerge: IP's economic importance has grown over time, investment in IP-protected assets was resilient during the recent recession, and that investment is growing much faster than investment in physical assets.

Figure 1.6, for example, illustrates all three of those points. It shows that total nominal investment in intangible assets protected by IP rights (represented by the blue line, which aggregates investments in copyrights, trademarks, registered and unregistered designs, and patents) in the United Kingdom was more than 2.5 times greater in 2011 than it was in 1990. It also shows that investment in IP rights barely declined after the financial crisis of 2008 and has since recovered. In addition, it shows that nominal investment in tangible assets was lower in 2011 than it was in 1998. Meanwhile, investment in IP-protected assets as a share of all investment in intangible assets held steady throughout the 21-year period at just under 50 percent in most years. Finally, total investment in IP-protected assets as a share of investment in tangibles grew from 36 per cent to 72 percent between 1990 and 2011 (see Table 2, as well). On the whole, the figure reveals that between 1990 and 2011 the United Kingdom transformed from a mainly tangibles-based economy to an economy driven primarily by intangibles, of which IP-protected assets are a major component. Note that the IP line does not include investment in assets protected by trade secrets.

Figure 1.6. Total UK Investment in Tangible and Intangible Assets, including IP (nominal billions of GBP)



Source: The figure is derived from data in Goodridge, Haskel, & Wallis (2014), pp. 9, 29 and from supplementary data kindly provided by Professor Goodridge.

WIPO data on worldwide IP filing trends, while different from data measuring monetary investment in IP, nevertheless suggest that the United Kingdom's experience is not unique, at least with respect to the points that IP's economic significance is growing and that it was resilient during the recession. Global filings for patents and registered designs declined in 2009, but they have recovered sharply and are now growing even faster than they were before the crisis. In 2012, patent filings grew by 9.2 percent, faster than any other annual increase in the past 18 years. Industrial design counts grew by an all-time record rate of 17 percent (WIPO, 2013).

Another report (United States Department of Commerce, 2012) also uses a different type of data but paints a picture of IP's overall economic significance that is roughly consistent with the reports from WIPO and the United Kingdom. Taking into account patents, trademarks, and copyright, this report identifies a group of 75 United States industries as IP-intensive. It then finds that there were 27.1 million jobs in those industries in 2010, which was 18.8 percent of all jobs in the United States economy. In terms of value-added, the IP-intensive industries contributed just over USD 5 trillion, or nearly 35 percent of GDP. Moreover, direct employment in the wake of the global financial crisis recovered 60 percent faster in IP-intensive industries than it did in non-IP intensive industries (comparing 2011 to 2010). Jobs in the IP-intensive sectors had higher average salaries, as well – 42 percent higher in 2010. What is more, IP-intensive industries exported more than 60 percent of all the merchandise exported by United States industries in 2010.

Similar or higher figures exist for the contributions of IP-intensive industries to the European Union's GDP (38.6 percent) and to total employment in the EU (77 million jobs, or 35 percent of the total), with average earnings in these industries around 40 percent higher than the overall average across the economy. Furthermore, IP-intensive industries account for more than 90 percent of all the merchandise exported from the EU (European Patent Office & OHIM, 2013). IP's economic resilience is also reflected in detailed service sector statistics on the IP "leasing" sector in the United States. Total revenues in the sector amounted to USD 20 billion in 2010, a four percent (nominal) increase over 2009, which is notable considering that the economy was in recession at that time (OECD 2013*b*, p. 11).

One more message that emerges from these numbers is that IP is no longer a boutique policy consideration, relevant to only a small number of industries. It has become more prominent as investment in intangible assets has gained ground on and, in some economies, overtaken investment in tangible assets. IP now reaches into more sectors than ever before. "IP is used everywhere in the economy, and IP rights support innovation and creativity in virtually every U.S. industry" (United States Department of Commerce, 2012). IP has reached a point where it warrants mainstream consideration, akin to competition, tax or trade policy.

Various types of data are also available on the *relative* economic significance of different types of IP rights. Table 1.2, for example, shows patterns of UK market sector investment in copyright, design, trademarks, and patents from 1990 to 2011.

Table 1.2. UK Market Sector Investment in Tangibles, Intangibles, and IPRs (nominal £billions)

	1990	**1995**	**2000**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Investment in Patents	2.9	3.3	4.3	5.1	5.2	5.8	5.9	5.8	5.9	6.3
Investment in Copyright	9.2	14.0	22.1	29.3	26.7	28.6	29.9	27.0	29.1	30.1
Investment in Registered Design	1.0	1.0	1.4	1.7	1.7	1.9	1.9	1.8	1.8	1.9
Investment in Unregistered Design	5.9	6.1	8.3	10.1	10.6	11.3	11.5	11.1	11.1	11.2
Investment in Trademarks	4.8	6.7	10.2	11.7	12.7	13.2	13.4	13.1	13.5	14.0
Total Investment in IPRs	23.8	31.1	46.3	57.8	56.9	60.6	62.5	58.9	61.4	63.5
Total Investment in Intangibles	47.9	63.9	92.1	118.1	118.6	125.5	128.3	123.3	127.6	126.8
Total Investment in Tangibles	66.9	66.5	93.8	100.1	102.2	116.4	111.8	92.0	94.4	87.9

Source: Goodridge, Haskel, & Wallis (2014), pp. 9, 29 and supplementary data kindly provided by Professor Goodridge. Note that trade secrets are not included in this table.

The table reveals several notable facts about investment in particular types of IP in the economy of the United Kingdom:

- Investment in patents is quite small relative to investment in assets protected by copyright, unregistered design, and trademarks. In 2011, investment in patents was just 21 percent of the investment in copyright, for example.

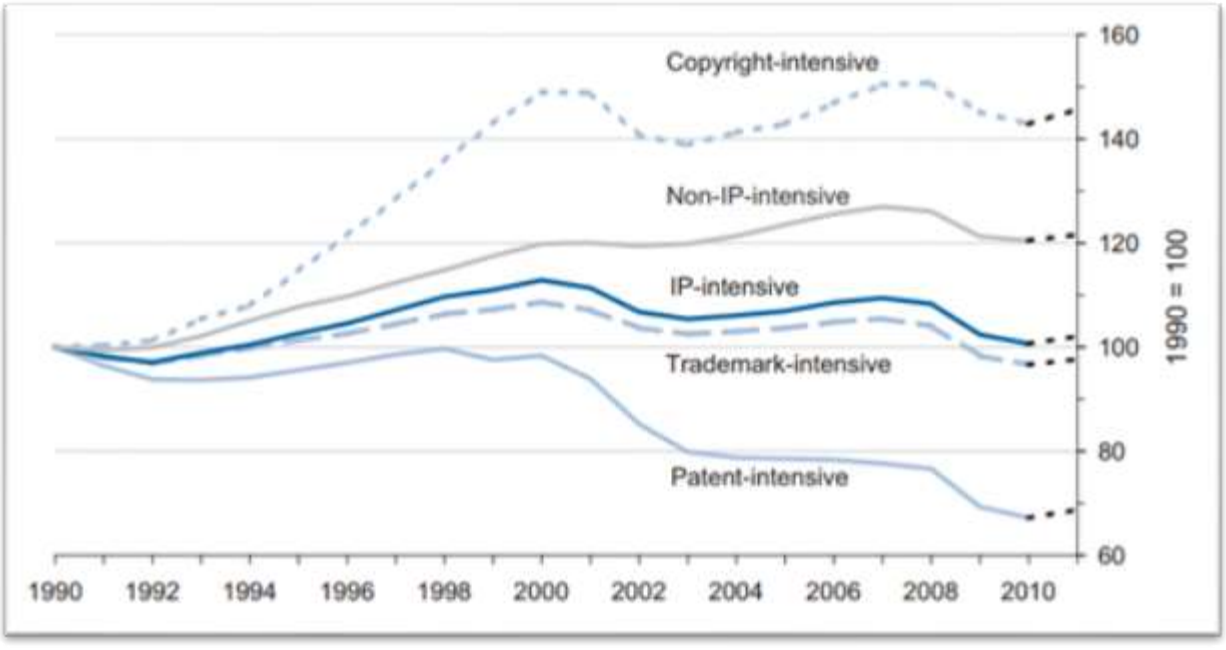
- Investment in copyright has grown more than investment in any other form of IP (with the possible exception of trade secrets), more than tripling on a nominal basis between 1990 and 2011. Growth in investment protected by trademark was a close second, growing slightly less than threefold during that period.

- Copyright, as of 2011, was by far the largest component of IP-protected investment (again, putting trade secrets aside as a possible exception), drawing more than twice the amounts invested in unregistered design and trademarks, respectively. Of all investment in IP rights, 47 percent was in copyright, 22 percent in trademark, 18 percent in unregistered design rights, 10 percent in patents, and three percent in assets protected by registered design rights.

- Investment in unregistered designs is substantial, approaching the level of investment in trademarks.

Copyright also has a strong showing in employment data from the United States. Figure 1.7 shows that job growth in copyright-intensive industries far outpaced that in trademark and patent-intensive industries from 1990 to 2011. In fact, employment contracted in the latter industries during that period, and markedly so with respect to the patent-intensive group.

Figure 1.7. Indexed Employment in IP-Intensive US Industries, 1990-2011



Source: (United States Department of Commerce, 2012, p. 40). Note that the Figure does not account for design right- intensive or trade secret-intensive industries.

Notably, copyright protects a significant amount of software investment in much of the world (especially where software is mostly not patentable) and, in terms of employment and gross value added,

the IT, software, and computer services sector sometimes overshadows the rest of the 'creative industries' (Department for Culture, Media & Sport, 2014).

To the extent that this chapter devotes more space to copyright issues than to issues related to other types of IP, a key reason is that according to the available data, copyright's dynamic role in economies appears to be more prominent than that of other kinds of IP.

Copyrights

Whereas patents protect ideas, copyrights protect the expression of ideas. But both forms of IP address the same underlying problem: if anyone is free to use or copy the inventions and creations of others, then the incentive to produce those inventions and creations dwindles. Effective copyright protection motivates creative outputs as well as their legitimate dissemination to the public.

Analysis of copyright's role in economic performance is significantly hindered by a lack of data (see section 3.7). Chapter 5 of this Report provides an indication of copyright's performance, though, with a set of 12 country studies.[27] Those studies illustrate how copyright-intensive industries[28] have performed, in terms of the value added and employment they provided[29], as they adapted to Internet growth, content digitisation, and globalisation. While the adaptation process is necessarily incomplete because technology will continue to evolve, the country studies suggest on the whole that the economic performance of copyright-intensive industries has been stable so far. When one considers that the period studied[30] includes a substantial and sustained global economic downturn, the "stable" performance takes on a more impressive aura.

Most of the countries in the sample reported positive growth, on average, in the value added generated by copyright-intensive industries. That corresponds with a total change (across the whole time range examined for each country, not per annum) in the share of GDP for the copyright-intensive sectors that ranged from a decline of 1.5 percent to an increase of 0.9 percent.

Employment figures for the copyright-intensive industries paint an overall similar, stable picture. During the analysed periods in the sample countries for which data are available, the number of employees in copyright-intensive sectors either grew or underwent a slight contraction. In the most recent year for which data are available (depending on the country), the copyright-intensive industries employed 2.3 to 5.6 percent of the workforce.

Patents

Global filings for patents are now growing faster than they were before the financial crisis struck. In 2012, they grew by more than 9 percent, the fastest annual increase in 18 years (WIPO, 2013, p. 6). The number of patents granted worldwide also grew in 2012. The increase of 13.7 percent over 2011 propelled the total above one million for the first time. Moreover, approximately 8.7 million patents were in force in 2012 (ibid at 7).

In addition, during the past few years, companies have paid previously unheard of amounts to acquire other companies' patent portfolios. In some cases, buyers simply buy an entire patent-rich firm. For example, Google acquired Motorola and its extensive collection of patents for more than USD 12.5 billion (though, in the end, Google kept only Motorola's patent portfolio, selling off other parts of the business, and it estimates that the portfolio cost between 2.5 to 3.5 billion (Helft, 2014)). Nortel auctioned off its patent portfolio for USD 4.5 billion.

While trends in patent filings and grants, as well as their market value in some high profile transactions, begin to provide a sense of patents' economic significance, homing in on their relationship

with innovation is a more elusive goal. It introduces a great deal of complexity. The effects of patents on innovation vary substantially from industry to industry, making it difficult to describe the relationship in universal terms. But it can be said that when academics started to examine the role that patents play in innovation in the 1980s, they found that patents were less crucial than many had believed. Firms in only a small number of industries, such as the chemical and pharmaceutical industries, tended to mention patents as an important factor in motivating their R&D investments. Elsewhere, patents were not considered to be very effective in protecting innovations (Levin, et al., 1987).

A later study showed that most firms rely on patents the least among various methods for protecting the returns from their inventions, whereas secrecy and lead time are used most heavily (Cohen, et al., 2000, based on a survey of nearly 1500 R&D labs in the United States manufacturing sector). Indeed, while results varied by sector, the authors concluded with respect to product innovations that "patents are unambiguously the least central of the major appropriability mechanisms overall" and that "in no industry are patents identified as the most effective appropriability mechanism" (Cohen, et al., 2000 at 9).[31] In another survey (Jankowski, 2012), more businesses in the United States identified trademarks and trade secrets as important forms of IP protection than any other. Copyrights were third, followed by patents.

Nevertheless, there has been a surge in the number of patents issued during the past 20 years or so.[32] A possible explanation for that is simply that there has been a sizeable increase in innovative activity, so there is more to patent. Several empirical studies have cast doubt on greater innovation as the primary cause, though. Instead, the studies attribute the patent surge to factors such as declining patent application fees and growing pressure to build up large patent portfolios for the purpose of negotiating with other patent holders.[33] Furthermore, the picture is muddled by the fact that China has been the main engine behind the surge in recent years (WIPO, 2013, pp. 3, 49), which could reflect either greater innovation taking place there or that globalisation has strengthened Chinese inventors' incentives to file for patent protection – or both.

In principle, patents encourage innovation in several ways. First, they give inventors greater incentives to invent by providing a measure of protection against imitators, who might otherwise let the inventor do all the hard and costly work of developing a technology and then simply copy it, making it difficult for the inventor to earn an attractive return. Second, in exchange for that protection, patents require the inventor to tell the public that the technology exists, to explain how it works, and to forfeit exclusive rights to the invention after a fixed period (usually 20 years). That enhances the process of knowledge diffusion by helping others to understand the invention and improve upon it or incorporate it in a new invention of their own. In other words, there is a technology spill-over effect that stimulates new ideas. Another benefit of disclosure is that it tends to decrease redundant R&D investments by firms who might otherwise continue trying to develop exactly the same technology. Finally, patents add to knowledge diffusion by facilitating exchanges via licensing agreements.

A number of countries began to strengthen their patent rights in the 1980s and have generally continued to do so. As a result, patentability extended into new fields, the rights themselves were enhanced, and they generally became easier to obtain. Commentators began to raise concerns in the late 1990s that too many patents were being issued, that their claims were too broad, and that the rights they conferred on patent holders were too strong.[34] The result, the critics claimed, was that innovation was actually being discouraged because it had become so difficult and costly to identify the patents that might be relevant to an invention and to pay for any necessary licenses.

Mark Lemley (2008) asserts that companies in some sectors have responded with an unexpected approach: They ignore patents.

> [B]oth researchers and companies in component industries simply ignore patents. Virtually everyone does it. They do it at all stages of endeavour. From the perspective of an outsider to the patent system, this is a remarkable fact. And yet it may be what prevents the patent system from crushing innovation in component industries like IT. Ignoring patents, then, may be a 'workaround' that allows the innovation system to function in the face of overbroad patent protection.[35]

Many empirical studies have been conducted to analyse the effects of changes in patent protection. Some of them concluded that while stronger patent rights contribute to a significant increase in the number of patents granted, they have little effect on R&D expenditures, which suggests that they are not boosting innovation significantly.[36] Other studies suggested that expanding patent rights into new areas like software led to a kind of patent stampede, in which firms rushed to collect patents on existing technologies for use as bargaining chips in licensing negotiations (Bessen & Hunt, 2004). Still others found that policy changes such as raising the amount of compensation awarded in patent infringement litigation are not perceived by firms as having a significant impact on their innovative activity (Motohashi, 2004). Finally, a recent OECD study using panel regression techniques to assess determinants of private sector innovative activity, proxied by R&D expenditure, across 19 countries found that strengthening patent rights had no statistically significant effect on firms' R&D investment (Westmore, 2013, pp. 21).

