Comparative Study of Patent Protection for Computer Software in a Sino-EU-US Context

Jon Uotila, 89701

Law and Information Society

Faculty of Law

Turku University

06/2019

The originality of this thesis has been checked in accordance with the University of Turku quality assurance system using the Turnitin OriginalityCheck service.

Tiivistelmä

TURUN YLIOPISTO
Oikeustieteellinen tiedekunta
TEKIJÄN NIMI: Jon Uotila
Comparative Study of Patent Protection for Computer Software in a Sino-EU-US Context
Tutkielma, 76 s.
Immateriaalioikeus
06/2019
Turun yliopiston laatujärjestelmän mukaisesti tämän julkaisun alkuperäisyys on tarkastettu Turnitin Originality Check -järjestelmällä.

Patentit toimivat instrumentteina, jotka tarjoavat omistajalleen monopoliaseman patentoidusta keksinnöstä päättämiseen. Tämän vuoksi patentteja ollaankin usein julkisesti kritisoitu yhteiskunnan edun vastaiseen kehitykseen vaikuttamisesta keksintöjen avointa jakamista rajoittamalla. Tietyn alan standarditeknologian patentinhaltija voi esimerkiksi hidastaa tai täysin pysäyttää standardisointiprosessin näin halutessaan. Tietokoneohjelmistot ovat keskeinen osa patenttien tarjoamasta suojasta keskusteltaessa, sillä alan kehitys on äärimmäisen nopeaa ja näin myös patenttisuojan rajaamisesta tulee hankalaa.

Tämän tutkielman tarkoituksena on syventyä ohjelmistopatenttien hakuprosessissa ja suojassa oleviin eroihin eri lainsäädännöissä. Ohjelmistopatentit suojaavat ohjelmistoja loukkauksilta, mutta globaalilla tasolla edes termiä ohjelmistopatentti ei olla yhteisesti määritelty.

Keskeiseksi tutkimuskysymykseksi tässä tutkielmassa muodostui ohjelmistopatenttien vaatimusten ja suojan vertailu Euroopan unionin, Yhdysvaltojen ja Kiinan välillä. Nämä kolme oikeusjärjestelmää valikoituvat tutkimuskohteiksi niiden koon ja merkityksen takia , sekä yleisinä markkina-alueina että ohjelmistomarkkinoiden osalta. Myös tekijänoikeussuojaa tullaan osiltaan käsittelemään suojamuotona, joka edelsi patenttisuojaa ohjelmistojen pääasiallisena suojana.

Tutkielma tulee keskittymään jokaiseen oikeusjärjestelmään ensin yksitellen, jonka jälkeen järjestelmien välisiä eroja ja samankaltaisuuksia tuodaan esille. Oikeusjärjestelmiä vertaillaan, jotta samankaltaiset ja erilaiset piirteet voidaan tunnistaa ja käyttää niitä keskustelussa patenttijärjestelmän kehityksestä.

Ohjelmistopatentit ovat selkeästi patenttioikeuden eniten huomiota saavien aiheiden joukossa, sillä ne koetaan osiltaan liian laajoina, johtavat moniin patenttipeikkojen alullepanimiin oikeustapauksiin, sallivat keksinnön julkistamisen hyvin niukilta osin, eivätkä ylipäänsä ole patenttisuojan arvoisia. Vuosien saatossa ohjelmistopatentteja koskevia ongelmia ollaan yritetty ratkoa monin eri konstein, mutta mikään ei vielä ole osoittautunut kovin pitkäikäiseksi. Ratkaisuehdotuksia ja näkemyksiä ollaan nopealssa tahdissa sekä hyväksytty että hylätty ympäri maailmaa.

Abstract

TURKU UNIVERSITY
Faculty of Law
Jon Uotila
Comparative Study of Patent Protection for Computer Software in a Sino-EU-US Context
Master's Thesis, 76 pages
Law and Information Society
06/2019
The originality of this thesis has been checked in accordance with the University of Turku quality assurance system using the Turnitin OriginalityCheck service.

A patent basically gives its holder monopoly for the patented subject matter, which is why strong patent rights often are criticized for conflicting with the open and free standards that benefit the public. Only by being the holder of one crucial patent within a standard technology, the holder is in a position to slow down or even fully stop the standardization process. The fast progress of computer technology makes defining the scope of the protection the law should afford computer programs quite difficult.

The purpose of this thesis is to examine how the application process, and intellectual property right protection for software patents differ in different legal systems. Software patents provide protection for the software, but globally there is no one legal definition of a software patent. This means that the first thing to establish, is how a software patent is defined in different legal systems, after which this thesis will move on to consider the actual main research question of the thesis.

The main question that will be considered in this thesis is how the protection a software patent provides differs between selected legal systems? The selected legal systems, i.e. the territorial scope of this paper will include the USA, the EU, and China. These three legal systems were chosen because of their substantial size and importance both as general markets, but even more importantly as highly competitive markets for software. Some attention will also be paid to copyright, as the form of intellectual property protection that preceded patents as the primary protection form for software.

The thesis will examine the protection each legal system offers individually, but the overarching issue regarding this thesis will be a comparison between the legal systems. The legal systems will be compared to each other, in order to identify their common and unique characteristics, ending up in a discussion for an ideal legal system, consisting of the best parts from the legal systems, in the view of the patent holder and society as a whole.

Business methods and software are among the most debated subjects within patent law, because these areas are considered far too broad in scope, the reason behind many "patent troll" lawsuits, doubtful to conquer the prior art requirement because of loose disclosure requirements, and in general not worthy of patent protection. During the years, solutions to the supposed problems of business method and software patents have been short lived. Solution proposals and approaches have been accepted and rejected at a fast rate globally.

Contents

References

Articles, Books, and Websites

Aalto-Setälä, Minna, Sundman, Christoffer, Tuominen, Markku & Uhlbäck, Asta: IPR käytännönläheisesti, 2016

Ahmad, Saghir: Legal Protection for Computer Programmes in EU, US and Pakistan: Software Piracy as a Challenge in Pakistan, University of Oslo, 2008

Alijabre, Abdulaziz: Understanding Software Piracy in Saudi Arabia and the Need for Change, Journal of Emerging Trends in Computing and Information Sciences, Vol. 3, No.11, 2012, pp. 1516-1520

Arena, Amedeo, Bergmann, Bettina & Himes, Jay L.: Two Bodies of Law Separated by a Common Mission: Unilateral Conduct by Dominant Firms at the IP/Antitrust Intersection in the EU and the US, European Competition Journal Vol. 9 No. 3, 2013, pp. 623-675

Arezzo, Emanuela & Ghidini, Gustavo: Biotechnology and Software Patent Law - A Comparative Review of New Developments, 2011

Association of the Bar of the City of New York, https://www.nycbar.org/member-and-career-services/committees/reports-listing/reports/detail/formal-opinion-2019-1-defining-ex-parte-proceeding-under-rule-33d, visited 15.5.2019

Bach, Joseph: Strategies for IP Protection in China, 2009

Ballardini, Rosa Maria: Intellectual Property Protection for Computer Programs – Developments, Challenges, and Pressures for Change, 2012

Ballardini, Rosa Maria: Some Lessons from In Re Bilski, Nordiskt Immateriellt Rättskydd NIR 2009/4

Boyle, James & Jenkins, Jennifer: Intellectual Property: Law and the Information Society – Cases and Materials, 2nd edition, 2015

Burk, Dan L.: The Inventive Concept in Alice Corp. v. CLS Bank Int'l, IIC, 2014, 45

Burk, Dan & Lemley, Mark: Policy Levers in Patent Law, Virginia Law Review, Volume 89, November 2003, Number 7

Chalecki, Jason, Gupta, Anoop, Kong, Dave, Li, John & Lin, Jerry H.: Applicability of Patent Protection to SW Inventions, 2004

Closa, Daniel, Gardiner, Alex, Giemsa, Falk & Machek, Jörg, Patent Law for Computer Scientists - Steps to Protect Computer-Implemented Inventions, 2010

Cohen, Julie E. & Lemley, Mark A.: Patent Scope and Innovation in the Software Industry, Vol. 89 No. 1 Calif. L. Rev., 2001

Guntersdorfer, Michael: Software Patent Law: United States and Europe Compared, 2003

European Patent Office, https://www.epo.org/law-practice/unitary/unitary-patent/start.html, visited on 14.6.2019

Hall, Bronwyn H.: Patents and Patent Policy, 2007, OxREP article

Hall, Bronwyn H.: The Global Nature of Intellectual Property: Discussion, 2001

Hall, Bronwyn H. & Ham Ziedonis, Rosemarie: The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semi-Conductor Industry, 1979–1995, The RAND Journal of Economics, February 2001

He, Guo: Patents, in Chinese Intellectual Property and Technology Laws, edited by Rohan Kariyawasam, 2011

Kizza, Joseph Migga: Ethics in Computing - A Concise Module, 2016

Lee, Nari & Zhang, Liguo: IIC, 48, 2017

Luginbuehl, Stefan & Ganea, Peter: Patent Law in Greater China, 2014

Marsnik, Susan J. & Thomas, Robert E.: Drawing a Line in the Patent Subject-Matter Sands: Does Europe Provide a Solution to the Software and Business Method Patent Problem?, Boston College International and Comparative Law Review, Volume 34, May 2011, Issue 2

Merges, Robert P. & Bian, Renjun: Software Patents after CLS Bank: US – China Comparison, 2014

Motohashi, Kazuyuki: Japan's Patent System and Business Innovation: Reassessing Pro-patent Policies, RIETI Discussion Paper Series 03-E-020, 2003

Mylly, Tuomas (red.): Immateriaalioikeudet kansainvälisessä kaupassa, Talentum Oyj, 2001

Mylly, Ulla-Maija: What ever happened to patent bargain? - Prospect theory and software patentability, NIR, Nordisk Immateriellt Rättsskydd, 5/2011

Raju KD: Interface between Competition law and Intellectual Property Rights: A Comparative Study of the US, EU and India. Intel Prop Rights Vol. 2, Issue 3, 2014

Samuelson, Pamela: Is Software Patentable?, 56 Comm. ACM 23, 2013

Samuelson, Pamela: Software Patents and the Metaphysics of Section 271 (f), 50 Comm. ACM 15, 2007

Samuelson, Pamela: Strategies for Discerning the Boundaries of Copyright and Patent Protections, 92 Notre Dame L. Rev. 1493, 2017

Sarvas, Risto & Soininen, Aura: Differences in European and U.S. Patent Regulation Affecting Wireless Standardization, 2002

Schwarz da Silva, J.: Future Internet Research: The EU framework, ACM SIGCOMM Computer Communication Review, Volume 37, Number 2, April 2007

Singh, Abhisek Kumar & Kashyap, Suryakant: Software Patentability: A Comparative Analysis, 2017, available online at: https://pdfs.semanticscholar.org/693e/b448fadca3fc8ae4949ff05a7d5e46252415.pdf

Thatcher, Matt E. & Pingry, David E.: Software Patents - The Good, the Bad, and the Messy, Communications of the ACM, October 2007, Vol. 50, No. 10

Tysver, Daniel A.: Why Protect Software Through Patents?, http://www.bitlaw.com/software-patent/why-patent.html

Virtanen, Perttu: Software Patents and "Technology Specific" exclusion in Article 52 (3) EPC. A Legal Chimera?, Nordiskt Immateriellt Rättsskydd 6/2013, pp. 620-632

WCT 1996 Article 4, https://wipolex.wipo.int/en/text/295157, visited on 8.1.2019

WIPO-Administered Treaties, https://www.wipo.int/treaties/en/ActResults.jsp?act_id=26, visited on 8.1.2019

World Intellectual Property Organization https://www.wipo.int/treaties/en/ip/berne/, visited on 8.1.2019

World Trade Organization (WTO), https://www.wto.org/english/docs_e/legal_e/27-trips_01_e.htm, visited on 8.1.2019

Cases

Alice Corp. v. CLS Bank International, 573 U.S. 208, 134 S. Ct. 2347 (2014)

Bilski v. Kappos, 561 U.S. 593 (2010)

Diamond v. Diehr, 450 U.S. 175 (1981)

Gottschalk v. Benson, 409 U.S. 63 (1972)

Parker v. Flook, 437 U.S. 584 (1978)

Oracle America, Inc. v. Google, Inc., 750 F.3d 1381, 750 F.3d 1376 (2018)

State Street Bank & Trust Co. v. Signature Financial Group, Inc., 149 F.3d 1368 (1998)

In re Alappat, 33 F.3d 1526; 31 U.S.P.Q.2d 1545 (1994)

Vicom T208/84, (1987)

Legislation, and Treaties

America Invents Act

Berne Convention for the Protection of Literary and Artistic Works

Chinese Patent Act

Digital Millennium Copyright Act (DMCA)

Directive 2001/29/EC (Copyright Directive)

European Patent Convention

Title 35 U.S.C. (US Patent Act)

The Agreement on Trade-Related Aspects of Intellectual Property Rights

WIPO Copyright Treaty

1. Introduction

1.1. Intellectual Property Rights in an Computer Environment

The Internet is a giant web of possibilities and opportunities, which at the same time is improving and constraining the wellbeing of individuals. On one hand, the Internet creates a massive amount of opportunities for economic growth, as well as better information flows. Simultaneously, governments and other stakeholders are at times working towards restricting access to information, as well as freedom of expression. The majority of countries have policies in place for protection against piracy, enforcement of intellectual property rights, protection of national security, and protection against hacking, among other things.[1]

Law and computer science have typically in the past been seen as unrelated and completely unrelated matters, however this contrast is no longer fitting. Especially, copyright law plays a big role in modern computer science. Computers and intellectual property are similarly not new concepts. As computers date back to Victorian England, the doctrine of copyright, for example, has its roots in the Tudor and Stuart eras in England. The more modern version of international copyright law was introduced for the Protection of Literary and Artistic Works, and ratified towards the end of the nineteenth century. The interconnection between computers, computer programs, and intellectual property is however comparatively new. Only since the introduction and massive expansion of the Internet and Internet related services, has the tension progressed from a more theoretical concern to widely affecting issue. Together with the growing popularity of and demand for computing technology, the amount of national and international regulations has also increased. One of most significant pieces of legislation in this category is the Digital Millennium Copyright Act, passed by the United States Congress in 1998. The fact that the Digital Millennium Copyright Act was established without criminalization of conduct neither necessary nor sufficient for copyright infringement, has stirred up a debate about it potentially ignoring the rights of the individual, to which the general public (and especially the computing masses) has become accustomed, and gives large media corporations, as copyright holders, exceptional power over copyrighted works.[2]

In a world, where the Internet has enabled quick returns for online products and inventions, also piracy in many forms is an ever growing problem, which costs companies a great deal in

[1] Aaronson, 2013, pp. 4
[2] Ahmad, 2008, pp. 1-2

lost revenue each year. All through the world, illegal copies of music, games, and software are sold both digitally and physically. When assessing the effects of software piracy alone, it costs the software industry millions of dollars. In several countries, it is considered quite unusual to purchase software legally, as downloading pirate software has become such a norm. Despite the huge amounts that the software industry as a whole loses each year due to software piracy, the losses are still not always considered a negative issue. Becoming a victim of software piracy might also have a positive side to it, as even the biggest companies within the industry have stated that even though software piracy has a negative effect on initial revenues, it also has the potential to create future customers for the companies. This effect comes from the fact that use of the software by the masses, no matter how it has been acquired, increase familiarity with the product and can eventually even make it a household name within the industry. The idea is that once the users become familiar with the product, or feel like they should use the product because everyone else is using it, they will eventually move away from piracy and start buying the software. It is unclear, whether or not this actually is the procedural development in such cases, and some have actually doubted that a user that previously has acquired the software without paying for it, would in the future choose to purchase the software.[3]

The legislation concerning intellectual property rights enables individuals to attain exclusive rights to their invention or creation, and to collect any monetary reward that the market would provide for that creation. Intellectual property rights such as these, make up the foundation for intangible ideas and concepts to produce tangible rewards to the right's holder. The intellectual property rights protect the interests of the rights' holder and can be enforced by governmental orders, the courts, and through the World Trade Organization's TRIPS (The Agreement on Trade-Related Aspects of Intellectual Property Rights) agreement. The WTO's TRIPS agreement consolidates the legal environments on an international level, and thus reduces trade barriers originating from different legislations. It also increases transparency between member states, as all members are required to publish their intellectual property laws, regulations, and decisions. On the other hand, law makers have not designed copyright laws with a proper understanding of how individuals actually would share such copyrighted material online. Both the US and the EU's approaches to online protection of intellectual property rights has caused

[3] Aljabre, 2012, pp. 1516

considerable disagreements between individuals and their governments, between companies and their customers, as well as between states with regards to trade relations.[4]

In December 1996, the international principles for implementation of copyright rules for online distribution of protected material were established. This was carried out at a diplomatic conference arranged by the World International Patent Organization, WIPO. The outcomes of the conference were international treaties concerning copyright in the new technological environment, i.e. the WCT (WIPO Copyright Treaty) and WPPT (WIPO Performance and Producer Treaty). In accordance with Article 8 of the WCT, the intellectual property right holder has the right to exclusively decide on the public distribution of his or her works, and also about making the works available for the public to use at the time and place of their choice.

