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Intellectual Property Law in China and Pakistan: A Comparative Analysis of Computer Software Protection

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Abstract
Computer software protection presents complex and interrelated challenges, particularly in copyright and patent law. Developing countries in the Asia-Pacific region, including Pakistan, struggle with inadequate legal frameworks to safeguard both national and international software, exacerbated by the rapid evolution of software-related products and services. In contrast, China has made substantial progress in strengthening software protection through comprehensive copyright laws, regulatory measures, and inter-ministerial coordination frameworks that promote the use of legitimate software. These initiatives have significantly improved China's software copyright protection system, fostering the growth of its software industry. Furthermore, China's Patent Examination Guidelines provide a structured approach to software patentability, distinguishing between conventional software, which lacks patent protection, and innovative software, which qualifies for such protection. Given these advancements, Pakistan can benefit from implementing well-defined legal and administrative measures to enhance software protection. This study examines China's current software protection policies, legislative and administrative frameworks, and their applicability to Pakistan, offering insights into potential legal reforms to strengthen software protection in the country.

Keywords: Copyright; Patent; Computer Software; software Piracy; Reverse Engineering; Sui Generis

Introduction

China's approach to software protection combines robust legal frameworks with practical enforcement strategies, offering valuable insights for countries like Pakistan. The Copyright Law of the People's Republic of China and the Regulations on the Protection of Computer Software are specifically designed to safeguard software innovations, granting creators exclusive rights to copy, distribute, modify, and translate their programs. Additionally, while the software itself is not directly patentable, the Guidelines for Patent Examination establish a pathway for protecting software-related inventions when integrated with hardware and addressing technical challenges. This unique approach, known as sui generis protection, sets a distinct standard apart from general patent law. China's policy implementation follows a dual-track system, where judicial and administrative entities work in tandem, reinforced by multi-departmental inspections across regions. By adopting principles of pragmatism and gradualism—balancing national realities with global best practices—China has built a comprehensive and dynamic software protection system that not only fosters innovation but also strengthens enforcement, making it a compelling model for developing nations.

Pakistan's software industry faces significant challenges due to the absence of patent protection for computer software, leaving copyright as the sole legal safeguard. The Copyright (Amendment) Act of 1992 expanded the definition of "literary work" to include software recorded on various digital media, ensuring some level of legal coverage. However, software piracy remains a pressing issue. According to the BSA Global

Software Survey (2018), an alarming 83% of computer software installations in Pakistan are unauthorized, amounting to an estimated market value of $267 million in unlicensed software. This widespread infringement has placed Pakistan on the Watch List of the United States Trade Representative's (USTR) Special 301 Report for 2023, which highlights countries with inadequate intellectual property protections. As piracy continues to rise, the lack of robust enforcement and legal protections poses a growing threat to Pakistan's digital economy and global trade relations.[1]

This paper delves into a range of pressing issues at the intersection of copyright law and computer science. As copyright regulations extend their reach into the realm of software development, ignorance is no longer an excuse—computer scientists and data professionals must now navigate an increasingly complex legal landscape. A common practice in the field, reverse engineering, serves as a crucial tool for understanding software behavior, troubleshooting defects, ensuring compatibility, and conducting security assessments. However, these activities are often classified differently under copyright law, varying across jurisdictions and legal frameworks. Unlike traditional literary works protected by copyright, software exhibits machine-like characteristics, functions within dynamic technological ecosystems, and is frequently distributed in formats unintelligible to human readers. This unique nature of software raises significant legal ambiguities, and academic research in the field faces potential legal scrutiny. Moreover, as unlicensed software piracy continues to rise, these issues become ever more relevant and urgent.

While reverse engineering is well-documented in software engineering, its implications within intellectual property law remain underexplored. Reverse engineering can be broadly defined as the systematic process of deconstructing, analyzing, and testing existing products to uncover their underlying technical principles. This process plays a vital role in innovation, yet copyright law often imposes restrictions that hinder software engineers from applying these techniques freely. The tension between legal protection and technological advancement creates a challenging dilemma, limiting the ability of researchers and developers to engage in exploratory analysis without risking legal repercussions.