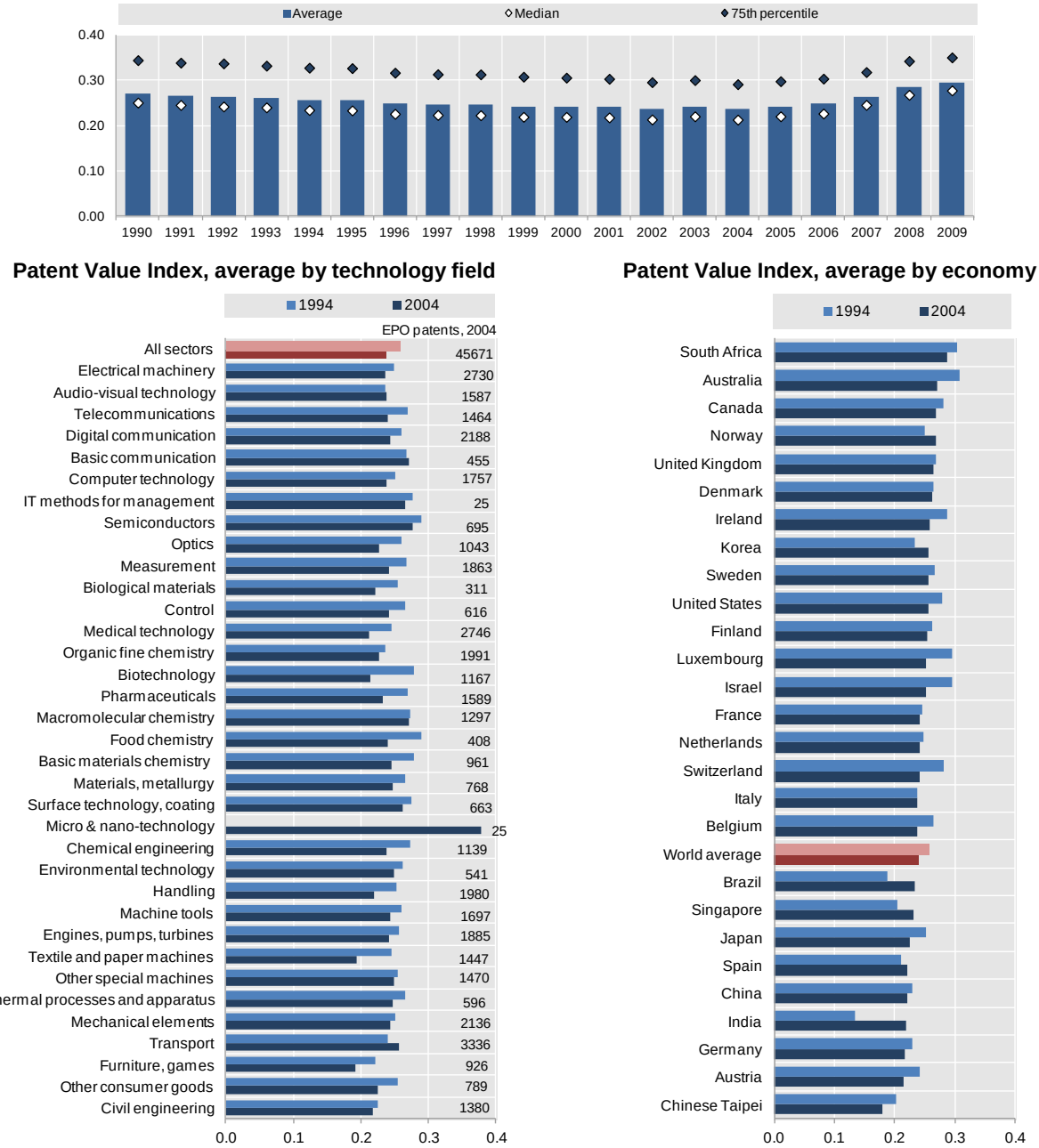
To help shed more light on the patent-innovation relationship, Chapter 2 of this Report provides a way to estimate the technological and economic value of patented inventions and the impact they may have on subsequent technological developments by proposing 13 indicators.[37] The indicators use measurable factors such as patent family size, backward citations, forward citations, and patent renewal. These factors enable analysis at the individual patent level as well as at the aggregate patent portfolio level. They can be used to study policy-relevant topics such as: firms' innovation strategies and performance; enterprise dynamics, including the drivers of enterprise creation and of mergers and acquisitions; the determinants of productivity; the output of R&D activities and the returns to R&D investments; and the output of universities and public research organisations. The Chapter therefore paves the way for future work that could better illuminate the contribution of patents to innovation and productivity.

So far, the indicators developed in Chapter 2 have been "test-driven" with statistics compiled from patent applications filed with the European Patent Office (EPO) during the period 1990-2009 and sorted according to the country of residence of the applicants.[38] Each indicator suggests that some countries have relatively strong innovative abilities and that some have relatively average or weak abilities. The results vary from indicator to indicator. But Chapter 2 also includes an experimental composite index that is based on a group of several relevant factors, whereas the other indicators look at only one factor at a time. OECD researchers generated results using three different definitions for this composite index, and those results were consistent in that they all suggest (again, this takes into account only EPO data):

- The average technological and economic value of inventions protected by patents has eroded over time, at least through 2004.[39] There might be a number of reasons for that erosion, including procedural aspects like patent application backlogs as well as strategic behaviours like defensive patent filings
- Patented micro and nano technologies have the highest economic and technological value (although there is a relatively small number of observations in that sector)
- Australia, Canada, Norway, South Africa, and the United Kingdom are the countries with the highest average technological and economic patent values.

The graphical results derived from one of the three versions of the composite index[40] appear in Figure 1.8 for illustrative purposes.

Figure 1.8. Composite Index of Patent Value, 1990-2009



Note: The composite index of patent value is based on the average value of its normalised component, by cohort of filing date and technology fields. The average by economy is provided only for economies with more than 50 patents reporting the index in 2004. The index is based on patent applications filed with the European Patent Office during the period 1990-2009. The economies listed in the "Patent Value Index, average by economy" refer to the country of residence of the applicants. The index does not intend or enable a comparison of the value of national patents of different economies.

Note for Israel[41]

Source: OECD, calculations based on PATSTAT (EPO, April 2012), October 2012. The small numbers on the right hand of the average by technology table show the number of observations on which statistics rely.

It must be emphasised that these results are a function of the particular data set and time period used. The purpose of showing them here is to provide an example of what the composite indicator can do. It is

certainly possible that the results will be substantially different when data from another patent office and/or from another time period are used in the indicator algorithms.

As mentioned above, the patent value indicators could be used to study a variety of research topics of potential interest to policy makers. In fact, the OECD's Economics Department has already used them as part of an econometric study of the extent to which changes in the patent stock are associated with flows of capital and labour to patenting firms (OECD, 2014*b*). Specifically, the study used the radicalness indicator (roughly defined as measuring how different an invention is from existing inventions) in concluding that when firms add patents that have higher-than-average radicalness scores, they experience larger-than-average increases in employment, capital stock, and turnover, among other factors. The study also found that young firms are more likely to file radical patents than older firms (OECD, 2014*b*, p. 26 and Tables 7 and B7).

The indicators could also be used, for example, to learn more about patent assertion entities (PAEs) and the environments in which they operate. That type of work has not been done, nor is it planned at the OECD, but it is an example of the indicators' many potential applications. PAEs are firms that generally do not invest in research, apply for patents or use patents to produce goods and services, but rather acquire patents and use them to generate licensing revenues through negotiation and litigation. PAEs were traditionally viewed as benign or even beneficial entities that help small inventors to profit from their inventions. More recently, the behaviour of some PAEs has raised concerns that they are exploiting low quality patents (meaning patents with inaccurate claims or patents awarded for inventions that are not genuinely novel or non-obvious), combined with the high cost of litigation in patent systems, to achieve unjustified settlements. Such behaviour could increase the cost of the affected products and retard innovation.

PAEs can be aggressively litigious, using infringement lawsuits, and the threat of filing them, to persuade or force other firms to pay for licenses. The impact of PAEs in some jurisdictions, particularly the United States where patent litigation is very expensive and courts do not traditionally require the loser to pay the cost of litigation, raises questions about the economic nature of the patents that PAEs use to drive their business model. Do they tend to have relatively high technological and economic value? Relatively low values? Do they merit the incomes they are generating in settlements and infringement awards?

Litigation statistics suggest that these questions are worth investigating. A report by the United States Government Accountability Office (2013) found that the number of defendants in patent infringement lawsuits increased by nearly 130 per cent between 2007 and 2011, with PAEs responsible for about 20 per cent of the lawsuits during that period. A newer study by PricewaterhouseCoopers (PwC) (2014) indicates that the latter figure has already risen substantially since 2011. It shows that PAEs now account for 67 percent of all new patent lawsuits in the United States – and that has happened during a period when growth in the total number of patent lawsuits filed is outpacing growth in patents granted (see Figure 1.9). In other words, there is more patent litigation than ever, and a large and increasing share of it is due to PAEs.

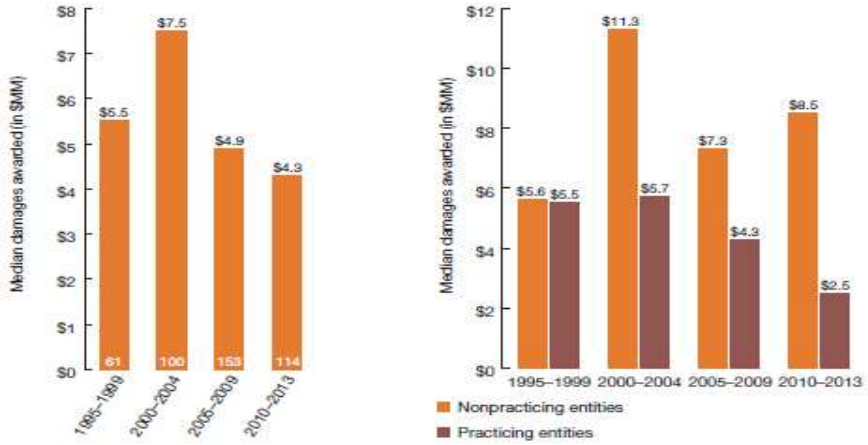
Figure 1.9. Growth in Patent Case Filings versus Patents Granted (US), 1991-2013

Years are based on September year-end.

Source: PricewaterhouseCoopers (July 2014), based on data from United States Patent and Trademark Office, Performance & Accountability Report Fiscal Year 2013, and United States Courts, Judicial Facts and Figures 2012.

In addition, the PwC study shows that while the median monetary award in patent lawsuits is generally declining, the median award to PAEs has been growing since 2005 and is now more than three times higher than the median award to practising entities (see Figure 1.10).

Figure 1.10. Median Damages Awarded in United States Patent Lawsuits, Practicing v. Non-Practising Entities



Median damages adjusted for inflation to 2013 dollars. Number of identified decisions is indicated within the respective columns of the left panel.

Source: PricewaterhouseCoopers, 2014 Patent Litigation Study (July 2014).

These trends add up to a substantial impact. A new study by Bessen and Meurer (2014) finds that more than 5,000 companies were named as defendants in lawsuits by PAEs in the United States in 2011 alone and that they incurred more than USD 29 billion in direct costs as a result. Most of the defendants were SMEs, i.e. the type of firms that tend to contribute greatly to productivity and job growth but are least able to cope with the cost of lawsuits (Hargreaves, 2011, p. 10).

Concerns about PAEs are spilling over into the European Union. In 2013, 16 large technology companies from around the world sent an open letter to EU Member States warning that draft procedural rules for a new Unified Patent Court could encourage PAEs to ramp up abusive litigation in Europe.[42] However, much remains unknown about PAEs, the net effect of their activities, and what the future holds for them. Recent changes to the jurisprudence and patent laws of the United States have weakened the position of PAEs in litigation, for example, by limiting the availability of injunctions against infringers, providing new alternatives to challenge a patent's validity, increasing the likelihood that a wrongfully accused defendant can recover its fees, and requiring heightened economic evidence to support damages requests. Implemented as a component of an econometric study, the patent value indicators might help to shed some light on the nature of the patents that PAEs are using to collect their royalties.

Trade secrets

The term "trade secrets" essentially means confidential business and technical information and know-how that a firm makes reasonable efforts to keep secret and that has economic value as a result. (See Chapter 3, Approaches to the Protection of Trade Secrets.) Estimating the economic value of trade secrets is challenging due to the secrecy requirements. However, some indications of their value and importance do exist. Almeling et al. (2010), for example, estimate that the annual cost of trade secret theft to United States firms is as high as USD 300 billion. Interviews with members of the European Chemical Industry Council have revealed that misappropriation of a trade secret or confidential business information often costs a firm up to 30 per cent of its revenue and sometimes much more (CEFIC, 2012). A panellist in the workshop noted that there is considerable anecdotal evidence that trade secrets can be worth substantial amounts, insofar as violation can lead to large damages actions or settlements (Chapter 8 of this Report). For example, in a case in which an alleged spy from Huawei was criminally indicted for having stolen trade secrets from Motorola, the latter claimed that the R&D costs of the stolen information exceeded USD 600 million (Anderlini, 2010).

Moreover, in a recent European Commission-sponsored survey of more than 500 businesses, 75 per cent of the respondents ranked trade secrets as "strategically important to their company's growth, competitiveness and innovative performance" (European Commission, 2013). That ranking was consistent across firms of all sizes, including SMEs. Furthermore, surveys by Cohen, et al. (2000) and (Jankowski, 2012) show that firms rate secrecy as being among the very most important means of protecting innovation. In many countries, the relative ease of use and lack of registration requirements for trade secrets have led SMEs to rely on trade secrets as the default mode of IP protection (Brant and Lohse, 2013). Another factor that may contribute to their popularity among SMEs is that, unlike copyright and patent law, trade secrets law is not especially technical.

In theory, trade secret protection encourages investment in R&D and the development of commercially valuable information in various interdependent ways. First, it can make the fruits of that investment more appropriable (by deterring employees, business partners and third parties from misappropriating or misusing information that qualifies as a trade secret).[43] Second, trade secrets can provide competitive advantages and therefore motivate investment in them through the enticement of supra-competitive profits (Lemley, 2011). For example, a trade secret might cover a cost-saving production process or a unique product. Third, in some cases trade secrets motivate investment in R&D and valuable knowledge by serving as an alternative or a complement to patent protection. This can occur, for instance,

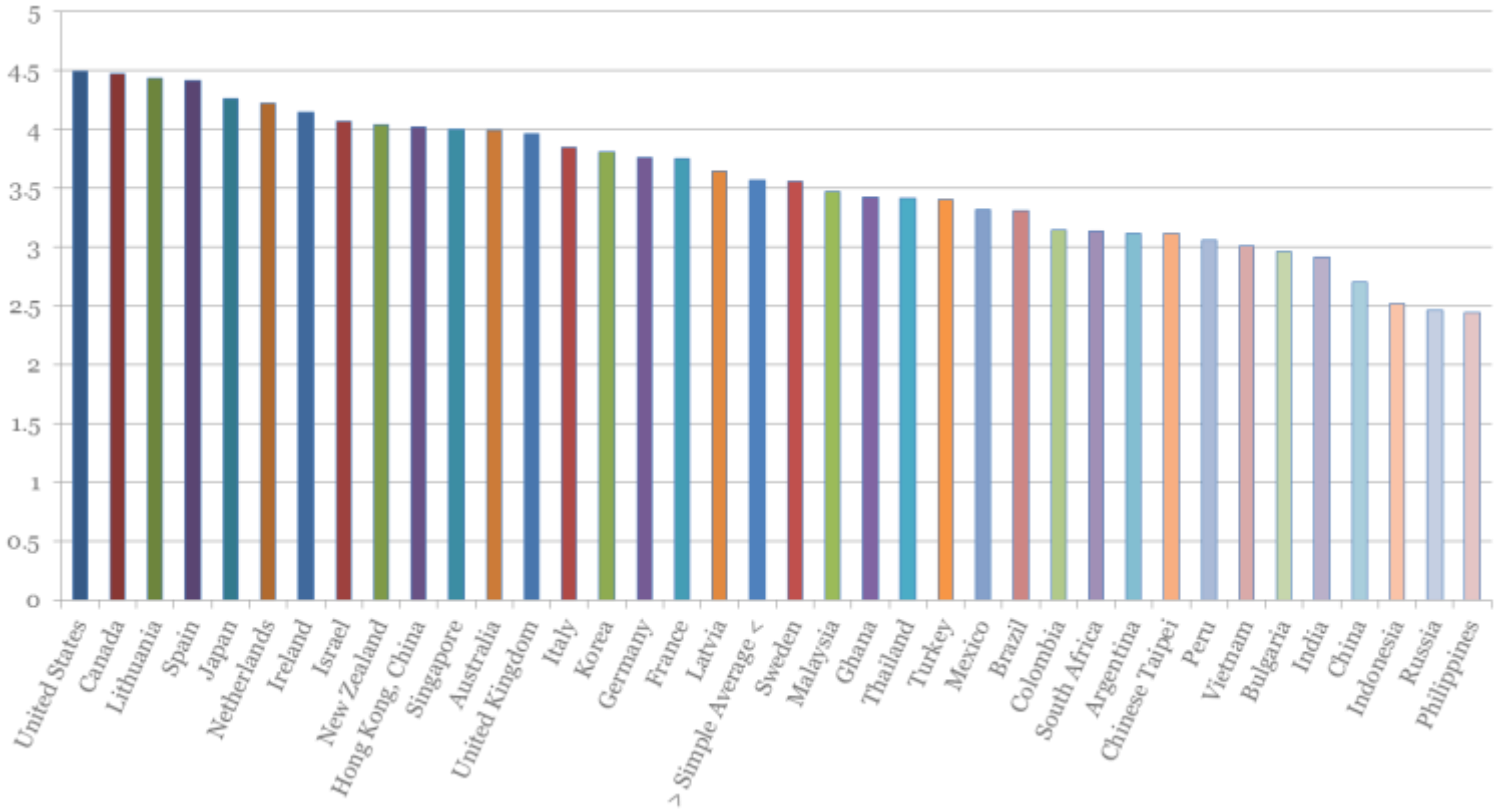
when KBC does not meet the requirements for obtaining a patent, a patent is considered too expensive to procure and maintain, or seeking one is deemed undesirable due to the disclosure requirement (Maskus, 2000; Friedman, et al., 1991). Trade secrets can also provide protection during the developmental phase prior to a formal patent application. In some cases, firms prefer to use trade secrets protection due to their immediate availability and/or potentially lower costs (e.g. see Arundel, 2001; Cohen et al., 2000).

To provide a means of examining the relationship between the strength of trade secret protection in an economy and that economy's performance, the OECD developed an indicator of the stringency of protection of trade secrets (the Trade Secrets Protection Index, or TSPI), which is presented in Chapter 3, then updated and expanded in Chapter 4. Using a broad sample of OECD and non-OECD countries, the TSPI reveals some similarities among them, notably with respect to the definition and scope of trade secrets. However, it also shows that there are many, and more substantial, dissimilarities concerning the implementation of protection for trade secrets. For example, differences are particularly pronounced in evidence gathering and discovery, protection of trade secrets during litigation, technology transfer requirements and the effectiveness of legal systems with respect to enforcement. That diversity is reflected in the wide range of scores in the TSPI.

The overall index scores for 2010, the most recent year for which data are available, are shown in Figure 11 below. OECD countries tend to have relatively high scores (reflecting stronger protection), while Indonesia, Russia and the Philippines are all relatively low. The words "high" and "low" are not intended to carry positive or negative connotations, though. The index's function is descriptive, not normative, so the scores it produces are neither grades nor ratings. Rather, the score is strictly an objective measure of the stringency of protection.

Whereas Figure 1.11 provides a static view, or snapshot, of the TSPI in a particular year, Figure 12 provides a dynamic view over 20 years. The overall average TSPI score increased incrementally in each period, but not all countries' TSPI scores grew at the same rate. There is a significant gap between the scores of the OECD economies and the trade partner countries in the sample. That gap has narrowed over time, though it remains significant. The OECD economies' scores gradually rose before stabilising in the 2005-2010 period. The average partner country scores, on the other hand, increased substantially following the TRIPS Agreement in 1995.

Figure 1.11. Trade Secrets Protection Index, by Economy, 2010



Source: Derived from Chapter 4, Figure 4.1.