In WCT Article 8, two issues are confirmed:

1. Making the protected works available for the public by any means of technology means making it available.
2. The term "public" in a digital environment means also private use in the homes of the users, when the work has been made available e.g. via the Internet.[5]

A patent basically gives its holder monopoly for the patented subject matter, which is why strong patent rights often are criticized for conflicting with the open and free standards that benefit the public. Only by being the holder of one crucial patent within a standard technology, the holder is in a position to slow down or even fully stop the standardization process. Patent policies formed by numerous standardization organizations have been put in place, in order to prevent this scenario.[6]

The fast progress of computer technology makes it difficult to define the scope of the protection the law should afford computer programs. Computer programs are significantly different from traditional literary works protected by copyright law, because computer programs include machine-like traits, are mainly functional in nature and often spread in a form that humans cannot read. In spite of these differences, computer programs receive protection under the copyright "umbrella" alongside e.g. literary and musical works of art. The most controversial issue in today's debate surrounding copyright of computer programs is whether or not it should be considered legal for competitors to reverse engineer a computer program, in order to discover and utilize its underlying ideas, interface specification, and protocols. A number

[4] Aaronson, 2013, pp. 12-13
[5] Mylly, 2001, pp. 97-98
[6] Sarvas & Soininen, 2002, pp. 1-2

of computer experts and legal scholars believe that the fair use doctrine's authorization to reverse engineering computer programs is a good thing for the development of new innovations. Others disagree, and instead consider that such replication always oversteps the rights of the copyright owner. This disagreement highlights the basic tension between the author's right to control his or her own work on one hand, and the public's right to access the ideas and functions of copyrighted work on the other hand.[7]

Also according to 2§ in the Finnish copyright law, the copyright holder has the exclusive right to govern about the copying of the work or making it otherwise publicly available. The law also categorizes transmitting of the work to a device, where the copyrighted work can be copied, as a form of copyright infringement. Such copyright infringements can for instance be uploading of a recording onto the Internet. By making the copyrighted work publicly available, the legislation means publicly displaying the copyrighted content, as well as all other forms of making the content available to the public. Special attention has been furthermore paid to transmitting the work to the public for resale, rental, or other distribution. These above mentioned ways of making the work available to the public are however mere examples, and thus do not constitute a list of all unlawful ways of infringement.[8]

Business methods and software are among the most debated subjects within patent law, because these areas are considered far too broad in scope, the reason behind many "patent troll" lawsuits, doubtful to conquer the prior art requirement because of loose disclosure requirements, and in general not worthy of patent protection. During the years, solutions to the supposed problems of business method and software patents have been short lived. Solution proposals and approaches have been accepted and rejected at a fast rate on both sides of the Atlantic Ocean.[9]

1.2. Background of the Topic

A patent holder is in a position to stop everyone else from producing, using, selling, or importing the protected invention. A patent that has been granted can be used for preventing others from taking advantage from an inventive part of a new computer program, or from utilizing the unique characteristics of a new website. When discussing the protection of intellectual property rights of software, a patent offers one type of protection, whereas copyright pro-

[7] Ahmad, 2008, pp. 2
[8] Mylly, 2001, pp. 99
[9] Marsnik & Thomas, 2011, pp. 228-229

tects the right's holder's interests in another manner. Copyright law can be used for preventing total copying of software, in addition to preventing partial copying of the software code (both of which are cases of "literal infringement"). As an addition to this, copyright does also provide some protection against cases of non-literal infringement, e.g. creation of "cloned" software. The basic principle of copyright law is that copyright only protects the expression of an idea, i.e. not the idea itself. As a consequence, copyright law does not prevent the creation of competing software that uses the same ideas as the protected original software. The end-result is that software patents provide much more extensive protection to the software creators than copyright law.[10]

The main intellectual property issue for most countries today is that IP laws are for the most parts nationally-based, whereas competition and innovation global are global to their character. The result of this is that rules and legislation is being carried out at separate level than where any potential problems take place. In this way, intellectual property policy is alike anti-trust or competition policies. The TRIPS agreement concerning patent harmonization is an attempt to manage the fact that competition within intellectual property policies is quite problematic of its nature: strengthening intellectual property in a nation will benefit only the country's own inventors by attracting more innovative activity, but if all countries would pursue the same advantages for their own, it would have a negative impact on global social welfare. This would happen in case the granted intellectual property protection is stronger than what would be needed for achieving an ideal level of invention.[11]

The issues become evident, if external factors that in the first place have lead a nation to change its intellectual property protection, mean that the policy's effects do not stop at the nation's borders. Nor are nations immune to similar policy changes in other nations. A nation with an extensive intellectual property policy in place has contributed to increasing the global incentives for innovation and any possible spillovers, while simultaneously reducing comparable incentives for innovative activities in other nations, by both attracting R&D to move within its borders and by increasing the costs of follow-on inventions in other nations.[12]

The overarching objective of the patent system is to create a profit-incentive for innovators, which goes beyond what is to be achieved through a free market. This incentive would support innovators in development of significant innovations that ultimately could benefit con-

[10] Tysver, 2015
[11] Hall, 2001, pp. 1
[12] Ibid, pp. 1-2

sumers and society as a whole. In order to reach this goal, policymakers should consider the following issues:

1. What is the aim of viable patent policies that will deliver innovators profit-incentives to applying for a patent?

2. Which of the policies within the target are good (or beneficial for society) and which are bad (or negative for society)?

3. Which of the policies within the target are optimal for society as a whole?

4. What issues within the process could end up hindering the policymaker from correctly identifying the right target and thus from finding a correct (or even just satisfactory) policy for the specific target?

Patent law calls for an innovation to be new, useful, and non-obvious to a person of normal skill within the field in question. When a patent has been granted, it gives the patent holder a scope of protection from imitation.[13]

1.3. Research Question

The purpose of this thesis is to examine how the application process, and intellectual property right protection for software patents differ in different legal systems. Software patents provide protection for the software, but globally there is no one legal definition of a software patent. This means that the first thing to establish, is how a software patent is defined in different legal systems, after which this thesis will move on to consider the actual main research question of the thesis.

The main question that will be considered in this thesis is how the protection a software patent provides differs between selected legal systems? The selected legal systems, i.e. the territorial scope of this paper will include the USA, the EU, and China. These three legal systems were chosen because of their substantial size and importance both as general markets, but even more importantly as highly competitive markets for software. Some attention will also be paid to copyright, as the form of intellectual property protection that preceded patents as the primary protection form for software.

[13] Thatcher & Pingry, 2007, pp. 47-48

The thesis will examine the protection each legal system offers individually, but the overarching issue regarding this thesis will be a comparison between the legal systems. The legal systems will be compared to each other, in order to identify their common and unique characteristics, ending up in a discussion for an ideal legal system, consisting of the best parts from the legal systems, in the view of the patent holder and society as a whole.

1.4. Research Methodology

The basic methodology used in this thesis will be a legal dogmatic one. As the software industry is a global industry that requires intellectual property rights protection across many jurisdictions, the thesis will contain a strong comparative element between the European, Chinese and the US legal regimes.

1.5. Definitions

1.5.1. Intellectual Property

Intellectual property roughly describes intangible things that someone can claim ownership for. Such intellectual property ownership of e.g. ideas, inventions, technologies, artworks, music, etc. can result in economic rewards, as it is a consequence of legal rights from activity in the industrial, scientific, literary, and artistic fields. Intellectual property rights are can be claimed by an individual or a group that have created, designed, or invented the activities or processes that have led to the source of the claim. These intellectual property rights, usually in the form of patents, trademarks, and copyright, protect the creators from infringement, and as such secure their moral rights, economic rights, as well as their rights to decide e.g. on the dissemination of the protected works.[14]

1.5.2 Computer Program

Computer programs and services are similar in the sense that both provide value to the customer, and both are intangible. For computer programs, this intangible character can display itself e.g. when a computer product is repaired or a computer network is installed or configured. Computer products can be quite easily defined, due to their tangible form. Also services can be defined with ease, as they provide a central value to the customers, even though they do not come in a tangible form. Software, however, is a category that cannot be classified as neither a product nor a service, and thus has the legal protection of software been a tricky issue. Software is in its essence a set of logical instructions for solving specific tasks. The in-

[14] Kizza, 2016, pp. 88

structions are performed in sequences that follow algorithms, and the development of such sequences go through the following phases:

1. Logic map: A general outline of the idea, process, or algorithm for solving the specific task. The outline is a flowchart, which includes the main components, i.e. input, output, processing, and decision, and the flow direction between them.
2. Source code: Source code is the set of rules that have been achieved by implementing the flowchart by using a programming language.
3. Object code: The object code is the following step, where the source code is turned into strings of zeros and ones by using a compiler or an assembler.
4. Memory-based executable code: When the object code is finished, it is transmitted to another system program, called a linker. The linker adds missing variable addresses and personal routines to the parts of the code, where they are missing, so that a load module can be produced. The loading is performed by another program called the loader, if execution is needed. Even though the software already has some value to both the producer and customer, it still lacks a tangible form.
5. Microcode: Microcode is also executable, but not loaded in physical memory. Instead it can be loaded on the computer's ROM or burned into the computer's hardware. If it has been burned into the hardware, it is very difficult to change and impossible to erase, and in this form, the program is called microcode.

When defining software, it is important to note that regardless of whether it is hardware or memory based, it has an intrinsic value at the execution stage to both the developer and the buyer, even though it may not have a tangible form.[15]

1.5.3. Patent

A patent is the legal right of an inventor to exclude others from imitating or using a particular invention. This right can also be called an "intellectual property right" and has been constructed to serve as an incentive for innovation.[16]

[15] Kizza, 2016, pp. 88-90
[16] Hall, 2007, pp. 1

2. International IP Protection and Protected Use of Software and Data

2.1. Copyright as the First Step in the Development of International IPR

The Berne Convention[17] for the Protection of Literary and Artistic Works was signed in Paris in 1896. It established in Article 1 "a Union for the protection of the rights of authors in their literary and artistic works"[18]. The signing parties agreed to a base level of protection of intellectual property, and since then, the Berne Convention provides an automatic protection of copyright.[19] The timeframe for protection granted for literary works is defined in Article 7(1) as it states that "The term of protection granted by this Convention shall be the life of the author and fifty years after his death[20]". The copyright holders of literary works are during the protection timeframe granted the exclusive right to make decisions about:

1. "authorising the reproduction of these works, in any manner or form[21]",
2. "authorising adaptations, arrangements and other alterations of their works[22]", and
3. authorising the cinematographic adaptation and reproduction, distribution, and public performance and communication to the public of these works[23]

As a treaty is an instrument of international law, and not national law, it generally becomes law only when it has been implemented domestically. With regards to intellectual property law, conventions are a very important source of legislation. For example, the Berne Convention has been widely implemented since its introduction in 1896, and reflects the minimum protection of international intellectual property rights. [24] Today, 185 countries are parties to the Paris Act of 1971 of the Berne Convention.[25]

The Berne Convention was last revised in the 1970's, i.e. before personal computers and the Internet became public commodities. Therefore, the definition of literary and artistic works in Article 2(1) does not explicitly include computer programs. Later treaties have made note of this problem, advocating that copyright holders of computer programs should benefit from the same protection by copyright law as copyright holders of literary works.[26] An example of

[17] World Intellectual Property Organization, visited on 8.1.2019
[18] Berne Convention, Article 1
[19] Ahmad, 2008, pp. 6-7
[20] Berne Convention, Article 7(1)
[21] Ibid, Article 9(1)
[22] Ibid, Article 12(1)
[23] Ibid, Article 14(1)
[24] Ahmad, 2008, pp. 7
[25] WIPO-Administered Treaties, visited on 8.1.2019
[26] Ahmad, 2008, pp. 11

such a treaty is the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), which is Annex 1C of the Marrakesh Agreement establishing the World Trade Organization.[27] With regards to computer software, the TRIPS agreement provides updated insights into how the Berne Convention should be interpreted, when stating that "Computer programs, whether in source or object code, shall be protected as literary works under the Berne Convention (1971)[28]".

The World Intellectual Property Organization Copyright Treaty from 1996 is another treaty, which similarly includes protection of computer programs into Article 2 of the Berne Convention, when stating that "Computer programs are protected as literary works within the meaning of Article 2 of the Berne Convention. Such protection applies to computer programs, whatever may be the mode or form of their expression."[29]

2.2. What Can Be Protected Through Patents?

Patents have come to serve an important role in society of today. If governed correctly, patents can have a positive impact for all parties involved. The characteristics of patents are that they provide incentives 1) to innovate and 2) to make the technological information publicly available. This can be seen as an agreement between the innovator and society. In the bargain the innovator receives a monopoly for the innovation for a set timeframe and in return society can benefit from increased innovative activity. For this reason, the requirement for the innovator to disclose the innovation has an important role in spreading the technological information in society. Furthermore, efficient spreading of technological information fosters technological competition and progress based on the patent information.[30] This is the ultimate goal when talking about software patents, and for achieving this goal, the legislation and interpretations need to be clear and transparent for everyone. The main problem hindering this transparency is, and has been, the vague conditions for patentability and interpretations of patentable subject matter.

In order for an inventor's patent claim to be successful, the invention has to be described, so that it is clearly demonstrated that:

[27] World Trade Organization (WTO), visited on 8.1.2019
[28] TRIPS Article 10(1)
[29] WCT 1996 Article 4, visited on 8.1.2019
[30] Mylly, 2011, pp. 444

- The invention has to include patentable subject matter, which differs between countries. For example at the EPO, the invention needs to include technical character, i.e. not only a description of an abstract idea.
- The invention has to be novel.
- The invention has to include an inventive step, which means that the invention has to technically contribute to the state of the art, in a manner non-obvious to anyone with some knowledge in the field.
- The invention can be used in an industrial process, i.e. it has to be applicable also in practice and not just in theoretical models.

In case the invention meets all the above criteria, the inventor is eligible for having the invention patented. If the patent is granted, the invention will be made public, and the patent will provide protection for a maximum of 20 years. When a patent has lapsed, anyone leveraged the patented invention without any special agreements or arrangements. But during the patent's applicability period, the patent holder's rights are being safeguarded through the Paris Convention. The Convention contains specific rules with regards to the so-called priority right, i.e. the applicant's right to file applications for the same invention in other countries during the priority period, which is 1 year in terms of patents. In practice, the priority period means that when priority is claimed, the date when the first application has been filed, i.e. the priority date, also becomes the filing date for later applications.[31]

The underlying principle of the modern patent is that an inventor is granted a limited timeframe, within which others are excluded from supplying or using the invention. This feature is designed to encourage the further inventive activity of inventor by preventing instant imitation from others. As a trade-off, the inventor must make the description and implementation of the invention public instead of not disclosing any information, thus allowing others to use the information contained in the invention for building upon it.[32]

An idea or the result of an effort can be protected in several different ways, out of which a patent is only one possibility. Other alternatives include trademarking, copyrighting etc., which have different legal requirements and offer different types of protection to the applicant. The common types of intellectual property rights will be shortly explained in the following:

[31] Closa, Gardiner, Giemsa & Machek, 2010, pp. 14-15
[32] Hall, 2007, pp. 1

A trademark means any sign used by an organization for distinguishing its products or services from competing products or services. The trademark can have quite significant monetary value in itself, but its main function is anyway to serve as a identifying character for products, services, or organizations.
Copyright is another form of protection, which separately from trademark provides exclusive rights for a predefined period of time with regards to its publication, distribution, and adaptation. After the copyright period has run out, the work enters the public domain. In general, copyright offers protection to the work until 70 years has passed from the death of the author. As for the protected subject matter, copyright only protects the form in which the idea and information have been expressed, not the idea and information separately. This is especially important when talking about software, as it is not the solution as a general idea that is protected, but rather how the idea has been expresser in program code. This approach resembles the treatment of e.g. poetry or theatre scripts, as writing a separate program with the same end result, but different code, would not offend the copyright of the protected software. The guiding principle is that neither the visual appearance nor the functions of the user interface are protected by copyright, but solely the code that the software was written in. As stated in the Berne Convention, copyrights for creations do not have to be declared, as they are to be understood to be in force automatically from the time that the creation has been recorded on a medium.
A utility model protects an invention, similarly to a patent, but utility models are more frequently used for inventions with a shorter life span or inventions that are less technically complex. The application process for utility models is also shorter and simpler than the equivalent for a patent, as there generally are not as many requirements to meet for application approval. In fact, in several countries, only the novelty requirement is required, and the inventive step requirement is not examined. Also the maximum protection period is generally shorter for utility models than for patents. The distinguishing feature for utility model protection is that utility models can be used for protecting the design and visual appearance of a user interface. In Europe, the European Design Directive specifies that designs should receive protection in 5-year time periods at a time, and for a maximum of 25 years.[33]

Copyrights and utility patents have also been mixed in some Supreme Court cases, especially regarding software. For example, in the Oracle vs. Google case, one of Google's defences was that software interfaces in its Android phone software were patent subject matter, and not

[33] Closa, Gardiner, Giemsa & Machek, 2010, pp. 15-17

copyright. The Supreme Court has been quite reluctant to deal with the issue concerning copyright and utility patent boundary, because of its complicated nature that makes it difficult to rule which elements qualify for copyright protection and which for utility patent protection.[34] The overlap problem concerning copyright and utility patents might to some seem only theoretical, but it can very well become reality for computer software innovations.[35]

2.3. General Characteristics of Software Patents

Comprehending the nature of software is vital, in order to understanding the complexity of the issue regarding patentability of software and business methods. In theory, software and business methods are closely connected to each other, as both are intangible processes that on their own do not create concrete outcomes. Another similarity is that business methods are frequently applied by the means of software. Whether the business method or the software is the legislative subject matter, when the business method is implemented by software is much harder to determine. Courts on both sides of the Atlantic Ocean have struggled with the question whether implementing software or a business method by the means of a computer program is required or enough for claiming legal subject matter. In other words, what are the required circumstances for business methods or software to become patentable inventions?[36]

Computer-implemented inventions have throughout the patent community been a widely debated topic for discussion. In this discussion, the term software patent is often avoided, because software has not been universally defined. Software is often understood to be a group of computer programs, procedures, and documentation either about data processing system operation or instructions for computers. The debate surrounding this issue, concerns the extent to which computer-implemented patents should be granted, and how this should be done. The important questions about software patents to be settled are:

- Where is the borderline between patentable and non-patentable subject matter?
- How much of the patented subject matter should be disclosed publicly?
- Should the inventive step evaluation be the same for software as for all other technical areas, or somehow different?

[34] Samuelson, 2017, pp. 1512-1513
[35] Ibid, pp. 1537
[36] Marsnik & Thomas, 2011, pp. 233-234

- What are the biggest differences between the most influential software patent legal frameworks, i.e. the USA, the EU, Japan, and China?[37]

Europe and the USA have traditionally been the primary geographical areas for software development, and thus also for setting standards for software inventions. Both the USA and all European states have signed the Paris Convention, which sets the norms for patent protection. However, the Convention neither clarifies the conditions for patentability nor for patentable subject matter. Another international agreement, the TRIPS agreement of the World Trade Organization also regulates patentability and patentable subject matter. Article 27 of the TRIPS agreement states that any invention can qualify for a patent, regardless of its field of technology, or if it is a product or process, as long as the invention is new, involves an inventive step, and is industrially applicable. In addition to this, the Article also includes a non-discrimination principle, which explicitly forbids discrimination of any field of technology. The TRIPS agreement thus provides a broad concept of patentability, an approach which has been viewed also as the guiding light for US patent law. Many have argued that the US Constitution does not provide clear limits for the patentable subject matter. The TRIPS has been a significant influence for US patent law, but US patent law has probably in turn influenced substantial parts of the global development, so that broad patentability has received an important role in worldwide patent systems. The TRIPS agreement sets the baseline for universal patentability by stating the three patentability requirements, i.e. novelty, inventive step, and industrial applicability, but leaves on other parts lots of freedom to its Member States to interpret the requirements. As a result, the approach in different Member States might considerably differ from one another. Even the content in Article 27 of TRIPS explicitly states that the terms "inventive step" and "capable of industrial application" can be used synonymously with "nonobvious" and "useful".[38] During the years, there have been heated debates over whether or not, and to what extent software and business methods should be patentable.[39] Academic research within this subject has mainly put focus on analyzing the traditional scope of protection, i.e. how strong patent rights should be granted to the inventor. The core issues within this research have been the doctrine of equivalents and exceptions from patent exclusivity, but in a wider scope affecting patent protection, equally important are the questions on patentability and the disclosure requirements. There has been some research on these issues,

[37] Closa, Gardiner, Giemsa & Machek, 2010, pp. 20
[38] Mylly, 2011, pp. 449-450
[39] Ballardini, 2009, pp. 365

but the analysis has often circled around how to achieve a narrow scope of protection for software technologies.[40]

As computers and computer software became more widespread during the late 20th century, the question arose as to what intellectual property protection actually applied to computer programs. A print-out of a computer program's source code surely satisfied the requirements of originality and literary value. The logical reasoning from this conclusion was that computer software in any form should receive the same copyright protection, as if they were literary works just as source code print-outs or other literary works.[41]

The fact that patentable subject matter has expanded is usually attributed to the presumptions of protectability and patentability, which often are viewed as the leading principles of modern patent law. The issue of patentability is an important issue in defining the scope of patent protection. This issue can further be divided into two sub-questions, the first of which is what is included and what is excluded from patentable subject matter. The second question is where the line between protectable and non-protectable inventions should be drawn. Together, these two closely linked questions define the patent eligible area.[42]

2.4. Protected Basic Uses of Computer Programs

As a counterpart to all the limitations often included in proprietary computer program licenses, some basic uses of software are always within the boundaries of end user rights. Such basic rights include the ordinary running of a computer program, the right to study the computer program, making back-up copies of the computer program, as well as reverse engineering of the computer program.[43]

2.4.1. Ordinary Running of a Computer Program

When running a software, it implicitly involves the copying of the software from the storage, on which it is delivered at purchase, into the computer's internal memory. When narrowly interpreting proprietary license agreements, this type of action would be considered a reproduction of the software, and thus would be considered a copyright violation. For example, in the USA, such copies were previously considered as copyright infringements according to the law, until the copyright law was modified to cancel this interpretation. Also in the EU, actions

[40] Mylly, 2011, pp. 445
[41] Ahmad, 2008, pp. 7-8
[42] Mylly, 2011, pp. 447-449
[43] Ahmad, 2008, pp. 16

that are necessary for using the software and made by the legal acquirer are categorized as protected use.[44]

2.4.2 Study

The right to study software is also an important right for the end user. The core of the protection of copyrights is that it is designed to protect how an idea is expressed, rather than the idea itself. Therefore, it is completely lawful to copy software for studying it. For example in the USA, this type of an exemption is called fair use. Also, in the EU, studying licensed software has been legally allowed since 1991.[45] As article 5(3) of Directive 91/250/EC states, a rightful user of a computer program cannot be prohibited from "observ[ing], study[ing] or test[ing] the functioning of the program in order to determine the ideas and principles which underlie any element of the program"[46].

2.4.3. Back-up Copies

Producing a back-up copy of software is also an important feature of normally running a computer program. It is however technically illegal by copyright law. In the USA, the end user is permitted to make a back-up copy of a computer program for "archival purposes", as long as all archived copies are deleted if the original copy becomes unlicensed.[47] Similarly, in the EU, the right of an end user of software to make a back-up copy is also protected[48].

2.4.4. Reverse Engineering

Reverse engineering of a computer program is also protected both in the USA, and the EU. In broad terms, reverse engineering is a legal method for obtaining knowledge about a given product. There can be many different reasons for reverse engineering a computer program, the most significant of which, in an industrial context, is reverse engineering for developing a competing product. Here lies the essence for protection against copyright infringement, as such protection is designed for protecting the copyright holder's expression of his or her work, but not the underlying idea. Because computer programs often need to be reverse engineered, for discovering how they work, it is essential that copying for reverse engineering is a legal right of a holder of a legal copy of the work. The right to reverse engineer a computer program does naturally not mean that it would be legal to copy the finished product, but in-

[44] Ahmad, 2008, pp. 16
[45] Ibid, pp. 16
[46] Directive 91/250/EC Article 5(3)
[47] Ahmad, 2008, pp. 17
[48] Directive 91/250/EC Article 5(2)

stead to discover and re-use the underlying concepts and mechanisms in another format of expression.[49]

The EU was the first jurisdiction to acknowledge the effective nature of reverse engineering for the purpose of interoperability. Already through Directive 91/250/EEC from 1991, the EU permitted reverse engineering of computer programs, in order to accomplish interoperability of separately created software with each other. The prerequisites for legal reverse engineering are that the reverse engineered software has to be a lawful licensed copy, the information needed for developing the interoperable product cannot be readily available, and the extent of reverse engineering is limited to what is necessary for achieving interoperability. Furthermore, the information acquired through reverse engineering cannot be used for other purposes than for developing the interoperable product, and any needless further dissemination is also not allowed. The Directive holds reproduction lawful for studying the underlying principles of the software or for error correction, irrespective of the license of the software.[50]

2.5. Intellectual Property Rights for Computerized Data

As a separate matter from protection of computer software, computerized data is protected from copyright infringements. During the last decades, protection of computerized data has been the subject of many legislative discussions and has thus received lots of attention.

International treaties have formed the basis for the development of legislation in the USA and in the EU. Maybe the most prominent of such treaties are the two treaties from the World Intellectual Property Organization (WIPO). As these treaties have been widely accepted and signed by many countries, they have come to set the international standards in this area.

The WIPO Copyright Treaty (WCT) was adopted in 1996 and is a re-negotiation of copyright law adapted for the modern day society. As it builds on the Berne Convention, it re-states the basic principles of copyright law. In Article 2 of the WCT, the Treaty states that copyright protection extends to expressions of ideas, and not to ideas themselves, nor to procedures, methods of operating, or mathematical concepts as such.

With regards to computer programs, Article 4 in the WCT iterates the established position that computer software should be considered literary works. Software receive copyright protection on the basis of Article 2 of the Berne Convention, and such protection should be applied to

[49] Ahmad, 2008, pp. 32
[50] Ibid, pp. 32-33

software irrespective of the mode or form for how they are expressed. The WCT also further builds on the TRIPS agreement, and e.g. goes on to consider the rental of computer programs. Articles 11 and 12 of the WCT cover the widespread digital distribution of copyrighted material, and also with protective measures provided by technology. The two Articles provide that contracting parties to the Treaty need to provide legal protection and penalties against bypassing of technological measures that are used by copyright holders for protecting their rights, and which prohibit unauthorized actions with regards to the copyrighted material.[51]

The WCT goes on to cover the enforcement of rights in Article 14, where is stated that contracting parties are required to adopt the measures of the WCT, in accordance with their own legislation. Contracting parties should also make sure that enforcement processes are put in place within their legal framework, in order to allow for effective recourse against any infringing acts. This provision also includes speedy awarding of penalties against infringers, and that the penalties should be awarded to an extent, as to having a preventive function against further infringements. There are also a number of interpretations supporting Agreed Statements to the WCT, and an example of such an Agreed Statement is a statement concerning Article 1, where it has been agreed that converting data into digital form can be considered reproduction for the purpose of copyright law.

The right to reproduce content, stated in Article 9 of the Berne Convention, as well as the exceptions to that rule, also applies to the digital environment, and especially to the use of copyrighted content in digital form. The Berne Convention has moreover been interpreted, as to labelling storage of a protected digital work in an electronic medium, as reproduction of the work in questions, in accordance with Article 9. The contracting parties have agreed that protection of copyrighted software under the WCT can be considered coherent with other international treaties.[52]

Generally speaking, the WCT Article 4 protection scope for software, when read together with Article 2, is fully aligned with Article 2 of the Berne Convention, as well as also in line with the scope of the TRIPS Agreement.

The WCT's reference to any right of the copyright holder, that can be infringed and that is covered by the WCT or the Berne Convention, has been interpreted as a reference to both the copyright holder's exclusive rights, and to the copyright holder's right to compensation. It is

[51] Ahmad, 2008, pp. 18
[52] Ibid, pp. 19

first and foremost the WCT, which has set the ground for national legal frameworks on all continents, and e.g. both in the USA and in the EU.[53]

[53] Ahmad, 2008, pp. 20-21

3. Computer Program Patent Protection in the USA

3.1. The Introduction of IPR in the USA

The discussions with regards to property the intellectual property rights of software dates back to the 1950's and 1960's. This is also the time when the first pieces of software were developed. The discussion originated from the USA, from where it then spread to other parts of the world. At first, intellectual property rights protection for software was not a big concern, as more or less all software were developed at universities, and were designed for collaboration and open sharing of research findings.[54]

As soon as software became more complex and required larger monetary investments, the debate about adding adequate protection for software started. During this discourse, the added protection to be assigned to software was suggested to be copyright, and as a result, in 1964 the US Copyright Office started accepting applications for software copyright. At first, the office required the applicant to submit the full source code of the software, which would be made publicly available. Because of this, and because software were not yet mass-marketed, copyright applications for software were quite limited in this era, and thus trade secrecy and licensing were the dominant forms of protection mechanisms for software. In the 1980's, the requirement for submitting the full source code was dropped, when software became officially copyrightable. Software also became mass-marketed during this time, thus making copyright the primary legal protection instrument for software.[55]

In the early 1980's, the US legal system encountered significant changes during a time that was characterized by strong patent rights. The most visible of those changes was the establishment of a centralized appellate court, the Court of Appeals for the Federal Circuit in 1982. Even though the Court of Appeals for the Federal Circuit (CAFC) has received lots of praise for unifying and strengthening the legal treatment of patent rights in the USA, there still is no definite answer with regards to its effects on innovative activities of companies. For instance, some surveys indicate that firms in most industries are not increasingly relying on patents for returns on R&D investments since the establishment of the court.[56] In addition to unifying the judicial treatment, the CAFC played a significant part in transforming the US legal environment from a patent skeptic to one that promoted broad and exclusive rights for patent holders.

[54] Ballardini, 2012, pp. 12
[55] Ibid, pp. 13
[56] Hall & Ham Ziedonis, 2001, pp. 2

This has become visible e.g. through the CAFC's broad interpretation of the patent scope, and from the court's decision to raise evidentiary standards, thus making it more difficult to challenge a patent's validity. Furthermore, the court has been more willing to grant preliminary injunctions to patentees during infringement cases, to award large awards for damages, and to issue out rulings that publicly have been interpreted as "pro-patent". Since the establishment of the court, plaintiff success rates have also significantly increased.[57]

3.2. Early Court Cases Pave the Way for the Future

In their rulings, the courts have held that processes that describe laws of nature or describe actions that can be performed by the minds of human beings are not classified as useful arts. Mathematical algorithms, in addition to formulas, were deemed non-patentable in the Gottschalk v. Benson case, with the outcome that courts started to reject software patent applications on the grounds that software were just compilations of non-patentable algorithms.[58]

Three years after the Gottschalk v. Benson decision, the Supreme Court changed its position in the Diamond v. Diehr case. In this case, the Court stated the requirement that the inventor should point to the particular application that the algorithms are used for. After this interpretation of the law, knowledgeable patent lawyers started claiming software inventions as different types of machines, pizza ovens etc. This requirement did not actually establish any limits on invention claims, as nearly any physical element was enough to satisfy the requirement. Even well-known machines, where the algorithm was the only new addition would qualify.[59]

In 1994, the Federal Circuit opened a new stage of patent protection through the decision in the In re Alappat. In the decision, the court ruled that the "otherwise statutory process or apparatus" requirement can be met by forming the claim to include a general purpose computer, hardware, or memory. Through this type of claim drafting a general purpose computer becomes a special purpose computer when it performs a specific function. After the Alappat ruling, inventors of software patents no longer had to pretend that they were patenting something other than what they actually were patenting, and in their claim they only had to include a machine in which the software would be implemented.
The Alappat case did however not include claims reading on software themselves, which created an obstacle for software implemented in a tangible medium. After the IBM case in 1995,

[57] Hall & Ham Ziedonis, 2001, pp. 7
[58] Cohen & Lemley, 2001, pp. 8
[59] Ibid, pp. 9

the PTO however issued new examination guidelines that urged examiners to approve claims of this nature.