Figure 1.12. Trade Secrets Protection Index, Average Score by Country Group and Year

Note: This figure presents a balanced panel of economies in each group for which data were available in each of the years shown. Inclusion in the OECD group is based on each country's membership status as of 2010. Country coverage is as follows:

Trade partner economies: Argentina; Brazil; China; Chinese Taipei; Colombia; Ghana; Hong Kong, China; India; Indonesia; Malaysia; Peru; Philippines; Singapore; South Africa; Thailand;

OECD countries: Australia; Canada; France; Germany; Ireland; Israel; Italy; Japan; Korea; Mexico; Netherlands; New Zealand; Spain; Sweden; Turkey; United Kingdom; United States.

Source: Chapter 4, Figure 4.2.

The scores in Figures 1.11 and 1.12 are interesting in and of themselves, but the TSPI's greatest value is in what the scores make possible: an empirical examination of the effect of trade secret protection on economic performance, including innovation. The variations in implementation of protection may influence firm-level decision-making and may have implications for some aspects of economic performance, especially innovation. Consequently, the development of the TSPI is a foundation for studying the impact of the stringency of trade secret protection on economies.

Such quantitative work is all the more important because economic theory on the expected outcomes from a strengthening of IP rights is inconclusive (Maskus, 2000; Primo Braga, 1990). Stronger rights may motivate stakeholders to increase innovation and access to innovation, expanding markets to the benefit of users as well as producers of IP. Even so, stronger rights might wind up creating or increasing market power such that rights holders have an incentive to constrain access and/or retard further innovations, possibly with little economic benefit to society as a whole. Therefore, empirical analysis is needed to test the hypothesis that more stringent protection of trade secrets is associated with greater innovation and diffusion. While such effects cannot be examined directly due to the lack of data, it is possible to study (with standard regression analysis) whether changes in the TSPI are related to net changes in economic indicators at an aggregate level while controlling for other factors.

That work is undertaken in Chapter 4, which uses an expanded time range, updated data, and a larger sample of countries to assess the economic implications of variations in the TSPI.[44] While Chapter 4 avoids making policy recommendations, it does present policy-relevant findings based on countries' actual experiences with trade secrets protection. That information may help policy makers to identify and choose among policy options for improved economic performance with respect to trade secrets.[45]

The main conclusions of Chapter 4 are that 1) the TSPI scores vary significantly both among countries at particular points in time, and within countries over time; 2) overall, the stringency of trade secrets protection grew substantially in the sample countries between 1985 and 2010; and 3) there is a positive and statistically significant relationship between the stringency of trade secret protection and indicators of innovation inputs (including R&D expenditure and R&D personnel as a share of the labour force) and international economic flows of investment and trade. (See Table 4.4 in Chapter 4.) Trade secret protection may therefore have implications for domestic innovation, international technology transfer and access to technology-intensive inputs and related products.

It must be stressed that what has been found is association, not necessarily causality. The results do not mean that ever stronger protection, for example, will yield similar results. Nonetheless, the positive and statistically significant relationships identified do indicate that adequately protecting trade secrets may be an appropriate policy for supporting certain key aspects of economic performance. Taken together, the information presented in Chapters 3 and 4 may assist policy makers in identifying options for using trade secret laws and policies to improve economic performance.

Design rights

By improving aesthetic features such as shape, configuration, pattern, or ornament, designs make products more appealing to consumers. Design rights therefore primarily concern the appearance of products, rather than their technical features. When a design is protected, the owner receives an exclusive right against unauthorised copying or imitation. In most countries, designs have to be registered to benefit from protection under industrial design laws, but certain jurisdictions, such as the United Kingdom and the European Union, also grant rights for unregistered designs (and those rights are typically more limited[46]).[47].

There is not a great deal of in-depth research available on the effect of design rights on economic performance at the firm, industry, or economy-wide levels. However, there are indications that design rights are becoming more important. Global design counts (the number of industrial designs contained in applications) rebounded sharply after 2009 and reached an annual growth rate of 17 percent in 2012 (WIPO, 2013, p. 10). That corresponded to a total of 1.22 million designs filed worldwide. Much of the growth was due to an increase in applications filed at the State Intellectual Property Office of the People's Republic of China. Approximately 2.7 million registered industrial designs are in force around the globe (ibid). In the United Kingdom, Hargreaves (2011) not only characterised the design sector as important and growing, but as already being the largest source of intangible investment in the economy. The global growth of design rights will likely be strengthened by developments such as 3-D printing, which has the potential to shift design infringement out of factories to anywhere there is a personal computer and a 3-D printer.

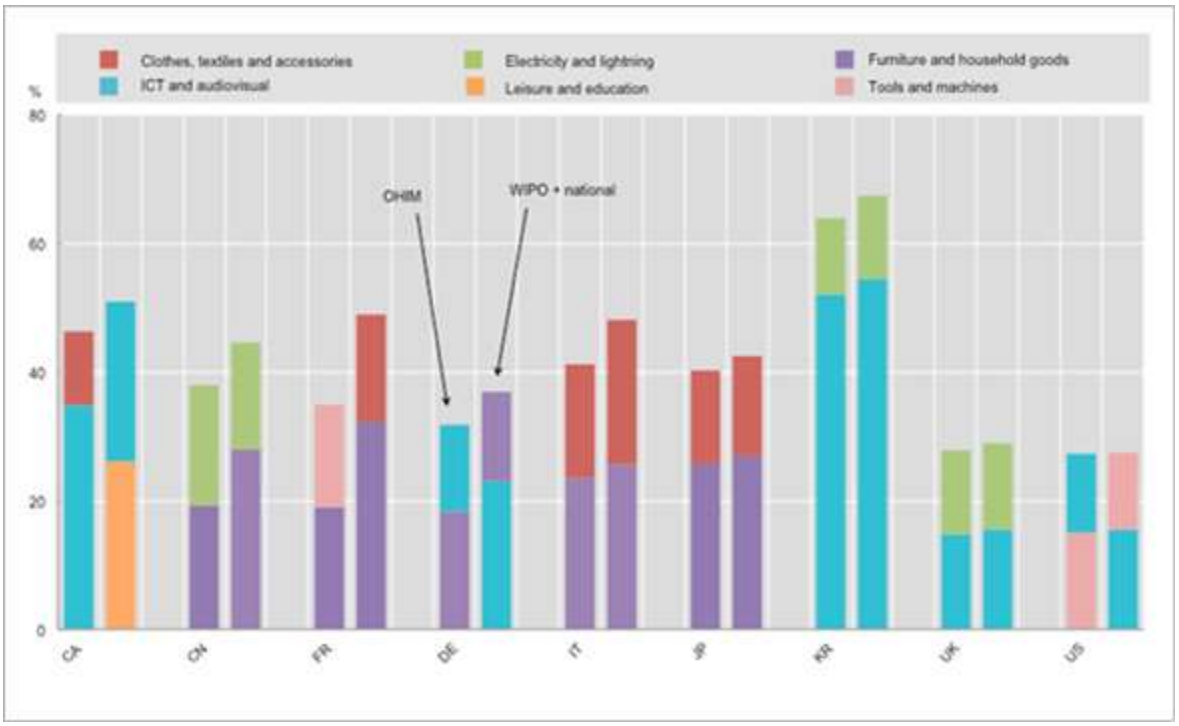
To provide a closer look at the nature and economic impact of design and design rights, Chapter 6 explores the primary areas of design activity in a subset of 8 OECD countries plus the People's Republic of China, compares traits of design protection regimes in those economies, and reviews evidence on how firms perceive the importance of design rights. It also surveys the literature on measures of design inputs and outputs. The chapter is intended to be exploratory rather than comprehensive or conclusive. It should therefore be considered as an initial step towards the possibility of a broader and deeper analysis of design-related issues.

The chapter observes that measurement problems abound with respect to design. For example, estimating the resources that go into developing designs is challenging because it is not entirely clear what should count as designs and design-related activities. The word "design" is applied to activities that range from engineering to art (Lawson, 2006). Designs can fulfil a number of different purposes that vary both among and within firms. Designs in some firms are used only in connection with particular products, for

instance, whereas in other firms they play a part in entire processes. In fact, designs are sometimes not directly related to developing a product or service, but concern something else such as corporate branding (Walsh, 1996).

By looking at data on registered designs, however, it is possible to gain some understanding of the types of products that attract the most investment in design IP. Figure 1.13 shows the top design categories for each country in the sample used in Chapter 6, based on design filings at OHIM and at WIPO plus national IP offices. As one would expect, given design rights' focus on aesthetics, consumer goods are most prominent in the figure.

Figure 1.13. Top Two Design Application Fields, by Country, 2009-11



Source: Chapter 6, derived from OECD Science, Technology and Industry Scoreboard 2013, p. 187.

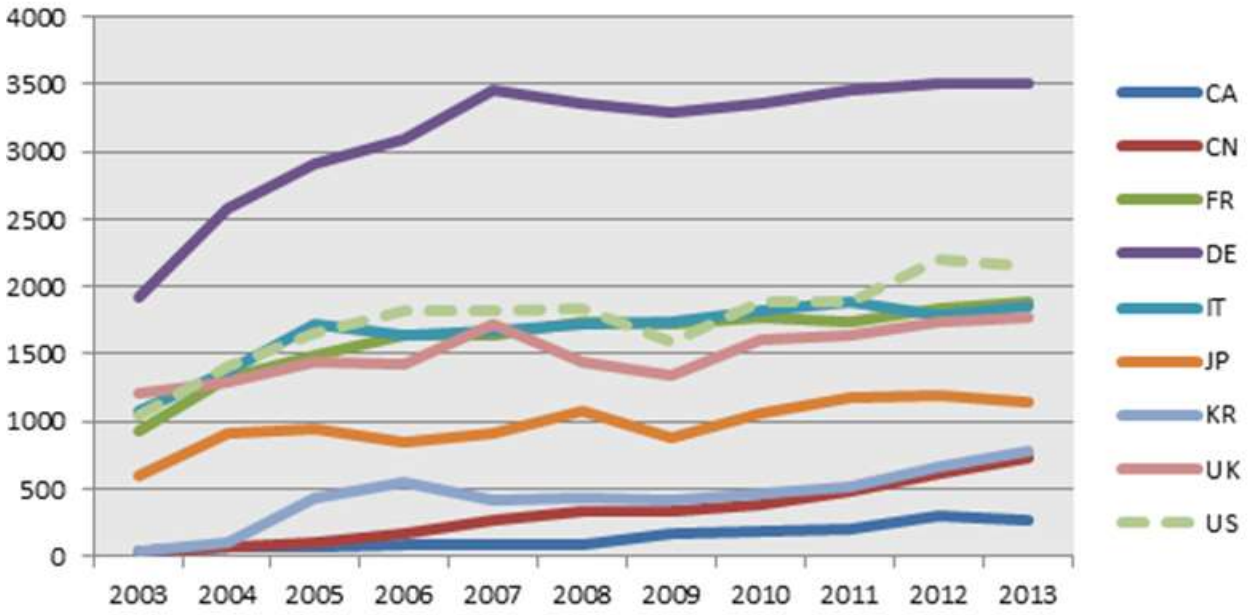
Although several international treaties affect design rights, such as the Paris Convention, the Berne Convention and The Hague Agreement, Chapter 6 shows that there are nevertheless substantial differences in the design rights frameworks of the sample countries. For example, the German and French laws place relatively more emphasis on authors' and inventors' rights, and courts in those countries tend to be faster and more proactive in protecting design rights. Furthermore, France's Institut National de la Propriété Industrielle has implemented a simplified procedure for registering designs. In Italy, the IP code contains a special provision to cope with the problems related to the short life cycle of a product and the processing time for the design application: the exclusive right takes effect from the date of filing the application, so the design holder has the right to base a legal action from the filing application date in order to guarantee effective protection in substantially disputed situations. Statistically, disputes on models and designs are very frequently dealt with in summary or urgent proceedings characterised by faster decisions. In most cases, the fast decision is not followed by an ordinary trial process.

The procedures in France and Italy contrast with the situation in the United Kingdom, which appears to be caught in a negative feedback loop regarding registered designs. UK inventors favour secrecy and

lead time over registered design rights for protecting their designs. But relying on lead time tends to cause shorter product cycles which, in turn, make it less worthwhile to undertake the burdensome application process for registering designs. Consequently, relying on secrecy and lead time instead becomes even more attractive. The result is the comparatively low rate of design registration in the UK that we saw earlier in Table 2, UK Market Sector Investment in Tangibles, Intangibles, and IPRs (see also Chapter 6, citing BOP Consulting, 2011).

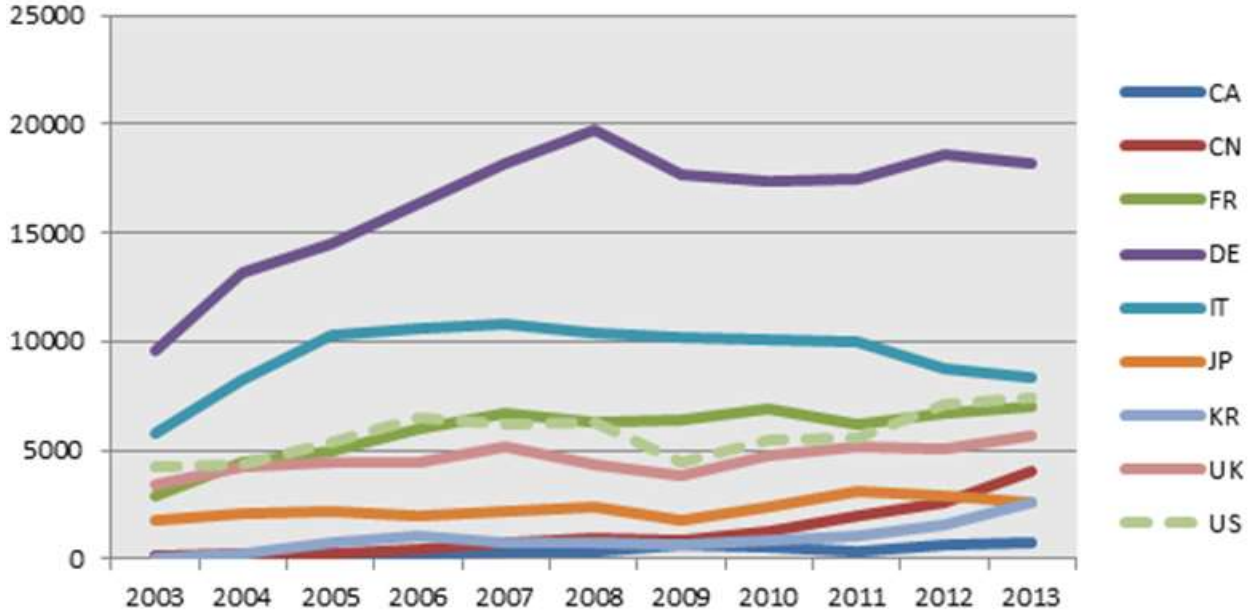
Looking at trends in OHIM design applications and OHIM registered designs among the nine countries studied in Chapter 6, we can see in Figure 1.14 that applications from most countries gradually increased over the past ten years.[48] During the same period, the total number of designs registered with OHIM from the leading countries of origin (Germany, Italy, France, US) grew at first, then levelled off or even dipped (Figure 1.15). Note, however, the substantial growth in registered designs from the People's Republic of China and Korea.

Figure 1.14. OHIM Design Applications by Country of Origin



Source: Chapter 6, Figure 6.5.

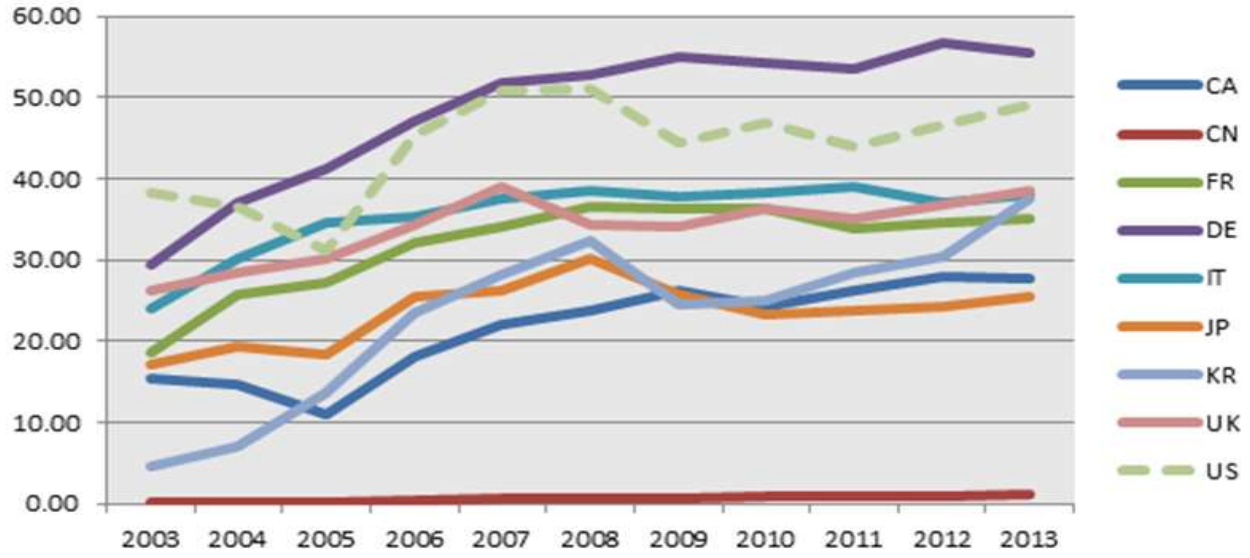
Figure 1.15. OHIM Registered Designs by Country of Origin



Source: Chapter 6, Figure 6.6.

While the two figures immediately above provide an indication of the relative magnitudes of design activity in the sample countries, it is difficult to draw from them a clear impression of which countries are relatively more and less design-intensive, given the fact that the countries vary so much in population and GDP. Figure 1.16 offers a perspective on design activity that is normalised on a per capita basis.

Figure 1.16. Combined OHIM and USPTO Design Stocks by Country of Origin per Million Inhabitants



Source: Chapter 6, Figure 6.9.

Now we can see that Germany has led consistently since 2004 in registered design output per capita, with the US not far behind. Meanwhile, Korea experienced the strongest growth. (China's normalised trend remains very low throughout the period due to the size of its population.)

Chapter 6 also surveys the literature and summarises the qualitative and quantitative methods used to measure resources devoted to design at the firm level (see Chapter 6, for more detail). The methods range from a binary inquiry on whether there is an aesthetic design group within the firm to surveys that request estimates on design spending. Likewise, the chapter includes summaries of the methods used in the literature for correlating design inputs with various outputs (see Chapter 6). For example, the methods include correlating design inputs with sales growth, profit margins, and stock market performance.