The last legal obstacle for patenting software as such disappeared in 1998, through the Federal Circuit's decision in the State Street Bank & Trust v. Signature Financial Group. In its decision, the Court reasoned that a physical structure was unnecessary, as long as the process or idea would be useful.[60]

3.3. Legislation as the Baseline

Although the majority of biotechnological and chemical patents need broad protection to cover for their potentially high cost and uncertain development procedure, the development of software does not require such elaborate protection. This is because the development process for computer programs tends to be quite quick, inexpensive, and straightforward. The bulk of the computer program development work consists of the initial coding, as opposed to development or production processes. Furthermore, software inventions tend to reach the market fairly quickly, and software development does not require significant capital investments, as opposed to industries where capital investments are needed, in addition to workforce, also for building laboratories and manufacturing infrastructure. Fixing potential bugs in the software and test marketing it to consumers might be very time consuming and require lots of effort, but it nowhere nearly matches the costs for safety and testing procedures legally required in the biotechnology and pharmaceutical industries.[61]

In society of today, it seems very clear that inventions relating to software fall within the innovation category as eligible for patent protection, as described in section 101 of the Patent Act.[62] In the USA, Title 35 U.S.C. §101 sets the guiding rules for patent protection

> *Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor. . . .*[63]

The subject matter eligible for patent protection under US Code 35 § 101 is widely considered as a very flexible approach that has and can be interpreted differently depending on economic and technological changes.[64] The starting point is broad protectability, as excluded from protection are only laws of nature, natural phenomena, and abstract ideas. The most relevant

[60] Cohen & Lemley, 2001, pp. 10
[61] Burk & Lemley, 2003, pp. 1687-1688
[62] Cohen & Lemley, 2001, pp. 8
[63] Boyle & Jenkins, 2015, pp. 649
[64] Ballardini, 2012, pp. 15

ground for exclusion for software is the non-patentability of abstract ideas. Previously, algorithms were considered parallel to laws of nature and thus non-patentable as such. In the case Diamond v. Diehr in 1981, the US Supreme Court clarified the interpretation of the rules, by stating that an invention does not become unpatentable just because it uses a mathematical formula or computer program. In 1994, the interpretation took a further step through the In re Alappat case. Through the ruling in this case, US courts began to accept software patent claims as long as the claim contained a reference to a machine. In order to meet this requirement, it was enough to refer to a general purpose computer for implementing the algorithm, thus making it a special purpose computer. In 1998, a step further was taken through the decision in the case State Street Bank v. Signature Financial Group, where it was elaborated that the patentability analysis should not focus on which patentable category the invention belongs to, but rather whether the invention has practical utility. In this case it was established that a mathematical algorithm can be granted patent protection, if the algorithm provides useful, concrete, and tangible results. This ruling practically ended the patentability limitation for mathematical algorithms and software.[65]

The copyright laws in the USA are aimed at protecting the rights holders, inspiring design of new solutions, and protecting other stakeholders. People are free to use the copyrighted content for e.g. criticism, commentary, news reporting, teaching, scholarship, or research in accordance with the "fair use" doctrine of 1976. Several different stakeholders, such as software developers, educational institutions, Internet search providers etc. depend on the “fair use” doctrine to make available or adjust information for consumers, students, and users. Many have claimed the “fair use” doctrine plays a positive part with regards to economic growth, as you are able to leverage the work of others and build upon it. Another positive aspect is that the legislation in the USA allows for one to not be held liable for using copyrighted content that has been made available online. On the other hand, the legislation in the USA grants copyright holders the right to demand third parties to take down copyrighted material. Third parties, who receive such a request, are required to act in accordance with the request in a way that corresponds with the USA’s rules for due process.[66]

In the USA, the question about reverse engineering computer programs became a hot topic in the legal debates and court cases in the early 1990’s. The United States Court of Appeals ruled in favor of reverse engineering for interoperability on the grounds of “fair use”. Fur-

[65] Mylly, 2011, pp. 456-457
[66] Aaronson, 2013, pp. 13

thermore, Section 1201 (f) of the Digital Millennium Copyright Act states three exceptions to the anti-circumvention requirements that relate to reverse engineering and interoperability.

Section 1201(f) (1) of the Digital Millennium Copyright Act states that an individual who lawfully has acquired the right to use a copy of a computer program has the right to bypass any access controls of the program for the purpose of identifying and analyzing the elements of the program necessary for achieving interoperability. The content in Section 1201(f) (1) can be derived directly from Article 6 of the EU Software Directive. This appears also to be the first time that the exact wording in an EU Directive has been incorporated into the US Code.[67]

3.4. To Reverse Engineer or Not to Reverse Engineer?

The Federal Circuit has, by reducing the enablement requirement and allowing for computer program inventions to be defined broadly, encouraged patents for computer programs to be drafted broadly and for those patents to be applied to supposedly infringing devices that are far from the original patented software. By doing so, the Federal Circuit's view seems to be that many narrower computer program patents for smaller improvements to the original will be invalid for as a consequence. Such patents may also be invalidated under the Supreme Court's on-sale piece, because according to this view a computer program invention can only be patented when program is subject of a commercial offer and when the inventor has outlined the broad functions of the computer program. This is the case, even if it is unclear how the code for the computer program will be written or if the program actually will work for the intended purpose, and it means that an inventor who waits until the code fully written before filing a patent application puts himself or herself at jeopardy for having the application rejected for not filing earlier.[68]

Patents for computer programs subsequently became the perfect candidate for allowing reverse engineering as a new patent policy. A number of legal experts explained how important it was to allow competitors to reverse engineer a computer program for seeing how it works and for discovering alternative design methods for avoiding copying.[69]

Intellectual property legislations that traditionally have protected software, also tended to allow for reverse engineering, e.g. trade secret law undoubtedly allows reverse engineering.

[67] Ahmad, 2008, pp. 33-37
[68] Burk & Lemley, 2003, pp. 1688
[69] Ibid, pp. 1689

This meant that software developers had to come to terms with the possibility that someone will reverse engineer the software and unveil the secrets that are contained in the code. Even as there were no exact provisions permitting reverse engineering, more or less every court came to the conclusion that reverse engineering is a legal act, at least for some purposes. The conclusion also meant that not all reverse engineering necessarily should be considered as fair use, and the courts thus made each judgement on a case-by-case basis with regards to the purposes and effects of the reverse engineering. Generally, reverse engineering has been viewed as lawful when it is used for spurring competition, e.g. when developing products that compete with the original, or accessing uncopyrighted ideas or processes that otherwise would be protected.[70]

Section 1201 of the Code's Development and Employment of a Technological Means for Enabling Interoperability states that "a person may develop and employ technological means to circumvent a technological measure, or to circumvent protection afforded by a technological measure the purpose of enabling interoperability of an independently created computer program with other programs, if such means are necessary to achieve such interoperability, to the extent that doing so does not constitute infringement under this title."

The scope of this exception is however unclear in several aspects. Firstly, it is not clear what kinds of "technological means" the Congress were referring to, with regards to this exemption. The implication allowing an individual to "develop and employ" such technological means can be interpreted as a reference to that only technological means developed by the individual are covered by the exemption, instead of allowing all commercially available technological means. However, it seems like the Copyright Office supports an expansive interpretation of the Section 1201 exemption paragraph. [71]

This procedural balance shifted when patent protection for software was introduced. The patent legislation does not include any provisions expressly allowing reverse engineering, or exceptions under which reverse engineering could be viewed lawful. As the Federal Circuit does not require inventors to disclose the source code or other detailed information about their software invention, software patents display unique characteristics that do not align with the traditional understanding of patents, where the trade-off for protection is detailed public disclosure of the invention. Another unique issue relating to software patents has to do with the

[70] Cohen & Lemley, 2001, pp. 17-18
[71] Ahmad, 2008, pp. 33-37 ?

specific reverse engineering techniques that are used. As infringement is defined as making, using, selling, offering to sell, or importing a patented product, reverse engineering a piece of software by decompiling it might very well be classified as a prohibited action. Software reverse engineering is clearly a form of product use, i.e. an action that the product owner has the right to do. However, decompilation can be defined as making a temporary or long-term copy of the software in either RAM or persistent memory, and such copies would likely be deemed as patent infringement, unless the action can be justified by some defense.[72]

Whether or not reverse engineering should be viewed as patent infringement depends on how the claim has been written. Software inventions can be classified as processes, articles of manufacture, or apparatuses, and in its most clear form, reverse engineering includes making or using the software that is covered by an article of manufacture or apparatus patent, because such patents cover the software itself instead of some use of the software. In the case of process claims, the evaluation whether or not the actions fall under infringement depends on what the claim covers. Claims that are internal to the software can be used automatically when the software is run or loaded, whereas external process claims require specific actions from the user. Thus, breaching external process claims is generally viewed as infringement, but automatically creating temporary copies is not a form of infringement.[73]

The typical argument for allowing reverse engineering is that it increases competition within a network standard, where competition between standards is impossible or very difficult. The general argument is strong as such, and so is also the more specific argument for allowing reverse engineering of patented software. There are four additional arguments for allowing limited reverse engineering rights specific to patents. The arguments are that reverse engineering promotes the fundamental policies of disclosure and enablement, makes sure that only components that are worthy of protection will be protected, keeps the balance of the intellectual property system, and helps patent holders to enforce their rights.[74]

During the years, a number of rules have governed certain types of innovations into the patent area and others to the copyright area. That division has nowadays more or less disappeared, at least when discussing software, as patents have expanded outside the technology area and copyright also protects some functional aspects of inventions. As patents and copyright in-

[72] Cohen & Lemley, 2001, pp. 18-19
[73] Ibid, pp. 20-21
[74] Ibid, pp. 22

creasingly overlap, it becomes ever more important that they take each other into consideration.[75]

3.5. Update on Patentable Subject Matter Through the Bilski-case

As software was initially viewed as mathematical formulas, they were not patentable in the USA. Cases such as Gottschalk vs. Benson, Diamond vs. Diehr, and State Street Bank & Trust Company vs. Signature Financial Group, have little by little made software patentable in the USA. USA's patent laws have by far the least restrictions for what patent protection can be granted, i.e. courts have shifted away from emphasizing that only tangible inventions may receive patent protection. Although software are protected by copyright laws, they can receive even stronger protection under patent laws. The same practice also extends to business methods, as the two quite often are linked to each other, i.e. business processes usually rely on both software and the Internet.[76]

In October 2009, the US Supreme Court gave its decision in the Bilski v. Kappos case, a decision which has had significant impacts on patentable subject matter ever since. In its decision, the Court ruled that Bilski's claimed trading risk-hedging method was not patentable subject matter, but the Court did still not completely declare business methods unpatentable. The Court chose to "leave open the possibility of some business method patents", and thus the Supreme Court Bilski case provided scarce guidance for future interpretations.[77]
The background of the Bilski case is that, as a first step, the US Patent Office rejected the initial application on the grounds of it being an abstract idea, which solved a mathematical problem. The rejection was also upheld by the Board of Patent Appeal and Interferences (BPAI), and thus the case went to the Federal Circuit. The Board of Patent Appeal and Interferences identified and also based its decision on three possible test for settling patentability:
1. If the process transforms physical subject matter to a different state or thing?
2. If the process falls outside the abstract idea exclusion by being initiated in some physical way and by not claiming ways of performing the abstract idea?
3. If the process results in a useful, concrete, and tangible outcomes, as put forward in the State Street case?[78]
In the next step, the Federal Circuit stated that a "useful, concrete, and tangible" test is not

[75] Cohen & Lemley, 2001, pp. 26-27
[76] Chalecki, Gupta, Kong, Li & Lin, pp. 9
[77] Arezzo & Ghidini, 2011, pp. 193
[78] Ballardini, 2009, pp. 367

suited for patentability, and as a result the court adopted the physical transformation test. This test determines patentability on the grounds that an invention transforms an article to a different state. Even though a different test was applied the Federal Circuit, the outcome was still the same, i.e. the claims were held unpatentable. Eventually, also the Supreme Court found the claim unpatentable, but reach its conclusion based on new grounds. The Court held that a machine-or-transformation test is not the only test for patentability, and stated that courts were not supposed to limit patentability outside the written legal framework. It also noted that the Congress' intention was to define the scope for patent laws broadly. Finally it identified other possibilities for limiting patentability of processes, i.e. unpatentability of abstract ideas.[79]

The most substantial contribution of the major opinion is clearly the adoption of the machine-or-transformation test, which was introduced by the Courts in the Diamond v. Diehr and the Gottschalk v. Benson cases, and under which, an invention only qualifies as patentable, if it:
a) Can be tied to a specific machine or apparatus, or
b) Can transform a specific article into a different state or thing.
When applying the machine-or-transformation test, the Court found that Bilski's invention contained unpatentable subject matter. At first, the Federal Circuit only addressed the transformation issue, and laid down that transformation should:
a) "Be central to the purpose of the claimed process"
b) Involve specific types of "articles".
The first criterion requires transformation to be meaningful to claim as a whole, and the second requirement meant that chemical or physical transformations of objects or substances clearly are patent eligible subject matter, not all transformations of e.g. electronic signals, electronically manipulated data, legal obligations, organizational relationships, or business risks are.
The second part of the test, i.e. what is meant by a "particular" machine was left for future cases to be determined. In a later case, the BPAI gave a negative answer to the question whether a general purpose computer would qualify as such.[80]

[79] Mylly, 2011, pp. 458
[80] Ballardini, 2009, pp. 368-370

3.6. Interpretation of the Claim's Inventive Nature Through the Alice-case

The decision in the In re Bilski, has significantly narrowed down patentable subject matter under the US jurisdiction, and in this way brings the US legislation closer to European norms.[81]As discussed above in the European setting, the subject matter limitation is not the only limitation on patentable claims. Also in the USA, Title 35 U.S.C. § 102 and 103 require that inventions has to be novel and involve an inventive step in order to be patentable. Even in the State Street Bank & Trust v. Signature Financial Group the Federal Circuit stated that patentable claims need to include these other criteria of patentability, as well as adequate disclosure of the invention. This same view was stressed by the Supreme Court in the Bilski case.[82] In the CLS Bank International v. Alice Corp. case, Alice obtained four patents for a trading platform conducting financial transactions. Some of the claims in Alice's application were in method form.[83] Others, on the other hand can be in system form, or in computer media form. In the Alice case, Alice noticed that CLS was taking advantage of Alice's patents, but CLS claimed that they were not infringing any patents and that the patents were invalid and thus unenforceable. A trial judge agreed with the CLS Bank, that Alice's patents were ineligible for patents as abstract ideas, likened to the patents in the Bilski case. Alice appealed about the ruling to the CAFC. The CAFC agreed that Alice's method and computer-media claims were invalid. With regards to Alice's system claims, the CAFC was evenly split, and as a result, the lower court decision was affirmed, i.e. Alice's system patents were also invalidated. [84] The Supreme Court decided the issue of patent eligibility by applying a test from the Mayo v. Prometheus case. The test first determines whether or not the claims are directed to a prohibited category, e.g. law of nature or abstract idea. The second step of the test concludes if the claims contain an inventive concept. The method claims in the Alice case failed the test, as the Court determined the claims as abstract ideas, and also found the abstract idea implemented in a generic computer system as too commonplace for being classified as an inventive concept. A further result of the method claims failing was that also the system and media claims failed, as routine implementations of ineligible abstract ideas. The test applied in the Alice case resembles the European Patent Office's "inventive step" approach, which in addition to the "inventive step" requirement also lists categories of prohibited subject matter. Especially

[81] Ballardini, 2009, pp. 364
[82] Mylly, 2011, pp. 459
[83] Samuelson, 2013, pp.23
[84] Ibid, pp. 24

Article 52 excludes discoveries, scientific theories, mathematical methods, mental acts, business methods, and computer programs "as such".[85]

3.7. A Critical View on US Software Patents

Several authors have criticized the developments in the operations of the US patent system, largely because the developments have increased the amount of granted patents, but without adding corresponding social welfare. The most controversial issues include:

1. Expanding patentable subject matter to include software, business methods, and gene fragments
2. An evident decrease in the inventive step requirement, especially with regards to the new subject matter areas
3. Insufficient prior art search, especially with regards to the new subject matter areas
4. Disproportionate claims of breadth and failure to supply enough information for somebody skilled in the art to replicate the patentable product or process.

Some of the critique has also included calls for an improved post-grant opposition system in the US. A system more like the EPO opposition system could potentially tackle some of the concerns raised. Ultimately, there is no doubt that competitors are generally the best suppliers of prior art, particularly in areas where there are few prior art containing patents available.[86]

Both the US opposition system, as well as the EPO opposition system in Europe, is designed for allowing third parties to question the validity of a patent after it has been awarded. In the USA, the re-examination of a patent can be requested at any time during the patent's validity, whereas in Europe, the request for re-examination must be made within 9 months of when the patent has been granted. The actual mean lag time between the patent application date and re-examination request date is about 6 years in the US and 5.9 years in Europe. In Europe, most of the delay comes from the lag in granting the patent in the first place, so the distribution is much tighter. Another difference between the two is that the US system is an ex parte administrative proceeding, whereas the EPO system is an adversarial administrative proceeding.[87] In an adversarial proceeding, lawyers generally only may present evidence that is helpful for their client, thus leaving it to the opposing lawyer to present evidence that is contrary to the client's position. In ex parte proceedings, the requirement is different, because in such proceedings the lawyer is required to present all material facts known to the lawyer, regardless of

[85] Burk, 2014, pp. 866
[86] Hall, 2001, pp. 3
[87] Ibid, pp. 3

how the evidence will impact the client's position.[88] This latter difference most likely is the reason behind the majority of the real difference between the two systems with regards to takeup and outcomes. Even though the current US system is third party initiated, the subsequent administrative proceeding is still ex parte. This means that the requestor's role is limited to filing an application for re-examination, receiving a copy of the patentee's response, receiving notice of the decision, and having the right to file a rejoinder to the patentee's response. The only evidence that can be submitted is prior patents and publications, and the applicant carries the burden of proof. A claim or patent can only be reversed if there are substantial questions about the patentability. Another factor of discouragement to third party applicants thinking about requesting re-examination of a patent is that any questions that have been or could have been raised during the re-examination process cannot be used again in litigation. The US re-examination system is quite rarely used, as a result of these significant limitations, with a total takeup rate of 0.3% of all patents granted. Distinctively, the European opposition system is adversarial to its nature, the re-examination requests can be initiated by any third party, in most cases by a competitor. The granted patent can be challenged by any patentability grounds: novelty, inventive step, or industrial applicability, and there is no limit to what kind of evidence can be submitted to support the client's position. Patent examiners receive the challenge, and if there is an appeal, it is received by a panel of administrative judges. This type of setting means that the process can become quite slow, and from time to time the litigation is further delayed while waiting for the outcome of the opposition. The average time span until a case is closed is 2-3 years on average, in comparison to 1.6 years for re-examination. The takeup rate for European patents is between 4 and 8%, with the higher figure characteristic of biotechnological or pharmaceutical patents.[89]

Just as everything else in society, also patent systems have and will continue to evolve, in ways that are influenced by global competition and technological development. Changes like the expansion of patentable subject matter coverage, enforcement system strengthening, and encouragement by upstream actors to patent can all be interpreted as driven by these global changes. As often can be seen with regards to innovation, many of the changes in patenting strategy have originated from the US, and from there spread around the world either through imitation or through intergovernmental negotiations. The downside to the development, if the target is an optimal patent policy, is that a great deal of the development in the US has origi-

[88] Association of the Bar of the City of New York
[89] Hall, 2001, pp. 3-4

nated from court decision, especially from the Court of Appeals of the Federal Circuit, and to a lesser degree by the Supreme Court. The decisions of the courts do not always consider the broad implications concerning the policy they set through the precedents, as their decisions primarily are addressed to individual cases. As an outcome of the decisions made by these courts, the patentability subject matter has been extended to include new technologies (bio-technology), technologies previously not included in the subject matter (business methods and software), and to scientific research tools, materials, and discoveries. The rights of patent holders in relation to patent infringers have also been strengthened through court decisions like Polaroid vs. Kodak (1986/1991), which awarded Polaroid with a significant settlement in damages and ended Kodak's instant camera business. This trend has since then however to some extent been reversed by Supreme Court decisions.[90]

It is quite evident that the current position in the USA has widened the boundaries of technology related invention patentability. This development stands in contrast with both the TRIPS agreement and the European Patent Convention, which both operate within quite strict definitions of technology. As a result, the USA can be viewed as having quite a neutral standpoint with regards to diverse technologies, because the absence of technology is not a deciding factor for determining subject matter patentability. Consequently, the law initially does not distinguish between patentable or not patentable technologies, and this feature also applies to software.[91]

Within the area of processes, to which many software inventions also can be argued to belong, the well-known Supreme Court decision Bilski vs Kappos of 2010 has played an important part in defining patentability. The judgement re-affirmed and limited the excluded subject matter to the three specific exceptions mentioned in the broad patent eligibility principles of §101, namely laws of nature, physical phenomena, and abstract ideas. In its decision, the Court directly applied the non-patentable exclusion of abstract ideas to the case, and thus found the business method in question non-patentable.[92]

Even though the initial patentability scope of inventions is clearly broader in the USA, it is still a relevant question to ask whether different technology areas receive different treatment in the USA. As there is no straight yes or no answer to this question, it still seems adequate to

[90] Hall, 2007, pp. 11
[91] Virtanen, 2013, pp. 623-624
[92] Ibid, pp. 624

say that while such differences exist between legislations, the conventional approach is that the differences do not affect the evaluation of subject matter patentability.[93]

A particular problem for software-related patents is the difficulty for the reviewer to establish the inventions innovative character. Even though software exists in all types of different medium or apparatus, the format of the innovative activity is still always text. Innovations that consist of code are naturally limited by constraints of logic, but software inventions still contain a certain kind of plasticity that cannot be found in other innovations. When comparing a code-based innovation for equivalence, two steps regarding originality and similarity have to take place. As a first step, the reviewer has to interpret the claim, i.e. the technological advancement that is made up by the code. As a result of all patents being defined by text, there is potential for a linguistic problem for all patents. The end result of this is that claims written at different conceptual levels will also be interpreted differently, and this issue seems to be aggravated for software patents. A great deal of software patents provide very little information about the computer program itself, which leads to a bigger variance with regards to abstraction level. Software can in many ways be considered as more flexible than other inventions, as two pieces of code may result in the same results, but still operate in a different manner.[94] The second step is that the reviewer needs to establish the right conceptual level for comparing the invention with court's interpretation of the claim. The review process may entirely depend on the chosen level of abstraction, and the evaluation of the accused infringing invention is made more difficult by the fact that code might perform actions in a different order than the written code might indicate.[95]

[93] Virtanen, 2013, pp. 625
[94] Cohen & Lemley, 2001, pp. 47-48
[95] Ibid, pp. 48-49

4. Software Patent Development in the European Union

4.1. Guiding Directives and Articles

The European Union (EU) implemented copyright protection for software slightly later than the USA. The European discussion initially concentrated on whether or not copyright law was consistent with the Treaty of Rome, but after it was declared that copyright fell under Art. 36 of the Treaty, the subject of discussion shifted software copyright as a concept. Eventually in 1991, the European Software Copyright Directive was finally issued. Copyright was chosen as the protection mechanism, because most of the EU Member States, as well as e.g. the USA, had already implemented the instrument for software, but also because other instruments, such as patents and contracts were deemed as inadequate or insufficient with regards to software protection.[96]

Just like the USA, also the EU has big and very influential industries that for some time have demanded a forceful legal framework to protect their copyrights online. The key difference in comparison to the USA is that the EU's 27 nations don't have a uniform way of dealing with the issue. Every country in the EU makes its own decisions about what content needs to be removed from the online environment for intellectual property right violations.
In several European countries, there has been growing concern about how the Internet, as an open network, will be affected by the strong focus on enforcement of intellectual property rights. Such concern became visible e.g. in society's response to the arrest of the operators of file sharing website, the Pirate Bay. As a reaction to the arrest, residents of different European countries organized themselves in both a political party, the Pirate party, and in civil society groups, with the ambition to rethink intellectual property rights. The Pirate party is arguing for major reforms to the copyright system, and that such reforms cannot be done without completely re-evaluating data access, data retention, and privacy etc.[97]

In contrast to the centralized patent system of the USA, European patent applications are handled by both the European Patent Office and national patent authorities. Both apply and interpret the European Patent Convention. As there are no pan-European courts that match the US Supreme Court, in Europe, both national courts and the EPO have authority over patent appeals with regards to subject matter. Even though member state courts make every effort to harmonize their rulings with the decisions coming from the EPO Technical Board of Appeal,

[96] Ballardini, 2012, pp. 13-14
[97] Aaronson, 2013, pp. 17

there have still been clear discrepancies between the two. As an example, there is a real possibility that an EPO granted software patent could be deemed invalid under UK law, as the UK courts interpret the EPC more restrictively than the EPO. If this scenario actually would become a reality, it would endanger the credibility of one of the most important principles of the EPC, i.e. patents that are granted by the EPO become valid in all contracting states just as if they had been granted by the national patent office. Further increasing the likelihood of non-streamlined decision-making can be attributed to the EPO's Enlarged Board of Appeals, which both denies the existence of conflicting decisions within the EPO and also refuses to shed any light on the term "technical", as a vital part of European patent subject matter. As a result, the EU needs to both shape and more closely define the subject matter policy for business methods and software, but also tackle the issue of conflicting and sometimes inconsistent approaches to patent policy between practitioners. It seems highly unlikely, that European patent authorities would be able to take these steps until a Europe-wide patent court with jurisdiction to settle such issues would be established.[98]

Another obstacle to European reform comes from the USA, in the form of the U.S. very liberal approach to business method and software patents. If the EPO would implement very clear guidelines and boundaries for patentable subject matter, it could disadvantage European inventors and the business community in comparison to their U.S. competitors, who can fully leverage the liberal U.S. treatment of software and business method claims. Therefore, well-defined European boundaries in this issue could probably only become a reality after the USA would shift its policy to include clear limitations on business methods and software patents.[99]
The EU has also implemented WCT provisions, but it took about five years for the EU to accept a directive designed to meet the requirements of the Treaty. Mostly, the provisions are in terms of content similar to provisions in the DMCA. In broad and general terms, Article 5 of directive 2001/29/EC contains provisions for the role of network access providers in the process of mechanical reproduction of online material, and e.g. the protections of Article 6 are quite similar to the legislation in the USA. For this reason, the provisions regarding technical protection measures for software apply in parallel to the provisions in the Copyright Directive.[100]

[98] Marsnik & Thomas, 2011, pp. 231-232
[99] Ibid, pp. 232
[100] Ahmad, 2008, pp. 30

4.2. Governing Legislation

Article 345 TFEU states that EU Treaties do not replace the member states' internal laws concerning intellectual property rights. Even though the EU Treaties recognize the member states' intellectual property rights, they can still under some circumstances limit their exercise. The harmonization process of national laws into EU intellectual property rights is an ongoing process. An example of the work left to be done regarding the harmonization, is that while companies have the possibility to apply for a Community Trade Mark, they still cannot apply for an EU patent. Copyright is still partly governed by national rules, even though for instance the term of copyright protection and many other copyright law related issues are ruled by EU directives.[101]

The EU formed the European Patent Convention as merging framework of patent laws for all its member states. The European Patent Convention's section 52 contains a definition of patentable inventions, as it describes them as "any inventions susceptible of industrial application, which are new and which involve an inventive step". The Convention does not, unlike the USA, define any categories of patentable inventions, and the legislative requirements are also to other parts very simple: industrial applicability, novelty, and inventive step. This approach more or less reflects the requirements in the USA of utility, novelty, and non-obviousness.

Some might say that the EU's definition of a patentable invention is slightly misrepresentative, as the term "industrial application" can have a wide meaning. Lots of people would interpret the definition as a clear indication of software having an industrial application, and that it therefore must be eligible for a patent. This is however not the case, as an invention also must be of "technical nature", in order to be eligible for a patent.

In paragraph 2 of Article 52 of the Convention, the Convention lists non-patentable applications:

- discoveries, scientific theories, and mathematical methods
- aesthetic creations
- schemes, rules and methods for performing mental acts, playing games, and computer programs
- presentations of information

[101] Amedeo, Bergmann & Himes, 2013, pp. 624-625

A previous significant difference between the EU and the USA was that patent application priority was determined on different grounds, namely within the EU the applicant who was first-to-file received priority, as opposed to the first-to-invent in the USA. This meant that an invention could not be known or in use before the patent application was filed. This substantial difference disappeared when the US changed their principles for application requirement and also took on the first-to-file system.

Although the European Patent Office issues patent that all the EU member states are required to honor, each member state still also has its own patent office and applies its own patent laws. Most commonly, the member states just re-issue the same patent that previously has been examined and issued by the EPO.[102]

As mentioned above, Article 52 clearly rules out mathematical methods, presentation of information, and computer programs from applications eligible for patent protection. Furthermore, courts have also ruled out software on the grounds of software only automating a person's mental tasks. In fact, the EU is coming closer to the USA with regards to software and business methods patentability. Many observers have argued that this development follows from many US companies filing for patents in the EU, and during their processes have challenged court decisions about the patentable subject matter.[103]

The European patent legislation usually denotes that the law should treat inventions similarly, irrespective of which technology branch they are situated in. As an example of this general principle, an invention within biotechnology should be patentable under the exact same conditions as one within mechanical engineering, and this treatment obviously also applies to software inventions. While patentable subject matter is only one aspect of the concept of technology neutrality, it has already for some time been the most prominent aspect both on a European and global level. This aspect of equal treatment of different technologies has been treasured as an international obligation since its introduction in Article 27 of the TRIPS agreement:[104]

> *...patents shall be available for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application.*

[102] Chalecki, Gupta, Kong, Li & Lin, pp. 7-8
[103] Ibid, pp. 9-10
[104] Virtanen, 2013, pp. 621-622

Within the European patent system, the main patent and computer related topic for discussion obviously circles around computer-implemented inventions (CII). A term such as "software patent" is by some considered inaccurate, and according to this view, CII should be used instead. CII are defined as:

> *Inventions whose implementation involves the use of a computer, computer network, or other programmable apparatus.*[105]

4.3. Patentable Subject Matter

The European Patent Convention provides a multilayered approach to the question regarding patentable subject matter. The top approach, in Article 52(1) of the EPC, states that "European patents shall be granted for any inventions, in all fields of technology, provided that they are new, involve an inventive step and are susceptible of industrial application". This means that the initial approach to patentable subject matter is neutral with regards to technology, as it does not try to limit technology provided, as long as the general requirements, i.e. novelty, inventive step, and industrial applicability, are met. The existence of an invention, as mentioned in Article 52(1) of the EPC, is also an interesting criterion for patentability. The existence of an invention is an obvious precondition for the general patentability requirements of novelty, inventive step, and industrial applicability, but the EPC does not further disclose how the term invention is meant to be defined. The only guiding information in this respect can be found in Article 52(2), where Convention includes a list of what is not regarded as an invention. The Article reads, as follows:

> *The following in particular shall not be regarded as inventions:*
> *(a) discoveries, scientific theories and mathematical methods;*
> *(b) aesthetic creations;*
> *(c) schemes, rules and methods for performing mental acts, playing games or doing business, and programs for computers;*
> *(d) presentations of information.*[106]

From the above list, it appears as also software amongst other excluded activities, is categorized as a non-invention, and thus would be excluded from patentability. Subsequently, software seems to be singled out by a technology specific provision from other information technology with regards to patentability. At first, this appears to contradict the principle of technology neutrality in the TRIPS agreement. However, Article 52(3) sheds some additional light on this issue: "The provisions of paragraph 2 shall exclude patentability of the subject-matter or activities referred to in that provision only to the extent to which a European patent appli-

[105] Ballardini, 2012, pp. 16-17
[106] Virtanen, 2013, pp. 625-626

cation or European patent relates to such subject-matter or activities as such." The questions about how the "as such" limitation relates to software, or other computer implemented inventions, has since been a hot topic for debate and development through case law within the EPO and Member States of the EPC.[107]