Most of the studies do not focus on design IP, but rather on design activity in general. However, one study did isolate the impact of design IP, and the results showed that they have a weak effect. While eighty-five percent of the UK businesses surveyed by The Design Council (2009) indicated that design was a significant part of their business model, 66 percent did nothing to protect their IP (regardless of whether it was a design or something else). A mere four percent used registered designs. Another four per cent used unregistered designs. That means not even ten percent of the businesses that consider design important use formal design protection measures.[49]

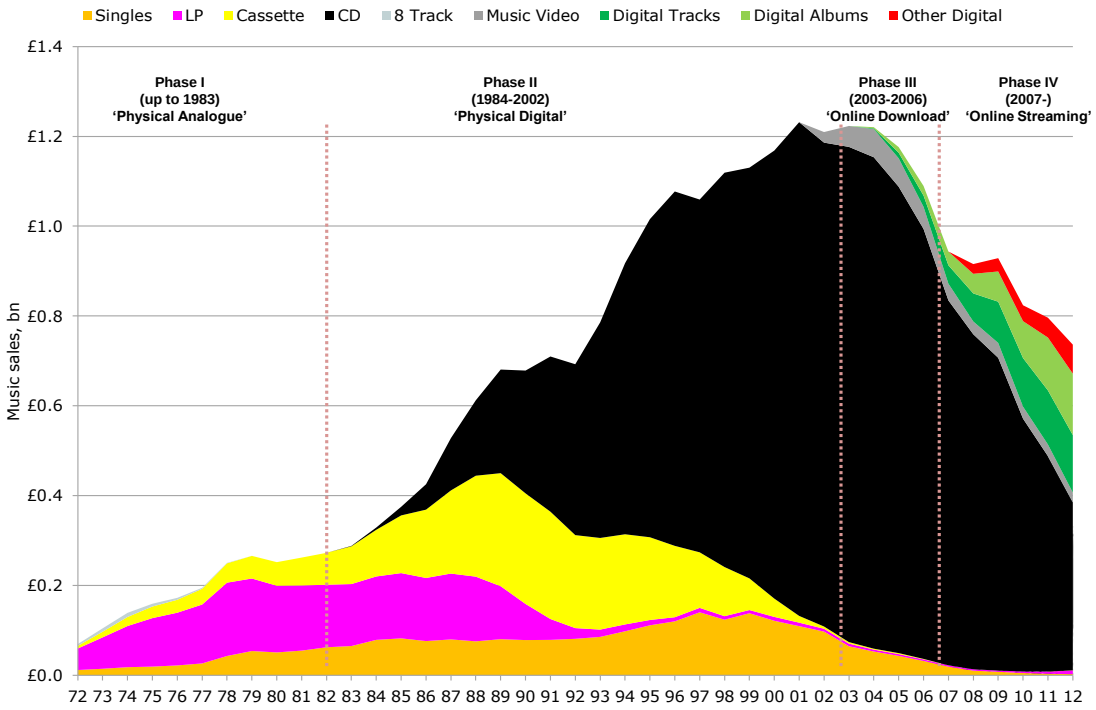
Why is firm reliance on design IP so low, at least in the UK? The answer may have something to do with the administrative burden of filing coupled with the brief commercial lifespan of many designs, mentioned earlier. But that cannot explain the fact that firms do not rely much on unregistered design rights, either. Moreover, in an earlier study, The Design Council (2005) found that companies that were "effective users of design" outperformed the UK stock market by 200 percent between 1994 and 2004.[50] Notably, the study determined which firms used designs effectively not by looking at whether or how they used design IP, but primarily by looking at which firms were nominated for and won design awards. Their financial performance, combined with what we know about how few of them are using design IP, leads to several questions. Are design rights necessary? What motivation do they provide for investing in design-related KBC? Should the framework be changed to make design rights more meaningful? The UK studies notwithstanding, though, Chapter 6 also shows that there has been, overall, a modest rise in registered designs among the sample countries, so those questions can be answered confidently only with the help of more studies, both within and outside of the UK.

How Internet Growth and Digitisation Are Affecting Stakeholders and IP Systems

The growth of the Internet in terms of traffic, bandwidth, and reach, in combination with digitisation, has had considerable effects on IP owners, consumers, and intermediaries, as well as on IP laws and the enforcement of those laws. Those effects have been significant enough that some commentators have gone so far as to argue that IP laws are no longer relevant or necessary in the Internet era. That, however, is not a consensus view. In fact, the OECD Council has stated that "effective protection of intellectual property rights plays a vital role in spurring innovation and furthers the development of the Internet economy" (OECD, 2011).

With that in mind, consider Figure 1.17, which illustrates how digitisation and then the Internet have changed the ways in which people access, listen to and pay for copyrighted content– in this case, music in the United Kingdom. It also captures the waves of innovation that brought one technological improvement after another to this sector.

Figure 1.17. The Evolution of Music Sales in the United Kingdom, by Format, 1972-2012



Source: BPI (2013).

Such changes, while carrying forward a wave of new and innovative business models, do not necessarily translate into profits, net gains for economies, greater productivity or greater consumer surplus, at least not immediately. The adoption of new technologies can take time. In the music sector, what online digital downloads did to CDs, streaming is now doing to downloads. According to data from a North American music sales tracking system, 2013 was the first year since Apple's iTunes store launched in 2003 that digital download sales declined. Streaming services, meanwhile, are growing (Bond, 2014), but revenues from streaming are still well below download and CD sales. Consequently, in the United Kingdom at least, as Figure 1.17 above shows, total revenues across all music formats were falling through 2012. That is not due to changing formats alone (though it may be true that customers spend less on average when they stream or download than they did when they bought CDs). The major culprit is likely to be piracy, which was greatly enabled by digital technologies. It is, however, difficult to obtain accurate and objective data on the precise magnitude of piracy that is taking place.[51] Furthermore, other factors may have contributed to a decline in sales, too, such as demographic shifts and increased competition (OECD, 2005).

In any event, although the declining revenues have raised questions about whether artists and some music labels can make enough money from streaming to survive, streaming models are still evolving and growing. Indeed, as IFPI points out, "The music business continues to expand into new markets and create new business models, attracting more users to digital music services and bringing artists to a wider global audience."[52] While global recorded music revenues fell 3.9 percent in 2013, there are signs that the decline is stabilising. Recorded music revenues in Europe and Latin America grew 0.8 percent in 2013.[53]

Moreover, the number of customers who pay for music streaming in the United States rose from 8 million in 2010 to 28 million in 2013 (Bond, 2014), and Spotify's paid subscriber base climbed from 12.5 million to 15 million during the last two months of 2014 alone (Cookson, 2015).

Chapter 5 of this Report provides a broader overview of some of the new business models that have been enabled by digitisation and the Internet. Some models, such as streaming film and television programming services and MMOG (massively multiplayer online game) services, use advances in digital technology to deliver content in new ways. Other types of businesses, such as e-reader device makers and developers of game apps for mobile phones, take advantage of the portability offered by the mobile Internet. Still others, again including the mobile game app developers but also businesses such as Spotify and Netflix, use business models that rely on web-based ads or subscriptions to generate revenue rather than unit sales.

Some of these new business models have brought very substantial benefits to consumers and have accordingly been rewarded with great financial success. Apple's iTunes Store, for example, is available in 119 countries and puts more than 26 million songs at the disposal of its customers. A music selection of that size would be impossible in a physical media, bricks-and-mortar retail store format. The iTunes Store also contributes to the popularity of iPhones, iPods and iPads. Apple's market value has soared as a result, eclipsing the value of some major countries' entire stock markets (Trotman, 2014). As Chapter 5 further points out, Facebook users have shared some 250 billion photos on the platform, while 100 hours of video are uploaded for sharing on YouTube every minute.

Another effect of digitisation and Internet growth is that it has led several countries to adjust their copyright laws. For example, some countries have implemented exceptions for temporary copying because Internet use would be severely impeded without them. One has added an exception for text and data mining (which would not be possible without digitisation) while several have implemented exceptions for cloud computing.

Chapter 5 reports on the legal settings and mainstream policy dialogues in 12 diverse jurisdictions, noting that all of them have amended, or are considering amending, their copyright exemption frameworks in light of the changes brought on by digitisation and the Internet. For example, the United Kingdom recently amended its copyright law to introduce a specific exception that allows text and data mining for non-commercial research purposes without the right holder's prior authorisation. In contrast, legislators in some countries, such as Israel and the United States, do not necessarily have to consider amending their laws every time there is a significant technological change that affects copyright. That is because their laws include an open norm for considering new unlicensed uses. It is left to the courts to determine whether a particular use qualifies as an exception or not, consistent with national laws and international treaty obligations. Because technology is constantly developing, certain other countries have considered, or are considering, adopting open norms, too. See Box 1.3.

Box 1.3 Open Norms in Effect or Under Consideration in Some OECD Countries

- The United States has had a flexible standard for copyright exceptions for many years. The "fair use" doctrine was originally developed by the courts and then codified in § 107 of the Copyright Act (1976). The doctrine is characterised by an open-ended list of purposes for which the use of a work may be regarded as fair, and by four factors to be considered in determining whether other particular uses are fair: 1) the purpose and character of the use, including whether such use is of a commercial nature or is for non-profit educational purposes; 2) the nature of the copyrighted work; 3) the amount and substantiality of the portion used in relation to the copyrighted work as a whole; and 4) the effect of the use upon the potential market for or value of the copyrighted work.
- Article 19 of Israel's Copyright Act of 2007 contains an open-ended fair use defence that can be invoked in a wide variety of cases and situations. The article is modelled after section 107 of the United States' Copyright Act (1976).
- Canadian law contains a flexible fair dealing exception that was updated in 2012. It is now considered by some commentators to be comparable to the United States' fair use doctrine (Geist, 2013, at 157-86).
- Australia has a fair dealing exception, but the courts have interpreted it less broadly than United States and Canadian courts have interpreted the fair use and fair dealing exceptions, respectively, in effect there. The Australian Law Reform Commission recently considered whether exceptions and statutory licences in the Copyright Act 1968 are suitable in the digital environment and whether further exceptions should be recommended. In its Final Report (Australian Law Reform Commission, 2014), the ALRC examined the comparative pros and cons of introducing a fair use defence or amending the fair dealing defence. It recommended that Parliament introduce a fair use exception.
- The Netherlands commissioned a study that considered the law and economics of adding an open norm to its copyright law in 2012 (van der Noll, 2012). However, the Dutch Government has not indicated any action to implement the recommendations in the Report.

Some countries have also adjusted their copyright frameworks in light of the higher incidence of piracy that digitisation and the Internet have enabled. For instance, Korea and the United Kingdom have introduced special police units to combat online piracy. Italy and the United States have passed new laws that make it possible to block websites that host copyright-infringing content.

There have also been some controversial legislative reactions to the impact of the Internet and digitisation on established copyright owners. Several countries have enacted or proposed amendments to their copyright laws[54] that create an ancillary copyright to the benefit of online publishers. The result is that certain material used by Internet-based news aggregating services could be infringing.

For example, Spain's law[55] imposes a compulsory license whenever a web site provides even a small fragment of a newspaper article. It also requires permission from the news publisher for the reuse of any photo posted to a periodically updated website. Spain's competition authority quickly criticised the law when it was proposed (Comisión Nacional de los Mercados y la Competencia, 2014). It noted that the main justification given for the proposal is to compensate the original news sites with "fair compensation" for the "direct competition" that occurs between them and the news aggregators, who do not share the costs that the "creative effort" entails. However, the competition authority found it questionable that there was any such direct competition, that any compensation was appropriate, or if there was, that it should flow toward the original sites. The latter is finding recognised that appearing in news aggregator results will drive more Internet traffic toward the original site than it would otherwise get. The authority also noted that the law would create a barrier to access for companies that want to enter the market for content aggregation.

Of course, copyright is not the only form of KBC protection that is affected by the rise of digital technologies and the Internet. Just as those factors facilitated piracy, for instance, they also made it easier

for company insiders and third parties to disseminate trade secrets rapidly (and not necessarily legally, as hacking and industrial espionage were also facilitated). Moreover, digital technologies like 3-D printing, in combination with the Internet, may greatly facilitate design rights infringement by eliminating the need for a traditional factory to produce goods using infringing designs; instead, all that will be needed is an Internet connection, a computer, and a 3-D printer.

With respect to patents, digitisation and the Internet have made it easier to access, search and sort the information contained in patents and that has unquestionably improved dissemination of that knowledge. This not only helps the public, but possibly patent examiners, too. Consequently, it might improve the quality of the patent examination process and therefore of the patents themselves. As patent offices digitise their patent literature, put more of it in searchable databases, and make those databases available on the Internet, it becomes easier for the public and patent examiners to search for, find, and determine what the prior art is. On the other hand, though, the Internet makes it easier to advertise and sell infringing items like counterfeit pharmaceuticals.

The Internet and digitisation have also opened up new opportunities to organise and publish the content of research projects, scientific publications and large data sets, so as to make them immediately available to other scientists, researchers, and potential users in the business community and society in general. In addition, digital technologies allow the collection of large amounts of data that can be the basis of scientific experiments and research, helping to make science increasingly data-driven. Consequently, it is now technologically possible to access, use and re-use research, articles and datasets at no or extremely low marginal cost and speed the transfer of knowledge amongst researchers and across scientific fields. That, in turn, can lead to new ways of collaboration and new research domains. However, publishing high quality, peer-reviewed scientific articles in reputable journals, and making that information available online in an organised, reliable and searchable manner, comes at a cost. Someone has to pay, even when the research itself is publicly funded, and the ability to recoup costs is part of what copyright facilitates. The interplay between copyright and open access to publicly funded research results is further discussed later in this chapter.

The net overall effects on an economy from Internet growth and digitisation are hard to disentangle from other factors, such as the recession that began in 2008. New Internet-based business models are adding to the recession's impact on older firms by helping to push them out of the market, but at the same time those new firms are generating jobs. The traditional publishing sector in the United States, for example – bookstores, printers, newspaper and magazine publishers – has shed 400,000 jobs since 2008. During the same time, Internet publishers and web search firms added 76,000 jobs. Clearly that is preferable to a loss of 400,000 jobs with no offsetting gains, but it is hard to know how many publishing jobs were lost due to the Internet firms' entry as opposed to the recession or other factors. Trying to figure out how consumers have fared while adjusting to these changes adds another layer of complexity. This much is clear, though: the Internet publishing and search salaries are nearly twice as high, on average, as the newspaper publishing salaries (about USD 80,000 versus USD 46,000).[56]

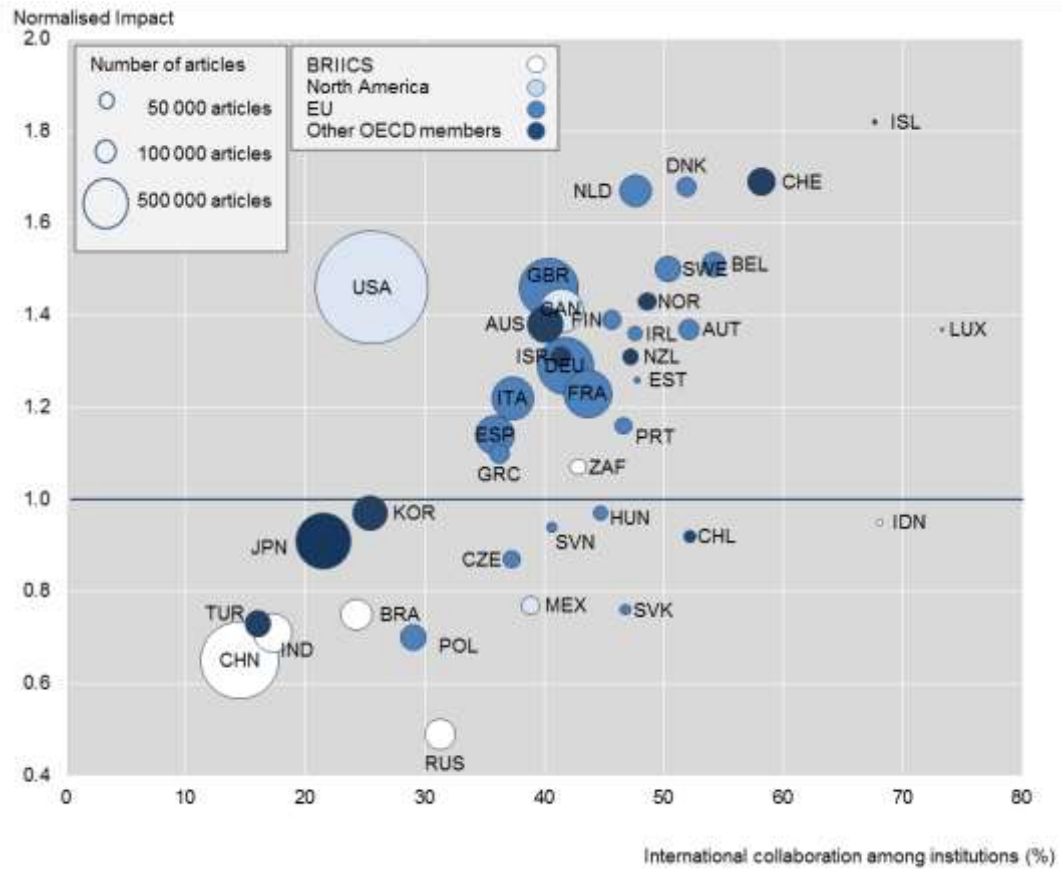
The Merits and Means of Open Access to Publicly Funded Research Results

Internet growth and digitisation, along with advances in "big data" and data analytics (see the other phase 2 report, *Data-Driven Innovation for Growth and Well-Being*), have also affected the ways in which publicly funded research results are accessed, disseminated and used. Digital technology is unquestionably bringing more and more possibilities to create, read, share, use and re-use scientific articles and data. That information is often covered by IP laws.[57] Open access (OA) principles, which aim to make the outputs[58] of publicly funded research more widely accessible and available for copying, use, re-use and further distribution in digital formats (while preserving authors' rights to control the integrity of their work and to be credited)[59], therefore raise a number of IP-related questions. One of the most important is how to define

research exceptions for protected material. (Open Access is explored in detail in Chapter 7, Legal Aspects of Open Access to Publicly Funded Research.)