Approaches to patentability may also significantly differ within the EU, because patent laws have not been fully harmonized between Member States. Even though the European Patent Convention has improved the harmonization between countries, for example it is not yet possible to receive an EU-wide patent. Inventors have the choice to either apply for a patent through their national patent offices or through the European Patent Office, but in both cases the validity of patents are evaluated based on the national legislation. Article 52 of the European Patent Convention aligns with Article 27 of the TRIPS agreement with regards to requirements that needs to be met, i.e. novelty, inventive step, and industrial applicability.[108]

Software inventions as such, were historically excluded from patentability in Europe. The start to a more lenient approach to software patents can be attributed to the ruling in the Vicom case in 1986. In the Vicom case, the invention related to a mathematical method applied in executing a computer program, and even though both mathematical formulas and computer programs belonged to excluded subject matter, the invention was still viewed as technical to its nature. Furthermore, the technical process of this claim should not be regarded as a computer program, and that technical means also includes the use of computer programs. The decisive issue in this case was the technical contribution to the prior art that the invention offers, regardless of that it utilizes modern technological means. The IBM decision became another turning point for software patentability in the EPO. In the IBM decision, it was stated that every execution of a program involves physical effects, but that this characteristic does not mean that the program in question is of technical character. Only if the program can produce physical effects beyond the normal physical effects, it should not be excluded from patentability. This decision lead to software product claims became more acceptable, and that the technical character became an unspoken requirement for inventions under Article 52 EPC. The next turning point within this area was the Hitachi case, in which the Technical Board of Appeal decided that methods involving technical means are sufficient for the existence of technical character. The purpose of the method did not matter under this ruling, in contrast to previous interpretations of the legal norms. In the Microsoft case of 2003, the interpretation went

[107] Virtanen, 2013, pp. 626
[108] Mylly, 2011, pp. 450-451

even further, when declaring that also computer-readable medium qualify as products with technical character, and that computer-implemented methods still should not be categorized as computer programs as such. This case significantly differs from the IBM case, as in the IBM case it was required that a computer program produces further technical effects, but computer-readable medium mentioned in the Microsoft case would never qualify under this requirement. The EPO has stated that the rulings in cases per se are not diverging, but that it is merely a question of normal evolution of case law.[109]

Even though the question about computer program patentability had existed in the EPO Boards of Appeal practice long before the famous IBM I and II cases in the late 1990's, the rational used in the decision making of those cases is still noteworthy with regards to software patentability under EPC. Most commonly the IBM cases are referred to as a result of the further technical effect approach that, together with the explicit acceptance of patentability of a computer program comprising of a computer-readable medium, at the time became a decisive criterion for the patentability evaluation of software. Yet, the reasoning used for justifying the existence of the further technical effect and underlying logic is still relevant for current analysis:

> *Within the context of the application of the EPC the technical character of an invention is generally accepted as an essential requirement for its patentability19. The exclusion from patentability of programs for computers as such (Article 52(2) and (3) EPC) may be construed to mean that such programs are considered to be mere abstract creations, lacking in technical character. The use of the expression 'shall not be regarded as inventions' seems to confirm this interpretation. This means that programs for computers must be considered as patentable inventions when they have a technical character.*

The IBM decisions found additional support and evidence for the requirement of technical character when implementing Rules 27 and 29 of the EPC concerning invention description content, and claim form and content. In brief, the invention description is required to reveal the invention in such terms that the technical problem and its solution can be understood, while the claims shall disclose the matter for which protection is sought in terms of technical features of the invention. As a result of the IBM decisions, the EPO practice and guidelines require patent examiners to give the existence of an invention and the list of excluded subject matter a wide interpretation in terms of Article 52. The ultimate goal is to determine, whether or not the claimed subject matter has technical character, and if it does not, there is no invention that fulfills the requirements of Article 52(1). This interpretation can be described as non-

[109] Mylly, 2011, pp. 452-453

technology-specific, because given that the subject matter in the invention has technical character, regardless what it is, it is considered an invention and not excluded from patentability on the grounds of the list of excluded subject matter in Article 52(2).

Only after this the deciding Boards continued in both cases to consider that the central issue was to define the meaning of the "technical character" feature, especially with regards to software. At the time, the decisive criterion became known as the "further technical effect" principle, which required that the further technical effect needs to go further than regular technical effects in the form of hardware modifications when a piece of software is run, or leads the software to solve a technical problem. This interpretation has been applied to software ever since. Still, the following question as to when technical character can be assigned to a piece of software has encountered different approaches during the years. Presently, the leading "any hardware" approach, which interprets the exception narrowly and thus permits the patentability of software broadly, is said to transform the meaning of Article 52 on software patentability.[110]

4.4. The Quest for a Unified Patent System

The analysis of software patentability focused for long on the question what is meant by software "as such", a question which has lost its relevance since it no longer stands in the way for software to patentable. The reflections do not however stop at this question, because since software as such exclusion is no longer relevant, the focus is shifted towards the interpretation of other patentability criteria. Such interpretations have a substantial effect on the protection scope.[111]

As the amount of actors is constantly increasing, and sectors are merging with each other, also the IP standards making processes has become more complex. Furthermore, it has had an impact on the degree of openness, transparency, and access. The European Commission is strongly promoting the fair rewarding of R&D investments through intellectual property rights. Signs of this support are also visible on the Commission's agenda. In this sense, international co-operation on new technologies are central for reaching broader consensus and early agreements regarding standards.[112]

[110] Virtanen, 2013, pp. 626-628
[111] Mylly, 2011, pp. 454
[112] Schwarz da Silva, 2007, pp. 87

The European Union has for some time trying to accomplish unitary patent legislation, through which one application would be enough for reaching unitary patent protection within the entire EU. The unitary patent was not designed to replace the European patent system, and both systems are thus available to applicants. Because all countries, who have agreed to the European patent system, are not members of the EU, a European patent still needs to be separately registered in all non-EU countries, as well as in all EU Member States that have not joined the new unitary patent system.[113]

The future will hold what the impacts of the unitary patent system will be. After the reform, companies operating only in their domestic markets will have to pay attention to all patents granted by the EPO, which have applied for unitary protection. This means that the risks for infringement and legal proceedings will increase. On the other hand, for companies operating in the European internal market, the unitary patent has been viewed as a cost effective way of receiving geographically wide and content-wise uniform patent protection. How case law of the new court system will take shape, will be closely scrutinized until new interpretations have been established and become predictable.[114]

[113] Aalto-Setälä, Sundman, Tuominen & Uhlbäck, 2016, pp. 125
[114] Ibid, pp. 129-130

5. China – A Late Arriver, but Fast Mover

5.1 The Basics of Chinese Patent Law

The Chinese Patent Law allows for three different kinds of patents, i.e. inventions, utility models, and industrial designs. The patent system is based on the first to file principle, as well as on early publication and delayed examination. The Patent Law in China also allows for foreign nationals to benefit from National Treatment when applying for patents.[115]

Out of the three kinds of patents, invention means any new technical solution that relates to a product, a process, or improvement of either one. The requirements of an invention are that it needs to include innovation, i.e. be unprecedented compared to prior art. It also needs to utilize rules of natural science. Furthermore, the invention has to provide a concrete technical solution to a problem, which means that it should be able to be exploited, have a definite technological effect, and be repeatable.
Utility model patents are of great importance in China, as the most common patent form. A utility model means a new technical solution that relates to shape or structure in a product that can be used in practice. Both utility models and inventions can be categorized as technical solutions, but they differ from one another through their scope, and inventiveness requirement. The subject matter of a utility model patent needs to be a product with a fixed form or structure, whereas an invention patent can be both a product and a process. Furthermore, the inventiveness requirement for utility models is less strict than that of patents, and the examination procedure for utility model patents is less complex and faster.
Industrial design means any new shape, pattern, or color design of a product, which is ready to be used for an industrial application. The requirements of the design are that it must depend on a product, and create an aesthetic feeling without any practical functions. This is a distinguishing difference in comparison to an invention or utility model, which are both are technical solutions that need to solve a specific technical problem.[116]

The Chinese patent legislation has been introduced not too long ago, in comparison to the USA and European countries. But even though China's patent law introduction in 1985 was quite late, the Chinese government has kept a steady pace ever since, with regards to updating the legislation and bringing in line with the international norms, for instance through the GATT Agreement on Trade-related Aspects of Intellectual Property Rights. As a consequence

[115] He, 2011, pp. 26
[116] Ibid, pp. 32-33

of China's short traditions with regards to intellectual property rights, it is hardly any wonder that the Chinese patent and copyright legislations are still to a large part inconsistent. Also, the nonexistence of case rulings in this area also makes it hard to entirely apprehend the effects of Chinese laws. Worth noting is also that Chinese courts hardly ever base their decisions on case laws, but rather on strict interpretation of the written norms.[117]

The Chinese Patent Act was formed in 1985, and since then the development of computer technology has been so rapid that it has raised several questions about the patentability of software implemented inventions. As there thus far has not been much case law on software patents, the biggest area of concern has been the issue of patent prosecution, especially with regards to eligibility for protection, as well as the inventive nature of technical and non-technical patent claims. As the provisions concerning these issues are still in the process of developing into their final forms, as examiners are gathering experience about the issues, the current system is not fully developed and mature.[118]

As an examination of any countries legal environment should begin with an inspection of the written law of the jurisdiction, one should ask oneself whether or not the Chinese intellectual property laws are sufficient. In spite of the novelty of Chinese intellectual property rights, they are as a matter of fact on the same level as those of similar countries, and actually closely resemble e.g. the laws of Germany. As mentioned above, the Chinese have also been repeatedly revised approximately every eight years, in order to make improvements to and create a suitable legislation fitting for an economic superpower such as China.[119]

The Chinese intellectual property rights' resemblance to e.g. Western European IP legislations can be explained by the facts that the Chinese have used the legislations of other developed countries as a benchmark, and that they have drafted their legislation to conform to international standards.[120]

In similar fashion as Japan and the EU, China also bases its intellectual property rights system on a first to file-principle, but also requires originality as a precondition for filing an application. Furthermore, the Chinese legislation also contains usefulness and non-obviousness principles, which also can be found in other countries.

[117] Chalecki, Gupta, Kong, Li & Lin, pp. 9
[118] Luginbuehl & Ganea, 2014, pp. 94
[119] Bach, 2009, pp. 5
[120] Ibid, pp. 5-6

China radically changed its patent law in 1992, as it expanded the patent protection's scope to include all types of technological inventions, i.e. both new products and new techniques, and also including pharmaceutical products. Before the reform, the Chinese legislation did not provide protection for chemical or pharmaceutical inventions, as such inventions were categorized as discoveries rather than inventions. Along with widening the scope of patent protection, also the length of protection was extended from the previous 15 years to 20 years, with the aim of conforming the Chinese legislation to the international environment. As a last point, China relaxed its compulsory patent licensing clause, in order to reduce the risk of patent holders being obliged to publicly disclose their technologies.[121]

When reading about Chinese intellectual property rights in Western media, the portrayed picture can quite easily lead the reader to believe that Western companies have little or no chance of receiving protection for their intellectual property in China. Without a doubt, many companies from the USA and the EU believe that Chinese companies would, if opportunity arises, copy their technologies, without the Western company having very little chance for remedy. Interestingly enough, a new perspective is on the rise among Chinese companies, who believe that foreign companies have the upper hand in enforcing their intellectual property rights in Chinese courts.[122]

Similarly to the USA, China has also chosen to protect computer software under copyright law instead of under patent or contract laws. Possibly distinctive to China is that the "Computer Software Protection Rules" were passed to explicitly address the software protection topic.

As previously mentioned, there is lots of uncertainty surrounding Chinese laws. One reason for such uncertainty originates from the following provision in Article 32 of the Computer Software Protection Rules:

> *Where the holder of software does not know or has no reasonable grounds for knowing that the software is infringing (upon an existing copyright), liability for infringement shall be borne by the supplier of the infringing software.*

This provision significantly differs from the other intellectual property laws, and means that not being aware of that you have been infringing someone else's intellectual property right could very well be a valid defense in Chinese courts.

[121] Chalecki, Gupta, Kong, Li & Lin, pp. 9
[122] Bach, 2009, pp. 4-5

Although software is protected under Chines copyright law, it is not protected under Chinese patent laws. As a matter of fact, software, business methods, methods for diagnoses and treatment of diseases, as well as several plant varieties can be interpreted as being unpatentable in China.[123]

Whether or not an invention related to software is patentable, is to the most part decided by Article 2(2)1 and Article 252. Article 2(2) contains a definition of the term "invention" according to Chinese law, as well as a reference to "technical solutions" as the subject matter that qualifies for protection. Article 252, on the other hand, excludes certain subject matter from patentability.

Although the Patent Act does not provide a clear definition as to inventions that are software related, the SIPO Examination Guidelines provides more details with regards to this issue. Firstly, the Guidelines define a "technical solution" as a combination of technical means that apply laws of nature for solving a technical problem. For the second part, the Guidelines define "rules and methods for intellectual activities" by describing them as rules and methods that govern individual people's thinking, expression, judgement, and memorization. Furthermore, the Guidelines also include extensive provisions about software-related inventions, which further explain the concepts of "technical solutions" and "rules and methods for intellectual activities", both with a focus on computer technology.[124]

5.2. How to Interpret the "Technical solution" Requirement?

Many software-related solutions are excluded from patent protection either as "rules and methods for mental activities" or as "non-technical". The Guidelines to the legislation state that in case all content of a claim contains, besides rules and methods for mental activities, also technical features, the claim as a whole should not be considered should not be excluded from patentability. In accordance with this provision, the greater part of software invention applications should not be excluded from protection as non-patentable rules and methods for mental activities, as most applications that relate to computer software also include technical features. However, the Guidelines also contain a paragraph stating that

> *if the solution of an invention application relating to computer programs involves the execution of computer programs not in order to solve technical problems, or does not reflect technical means in conformity with the laws of nature by computers running programs to control and process external objects, or the effect obtained is not re-*

[123] Chalecki, Gupta, Kong, Li & Lin, pp. 10-11
[124] Luginbuehl & Ganea, 2014, pp. 95

strained by the laws of nature, the solution is not a technical solution as provided for in Article 2 and is not the subject matter of patent protection.