The significance of such questions should not be underestimated. Scientific research is vital to solving global challenges such as climate change, disease, and security issues. Access to research data not only increases the returns from public investment in confronting those challenges, but it also reinforces open scientific inquiry, encourages diversity of thought, allows a more accurate validation of research results, and leads to the advancement of knowledge in new fields (OECD, 2014). Prompt and cost efficient access to publicly-funded scientific research therefore promotes general economic and social welfare (OECD, 2007; European Commission, 2007). Furthermore, to the extent that OA leads to greater collaboration among researchers from different institutions and countries, it can also lead to outputs that have a stronger influence in their field. Figure 1.18 shows that there is a positive association between international collaboration and the impact of scientific publications:

Figure 1.18. The Impact of Scientific Production and the Extent of International Scientific Collaboration, 2003-11



Note: Whole counts of internationally co-authored documents. The normalised impact is derived as the ratio between the average number of citations received by the documents published by authors affiliated to an institution in a given economy and the world average of citations, over the same time period, by document type and subject area. The international institutional collaboration indicator is based on the proportion of documents involving institutional affiliations with other countries or economies, as a proportion of documents attributed to authors with an affiliation in the reference economy. Single-authored documents with multiple affiliations across boundaries can therefore count as institutional international collaboration.

Source: OECD, 2013*c*, p. 60; data available at http://dx.doi.org/10.1787/888932890314.

Box 1.4 sets out more information about the benefits that open access to publicly funded research results can offer for research and innovation.

Box 1.4 Rationales for Open Access to Publicly Funded Research

- Improved efficiency in science: OA can increase the effectiveness and the productivity of the research system by: 1) reducing duplication and costs of creating, transferring and re-using data; 2) allowing more research from the same data; 3) multiplying opportunities for domestic and global participation in the research process;
- Increased transparency and quality in the research validation process, by allowing replication and validation of scientific results to a greater extent;
- Faster knowledge transfer: OA can reduce delays in the publication of articles and data sets and accelerate the progression from research to innovation;
- More knowledge spillovers to the economy: better access to the results of publicly funded research can foster spillovers and boost innovation across the economy. The disclosure and release of public and scientific data may promote the development of innovative products and services in firms as well as increase awareness and conscious choices among consumers;
- Greater effectiveness in overcoming global challenges: global challenges call for co-ordinated international actions. OA may promote collaborative efforts and faster knowledge transfer, leading to better understanding and potentially to the identification of solutions for challenges such as climate change and ageing populations;
- More engagement by citizens in science and research: OA initiatives may promote awareness and trust in science among citizens. In some cases, greater citizens' engagement leads to participation in scientific experiments and data collection.

Source: OECD, 2013*e*; European Commission, 2012*a*.

Accordingly, OA principles have been viewed with increasing favour by some policy makers, research funding agencies, higher education institutions and researchers. Sometimes that favour is reflected in generally applicable laws and sometimes in the policies of individual organisations. Furthermore, the measures taken do not always reflect all OA principles, e.g. they might cover only access and not reproduction or re-use (OECD, 2014*c*).

OA initiatives undertaken in Europe and the United States will be summarised presently, but first it is useful to briefly explain the two main ways in which OA principles can be put into action. One, known as the "Golden Road", requires authors to pay the cost of publishing their publicly funded outputs in journals that provide free open access. The other, called the "Green Road", permits authors to publish their publicly funded works via traditional channels but requires the authors to self-archive and to provide access to those works by making their own e-prints free for everyone. The Golden Road is considered preferable by OA advocates because it tends to entail fewer restrictions on authors. That is because authors are more likely to retain only limited rights when they publish in traditional, non-OA subscription journals. Therefore self-archived, Green Road articles typically come with a licence that restricts what readers can do with the material. Moreover, it is not necessarily easy for readers to determine from the licenses what those restrictions are (see Chapter 7, Guibault, 2011, at 137-167).

The European Commission is in the process of implementing OA principles, which are reflected in its model grant agreement for the Horizon 2020 research programme. The Commission is promoting OA not only for scientific publications, but for their underlying data. Accordingly, the model agreement requires recipients to deposit the data and associated metadata that are necessary to validate published results (as

well as the scientific publications themselves) in a research data depository and to take measures that allow third parties to access, mine, exploit, reproduce and disseminate that data at no charge. However, the Horizon 2020 OA policy is not binding on Member States, which leaves Europe with a number of inconsistent national OA policies instead of one consistent policy. The spectrum of approaches includes, for example, a mandatory Golden Road for publications and data (Research Councils of the United Kingdom) and a Green Road for publications only (Germany) (Chapter 7).

In the United States, a White House Directive requires all federal agencies that spend more than USD 100 million on research and development to come up with plans to make the published results of their federally funded R&D freely available to the public. It directs agencies to use a 12-month post-publication embargo period as a guideline for making research papers publicly available.[60] There is also a pending bill, the Fair Access to Science and Technology Research (FASTR) Act, which is similar to the Directive but cuts the embargo period to six months and would carry the weight of a statute. The Directive expressly states that each affected agency's "plans must also describe, to the extent feasible, procedures the agency will take to help prevent the unauthorised mass redistribution of scholarly publications." In other words, the agencies must ensure access, but they should also try to restrict copying and sharing. FASTR, meanwhile, mandates Green Road OA but says nothing about Golden Road OA. See Chapter 7 of this Report for more information on the relevant aspects of IP regimes and OA approaches in a sample of jurisdictions.

UNESCO (2012) has, incidentally, issued Policy Guidelines for the Development and Promotion of Open Access that explain what OA is and provide practical steps for governments, institutions and funding agencies that wish to put OA policies in place. The guidelines are not prescriptive, but rather aim to promote OA by facilitating more knowledgeable decisions to adopt OA policies and strengthen national research systems.

One way to gauge the actual impact of OA is to compare the number of citations that OA publications receive with the number received by non-OA publications. The academic literature contains several studies that make such comparisons (e.g. UNESCO, 2012; Swan, 2010; Wagner, 2010; OpCit Project, 2012). Most of them demonstrate that OA has the effect of increasing citations. However, there is no consensus on the intensity of that increase. A minority of the studies do not show any citation advantage at all for OA publications (Davis et al., 2008; Fradsen, 2009; Lansingh & Carter, 2009).

Academics are not the only groups that can potentially benefit from greater OA, though. The demand from the business sector and individual citizens to access research results is significant. For example, the usage data from PubMedCentral (the online repository of the United States National Institutes of Health, where an OA policy is in effect) show that 25 percent of the daily unique users are from universities, but 17 percent are from companies, 40 percent are individual citizens and the rest are from government or other categories (UNESCO, 2012).

Chapter 7 of this Report explores the interplay between OA policies and IP laws in a sample of jurisdictions, reaching a number of conclusions and raising several questions:

- The explosive growth in data volumes will probably not make copyright protection either more or less relevant than it is now, provided that the criteria for copyright protection are applied strictly (either in the form of an 'originality' requirement or that of being an 'author's own intellectual creation').

- However, in countries with laws that protect databases, the growth in data may bring about a trend towards private appropriation of databases. If that happens, applying OA principles to publicly-funded scientific output will become more important.

- The increase of machine-generated data in science (e.g. scientific sensors) may raise certain challenges, especially the question of whether such data meet the criteria for IP protection.

- A related challenge might be the use of machine-generated data to identify rights owners. Ideally, the machine-generated data will not qualify as protectable subject matter so that it will in principle be free for everyone to use for the purpose of identifying rights owners.

- Another concern is the lack of clarity in national or supra-national legal frameworks. Legal frameworks are being adapted to promote OA in several jurisdictions. Researchers and scientists need to understand exactly what is allowed and forbidden in order to make legitimate use of OA. The frameworks are not always easy to navigate, though. For example, the European Union's Information Society Directive gives copyright owners the exclusive right to reproduce their works, communicate them to the public and distribute them. Notably, the Directive allows Member States to make an exception for situations in which a protected work is used for the purpose of illustration for teaching or scientific research. However, the exception is optional, and that has led not only to varying approaches from country to country within the EU but to vagueness, because there is no single, clear standard even among the countries that have implemented the exception (Guibault, 2010, at 55-66; Triaille, 2014, at 403).

- An unresolved issue is how the ownership of rights to articles and data, as well as the applicable licensing terms, affect OA when the research is funded by public/private partnerships. When governments partner with external organisations on research projects, the ownership of the resulting outputs is regulated by contract. Depending on a number of factors – the law, relative bargaining power, the organisation's policies – copyright ownership may wind up entirely in the hands of the external partner. The author rarely retains it, but who owns the rights greatly affects how the outputs will be published – traditional channels, Green Road OA, or Golden Road OA.

While an objective of OA is to make access and use of publicly funded articles and data cost-free to users, doing so is not costless. Someone still has to pay to support peer reviews, the publishing process, archiving, etc., and it is often the authors who pay. However, many agencies in countries that implement OA policies are setting aside funding to help researchers at institutions meet mandates for OA publishing. Smaller countries, smaller institutions and academic societies, though, may face additional funding hurdles.

Meanwhile, the private sector is making progress with OA initiatives. Initially threatened by OA publishing, scientific publishers are now developing business models of their own for OA and offering new data curation and storage services. Moreover, new research data start-ups are challenging established publishers, creating pressure to innovate in the publishing sector (see Chapter 7, "Promoting a New Era of Scientific Discovery", DSTI/ICCP(2014)16/CHAP8, in the other phase 2 report, *Data Driven Innovation for Growth and Well-Being*).

It is critical for OA initiatives to achieve a good balance between openness and protection/control, so as to promote sharing without reducing the incentives to conduct research and compete. For example, OA to scientific publications may not necessarily involve access to data and the associated right of use and re-use and vice-versa. Free licensing solutions, such as the Creative Commons 4.0 licence[61], are available and enhance openness in data without the loss of control over ownership.

Consumer Protection and Copyright in the Digital Era

Because digital content products are often subject to copyright protection, the OECD Committee on Consumer Policy's work in establishing policy guidance for digital content products adds another

dimension to the broader discussion on the impact that copyright systems are having and how they are functioning in the digital era. The Committee on Consumer Policy examined trends and consumer policy challenges in the acquisition and use of digital content products, focusing on those that consumers store, access or receive in an electronic (i.e. intangible) format. That resulted in an analytic report (OECD 2013d) and ultimately policy guidance (OECD 2014e) which recommends that consumers be provided with clear and conspicuous information about functionality, interoperability and geographic limitations, and with effective protection against misleading or unfair commercial practices.

With the spread of broadband, easy-to-use mobile devices and online and mobile payments, products such as books, music, films, videos and games are increasingly supplied and acquired by consumers in an electronic format via the Internet and other ICT channels (such as mobile operators' networks) through streaming, downloading or cloud computing platforms. While such technological advances are providing consumers with many new possibilities to legitimately copy, share, transform and transfer a wide range of high quality intangible digital content products, their ability to do so is often limited by: *i)* copyright laws; *ii)* the terms and conditions in end-user licensing agreements (EULAs); *iii)* other terms of service provisions; and *iv)* technical measures (commonly referred to as "digital rights management" [DRM]) that limit or prevent product access and usage across the consumer's devices.

Such limitations can vary significantly from one product to another. For example, the period over which a consumer may be able to use a product may be limited or indefinite; the number of times a product (such as a piece of music or an e-book) can be accessed, streamed or downloaded may be limited; and there may be conditions or limitations for sharing a product with others, including friends or family members. Further, consumers may be unable to play, listen, or watch a product on different devices. Moreover, consumers may not always be able to access a product that they have acquired in one jurisdiction while travelling in another; they may be unable to acquire an intangible digital content product offered by businesses located in other jurisdictions. The latter limitations are, in many instances, due to geographical licensing restrictions or other specific limitations placed on products by suppliers.[62] There are market incentives to overcome these challenges, but solutions have not yet been created and implemented in all markets.

Surveys reveal that a vast majority of consumers are often unaware of the limitations just mentioned and generally expect to enjoy the same rights with digital content products that they have with physical goods. This is partly due to the fact that consumers are often unsure about what is permitted under existing copyright law and how the law applies in different circumstances.[63] Moreover, consumers tend not to read EULAs, which often contain complex and lengthy terms and conditions that are not always easily accessible prior to making a purchase (European Commission, 2011).

A number of misleading commercial practices have been reported. These practices include, for example, businesses' failure to provide conspicuous, adequate and timely information to consumers about product access and usage, and suppliers pushing product updates without prior notification (Europe Economics, 2011).

Knowledge Diffusion from Patents and Trade Secrets

Among the benefits that IP rights bring to economies is their ability to stimulate knowledge diffusion. Whether it occurs via a disclosure requirement in an application process, through a licensing agreement, or by way of a partnership arrangement bound by confidentiality agreements, knowledge diffusion is facilitated by IP. In this section we will explore and compare the diffusion effects from patents and trade secrets. As we will see, inventors sometimes have a choice between these two forms of protection, so it can be interesting to examine what drives their decisions and what the resulting effects on diffusion are.

Note that diffusion depends on more than just disclosure. It requires dissemination, too. Thus, in the context of the patent system, for example, diffusion requires more than just the act of providing information in a patent application. It also depends on that information being made available to the public, and on the public accessing and using that information.

It is also important to bear in mind that IP covers a huge variety of KBC. That can lead to some special, and perhaps counterintuitive, situations. For example, the greater knowledge diffusion that results from patents is generally assumed to be a desirable effect because it enables further innovation. There are circumstances, though, when society may at least arguably be better off if proprietary knowledge remains out of the public's reach. Consider a recent case: calls for Google to make its search engine algorithm transparent so that greater competition might be stimulated in European Internet search and advertising markets (Vasagar & Fontanella-Khan, 2014). Although the functional core of Google's algorithm has been known for years (Brin & Page, 1998; Page, et al. 1999), certain aspects of the algorithm are held as trade secrets. Some of them are designed to thwart search engine optimisers, which are services that aim to boost a site's rank in search results by attempting to understand a search engine's methods and manipulate them to distort the results in a client's favour. Critics of the idea that Google should be required to disclose its full algorithm contend that the result would not only be bad for Google, but for everyone. The optimisers would obtain complete knowledge of how the algorithm works, and with that information in their hands, Google's search results would soon become distorted and unreliable (McGeer, 2014; Pasquale, 2010, at 350; Grimmelmann, 2010, at 454).

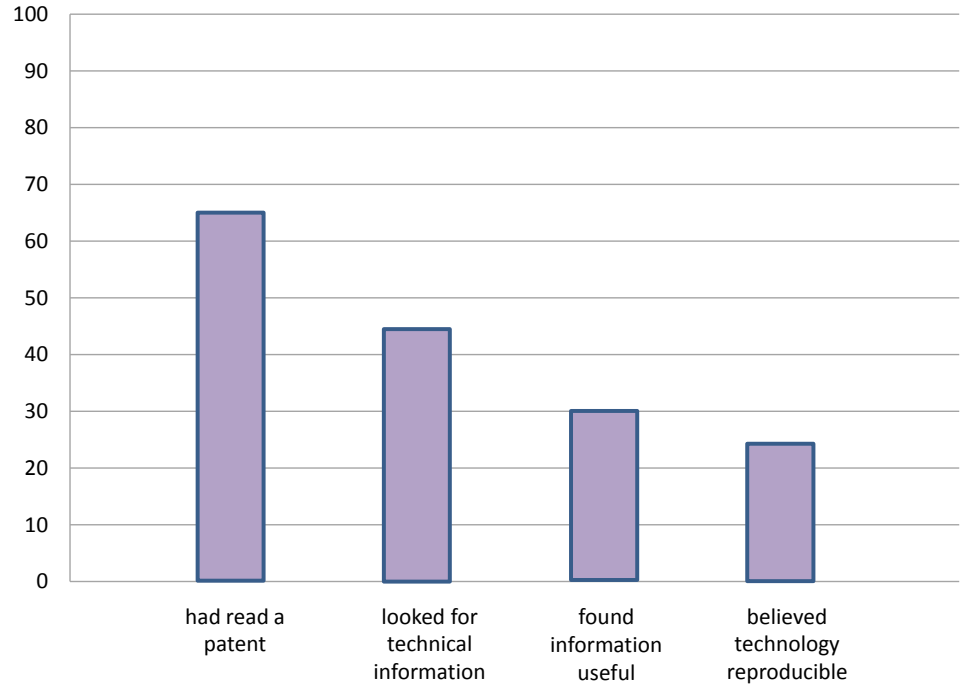
There are undoubtedly several other exceptional situations in which knowledge diffusion would probably be harmful to society. Information about how to build bioweapons or other weapons of mass destruction, for example, comes to mind.

Patent disclosure and diffusion

The disclosure requirement is a key component of the exchange built into the patent system: in principle, exclusivity is granted to inventors during the short and medium term while the information disclosure facilitates knowledge diffusion and more innovation in the medium and longer term. In essence, patent disclosure requirements call for information that is sufficient to enable a person skilled in the art to replicate the invention. But a wide array of other information can be found in patent applications, too. Beyond the technical information, there is legal and business information. That makes patent information potentially useful to different audiences for different purposes. Researchers, potential licensees, competitors, policy makers, and patent examiners may all find helpful information in patents applications.

It is not clear that disclosure is a very effective means of diffusing knowledge in practice, though. Empirical results vary from sector to sector and by firm size, but the overall extent to which reading patents promotes follow-on innovation is not known. There is also some evidence that the quality of disclosure is inadequate in some instances (Chapter 8). In one study, Ouellette (2012) surveyed about 200 nanotechnologists. Sixty-four percent of the respondents had read a patent, and 60 percent of those who had read patents for scientific (i.e. non-legal) reasons said that they had found useful technical information. Accordingly, the survey indicates that patent disclosures are certainly not useless, insofar as some scientists get some value from the information disclosed.

Figure 1.19. Responses of Nanotechnologists to Questions about Patent Disclosures (% positive)



Source: Ouellette (2012).

However, 36 percent of respondents had never read a patent and 40 percent of those who had read a patent for technical reasons did not find any useful information. Furthermore, 62 percent of the patent readers thought that the patents they read did not provide sufficient disclosure for a nanotech researcher to recreate the invention. Ouellette's work suggests that the quality of disclosure could be significantly improved and casts doubt on whether the existing 'enablement' requirements are meaningful. Fromer (2009, at 560) notes that "a good deal of evidence suggests that technologists do not find [that patents] contain[] pertinent information for their research."

Another problem is that certain strategic behaviours by patentees can degrade knowledge diffusion. For example, so-called "thesaurus patents" are applications that have been drafted in ways that make it harder to understand the invention, or even simply to discover it through a computerised word search in the first place. Furthermore, applicants have an incentive to disclose no more about how to reproduce the invention than the bare minimum required by the law.[64]

But it is critical that disclosures are as useful as lawmakers intended them to be. We have seen that intangible assets are becoming an ever-more important component of OECD economies. And we will see in section 3.6 that IP is becoming an increasingly important source of financing for SMEs, which generate a disproportionate share of job growth. Those financing markets, like all markets, depend on information to function well. "It is crucial that patent data is seriously useful in order to make markets work. If intangible capital is the foundation of the economy for the next century, then it is necessary to have a well-functioning information system in place: hiding such vitally important data will not help progress" (Chapter 8, paraphrasing remarks by Tony Clayton).