Because of this, a claim containing technical features should not be excluded from patent protection just because it relates to rules and methods for mental activity, as long as it some technical subject matter. Just in case the technicality requirement in the Patent Act is not met in a way that the solution does not solve a truly technical problem, the application is not eligible for protection. For this reason, the vital question for the Chinese examiners is whether or not the inventions subject matter relates to a "technical solution", in accordance with Article 2 pf the Patent Act. The deciding issue is therefore what subject matter can be categorized as technical. Fortunately for the examiners, the Guidelines provides a definition for what should be categorized as a "technical" subject matter, namely according to the Guidelines the solution must include 3 elements, in order to be classified as "technical". Firstly, the invention should resort to "technical means", and secondly, the invention should solve "technical problems". The third element mentioned in the Guidelines is that the invention should produce a "technical effect". Within the patent field, the term "technical" is one of the most frequently used terms, as it forms a dividing line between subject matter that is patentable and non-patentable. The Chinese law makers have opted not to define the term "technical", but the Guidelines still seem to reflect a common understanding, according to which a solution is "technical" if it is "restrained by the laws of nature".[125]

5.3. Rules and Methods for Intellectual Activities and Laws of Nature

"Rules and methods for intellectual activity" are in a global scope excluded from patent protection, but the interpretation of this term varies between countries. For example, in the post-EPC era, mathematical methods are considered their own category, and as such, separate from rules and methods for intellectual activities. This distinction is contrary to the SIPO Guidelines, according to which mathematical methods form a part of the category "rules and methods for intellectual activity". It is important to note that mathematical theories and other abstract concepts, very well can be "technical" to their nature and even become tools for technical activity. As a result of this, checking the conformity between the laws of nature and abstract concepts such as mathematical theories is not enough to fully exclude them from patent protection. The deciding factor for excluding abstract intellectual concepts from protection is if they form basic tools for research, because their monopolization in that case could jeopard-

[125] Luginbuehl & Ganea, 2014, pp. 95-97

ize future research and stall development. As a conclusion, excluding such abstract concepts from patent protection is justified for finding a necessary balance between patent holders' and the general public's interests. Especially abstract concepts that cover an overly broad subject matter should be excluded from patent protection.[126]

The tight connection between the novelty and inventive step criteria, and examination of patentability exceptions has for some time been an interesting issue, not least for academic scholars. Several patent systems have opted to scrutinize the claim's technical contribution in comparison to the prior art, and together with patentability exceptions. Conversely, a popularity growing opinion seems to be challenging this traditional view of analyzing the technical contribution together with prior art. According to this more recent opinion, the patentability criteria of novelty and inventive step are better suited for concluding the level of technical contribution offers in relation to the current state of the art standards. This new approach is very much reflected in China's "three elements of technical solution" definition, as well as in the EPO's case law, where the computer implemented inventions patentability is covered from the standpoint that all claims should be examined with the inventions "further technical effect" in mind, even though it could lead to the subject matter not being excluded. As the distinction between "technical" and "non-technical" strongly depends on the problem to be solved by the invention and how that problem should be solved, the term "technical" inevitably becomes the link between the criteria for patent eligibility concerning the inventive step requirement. This link exists regardless of whether the "technical contribution" has been tested as a part of the patent eligibility testing or also as a part of the inventive step testing. As a matter of fact, the results in both cases might not at all be different. A special characteristic of the Chinese patent examination process, is that even though the "technical contribution" is scrutinized within the general patent eligibility examination, Chinese examiners also apply the criterion in inventive step examination.[127]

Just like any other developed states, China also has incorporated intellectual property laws concerning patents, trademarks, copyrights, and trade secrets. As an addition to utility patents and design patents, Chinese law also includes "patents for utility models", which cannot be

[126] Luginbuehl & Ganea, 2014, pp. 97-98
[127] Ibid, pp. 101-102

found e.g. in U.S. legislation. It is essential for Chinese intellectual property law, that a practitioner understands each one of these options, and how to apply them in a given situation.[128]

5.4. Patents for Inventions

In China, all patent application are submitted to and handled by the State Intellectual Property Office in Beijing, where e.g. patents for inventions are handled in the same manner as in Western countries. Generally, patent applications are examined for compliance with regards to sufficiency of disclosure, novelty, and inventiveness, which are the requirements for having one's patent application approved. China is also a member of the Paris Convention and the Patent Cooperation Treaty, which means that companies that first have filed their patent applications outside of China may at a later time use the Patent Cooperation Treaty vehicle to enter China.

Similarly to both Europe and the USA, jurisdictions where the first-to-file is entitled to receive protection for their patent, the Chinese law also favors the applicant which is first-to-file. However, a significant difference between the USA's and China's application procedures is that in the USA, patent applications are placed in an examination queue after filing, in China, patent applicants are required to file a request for examination within three years of filing their application. If the applicant neglects to file such a request, the application will not be examined and thus will be considered abandoned.

Although business methods can often be difficult to patent, software can be patented in China, if the application is filed properly. Business methods can only be eligible for a patent, if they include technical innovations. Such technical innovations have to mean technical improvements to the product, i.e. a new ways of doing business are not sufficient. Software applications can on the other hand be submitted for methods, apparatuses, or storage media. Even though patents in China are relatively more expensive than other forms of intellectual property rights protection, they are still much cheaper than jurisdictions such as e.g. Japan and Europe.[129]

5.5. Selecting the Correct Patent Claims

Different types of patent claims require different forms, and in accordance with the Guidelines an invention application claim for computer software should be drafted either as a process claim or a product, which also can be referred to as an apparatus claim. The form of

[128] Bach, 2009, pp. 7-8
[129] Ibid, pp. 8-9

claim should be supported by the description, which is why for instance a product claim that is only based on the flow of software disclosed in the description would probably be rejected. The correct form of claim for this type of an invention would obviously be a process claim. Conversely, the applicant might have doubts about whether or not a process claim will provide sufficient protection to the invention. A major concern for the applicant could be that a process patent only protects against infringing users, a concern based on the fact that for software, patent holders can only enforce their rights against infringing computer device users, and not against the manufacturers or distributors of the device being used. This problem originates from the conflict between the traditional comprehension of a process patent and the special features linked with running computer software. In its traditional form, a process needs to start at the initiative of someone, in order for these persons or organizations could be held liable for patent infringement. But in case of software, the process can be automatically initiated by computers as soon as the software has been loaded into the computer. During this type of a process, the only action required by someone might be limited to pushing one button, and patent holders often do not want to take legal action against such an operator. They would rather sue the manufacturers of the device necessary for starting the process. For serving towards the interest of patent holders with regards to their possibilities for suing the manufacturers, SIPO has developed a software specific form of claim, which relates to the flow of computer programs. This revised provision is stated in the Guidelines, as following:

> *If an apparatus claim is drafted on the basis of computer program flow completely and according to the way completely identical with and corresponding to each step in the said computer program flow, or according to the way completely identical with and corresponding to the process claim reflection the said computer program flow, i.e., each component in the apparatus claim completely corresponds to each step in the said computer program flow or each step in the said process claim, then each component in the apparatus claim shall be regarded as function modules which are required to be built to realize each step in the said computer program flow or each step in the said method. The apparatus claim defined by such a group of function modules shall be regarded as the function module architecture to realize the said solution mainly on the basis of computer program flow described in the specification rather than entity devices to realize the said solution mainly through hardware.*

In the beginning, patent applicants were thrilled for the opportunity of drafting a product claim based on the software flow, without any fear of rejection due to insufficient support by the disclosed solution. As a result, the new claim simplified the suing of the manufacturers, but in turn the draft of such a claim, especially with regards to several claim requirements, was quite difficult to adhere to. It is widely considered that as the complexity of software increases, it will also become more difficult to describe the software in terms of hardware, espe-

cially as an increasing amount of solutions are being based on the software flow instead of on the hardware. Because of this development, one could expect that these types of claims would be accepted even if they would not be described through the hardware.[130]

5.6. Enforcement and the Courts' Role

How intellectual property rights are enforced in China is such a complicated matter, that it deserves to be covered separately. In contrast to the USA, where one can enforce his or her rights through the justice system, intellectual property rights in China are enforced either in courts or through administrational proceedings. The more customary administrational process starts by the rights holder filing a complaint at the local administrative office. If there is reason to suspect infringement of intellectual property rights, the administrative office can quite effectively acquire information about the goods, and also if needed, seize the infringing goods. The local administrative office can also fine the infringer, but it does not have the authority to award any damages. The local administrative offices might also have different authority limitations with regards to both subject matter and jurisdiction. For cases regarding patent infringement, local offices, established by the State Intellectual Property Office, have been established all over China, with the responsibility to receive and investigate allegations concerning infringement. However, an intellectual property rights holder does not solely need to rely on such local administrative offices, but also has the option to file a complaint with the courts. The advantage of the Chinese legal system, compared to the US equivalent, is that the Chinese proceedings are significantly cheaper. The downside of the Chinese system is that navigating the system probably requires help from a local lawyer. One distinctive feature of the Chinese legal system is that the court's acceptance of a complaint is regarded as a minor victory for the plaintiff, and is usually publicly communicated through press releases.[131]

While China is a civil law country, courts are still relied upon for interpretation of texts of laws. This expectation dates back to the early days of intellectual property laws in China, when the laws were very simple and general. Courts were thus expected to fill the gaps, and have since been active in generating precedents. Within intellectual property rights, the rights have been extended to cover wider subject matter or award stronger protection than what the formal rules would provide. Chinese courts have also been known for using foreign doctrines

[130] Luginbuehl & Ganea, 2014, pp. 105-107
[131] Bach, 2009, pp. 14-15

for deciding difficult cases, thus incorporating foreign legal concepts and rules into the Chinese legal environment.[132]

Chinese courts are not independent, even though independence and accountability are central to governance in courts. However, Chinese courts' administrative hierarchy is very similar to corresponding administrative organs, which is why it is difficult for judges to avoid the influence of the administration. In Chinese courts, officials at different hierarchal levels, as well as the political party and other administrative organs can try to influence specific cases. Judges are usually selected by the political party, and also the court budgets are determined by local governments. The result is that many foreign commentators have questioned the nature of the Chinese system with its strong presence of local protectionism, especially with regards to IPR enforcement in China.[133] As mentioned above, the Chinese intellectual property rights legislation is enforced by courts and administrative agencies, a fact that makes the Chinese IPR enforcement unique. The courts' roles also include performing judicial reviews over administrative acts.[134]

The specialized IP courts are also exploring the option to implement the principle of precedents for their decisions. In 2015, the Supreme People's Court established a base for IP precedents in the Beijing IP Court. The Court produced a guideline, which clarified which precedents could be followed, when a precedent can be created, and how a precedent can be compiled etc. China, being a civil law country, still is in a challenging position for introducing a system of IP precedents, without jeopardizing the coherence of the entire Chinese judicial system. Nevertheless, the precedents principle is expected to increase uniformity for IP law disputes.[135]

5.7. Will the Development of Patent Practices Continue?

The Chinese government has made remarkable efforts in creating and promoting a culture of innovation with the aim of changing China's profile from a manufacturing nation to a nation of innovations. This type of shift is also self-fulfilling, as Chinese companies in the middle of transformation from ´manufacturing to innovation will push the authorities for increased enforcement of their intellectual property rights. This transformation will obviously also benefit foreign companies wishing to register their patents, trademarks, and copyrights in China. On

[132] Lee & Zhang, 2017, pp. 905
[133] Ibid, pp. 910
[134] Ibid, pp. 906
[135] Ibid, pp. 910

the other hand, companies that mistrust the Chinese legal environment, and therefore neglect to seek protection for their intellectual property rights, may find themselves sued for infringement, without having a chance to counter the lawsuit with any intellectual property rights of their own.[136]

Patent application examination regulations concerning software, as well as the practices related to examination are constantly being improved. The current Chinese legal framework seems quite conservative in comparison to other legal frameworks. Thus, development within this area has to keep the same speed in other legal areas, in order for the entire patent system to be aligned with the objectives of Chinese technological development.[137] As the EU and the USA have both developed guidelines for IP and competition issues, they could also be used as an addition to the TRIPS Agreement's anti-competitive practices regarding anti-competitive actions in technology licensing and transfer. This type of guidance could be helpful for IP and competition policy formulation in developing countries.[138]

[136] Bach, 2009, pp. 15-16
[137] Luginbuehl & Ganea, 2014, pp. 107
[138] Raju, 2014, pp. 18

6. Analysis and Conclusion

6.1. Choosing the Correct Form of Protection for Software

From what has been described earlier, it is quite obvious that the legislative environments surrounding the intellectual property of computer software are far from being perfect. Even rules which have admirable objectives might have some issues with regards to how they are implemented. The following part aims to discuss potential improvements to the legislation surrounding computer programs.

The first overarching question relates to copyright of software, and whether copyright at all should be applied to software. As copyright protects the expressions of ideas, without protecting the ideas themselves, copyright is not usually used for protection of functional objects. For functional objects, patent protection is far more typical. Already during the 1980's and 1990's there were suggestions that copyright was not the right form of protection for software, and similar suggestions can still be heard as a consequence of the reasoning that copyright protection might hinder innovation within software development.

With regards to patent protection, computer software fit this category exceptionally well, as they are expressive of nature and functional to their character. Patents are exclusive rights for inventions, and are awarded if the invention is novel and inventive. If the invention meets the prerequisites and is awarded with patent protection, the protection time period is shorter than for copyright, but instead there is no room for using the protected invention for independent development. In essence, the patent provides the patent holder with a monopoly on the method. There is no doubt that software can receive patent protection, and thus makes software one of the few intellectual property right categories that can receive more than one kind of intellectual property right protection.

Software can appropriately be suggested to be protected by a unique, i.e. sui generis, form of intellectual property protection, as a result of software combining expression and functionality. For this reason, many have suggested a hybrid protection model consisting partly of patent and partly of copyright protection. According to this suggestion, protection for a short time period should be completely or nearly automatic, especially for innovative developments, where the right's holder can receive some revenue from the development work. Through such development, software could receive practical and valuable protection. However, as copyright protection tends to be deeply integrated into international and national legislations, it is quite

unlikely that sui generis protection for computer software would be implemented, despite practical appeals and well-considered opinions saying that it might be worthwhile to reconsider this standpoint.

Intellectual property protection for software needs to also be considered from the view that software could be categorized as speech. For instance, the legislation in the USA guarantees freedom of speech, a right that can only be regulated if there is an important governmental or social interest. This definition has become meaningful also for software through recent US court decisions, where the courts have held that software code indeed can be classified as speech, at least to some extent. This interpretation means that also software in source code form can receive the same type of protection as speech. For instance, there have been claims that software is the central key in communication in modern society, and that it will become the dominant form of discourse eventually. Software code is also in an ever greater extent defining the boundaries for our communication. The essence of this discussion is to emphasize the overarching nature of software with hopes of a political decision to be made with the essence of software in mind.[139]

6.2. Summary of Key Differences

The majority of countries look as if they are coming together and more or less agreeing on standards with regards to intellectual property rights, particularly in the field of patent laws, which often cause the biggest debates. The USA, the EU, and China have significantly come closer to each other through amendments, and even though China was later to get started in the global market, they have been catching up quickly. There are lots of similarities between the selected nations, but a few of the key differences between the patent legislations in the USA, the EU, and China are the following:

All three include a first-to-file system, but the US system is limited to one year, whereas the other two legislations require complete novelty.

- The USA is clearly the least restricting when evaluating patents for software, while the EU is the most restrictive.
- Software as such is not patentable in China.

[139] Ahmad, 2008, pp. 51-53

- The legal proceedings are clearly different in China, because case law and precedents have little or no significance there.[140]

The US Congress passed the America Invents Act in 2011, and its main provision came into effect in 2012 and 2013.[141] Prior to the launch of the America Invents Act (AIA), the USA was one of the few states that had implemented a first-to-invent system. Even though the change to a first-to-file system was not required by international treaties, it brought the US' legislation more in line with the international standards. Even after this significant shift, there are still substantial differences between patent legislations in different countries. One example of such differences is the "one-year grace" period in the USA (§102(b)), for which there is no equivalent in many countries, as inventors are required to file their applications before publishing the invention.[142] The other main change that the AIA brought was an expansion of patent reviewing processes. For example, AIA's "post-grant review" statute means that anyone has the right to challenge a patent's validity within nine months of its issuance. The aim of this reform is to improve the patent quality, through better mechanisms for invalidating patents that never should have been granted.[143]

I. Comparison Chart[144]

	USA	Europe	China
REQUIREMENTS			
- **Who can file**	First to file	First to file	First to file
- **Uselfulness**	Yes	Industrial applicability	Yes
- **Novelty**	1 year grace	Absolute novelty	Absolute novelty
- **Non-obviousness**	Yes	Yes	Yes
- **Technical aspects**	No	Yes	Yes
DURATION			
- **Inventions patent**	20 years	20 years	20 years
- **Design patents**	14 years	25 years	10 years
- **Utility model patents**	N/A	10 years	10 years
PATENTABILITY			
- **Machines, apparatus**	Yes	Yes	Yes
- **Software**	Yes	Yes	No
- **Business methods**	Yes	Yes technically, but most restrictive	No
- **Mathematical algorithms**	Not by itself	No	No
- **Laws of nature, pure scientific truth, mathematical formulae**	No	No	No

[140] Chalecki, Gupta, Kong, Li & Lin, pp. 13
[141] Boyle & Jenkins, 2015, pp. 640-641
[142] Ibid, pp. 649
[143] Ibid, pp. 640-641
[144] Chalecki, Gupta, Kong, Li & Lin, 2004, pp. 12

6.3. Patent Law Comparison: USA vs. China

Before the US Supreme Court opinions in In re Bilski and CLS Bank v. Alice, the US intellectual property legislation was known for having fewer restrictions on software patents than many other countries. After these cases however, the situation has changed, and if one now compares Chinese patent law and current US law with regards to software, you can see that US law restricts software patents significantly more than its Chinese counterpart. Since China yet does not have any decided cases in the software patent area, the basis for examining the software patent environment has to be the Chinese Patent Act, it regulations and guidelines. For example, Article 2.2. of the Patent Act states that only "technical solutions" are patentable subject matter. Furthermore, Article 25.2. also excludes "rules and methods for mental activities" from being patentable. The consequence of these restrictions is that a software technology must satisfy both the requirement of being a technical solution, as well as the requirement of not being a rule or method for mental activities, in order to qualify for patent protection. The Patent Act's guidelines define a "technical solution" as a program, which has the purpose of solving "a technical problem by a technical means to produce a technical effect". This definition still remains somewhat vague, as the guidelines do not include any definition of "technical problem", "technical means", or "technical effect". In reality, patent examiners do enjoy some flexibility when applying the guidelines and rules. Nevertheless, there are requirements that an applicant should try to meet, when he or she is drafting a patent. Consequently, and at least to some extent, the patentability of software related technologies rely on the examiner's perspective and how the application is drafted by the patent lawyer.[145]