A counterbalancing factor is that digitisation and the growth of the Internet have been especially beneficial for the dissemination aspect of diffusion. By digitising their application processes and putting databases of their patent information online, patent offices around the world have made substantial

progress in improving access to patent information (Chapter 8). Not only that, but the information can be obtained faster, more affordably, and it is searchable, as well. By encouraging and funding these efforts by patent offices, governments can help to ensure that economies are getting the maximum amount of knowledge diffusion from their patent systems.[65]

Several other ideas for improving the utility of patent disclosures emerged at the expert workshop held in connection with this report (Chapter 8). One recommended approach is simply to put more effort into applying the disclosure laws that we already have. Greater time and resources could be devoted to scrutinising the adequacy of disclosure during the patent examination stage, to ensure that, for instance, the patented technology is reproducible by a person skilled in the art. In addition, a peer review system might be helpful because, although patent examiners have scientific backgrounds, it is difficult for anyone to be skilled in every area. Another possibility concerns the lag between the date of filing and the date of publication (when disclosure occurs). That lag can be considerable, and may seem even longer in fast-moving fields. Reducing the lag, at least in some technology areas, could make disclosures more useful by ensuring that the information is still fresh.

Trade secrets and diffusion, and a comparison with diffusion from patents

It may seem counterintuitive, but some knowledge diffusion may be expected to result from trade secret protection. Trade secrets are confidential, but they are commercial, too. The laws therefore anticipate and accommodate a certain degree of protected disclosure. By providing a legal framework for safeguarding firms' valuable and secret information, including remedial measures in case of a breach, laws covering trade secrets can give firms the confidence and security they need to collaborate more closely with business partners. Thus, trade secrets owners are sometimes willing to share sensitive knowledge with other firms (subject to licensing and/or confidentiality agreements). Moreover, when employees switch jobs, even though non-compete agreements may limit the amount of information they can share with their next employer, the employees may be able to share some useful know-how that is related to the trade secrets but is not actually part of them (Lemley, 2011).

In principle, however, one might expect a smaller diffusion effect from trade secrets than from patents. Patents require the invention to be disclosed to the public, whereas trade secrets protection is premised on keeping the invention secret (or sharing it, at most, only with business partners that are subject to confidentiality agreements). In addition, patents eventually expire, putting the invention they once protected into the public domain. Trade secrets, on the contrary, can endure indefinitely. Although trade secret laws do not prohibit reverse engineering, firms are unlikely to rely on trade secret protection for their valuable knowledge if it is easy to reverse-engineer and if they can choose patent protection instead.[66] Finally, the diffusion effect associated with patents can stem from both licensing agreements and the disclosure requirement in the application process, whereas there is obviously no disclosure requirement for trade secrets.

On the other hand, it has been discussed already that patent disclosures are not necessarily optimal. Furthermore, patent protection might be used in combination with trade secret protection in a manner that inhibits the beneficial effects of disclosure requirements. For example, if even a person skilled in the relevant discipline would be unable to reproduce an invention despite having all of the patent documentation at hand, e.g. because the inventor has revealed the absolute minimum necessary to obtain the patent but has kept some crucial know-how secret, then the owner has essentially bundled patent protection with trade secret protection. That strategy, if successful, would obviously restrict the intended benefits of the patent disclosure system. Nevertheless, it seems difficult to conclude that patents' average knowledge diffusion effect is smaller than that of trade secrets.

This point is theoretical, though – and it must remain theoretical – because empirical data on trade secrets is scarce due to their non-public nature. We simply cannot know the number or value of trade secrets in an economy, how long they have existed, or how much knowledge they diffuse, because they are hidden from public view. What we do know is that firms generally say they rely more on secrecy than on patents (though in certain sectors, like pharmaceuticals, the opposite is true),[67] and there is evidence that the main reason businesses use trade secrets instead of other forms of IP protection is to avoid having to disclose valuable information to the public (European Commission, 2013). If it is correct that one should expect a greater knowledge diffusion effect from patents than from trade secrets, and governments want to encourage such diffusion because it fosters innovation and growth, then it could be worth considering what can be done to make filing for patents more appealing to firms when they have a choice between trade secrets and patents.[68]

Part of that consideration would necessarily involve the subject of cost, which is another factor that motivates some firms – particularly innovative SMEs – to favour trade secrets protection over patent protection (Brant and Lohse, 2013). It is clearly important for SMEs to have an affordable means of protecting their valuable KBC. Granted, there may be a relatively higher societal cost with trade secrets in that they probably generate less diffusion than there would be with a patent. However, that may be preferable than not getting the innovation at all. Furthermore, when inventors opt for trade secrets protection instead of a patent, they leave the door open for subsequent inventors to innovate in ways that might have infringed the patent. Finally, making patents substantially cheaper might encourage a surge of low quality, low value patent applications.

IP-Based Financing Deserves Attention

OECD data covering 2001 to 2011 indicate that, although young firms account for only 17 percent of total employment, they contribute disproportionately to job creation – 45 percent of the total – across a group of 15 OECD countries that were studied (OECD, 2013*c*, p. 198).[69] However, there was substantial variation within the sample, a fact that highlights the importance of national policies and business environments in encouraging the formation and development of new businesses. Among the most important factors affecting the success of young firms is the ease of access to financing. Capital is often relatively difficult for young firms to obtain because they do not have long histories of consistently repaying loans and they tend to lack collateral – or at least what banks have traditionally viewed as collateral. But some young firms have untapped resources in the form of IP, which – if it can be properly valued and if markets for IP-based financing are functioning well – can be used to persuade lenders to provide financing.

This is a timely issue because even though young firms are responsible for so much job creation, it became even harder for them to obtain financing between 2007 and 2012 (OECD, 2013c, p. 200). Of course, not all start-ups need or merit external capital, and not all of them have IP. But due to the financial crisis, banks were unable or less willing to provide loans to young, innovative start-ups, and venture capital firms became more risk-adverse. The financiers therefore focused on more mature businesses, leaving an important source of job creation underfunded. If IP-based financing had been less constrained and more developed, it could have made the difference between success and failure for young firms with promising IP. Policy makers interested in job growth may benefit from taking a closer look at what is constraining IP-based financing and what can be done to unleash it. That is the purpose of Chapter 9 of this Report.

Chapter 9 notes that asymmetric information, moral hazard, and certain other features of innovation have the combined effect of driving interest rates for financing innovation higher than for other types of financing. Those factors also lead to inefficiently low funding for innovative firms, in part because the factors make it harder to use KBC as collateral. Knowledge-intensive start-ups and young SMEs are probably the most financially constrained, essentially because they lack tangible capital and track records.

They are therefore the ones that would stand to benefit the most if IP-based financing were more widely available.

IP can facilitate financing, especially for SMEs, in two ways. First, IP can serve as a signal of a firm's quality (both managerial and technological) and potential, helping to reduce information asymmetries between internal managers and external investors. Second, IP can boost profitability because it confers exclusive rights to use inventions or creations, which can lead to competitive advantages. If there is a well-functioning secondary market for IP, IP can also be sold off if the firm that owns it has trouble repaying its loans. In other words, IP can serve as collateral in debt financing.

Chapter 9 further explains that debt financing connected to IP (i.e. mainstream and IP-backed lending and securitisation, IP sales and lease backs, and venture debt) is growing, but the lack of data prevents researchers from determining its actual size. In any event, large firms use debt financing more than smaller firms in IP-intensive sectors, due to the complexity of these transactions and the fact that large firms more often have IP that is already commercialised and earning a return. Smaller firms must rely more on equity financing, in which angel investors or venture capitalists recognise and estimate the present value of IP assets that have not necessarily begun to generate profits yet. A substantial body of empirical work has found that young, high-growth firms with IP assets receive more funding than firms without IP.

Nevertheless, IP-based finance is significantly under-used, especially by SMEs that are most in need of it (Brassell & King, 2013). One major reason for that stems from a lack of opportunities to sell IP in a secondary market, which is due to both uncertain redeployability and immature IP markets (Brassell & King, 2013; European Commission, 2014).

Policy makers are striving to support IP markets in several countries. Generally, their efforts fall into two categories*: i)* supporting greater transparency of IP ownership and transfer information via disclosure requirements or measures to foster greater clarity in patent claims; and *ii)* creating new IP market infrastructures. Transparency and reliability in IP markets require greater attention because they are currently undermined by insufficient information on IP ownership and transfers, as well as by uncertainty over the legal protection and technological breadth of IP rights (Harhoff, 2009; Brassell & King, 2013; Terroir, 2014). To promote transparency in ownership and transfers information, new disclosure requirements could be introduced, for example through reporting regimes managed by IP offices. An example of this type of measure is President Obama's announcement of an executive action in June 2013 to increase transparency in the patent system by requiring patent owners and applicants to provide the USPTO with up-to-date information on the attributable owner of patents and patent applications.[70] Examples of measures to create new IP market infrastructures are the UK's Copyright Hub, an online licensing and copyright education platform, and Denmark's IP Marketplace, an online market where IP owners and buyers can list, buy, sell, and license intellectual assets.[71]

Another approach that governments can take is to help manage the risks associated with the collateralising IP. Government agencies and development banks can do that through risk-sharing mechanisms. Those mechanisms must allow IP to count as a credit-scoring enhancement. Alternatively, governments could support the formation of IP insurance companies, though it remains unclear exactly how best to do so.

Building awareness and trust within SMEs and the financial sector with regard to IP-based financing is also crucial to facilitate the rise of IP as a full-fledged asset class. Awareness of the potential value of IP for obtaining financing is a stubborn constraint. As we have seen, for most firms, registered forms of IP are not the method of choice for protecting intellectual assets. Instead, they tend to rely on secrecy, complexity, and/or first mover advantages. This is especially true of young, innovative firms (OECD,

2011; Brassell & King, 2013). Policy makers can help by designing and implementing awareness campaigns and by increasing the reliability of valuation standards and corporate reporting of IP assets.

Better Copyright Data Will Enable Data-Driven Copyright Policy

Part 3.1 showed that, where comparative data are available, investment in copyright has grown more than investment in any other form of IP, that it is the largest component of IP-protected investment, and that job growth in copyright-intensive industries has been much better than that in trademark and patent-intensive industries. Nevertheless, patents have received far more scholarly attention than copyright (WIPO, 2011, Chap. 2, p. 75). One reason for that discrepancy is that while patent-related data is plentiful, given the requirement of filing a patent application, less information about copyright is publicly available. Researchers go where the data are, and patent systems have plenty of data. To enable better-informed policy making decisions, copyright has some catch up to do.

The relative lack of copyright information is mainly due to the fact that most copyrights are not registered in most countries. There are some databases, thanks to public registration systems in some countries as well as certain private sector organisations. But they do not provide comprehensive coverage of all copyrighted works and they tend to be incompatible with one another (U.S. Dept. of Commerce, 2013, at 89-94). Consequently, it is harder to determine systematically even quite basic information about copyrights, such as how many there are and who owns them. Ideally, policy decisions about all forms of IP, including copyright, would be supported by reliable data and objective analysis, so more investment in collecting and measuring copyright data is worth considering.[72]

This issue was discussed at the Expert Workshop (see Chapter 8) and there was uncharacteristically broad agreement among the panellists that the lack of copyright data is a significant problem that needs to be addressed. As one speaker said, policy makers need to help generate the data, not just consume it.

What can be done? One possibility is to implement more measures designed to encourage voluntary registration. The main purpose of copyright registration is to create an official record of the date, owner and content of a work so that there is always a reliable basis on which to adjudicate legal claims concerning the work. But an added benefit of registration is that it could help to alleviate the dearth of data on copyright that is impeding quantitative analysis of its benefits and weaknesses.

Other possibilities include funding research and surveys to estimate the benefits of more registration, and changing accounting rules that apply to creative industries to enable better data collection.

Effective Tax Rates on Investments in IP

Phase 2's tax component, a stand-alone report entitled "Effective Tax Rates on Investments in Different Types of Knowledge-based Capital", provides a framework for modelling effective tax rates for different types and for different business uses of KBC (OECD, 2014d). The types of KBC include, for example, computerised information, innovative property including R&D, and economic competencies. The different business uses of KBC are *i)* self-constructed for long term use; *ii)* self-constructed for sale; and *iii)* acquired KBC. Part of the report addresses design features of KBC taxation, including deductibility of expenses, taxation of future income at reduced rates (e.g. "patent boxes"), treatment of losses, and various types of tax relief such as tax allowances and credits. Ultimately, the report shows differences in effective tax rates across different types and uses of KBC. It then provides suggestions on how governments can more cost-effectively direct their fiscal efforts to support the private sector in creating KBC.

The tax report notes, among other things, that tax incentives to encourage R&D must be carefully designed to ensure they benefit all companies undertaking innovation investments, including SME's and start-up companies. It also observes that while KBC investments that fall into the category of R&D benefit

from tax subsidies in many countries, other types of KBC investment generally do not have specific tax incentives. But non-R&D KBC may have potential positive spillovers, too, which would merit government incentives.

Other Policy Challenges in Need of Further Study

Planned Work on Measuring Patent System Quality[73]

The OECD's Economics Department in collaboration with the Directorate for Science, Technology and Innovation (DSTI) is designing a data collection exercise to facilitate the construction of new policy indicators related to patent rights. This exercise is organised around two main pillars. First, a questionnaire is being developed which aims to collect detailed information on countries' rules, laws and standards, as well as capacities, for reviewing patent applications, granting patents, litigating validity and infringement cases, and determining outcomes in those cases.

Second, the Secretariat expects to produce a proposal by March 2015 for a project that will identify the key features of patent systems that influence economic outcomes and summarise a new indicator.

The remainder of this section of this chapter suggests, in order of priority, a number of other policy challenges that are not addressed, or that are only partly addressed, in the phase 2/IP report.

Leveraging the Patent Value Indicators to Gain Further Insights on Innovative Activity

As mentioned above, when statistics compiled from patent applications filed with the European Patent Office were fed into the patent value indicator algorithms developed in Chapter 2, the results varied from indicator to indicator. However, by looking at all of the indicators' results, one could compile country profiles from which a more comprehensive picture of each country's innovative strengths and weaknesses, to the extent that they are reflected in patenting activity, would emerge. One must bear in mind the earlier discussion about the limits of the association between patenting and overall innovation, but nevertheless, data from other patent offices and expanded time horizons could be fed into the indicators to enrich the results. Furthermore, by linking the indicator data to data related to countries' industrial structure and framework conditions, it would also be possible to identify and analyse the factors and conditions that foster (or hinder) the high-value patenting activity and hence the competitiveness of firms, industries, and economies. Those additional projects have not been undertaken, but now that the indicators have been created it would be possible to do them.

IP Bundles

In the past, firms that used IP tended to rely more frequently on one particular type, and to the extent that they owned multiple kinds of IP, they may have been used in very distinct parts of the firm's business operations. For example, pharmaceutical companies relied primarily on patents (and still do), while soft drink makers relied heavily on trade secrets. Media companies could rely almost exclusively on copyright while maintaining trademarks on their brand names. Today, more companies use a bundle of IP rights to protect their KBC. For instance, in-house software used in product design and manufacturing is common at larger firms and is typically protected by copyright, while the products themselves may be protected by patents, trademarks, and/or even more copyrights. Indeed, there is evidence suggesting that firms worldwide increasingly rely on the joint use of patents, trademarks, and industrial designs (OECD, 2013*c*, p. 186).

How are firms using bundles of different types of IP to be maximally competitive? How do the different types of IP interact and complement each other? Are those interactions promoting or harming

innovation? Why do firms sometimes specifically choose *not* to use certain types of IP to protect their KBC?

Sub-topics include:

- **Introduction to IP Portfolios** – What do companies with multiple types of IP typically use the different types for? In other words, why do they choose one form of IP protection over another for a given invention, creation or idea? Is it more common in today's economy than it was in the past for firms to have substantial amounts of multiple types of IP? If so, what drove that change? How do the different types of IP interact and complement each other? Are those interactions promoting or harming innovation?

- **Strategic Use of IP Portfolios** – Do companies sometimes use multiple types of IP in ways that provide greater-than-optimal protection? If there are loopholes or faults in the frameworks, what should be done to fix them? In what ways are the different types of IP and associated policies working well together? How are those complementarities stimulating or inhibiting greater innovation?

The Competition/IP Interface

There is no shortage of challenges for policy makers at the intersection of competition and IP regimes. These include: how to make the FRAND concept clearer and more enforceable (FRAND means "fair, reasonable, and non-discriminatory"; holders of standard-essential patents sometimes commit to FRAND terms for licensing their patents before their technology is incorporated into the standard), hold-up and reverse hold-up in standard-setting situations, reverse-payment settlements in the pharmaceutical industry, and the behaviour of patent aggregators and how to monitor and analyse their acquisitions to protect competition, given that markets for the relevant products might not even exist yet. There have also been claims that patent assertion entities sometimes use their patents in a manner that violates competition laws (Carrier, 2013; Guniganti & Knox, 2013; Wyatt, 2013).

Collaborative Innovation

New technologies have been emerging out of the cross-fertilisation of different fields, such as the combination of biology and computer programming to form synthetic biology technologies. In addition, open innovation and open access have increased the frequency of joint inventions and authorships. Not all IP systems currently handle collaborative efforts to invent very well. When there are multiple contributors to an invention and/or their contributions overlap, it is not necessarily obvious how to allocate IP rights in all regimes, though it is in some. This is an issue for both patents and copyrights. How economically significant is the problem? Is there a best approach? Can we identify regimes where the allocation of rights are clearly delineated and encourage others to align with those best practices?

Patent Thickets

A patent thicket is a high density of patent rights issued in a certain technical area, which creates an overlapping web of IP rights that must be navigated in order to commercialise a product. The potential difficulties caused by a patent thicket could be amplified if there is low patent quality (meaning inaccurate patent claims and patents that are not genuinely novel or non-obvious). Patent thickets are most frequently mentioned as a concern in high tech and complex product industries, like ICT. A 2013 report commissioned by the United Kingdom's Intellectual Property Office, for example, found "overwhelming evidence that patent thickets arise in specific technology areas" and its econometric analysis shows that the density of patent thickets in given technology areas correlates with reduced entry into patenting in those

areas (Intellectual Property Office, 2013). The degree to which thickets retard innovation, however, remains unclear, as high tech and ICT industries continue to innovate, develop, and grow rapidly. Moreover, there can be over-lapping patent rights even in the case of a well-defined patent scope on perfectly valid patents (Shapiro, 2001). Cross licensing arrangements and patent pools have been identified as tools that can help with navigating patent thickets.