In Article 25, the Patent Act lists several exclusions to patentable subject matter, one of them being "rules and methods for mental activities". To be precise, a patent will not be excluded from patentability, if it withholds "technical features". However, in practice an application has to include at least one "technical feature", which is distinctive from the prior art, in order to beat the hurdle. The general conception is that the "rules and methods for mental activities" standard is inferior to the "technical solutions" standard, as a patent application quite easily can live up to the "rules and methods for mental activities" requirement, as long as it meets the "technical solutions" criterion.[146]

[145] Merges & Bian, 2014, pp. 9
[146] Ibid, pp. 10

In China, just like in the USA, the patent examiners consider whether or not all features that add to the prior art are of technical character. The difference is that a Chinese examiner will likely not find that additional limitations, such as the use of rules rather than artists, for setting the balance and transitions between phenomena, as abstract ideas. The required technical feature is met if the claimed software invention uses computers to implement a specific algorithm for solving an actual technical problem. It looks like the Chinese patent law is closer to the "tied to a machine" requirement in the USA, a requirement highlighted in In re Bilski. The "tied to a machine requirement is basically less restricted than the current requirement that has been established in CLS Bank vs Alice. Comparing to them, the current US patent law seems to be reaching too far with regards to restricting software related patents.[147]

6.4. Patent Law Comparison: Europe vs. USA

It seems evident that the software patentability is not uniform, thus while the EU emphasizes "technical advancement", the U.S. has a liberal approach allowing application of a formula. The U.S. PTO guidelines state that if computer-readable memory influences the computer process, then the claim can be granted. In Europe, the claim's nature is required to be laid down in more detail. Thus, the U.S. can be viewed as having a pro software patent approach, whereas Europe is more in favor of non-patentability.[148]

It is interesting to note that, especially in the beginning, most of the European software patents were granted to companies from the USA and Japan. This surprising fact probably can be traced back to that Europeans are used clear legislative rules, and therefore assumed that software weren't patentable as they were literally excluded in §52. On the other hand, American companies were eager to challenge European corporations on software patents in order to create case law precedents.[149]

The biggest differences in the prior art requirements essential for patenting between the USA and Europe, can be divided into three categories:

1. The US system offers a grace period, while the European system does not
2. The US system includes geographical restrictions, while the European system requires ab-

[147] Merges & Bian, 2014, pp. 12-13
[148] Singh & Kashyap, 2017, pp. 5
[149] Guntersdorfer, 2003, pp. 7

solute novelty

3. The two systems have different interpretations of commercial and public use[150]

The Bilski case left lots to be interpreted and defined for future cases. For now, it is still fair to say that the Bilski case represents a significant shift in US patent policy by substantially narrowing the scope of process patents. By doing so, the Bilski case moved the US Patent Office's practice in the direction of the practice in Europe, where business methods are not considered patentable. Allowing abstract inventions, such as those related to business methods, is a clear difference when comparing the broad American approach to the more restrictive European approach. Without doubt have the European patent policy limits functioned as a blocking filter for insignificant inventions, thus leading to better quality patents. It is plausible that also CAFC had this type of development in mind when making its decision.[151]

An analysis of the case law discloses that EPO case law has to great extent followed the rulings and interpretations in the USA. In the 1970's, algorithms were declared unpatentable in the US, and the European Patent Convention also excluded computer programs from patent protection in 1973. The next step of development was taken in the US, in the Diamond v. Diehr case, which to a great deal resemble the Vicom case in Europe. These cases meant that claims directed at a technical process were no longer considered excluded subject matter. US developments have surely put pressure on the European patent system later on, and one can also find links between the interpretations and developments in the European cases Pension Benefit (2000), Hitachi (2004) and Microsoft (2006), and previous US decision of the same logic in the cases In re Alappat (1994), State Street Bank & Trust v. Signature Financial Group (1998) and AT&T v. Excel Communication (1999). These decisions in turn broadened the patentable subject matter, and interpreted the term "software as such" narrowly.[152]

The Bilski and Alice cases casted a shadow on the popularity gaining view that court decisions provide the optimal mechanism for achieving a patent reform in the USA. Until recent years, patent law development in the USA has followed a two-step process, where the first step is a Congress hearing for airing industry concerns, and the second step is a judicial opinion that attempts to provide a solution for these concerns.[153]

[150] Sarvas & Soininen, 2002, pp. 16
[151] Ballardini, 2009, pp. 370
[152] Mylly, 2011, pp. 460-461
[153] Arezzo & Ghidini, 2011, pp. 193

After the Bilski v. Kappos case, the subject matter law within US patent processes returned to the 1980's, with the exception of a revitalized exclusion of abstract ideas. As a result, any mixed process invention claim that does not completely fall under laws of nature, physical transformations, or abstract ideas, will meet the threshold for patentable subject matter. Until there are a clear set of rules to follow, the USPTO has to apply the vague standards of the Benson, Flook, and Diehr cases. In case the claim includes a physical transformation of matter, then all previous decisions agree that the invention is patentable. But if not, it is unclear under what conditions a claim will not be labelled as an abstract idea, and thus excluded from patentability. Nevertheless, a business method claim has to also meet the requirements of novelty and innovative step, and it has thus been suggested that the CAFC should shift the critical patentability standard to these tests instead of the subject matter requirement of Section 101.[154]

6.5. Patent Law Comparison: China vs. Europe

The strong role of administrative organs with regards to making and implementing Chinese intellectual property laws makes the Chinese regime unique compared to other countries. Even though this set-up creates a critical problem of neutrality, it still might be necessary for efficient implementation of IP laws in China, where there is strong resistance against intellectual property rights as private rights. The criticism against the role of the administrative bodies has primarily focused on lack of transparency, inconsistency in implementing laws, insufficient resources, conflicts of interest, and lack of collaboration between government offices. In this perspective, the specialized IP courts in China might create a much needed balance for IPR governance. Within the governance of the IPR's that are private rights, decisions in courts are vital, but because of the Chinese specialized IP courts' lack of judicial independence, e.g. compared to Europe, they face questions of impartiality. When the courts become more independent from the influence of administrative bodies, the outside forces will have less influence on judicial decision-making regarding IPR's. At this stage, it is also expected that the courts should function as a peer institution to the administrative bodies, instead of having a subordinate role.[155]

Regardless of its successful case dockets, it still seems to be too early to determine the specialized IP courts have a positive effect on the Chinese enforcement of intellectual property

[154] Marsnik & Thomas, pp. 265
[155] Lee & Zhang, 2017, pp. 919-920

rights. Nevertheless, there are already signs that they will provide uniform interpretation of the law, e.g. neutral selection of judges, use of technical experts, and the proposal of establishing the principle of precedents all point towards a bright future. If nothing, the courts will at least signal that intellectual property rights are private rights that shall be governed in a court of law, thus making IPR's in China significantly more market-oriented.[156]

From the cases and legal development thus far, one might get the impression that subject matter exclusions for software patents is no longer a relevant ground for dismissal, and that software patents only are rejected due to the lack of inventive step. This is at least partly true, because concerns have been raised about patents being granted to too trivial inventions. One problematic issue that has been identified in these discussions has been the practical difficulties of identifying prior art of new technologies, and as a consequence of this the quality of granted patents is relatively low. In addition to these practical problems, it has also been argued that the inventive step analysis has lost its meaning and that as a result patents are granted solely on the basis of novelty.[157] Article 52 of the EPC could significantly be clarified in the field of computer programs. Especially the inventive step concept should be reformulated, and the patentability scope limited.[158] It seems fair to say that the current shattered patent law norms and interpretations are not equipped to solve all the present issues, and for solving the issue, the systems need to become cohesive, preferably on a global level.

Europe seems now to be closer than ever to creating a unitary patent system. The discussion with regards to this has been ongoing for decades, and the current fragmented situation makes it challenging for companies to operate in an uncertain and potentially distorted legal environment. Also courts and legislators face these issues. Among the most recent initiatives are two reforms presently under discussion, namely the unified patent system and the Unified Patent Court. Under the unified patent system, EPO granted patents could apply in all Member States, co-existing with national patents. Furthermore, the EPO would be handed the tasks of soliciting, registering, publicizing, collecting and distributing renewal fees.[159] The European Patent Office's website states that:

> *The EU regulations establishing the Unitary Patent system (No 1257/2012 and No 1260/2012) entered into force on 20 January 2013, but they will only apply as from the date of entry into force of the UPC Agreement, that is, on the first*

[156] Lee & Zhang, 2017, pp. 921
[157] Mylly, 2011, pp. 456
[158] Ballardini, 2012, pp. 27
[159] Ibid, pp. 18-19

> *day of the fourth month following the deposit of the 13th instrument of ratification or accession (provided those of the three Member States in which the highest number of European patents had effect in the year preceding the signature of the Agreement, i.e. France, Germany and the United Kingdom, are included).*[160]

The start date of the new system is expected for the first half of 2019, but no exact date is yet to be announced. The more cohesive the EU internal patent processes can be made, the more European companies, inventors, and societies will benefit from the unified processes.

The basis for intellectual property protection legislation is that imitation is associated with copying, and many scholars have argued that both intellectual property right holders and society would benefit from weak intellectual property enforcement and protection, especially in an interactive and dynamic environment, like the Internet. This argument is based on the fact that there seems to be little or no evidence suggesting that copying or imitation prevents innovation in a dynamic environment. The supporters of this argument conclude that the ideal form of intellectual property protection would be weak enough to encourage cross-licensing, but still strong enough to prevent direct copying.[161]

Potentially one of the most surprising weaknesses of software patent research is the lack of an official definition for software patents. Most often it is quite clear what is meant by a software patent, but the lack of definition becomes an issue when there is an attempt to analyze existing patents. Unexpectedly, research shows that software patents very seldom are applied by traditional software companies. According to one study, about five percent of software patents belong to software companies. The main parts of software patents belong to big manufacturing companies in industries where strategic patenting is common.

During the past decades, there has been significant increase in software patents. An increase, which, according to one study's findings, can be accounted to the increase of the cost effectiveness of acquiring a software patent. The same study also finds that these patents often become a substitute for research and development within companies. These findings are the complete opposite to the traditional incentive theory of patents, and they also tend to take place in industries, where strategic patenting is a common practice. For the increase in software patents being accountable for the cost effectiveness of acquiring such, the following provisions must be true. First, the increase in software patents has to be a result of increased research and development in a few selected industries. Secondly, the demand for research and

[160] EPO, visited on 14.6.2019
[161] Chalecki, Gupta, Kong, Li & Lin, pp. 14

development has to be price inelastic within the selected industries, but not in the other parts of the overall economy. The final conclusion is that simultaneous fulfillment of these provisions is quite unlikely.[162]

There are some key features of the software industry that make it vulnerable to another issue intensified by the increasing number of patents. When innovations follow each other, the later innovators will obviously become subject to infringement claims, made by the intellectual property right holders. If the later innovators expect costs from such claims, they might lose interest and not fully develop their research and development. Within the software industry this issue is a reality, as innovation certainly can be described as sequential, and the problem has already been identified as an existing hurdle. This hurdle could be avoided, if the innovation could be licensed before performing research and development, or through ex ante licensing.[163]

As a result of long discussions about how to define technical subject matter, the EPO settled on the "any apparatus" approach, where a claim would meet the Article 52 requirements as long as it contains a reference to any apparatus. Similarly to the American jurisprudence, also some EPO decisions have come to involve computer implementation of business methods. All of the EPO decisions have in the end denied the applications on the grounds of lack of an inventive step. All of the claims were sufficiently technical with regards to their subject matter, but in the end were evaluated as too obvious. The U.S. Supreme Court made a similar ruling in its Alice Corp. opinion, even if it avoided the central issue by using an obviousness test, the "inventive concept" test, into the subject matter determination. The test drives patentees towards more specific apparatus claims, closely parallel to the EPO's "any apparatus" approach. Thus, one might argue that subject matter evaluation in the USA and in Europe are coming together with similar standards.[164]

6.6. Proposals for Change

As the software industry is relatively young and has such an explosive growth rate, it can hardly come as a surprise to anyone that worldwide software intellectual property standards are lagging behind this development. Positive aspects for tackling this issue are that there is a vast amount of interested stakeholders, such as companies, consumers, and societies, as well

[162] Ibid, pp. 18-19
[163] Chalecki, Gupta, Kong, Li & Lin, pp. 19-20
[164] Burk, 2014, pp. 867

as that a large amount of academic research has targeted this topic. There is a lot of criticism and complaints facing the current system, and equally many in number are the proposed alternatives for solving the issues. By closer examining the existing proposals, one can distinguish between two separate groups. The first group consists of incremental proposals that focus on improving the quality of issued patents, but are content with the current structure and granted protections. The second group consists of structural proposals, which focus on modifying the actual definition of a software patent, or completely removing software patents.[165]

When closer examining the patent protection reduction, there appears to be two variables that have changed over time and vary between different jurisdictions. Firstly, it is possible to adjust the length of patent protection. If protection length for software patents would be reduced, the patents would continue to receive protection, but at the same time reduce the innovation-inhibiting effects that patents might have. The results of such a modification would be that securing a patent still would have its rewards, but decrease the effect of the patent becoming its own reward. Secondly, it is possible to adjust the breadth of the granted protection. For example, when assessing the similarity between patented software and a competing product, it becomes necessary to decide how different the competing product has to be, in order to avoid infringement of the patent. It is also necessary to decide how expensive it should be to commit infringement, on a scale from light royalty payments all the way to strict payments of triple damages.[166]

The proposal for completely abolishing software patents has received some public support in the USA, but even stronger public support in the EU, where the legislation concerning software patents is undergoing close scrutiny and change. Even though the EU's codified law forbids the patentability of computer programs, there seems to be a growing trend for relaxing the restriction.[167] The software industry in the USA has obviously made great investments into software innovation patenting during the last three decades, and some attribute patenting as a factor behind the success of the industry. Due to this, it seems unlikely that Courts would abolish software patents altogether. There are however those who argue that disappearance of software patents would have no impact on the innovation and competition levels of the software industry.[168] There seems to be an emerging shift in this direction, as e.g. Germany has passed a resolution for the termination of patenting of software inventions. Also New Zealand

[165] Chalecki, Gupta, Kong, Li & Lin, pp. 22
[166] Ibid, pp. 24
[167] Ibid, pp. 27
[168] Samuelson, 2007, pp. 19

has been considering a prohibition of software patents. In the last decade, the U.S. Supreme Court has questioned many software patents, and even the Court of Appeals for the Federal Circuit has struck down some software patents, e.g. in the Alice-case.[169]

All in all, the intellectual property boundaries in the EU or in the USA can hardly be simplified in either jurisdiction for having a preference for competition over IPR's, or vice versa. In a similar manner, at the same time as there are doctrines that clearly seem to be increasing transatlantic differences between the legislations (e.g. the refusal to license), there are also counteracting doctrines that bring the two closer together (e.g. patent fraud). The result is a broad picture of two different legislative environments that combine substantive, procedural, and institutional measures for reaching the same goals, i.e. fostering innovation and maximizing consumer welfare.[170]

Both within this area, as well as within other areas, patent systems around the world can certainly learn from one another.[171]

As a result of advancing business globalization, patent systems also would need to be adapted to this more international environment. Even though patent systems have undergone major revisions during the past decades, there still can be found major differences between countries, especially between developed and developing nations. This would obviously require focused decisions at the OECD with the support of national patent offices.[172]

It could certainly be very useful to have an interaction effects model of different IP systems in different judicial area. Especially if the model would incorporate the costs and benefits of an IP system and also would allow for some R&D in exchange for the rights offered to the rights holder by the jurisdiction. This type of model could allow for a more accurate assessment of the global optimality of different IP systems currently implemented globally, and also reveal how the systems work together.[173]

[169] Samuelson, 2013, pp. 23
[170] Amedeo, Bergmann & Himes, 2013, pp. 675
[171] Merges & Bian, 2014, pp. 13
[172] Motohashi, 2003, pp. 30
[173] Hall, 2001, pp.4