Conclusion

This chapter has provided an overview of the report, highlighting the key findings related to the main themes: the importance of IP as a source of growth and innovation and the effects on IP systems and stakeholders of several major developments, especially content digitisation and the growth of the Internet. The overview shows that in spite of substantially changed technological and economic conditions, IP remains vitally important to innovation, employment, and growth. Those changed conditions have, however, created a number of challenges that stakeholders are working through. It is clear that having more complete data on IP to serve as an underpinning for policy discussions would be extremely helpful. However, so would deeper thinking about what IP's fundamental purpose is because debates about optimal frameworks also need to be grounded by clear principles and standards. Those are not always apparent in IP discussions, particularly where copyright is concerned. Yet copyright appears to be the most economically significant type of IP, it seems to be the form of IP that has been most affected by digitisation and the Internet, and it generates the most controversy.

ANNEX 1.1. SUMMARY OF PHASE 1'S MAIN FINDINGS

At the start of 2011 the OECD began work on a two-year project entitled **New Sources of Growth: Knowledge-based Capital**. The motivation for the project was two-fold. The first was to examine in depth a finding highlighted by the OECD's 2010 **Innovation Strategy**, namely that many firms that innovate do not invest in R&D. Instead, innovation in such firms is based on investments in a wider range of intangible assets – knowledge-based capital (KBC). Secondly, the NSG-KBC project aims to help governments and policy analysts better understand the determinants of growth. Today, the importance of growth can barely be overstated. The drawn-out nature of the global crisis, sluggish macro-economic conditions in many OECD economies, weak labour markets and burgeoning public debt have all added urgency to the search for new sources of growth. Furthermore, rapidly ageing populations, combined with natural resource constraints, mean that the future of growth in advanced economies will increasingly depend on productivity-raising innovation. Drawing on inputs from across the OECD Secretariat, the work summarised in this synthesis report aims to provide evidence of the economic value of knowledge-based capital as a new source of growth and to improve understanding of current and emerging policy challenges.

KBC results from business investment in non-physical assets such as research and development (R&D), data, software, patents, new organisational processes, firm-specific skills and designs. In many OECD countries, business investment in KBC has increased faster than investment in physical capital (machinery, equipment, buildings). In some countries, business investment in KBC significantly exceeds investment in physical capital.

KBC and growth

Inherent features of KBC are growth-promoting, and various forms of evidence link business investment in KBC to growth and productivity change. Unlike physical capital, KBC can foster growth because the initial cost incurred in developing certain types of knowledge is not re-incurred when that knowledge is used again. This can lead to increasing returns to scale in production. Investments in many forms of KBC – such as R&D, design and new business processes – also create knowledge that spills over into other parts of the economy, again spurring growth. Growth accounting studies for the European Union and the United States show that business investment in KBC contributes 20% to 27% of average labour productivity growth. And during the global crisis, investment in KBC has been relatively resilient. KBC is also transforming the determinants of competitive success for firms. For instance, in the automotive sector, the cost of developing new vehicles is increasingly dominated by software, with high-end vehicles relying on millions of lines of computer code.

As overall business investment in KBC increases – and because of KBC's particular economic features, especially its intangible nature – certain key policy settings need to be updated. Ensuring that policies are up to date and conform to good practice is essential in the fields of taxation, innovation, entrepreneurship, competition, corporate reporting and intellectual property. This also holds for policies that enable the exploitation of data as an economic asset. The rising importance of KBC also amplifies the importance of some framework policies already understood to be essential, such as education. Getting the key framework conditions right, while a challenge, is in fact a low-cost step for policy makers in fiscal terms.

Innovation

The breadth of the assets that make up KBC points to the need for policy makers to adopt an enlarged concept of innovation, beyond the conventional view in which R&D is pre-eminent. Other assets such as organisational capital and design, and the ability to create value from data, are important arenas of innovation and productivity growth that often require specific policy action. Well-designed support measures – such as those that facilitate access to finance for innovative firms – along with frameworks that foster collaboration to innovate, supply-side measures that support KBC investments in areas of highest social return, and the redesign of some long-standing innovation programmes, are all important. And demand-side policy – particularly innovation-oriented competitive public procurement – could help support KBC investments that also meet public needs. Policy stability – keeping policy uncertainty to a minimum – is also important.

Entrepreneurship and business development

The accumulation and optimal use of KBC requires experimentation (for instance with new business models and organisational forms) in firms of all sizes. Evidence from thirteen OECD countries for 2001-11 shows that young firms (*i.e.* below five years of age), many of which use KBC intensively, accounted for 18% of total employment but generated 47% of all new jobs created. Policy should make it easier for firms to develop and commercialise new ideas by lowering the costs of failure and encouraging firms to take risks and experiment with potential growth opportunities. All this requires well-functioning product and labour markets. Also essential are bankruptcy laws that do not overly penalise failure (reducing the stringency of bankruptcy legislation from the highest to the average level in the OECD could raise capital flows to patenting firms by around 35%) and well-functioning systems of debt and early-stage equity finance. Indeed, the countries that invest more in KBC are those that reallocate resources to innovative firms more effectively. As a share of gross domestic product (GDP), the United States and Sweden invest about twice as much in KBC as Italy and Spain, and patenting firms in the United States and Sweden attract four times as much capital as similar firms in Italy and Spain. Macroeconomic and political uncertainties are also likely to hinder business investment in KBC.

Taxation

A wide variety of tax policies affect innovation and growth, as examined in previous OECD publications such as *Tax Policy Reform and Economic Growth* (2010). Work reported here focuses on effects on KBC investment by multinational enterprises (MNEs) of limited corporate income tax on returns on investment. R&D tax incentives play a central role in many countries in encouraging investment in KBC. However, the effective tax rate on such investments depends also on other aspects of the tax regime, including not only explicit government policies (such as 'patent boxes') but also the cross-border tax planning strategies now widely used by MNEs. New analysis is provided that finds that overall tax relief for R&D by MNEs, when factoring in relief resulting from cross-border tax planning by MNEs, could well be greater than governments foresaw when their R&D tax incentives were designed. The study considers how MNEs are able to transfer KBC to offshore holding companies, and how interactions of tax systems may encourage the use of KBC in foreign rather than domestic production. Consequently, countries may be losing tax revenue from the commercialisation of subsidised R&D and foregoing some potential domestic knowledge spillovers associated with production (while still gaining the benefits of knowledge spillovers from the subsidised R&D performed locally). Furthermore, 'stand-alone' firms that are not part of a multinational group of companies, and thus are unable to adopt cross-border tax-planning strategies, may be placed at a competitive disadvantage, relative to MNEs, in undertaking and exploiting R&D. The findings add to arguments for:

- *Targeting R&D tax credits on 'stand-alone' firms without cross-border tax planning opportunities.* This message is further supported by other OECD analysis showing that fiscal incentives may favour less dynamic incumbents at the expense of dynamic young firms.

- *Reducing unintended tax relief for MNEs on the exploitation of KBC through international co-operation.* New work to address base erosion and profit shifting (BEPS) should take into account growth in the importance of KBC and intra-group trade in intangibles.

- *Recognition of the risk that the increasing reliance of countries on tax incentives for R&D could, in some cases, increase foregone tax revenue without resulting in 'incremental' R&D (i.e. additional R&D spurred by the incentive) and without increasing income from R&D commercialisation. In this environment, it is essential to pay careful attention to the design of R&D tax credits to reduce these risks.*

- *Gathering more data to estimate the amounts of income being shifted to no-/ low-tax countries through MNE tax planning involving KBC, given potentially significant implications of this planning for countries' public finances.*

Competition policy

Industries founded on KBC raise new issues for competition policy. This is particularly true for the digital economy. Never before have leading firms grown so large so quickly, and the nature of competition also differs in some respects from other sectors. Some experts have observed, for example, that unlike traditional manufacturing sectors, the digital economy's most meaningful competition takes place among platforms created by companies that use very different business models, rather than among companies that all follow more or less the same model. Apple, Google and Microsoft illustrate that point, as they all compete in the market for mobile phone operating systems but each has a different business model. Competition *among* platform providers may therefore be more important to innovation and consumer welfare than competition *within* platforms (such as rivalry among companies that create apps for the iPhone). Competition policy should: properly account for inter-platform competition; promote the elimination of unnecessarily anti-competitive product market regulation; and include the effective enforcement of competition law, which will protect and encourage innovation.

Intellectual property rights

High-quality intellectual property rights (IPR) are an increasingly important framework condition. The rise of KBC is shifting IPRs from a largely technical area that is important to a few sectors to an area with economy-wide prominence. Concerns are growing that not all facets of IPR are well suited to this more pervasive role and that some intellectual property regimes have not kept pace with technological change (many copyright systems were designed for a world of paper and print and may inhibit new digital services). In a world increasingly based on knowledge assets:

- IPR systems must be coupled with pro-competition policies and efficient judicial systems.

- Steps should be taken to address the erosion of patent quality (i.e. the accuracy of patent claims and whether patents reflect genuinely novel innovations). OECD data suggest that patent quality across the OECD area has eroded steadily over the last decade.

- There is a need for greater mutual recognition and compatibility across IPR systems internationally (for instance to permit cross-border copyright licensing). Better understanding is

needed of how firms combine different IPRs (not only patents, but also trademarks, design rights and copyrights) in their overall innovation strategies.

Capturing value in global value chains

The geographic fragmentation of production chains is a salient feature of the global economy. Investment in KBC plays an important role in global value chains (GVCs) and international competitiveness. The highest level of value creation in a GVC is often found in upstream activities such as concept development, R&D or the manufacture of key parts and components and in certain downstream activities such as marketing, branding or customer service. These activities all involve KBC and define the extent to which firms generate the value available through GVCs. *Getting policies and framework conditions right is important to ensure that high-value jobs are created and maintained in GVCs.* China, Brazil and other emerging economies are also making concerted efforts to help their businesses develop KBC.

Financial markets

In traditional debt markets, tangibles (assets such as equipment and structures) have well-defined market prices and readily serve as collateral. While there are innovations in the securitisation of debt using KBC, more could be done (for instance by facilitating robust markets for intellectual property). The increasing importance of KBC underscores the need for market-enhancing policy instruments to address shortfalls of early-stage risk capital that affect young KBC-intensive firms and the need for better ways for firms to communicate the value of KBC in their business models.

Corporate reporting

The value of many of the world's most successful companies resides almost entirely in their KBC. In 2011, for example, physical assets accounted for only about 13% of the value of Nestlé, the world's largest food company. Across countries, there is a positive correlation between the market value of firms and investment in KBC. Nevertheless, corporate financial reports provide limited information on companies' investments in KBC. This may hinder corporate finance and governance. Governments might: *i)* support better corporate disclosure by establishing voluntary recommendations and guidelines or by backing private-sector reporting initiatives; *ii)* create mechanisms to facilitate companies' reporting of investments in KBC; *iii)* introduce frameworks for auditors; *iv)* engage in international co-ordination to improve international comparability of data and information supplied by companies; and *v)* promote the establishment of asset classifications that would increase consistency in data collection and reporting.

Measurement

A fuller understanding of innovation and growth, and the design of better policy, require governments to do more to measure investments in KBC and to agree on common measurement guidelines. Current international accounting standards, such as the System of National Accounts, capture a number of KBC investments, such as software and R&D, but efforts to develop guidelines for robust and comparable measurement should continue. This will require significant investment in the statistics needed to measure reliably all the forms of KBC referred to in this report. In the short to medium term countries are encouraged to develop additional measures via satellite accounts to maintain the international comparability of GDP. This will help to improve understanding of growth and productivity. As an indication of the potential impact of better measurement, accumulated investments in KBC (not measured in GDP) amounted to around USD 4.1 trillion in the United States in 2007. In fact, around 40% of growth is still an unexplained "residual", and better measurement of KBC can help fill a part of this gap.

Using data as an economic asset

Creating economic value from large data sets is at the leading edge of business innovation, while companies that base key decisions on data analytics outperform other firms. While there is no clearly optimal policy in this fast-evolving field, it is evident that to unlock major economic benefits all OECD governments must do more to implement coherent policies in the fields of privacy protection, open data access, information and communications technology (ICT) infrastructure and ICT-related skills.

Education and training

Growing business investment in KBC amplifies the importance of getting human capital policies right. Human capital is the foundation of KBC: software, for example, is essentially an expression of human expertise translated into code. The rapid evolution of different parts of the KBC-intensive economy inevitably generates skills shortages. Research in the United States suggests a shortfall of some 1.5 million managers and analysts with adequate understanding of the business benefits of data. The NSG-KBC project highlights the importance of policies to balance skills supply and demand efficiently (as elaborated in the OECD Skills Strategy). Public-private partnerships can also help to better align curricula and programmes with the needs of business. And given highly constrained public finances, in countries where educational attainment is already high, efforts to improve the quality of education will often be a priority.

The rise of KBC has profound implications for employment and earnings inequality. A KBC-based economy rewards skills and those who perform non-routine manual and cognitive tasks, but may also reward investors (who ultimately own much of the KBC) over workers (in the United States, for instance, wages as a share of GDP are at an all-time low). Rising investment in KBC can create winner-takes-all opportunities for a few, while entire occupational categories can be replaced by machines and software. KBC changes the demand for skills, and to the extent that workforce skills can adjust rapidly to new technologies, aggregate growth will be enhanced without greatly exacerbating income inequality. Major societal challenges will certainly arise as driverless vehicles, machine-based X-ray diagnostics, automated report-writing, and many similar advances in digital technology become widespread.

NOTES

1 C. Corrado, C. Hulten and D. Sichel (2006), "Intangible Capital and Economic Growth," Federal Reserve Board Discussion Series 2006-24, available at: www.federalreserve.gov/pubs/feds/2006/200624/200624pap.pdf; Leonard Nakamura (2008), "Intangible Assets and National Income Accounting," Federal Reserve Bank of Philadelphia Working Paper No. 08-23, available at: http://philadelphiafed.org/research-and-data/publications/working-papers/2008/wp08-23.pdf; C. Corrado, C. Hulten and D. Sichel (2009), "Intangible Capital and U.S. Economic Growth", Review of Income and Wealth, Series 55, No.3, September, available at: www.conference-board.org/pdf_free/IntangibleCapital_USEconomy.pdf.

2 Note that non-exclusive frameworks like open source and public domain are also important for creativity and innovation because they provide a common ground on which creativity and innovation – using private or exclusive rights – can flourish. For example, the publication policies of firms like IBM show how publication to prevent patenting can be used successfully to establish technology standards which customers and others can use. Research commissioned by the UK's Intellectual Property Office (www.create.ac.uk/blog/2014/12/10/create-event-reflects-on-value-of-the-public-domain/) shows how the use of public domain creative material raises the commercial attractiveness of investment in new creative work. Non-exclusive frameworks complement, rather than compete with, IP rights.

3 See www.oecd.org/general/ministerialcouncilmeeting2012-chairssummary.htm; www.oecd.org/mcm/chairssummary-oecdministerialcouncilmeetingmcm29-30may2013-itsallaboutpeoplejobsequalityandtrust.htm; and www.oecd.org/mcm/mcm-2014-chair-summary.htm.

4 See www.oecd.org/mcm/C-MIN(2013)1-ENG.pdf; and www.oecd.org/about/secretary-general/MCM-2014-Strategic-Orientations-SG.pdf.

5 In some countries, creative expression created by producers of sound recordings as well as performers are protected under "related rights" or "neighbouring rights" regimes in national copyright laws, but they are considered part of the copyright "community".

6 Many countries do not define trade secrets expressly as IP, even though they are covered under the TRIPS Agreement (Agreement on Trade-Related Aspects of Intellectual Property Rights, the first international agreement to protect trade secrets expressly). Most countries protect trade secrets under a civil statute, while a growing number also provide supplementary protection under criminal law. In common law countries, the protection of trade secrets was founded on common law court decisions and precedent about agreements between employers and workers or between business partners. See Chapter 3, Approaches to the Protection of Trade Secrets.

7 This should not be interpreted as suggesting that the effects of ICT development on KBC, including IP, are limited to ICT industries themselves. ICT development is facilitating KBC in many other areas of the economy, as well, like banking, agriculture, and scientific research.

8 *See, e.g.* OECD (2013*a*), p. 50 ("Recent decades have seen a trend for countries to strengthen patenting regimes in favour of patent holders."); Chapter 4 of this Report (showing that trade secrets protection has grown stronger in both OECD and non-OECD countries over the past 25 years); Chapter 5 of this Report (see in particular country studies of Australia, Canada, Japan, and Korea); Sell (2003), at p. 63 (noting that "Over time, the scope of subject matter eligible for copyright protection has broadened considerably" and

that, for example, "[u]nder TRIPS computer programs are protected as 'literary works'" and that "[w]hile some users of copyrighted information have protested this expansion of copyright, the recent trend has been to protect more rather than less."); International Trademark Association Factsheet, "Types of Protection: Nontraditional Trademarks" ("Traditionally, a mark will consist of a word, logo, or a combination of both... However, over time other elements besides words, logos or graphic designs have served to identify the source of goods or services, thus serving the function of marks. These are called nontraditional marks."), available at www.inta.org/TrademarkBasics/FactSheets/Pages/NontraditionalTrademarksFactSheet.aspx; *see also* Copyright Term Extension Act of 1998 (amending 17 U.S.C. §§ 108, 203(a)(2), 301(c), 302, 303, 304(c)(2) to extend copyright term in the United States from life of the author plus 50 years to life of the author plus 70 years); Directive 2011/77/EU (extending the term of copyright protection for performers and sound recordings to 70 years in the EU); WIPO Copyright Treaty and WIPO Performances and Phonogram Treaty (also known as the WIPO "Internet Treaties," these treaties entered into force in 2002 and "update and supplement the major existing WIPO treaties on copyright and related rights, primarily in order to respond to developments in technology and in the marketplace" (www.wipo.int/copyright/en/activities/internet_treaties.html) by adding anticircumvention protection, protection against tampering with rights management information, a communication to the public/making available right, and by harmonising performers' rights – changes that the International Intellectual Property Alliance describes as requiring signatories to "upgrade their copyright laws" (www.iipa.com/wipo_treaties.html)); Gilson & LaLonde (2005). Of course, not every development has moved in the same direction. For example, the United States Supreme Court recently held that an abstract idea does not become patent-eligible merely because someone implements it through a generic computer. *Alice Corp. v. CLS Bank International*, 573 U.S. ___ (2014). Although the opinion does not mention the word "software," it is expected to restrict patent rights for software. See Graham (2014) (quoting Professor Mark Lemley: "I expect that holding to invalidate the majority of all [U.S.] software patents in force today."), available at www.law.com/sites/articles/2014/06/19/cls-bank-ruling-a-big-deal-for-valley-software-patents/.

9 See CISAC (2014), at 57-58 (indices of creativity correlated with the strength of national IP system); but see Hargreaves (2011), at 19, ("Economic evidence is clear that the likely deadweight loss to the economy exceeds any additional incentivising effect which might result from the extension of copyright term beyond its present levels.").

10 Big data also raises concerns about potential effects on employment and about the need to improve skills in the work force, as well as about trust (an umbrella term that includes privacy, cybersecurity, and consumer protection), which are discussed in detail in Chapters 5 and 6 of the other main phase 2 report, *Data-Driven Innovation for Growth and Well-Being*.

11 That there is a real possibility that IP policies in OECD countries do not always succeed in striking such a balance is suggested by a number of recent legal reforms and government or government-sponsored studies that address the balance. See, e.g., Canada's Copyright Modernization Act 2012, which enacted amendments whose rationale was both to strengthen the ability of copyright owners to control the uses of their online works and to improve the copyright law's ability to spur creation and innovation and to support new business models in the digital age. As noted in Chapter 5 of this Report, discussants at public consultations on copyright modernisation in Canada were asked what sorts of copyright reforms would best foster innovation and creativity. *See also* Van Der Noll, et al. (2013) (an economic study on flexible copyright commissioned by the Dutch Ministry of Economic Affairs, Agriculture and Innovation); European Commission (2014) (Expert Group's report on text and data mining); Hargreaves (2011); Chapters 7 and 8 of this Report.

12 Open access commonly refers to efforts to make the outputs of publicly funded research more widely accessible in digital format to the scientific community, the business sector, and society in general. See Chapter 7.

[13] Partitioning strategies involve subdividing one (sometimes major) innovation into pieces and seeking to patent them as separate inventions. (Giarratana & Fosfuri, 2007).

[14] Patent congestion is a term that essentially means an overload of patent applications that results in less rigorous patent examinations. (Caillaud & Duchêne, 2011).

[15] Specifically, CEO Elon Musk announced that Tesla "will not initiate patent lawsuits against anyone who, in good faith, wants to use our technology." Finley (2014) (noting that Tesla CEO Elon Musk's "stance underscores the sentiment–widely held in Silicon Valley–that today's technology moves too fast for the U.S. patent system"). Musk added that Tesla will continue to file for patents, but when they are granted, Tesla will "put them into what is essentially an open source category". Ibid.

[16] Examples of digital copyright exchanges include the Copyright Hub in the United Kingdom and SIPX in the United States.

[17] Given the multitude of IP policy challenges that are in need of attention and that many, if not all, of them are complex, they could not all be adequately addressed in one project. This report, therefore, is not an attempt to do that. Instead, it is an effort to make progress in certain key areas. A list of challenges that are not addressed here and that remain ripe for further study is presented near the end of this chapter.

[18] Here "society" is intended to mean society in an economy-wide sense, not consumers alone, so the societal benefits we focus on are factors like innovation, productivity, and GDP growth. Also, the exchange concept is weaker with respect to copyright than patents, but there is still a give and take in the sense that copyright protection eventually expires and certain exceptions apply to it, but copyright also provides a stronger incentive to create and disseminate content.

[19] The summary of the Workshop reflects the information exchanged among the parties at that event. The views presented at the Workshop and reflected in the summary are the experts' own and do not necessarily represent the views of the OECD or any of its Member countries.

[20] Pallante (2013) (also noting that "authors do not have effective protections, good faith businesses do not have clear roadmaps, courts do not have sufficient direction, and consumers and other private citizens are increasingly frustrated" and that "Congress should approach the issues comprehensively over the next few years as part of a more general revision of the statute).

[21] Robert Goodlatte, interviewed by Tamlin Basin in Patent, Trademark & Copyright Law Daily, "Copyright Review Process Will Continue into 2015; Education and Circumvention Will Be Next Issues Examined" (August 20, 2014), available at www.bna.com/copyright-review-process-n17179894026/; *see also* http://judiciary.house.gov/news/2013/04242013_2.html (in which Chairman Goodlatte acknowledges that "[t]here is little doubt that our copyright system faces new challenges today" due to digitisation and the Internet).

[22] Commissioner Oettinger (Oettinger, 2015) stated: "The other sector we have to look at is copyright. In a digital era, copyright legislation need[s] to be adapted, which will not be easy. On the one hand, we have to preserve and foster our European culture and therefore protect the intellectual property. On the other hand, there is an internet community which has other interests. In our reform we therefore . . . need to find a reasonable balance between the rights of the producer, creator and users."

[23] United States Department of Commerce Internet Policy Task Force (2013), p. iii. The report further explains that "[i]t is time to assess whether the current balance of rights, exceptions and responsibilities – crafted, for the most part, before the rapid advances in computing and networking of the past two decades – is still working for creators, rights holders, service providers, and consumers. The Internet must continue to support a legitimate market for copyrighted works as well as provide a platform for innovation and the introduction of new and dynamic services that drive digital commerce." Ibid.

[24] Copyright Modernization Act, S.C. 2012, c.20, available at http://laws-lois.justice.gc.ca/eng/annualstatutes/2012_20/FullText.html.

[25] As a result of the work on the other main pillar of phase 2, which is the report entitled "Data-Driven Innovation – Unleashing Data for Growth and Well-Being", we will propose to develop an OECD Council Recommendation on open access to data in collaboration with CSTP and GOV that would merge other open data-related OECD Council Recommendations, in particular the OECD (2008) *Council Recommendation on Enhanced Access and More Effective Use of Public Sector Information* developed by CDEP in 2008 and the OECD *Principles and Guidelines for Access to Research Data from Public Funding* developed by the CSTP in 2005.

[26] An "IP system", as the term is used in this report, is the law and policy framework that governs IP rights. "Effectiveness" refers to how well the IP system promotes technological and artistic creation and diffusion, as well as innovation.

[27] The 12 jurisdictions studied in Chapter 5 are Australia, Canada, Chile, Egypt, the European Union, Italy, Japan, Korea, Poland, Switzerland, the United Kingdom, and the United States.

[28] The copyright-intensive industries are defined separately for each of the 12 jurisdictions studied, using a methodology developed by WIPO (2003). In some cases that methodology was subsequently refined and the updated methodologies are discussed in Chapter 5, as well. The original WIPO study identified nine core copyright-intensive industries: press and literature; music, theatrical productions, and operas; motion pictures and videos; radio and television programming; photography; software and databases; visual and graphic arts; advertising; and copyright collective management societies.

[29] Using value added and employment data for copyright intensive industries to measure copyright's economic importance is a rough approximation. It is an overestimate because it gives copyright the credit for all of the economic activity in these industries. On the other hand, it is an underestimate because it assigns no value to the non-economic (cultural) contributions made by copyrighted works, nor does it capture the innovation that copyright enables.

[30] The analysed period varies from country to country, but only the timeframes for Egypt and Japan do not include the 2008 financial crisis or the years that followed it.

[31] A handful of industries, however, reported greater patent effectiveness concerning product innovations. These included medical equipment, drugs, special purpose machinery, computers, and automobile parts. Ibid at 10 and Tables 1.1 and 1.2.

[32] The number of patents granted annually around the world tripled from about 400,000 in 1995 to almost 1.2 million in 2012 (WIPO, 2013, p. 48, Figure A.1.2.1).

[33] See, e.g., (Eaton, et al., 2004) at 48 (concluding that almost two-thirds of the roughly six percent annual growth in European patents between 1991 and 2000 was caused by a decline in EPO application fees); (Bessen & Hunt, 2004) (contending that US manufacturing firms were adding software patents to their portfolios not as a result of more innovation but simply because software had become patentable and the firms were using them to intimidate potential entrants, make competitors pay royalties, and defend themselves from infringement lawsuits); (Hall & Ziedonis, 2001) (finding that the doubling of patenting rates over a decade in the semiconductor field reflected firms' desire to bulk up their patent portfolios in order to blunt innovation-blocking strategies by rivals that owned other technologies necessary for making semiconductor chips).

[34] See, e.g., Merges (1999); National Academy of Sciences (2004) at 41-49. Consider the comments of an executive from Texas Instruments, as well: "TI has something like 8000 patents in the United States that are active patents, and for us to know what's in that portfolio, we think, is just a mind-boggling, budget-busting exercise to try to figure that out with any degree of accuracy at all." Testimony of Frederick

Telecky, US FTC/DOJ Hearings on Competition and Intellectual Property Law and Policy in the Knowledge-Based Economy (28 February 2002), available at www.ftc.gov/opp/intellect/020228ftc.pdf (quoted in Kahin (2004) at 211). If a company with the resources of Texas Instruments cannot afford to determine what it has in its own patent portfolio, one can imagine how hard it could be for small potential entrants to determine their risk of triggering a patent infringement lawsuit; *but see* Walsh, et al. (2003) at 285 (finding that threats of patent infringement are not deterring much biomedical research, if any at all).

35 Lemley (2008) (the quotation is from the abstract of the online version of the article, available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=999961&download=yes).

36 Jaumotte & Pain (2005) at 49 (finding that an increase of one unit in their model's IPR index was associated with an increase of just over five percent in R&D spending but was also estimated to raise the total number of patents by over 30 percent).

37 Please note that Chapter 2 refers to the technological and economic value of patented inventions as "patent quality." However, the term "patent quality" can also mean other things, such as the likelihood that a patent will survive a validity challenge in court. That is a different concept. To avoid confusion, the Synthesis chapter refers to "technological and economic value" instead of "quality".

38 The data are based only on patents granted by EPO; they do not include patents granted by national patent offices. The analysis therefore allows no performance comparison of various patent offices.

39 See Chapter 2, Measuring the Technological and Economic Value of Patents. The downward trend in technical and economic value can be seen in the composite index charts between the years 1990 and 2004, as well as in the charts that break the index down by technology fields and countries from 1994 to 2004. Data beyond 2004, though shown in the composite index charts, is unreliable because it suffers from a timeliness problem. That is due to the five-year citation window used to compile the data. In other words, after 2004 there is a reduced number of observations, which prevents a reliable measure.

40 This definition uses four components: the number of forward citations (up to 5 years after publication); patent family size; number of claims; and the patent generality index. Only granted patents are covered by the index.

41 *Note for Israel* - The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities or third party. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

It should be noted that statistical data on Israeli patents and trademarks are supplied by the patent and trademark offices of the relevant countries.

42 The letter, dated 26 September 2013, is available at: http://graphics8.nytimes.com/packages/pdf/business/26trolls-letter.pdf.

43 See Kitch (1980) (arguing that the greater appropriability comes about due to a decrease in the risk of theft); Friedman, et al. (1991) (attributing greater appropriability to lower costs of protection where trade secret laws are clear and enforcement is effective).

44 The sample is expanded to 37 countries and a 25-year range (1985-2010).

45 Please note that, like virtually all indicators, the TSPI is not without certain limitations, which are acknowledged in Chapters 3 and 4. The TSPI captures stringency of protection only for those elements that are expressly described in Chapters 3 and 4. Although there is a positive association of those aspects with key indicators of economic performance and it appears fairly robust, that does not mean that all of the possible complexities of the relationship were captured or that conclusions can be extended to other aspects not covered in this Report. Instead, the chapters present an indication that protection for the TSPI-covered

elements of trade secrets appears to be positively associated with the areas of economic performance considered in the chapters (selected innovation and international economic indicators).

46 For example, in the United Kingdom, the legal protection afforded to Registered Designs lasts up to 25 years and applies to both two and three dimensional designs, whereas the protection granted to unregistered Design Rights expires sooner and applies only to three dimensional designs.

47 Different jurisdictions use different terms for registered designs, such as registered community designs, design models, design patents, and industrial designs. However, regardless of the terminology used, a design must be new and distinctive to be protected under the applicable law.

48 Note that OHIM began to accept filings for design rights in 2002, so these figures show the early phases of the OHIM protection regime. Some of the increase in applications and the stock of registered designs over the time period shown may reflect the initial novelty and subsequent maturation of the OHIM regime rather than an increase in design activity.

49 Incidentally, the same study found that copyright and trademark protection were used by more firms (26% and 12%, respectively), while only 3% used patents.

50 *See also* Hertenstein, et al. (2005) (finding that "good industrial design is related to corporate financial performance and stock market performance").

51 Hargreaves (2011) at 73 ("we have not found either a figure for the prevalence and impact of piracy worldwide or for the UK in which we can place our confidence"); U.S. Department of Commerce, 2013, at 39 (noting that "copyright infringement over the Internet has proven difficult to quantify"); see also OECD (2008) and Stryszowski (2009).

52 IFPI's "Global Statistics: Facts and Stats" web page, at www.ifpi.org/facts-and-stats.php (last visited 26 September 2014); *see also* IFPI (2014).

53 Ibid.

54 Such laws have been enacted in Germany and Spain, are pending in Israel, and have been proposed in France.

55 Congreso de Los Deputados, Proyectos de Ley 121/000081 Art. 32.2 (21 de febrero de 2014), p. 8; Chappell (2014).

56 Data as of April 2014. See New York Times, "How the Recession Reshaped the Economy, in 255 Charts," 5 June 2014, available at www.nytimes.com/interactive/2014/06/05/upshot/how-the-recession-reshaped-the-economy-in-255-charts.html. Data come from the United States Bureau of Labor Statistics' Current Employment Statistics program.

57 Copyright virtually always applies to publications, but not necessarily to research data, because the latter typically lack the element of originality that is essential for copyright protection. In the European Union, Japan, and South Korea, however, *sui generis* database rights also exist and can apply to research data.

58 Those outputs include articles, monographs, raw data, metadata, digital representations of pictorial and graphical materials and scholarly multimedia material (see Chapter 7 of this Report).

59 See Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (October 2003), available at: http://oa.mpg.de/lang/en-uk/berlin-prozess/berliner-erklarung/.

60 *See* www.whitehouse.gov/sites/default/files/microsites/ostp/ostp_public_access_memo_2013.pdf.

61 *See* https://creativecommons.org/licenses/by/4.0/.

62 More information on product access and usage limitations can be found in the Committee on Consumer Policy's 2013 analytic report *Protecting and Empowering Consumers in the Purchase of Digital Content Products* OECD (2013d).

63 *See* Pallante (2013) at 5 ("[T]he public is very confused. Many of you have told me that your constituents have no idea what to do with copyright, whether they are teachers, private citizens in their homes, higher education institutions"); *see also* www.consumerfocus.org.uk/policy-research/digital-communications/copyright.

64 The Federal Trade Commission held a series of hearings in 2008-09 that addressed these and many other issues related to the notice provided in patents. See Federal Trade Commission (2011) at p. 15 ("The ability of third parties to foresee evolving claims depends on the extent to which the specification provides effective notice of the range of claims that ultimately might issue. The disclosure requirements of [35 U.S.C.] Section 112 (written description and enablement) provide protection against undue broadening of claims through additions and amendments. Panelists from the IT industry expressed concern about how well these protections allow them to foresee claims that might issue. One reason is the perceived lax enforcement of the Section 112 requirements for IT patents."); ibid at 110 & n.230 ("One concern raised repeatedly during the hearings was that claims frequently use terms with no apparent definition or explanation in the specification. Clarity would be added, and notice improved, if applicants were pressed to include definitions or contextual explanations of key terms. . . . [T]he PTO's just-issued Supplementary Examination Guidelines take a substantial step in this direction" (citing 76 Federal Register at 7,166, which encourages applicants to use glossaries as a best practice in patent application preparation)); ibid at 128 ("The lack of a common, predictable terminology, already identified as a concern affecting patent clarity, particularly in IT, also undermines effective patent searching. Panelists noted that variation in the terms used to describe inventions can limit the effectiveness of electronic database searches and called for 'taxonomical advances' to better represent the 'intellectual space' to be searched."); see also National Academy of Sciences (2004) at p. 63 ("While alternative means of technological diffusion . . . are exceedingly robust, some features of the legal system make a patent a less than ideal vehicle for communicating technical information in a timely way despite the requirement that it be written to enable a person of ordinary skill in the art to practice the invention. First, a patent is written by an attorney or a patent agent to persuade an examiner to grant and a court to uphold a property right of the desired scope. Beyond the minimum disclosure required by the patent statute, the applicant has no incentive to disclose information that would be useful to a potential competitor...").

65 Incidentally, such efforts also improve the patent examination process. By linking their databases, patent offices can improve the prior art searches that take place during their examinations. More thorough searches lead to higher quality patents (in the sense that the patents are more likely to withstand legal challenges to their validity).

66 Not all patentable KBC could be protected as a trade secret, and not all KBC that could be protected by trade secrets would be patentable. However, some KBC could be protected by either one. In referring to a choice between patents and trade secrets here, we are referring only to situations where the nature of the KBC makes such a choice possible. Sometimes the nature of the asset provides a clear indication that there is only one type of appropriate protection. Patents generally offer protection for technological inventions that are useful, novel and non-obvious. Trade secret protection is generally available for a broad range of commercial information that is useful and not widely known, but it need not be novel. The broad scope covers subject matter that may not be patentable such as know-how.

67 Arundel, 2001 (finding that European firms, especially smaller ones, tended to prefer trade secrets protection to patent protection); Cohen, et al., 2000 (reaching similar conclusions based on a survey of US firms).

[68] Patents and trade secret laws provide different ways of protecting KBC. Not all patentable KBC could be protected as a trade secret, and vice-versa. However, some KBC could be protected by either one (though never both) and the inventor's choice will affect the degree of knowledge diffusion that accrues to society.

[69] These figures differ slightly from those reported in the Entrepreneurship and Business Development section of the Annex to this chapter because the Annex refers to a different (slightly smaller) sample of countries.

[70] See www.whitehouse.gov/the-press-office/2013/06/04/fact-sheet-white-house-task-force-high-tech-patent-issues.

[71] See www.copyrighthub.co.uk and www.ip-marketplace.org.

[72] See National Research Council of the National Academies (2013) (describing a wide range of copyright questions, calling for greater investment in data collection and suggesting approaches that would facilitate it, with the objective of enabling better empirical research to inform decisions about the copyright system in the digital age).

[73] Please note that this work on patent *system* quality is quite different from the work in Chapter 2 of this report, which is about the technological and economic value of *individual* patents and patent portfolios. The term "patent system" here refers to the legal and policy regime that governs the way patents are awarded, used, and enforced in a jurisdiction.

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