In today's digital landscape, software has evolved into an indispensable asset, empowering organizations to streamline daily operations such as revenue management, accounting, strategic planning, customer interaction, and partner collaboration. As software capabilities advance, businesses increasingly rely on these tools to refine their operational models, enhance productivity, access new markets, and secure a competitive edge. However, this digital transformation is not without peril. Emerging technologies, while promising, are accompanied by an alarming surge in cyber threats. Malicious software, or malware, poses a persistent and evolving danger, disrupting businesses and economies worldwide. Studies indicate that cyberattacks occur at an astonishing frequency—eight new threats surface every second (Alex et al., 2018). The scale and sophistication of these attacks have intensified, leading to escalating costs and catastrophic consequences. On average, organizations take approximately 243 days to detect malware infiltration, while full remediation efforts can extend up to 50 days (Merete et al., 2013; Singh et al., 2019). The growing frequency and impact of these threats underscore the urgent need for robust cybersecurity strategies, proactive defense mechanisms, and legal frameworks that strike a balance between protection and innovation.

The Software Alliance (BSA) has reported that it is becoming increasingly apparent that using unlicensed software is closely linked to malware attacks. According to the Business Software Alliance report, thirty-seven per cent of computer softwares installed is not yet authorised. Each malware assault can incur costs of $2.4 million for an average enterprise and may require up to 50 days for remediation. The company's expenses will exceed $10,000 for each compromised gadget, while global expenditures by enterprises approximate $359 billion every year. The Asia Pacific area has the greatest global percentage of unlicensed software usage, with 57 percent of its software unauthorized, despite a four-point decrease since 2015. The region's unlicensed software is valued at $16.4 billion, significantly surpassing any other region and accounting for almost a third of the global market value of unlicensed software. The rate of unlicensed software installation in 2017 was 83% in Pakistan. The commercial value of the unlicensed software is 267 million dollars (BSA 2018).

[1] The United States Trade Representative (USTR) does an annual assessment called the Special 301 Report to identify countries that impose market access barriers detrimental to American intellectual property rights holders or that do not offer sufficient protection for these rights.

China suffered overwhelmingly devastating attacks of malware, which paralysed nearly 40,000 Chinese companies. A malware threat rapidly passed unlicensed and unencrypted software to the point of affecting prominent academic institutions such as Tsinghua University, halting electronic payment systems nationwide at service stations of Petro China, closing Bank of China's ATM, and impacting primary corporate operations such as China Telecom and Hainan Airlines. F-Secure, a Finnish cybersecurity firm, confirmed that many computers in China using pirated software contributed to the scope and intensity of the devastating attack (Mozur 2017).

Literature Review

By the conclusion of the 19th century, a global agreement was established through the Berne Convention regarding the protection of literary and artistic works, solidifying copyright law in its contemporary form. The association among computers, software, and intellectual property is rather recent. The heightened tension can be attributed to several factors, including the proliferation of personal computers, the global expansion of the Internet, and the rise of digital data as a viable means of data transmission. Science fiction has transformed into scientific fact in less than ten years. The WIPO Copyright Treaty (WCT), enacted on 20 December 1996 in Geneva, is a contemporary revision of copyright legislation. It is building upon the Convention of Berne.[2] It re-iterates the fundamental concept of copyright law.[3] Copyright protection pertains to expressions rather than ideas, techniques, operational methods, or mathematical principles. The WCT reaffirms the conventional position that computer software constitutes a literary work.[4]

Computer software, as defined in Article 2 of the Berne Convention, is classified as a literary production. This protection pertains to computer software, regardless of the form of expression or type (Wu & Huang, 2023). Based on TRIPS, the WCT is considering renting computer software.5 Articles 11 and 12 provide for the broad digital distribution of copyrighted material. Article 11 deals with the protection by technological measures, which states that "contracting parties shall provide adequate legal protection and effective legal remedies against the circumvention of effective technological measures that are used by authors in connection with the exercise of their rights under this Treaty or the Berne Convention and that restrict acts, in respect of their works, which are not authorised by the authors concerned or permitted by law."

Article 12 communicates a similar sentiment vis-`a-vis rights management information. Which states that "Contracting Parties shall provide adequate and effective legal remedies against any person knowingly performing any of the following acts knowing, or for civil remedies having reasonable grounds to know, that it will enable, facilitate or conceal an infringement of any right covered by this Treaty or the Berne Convention: to remove or alter any electronic rights management information without authority; to distribute, import for distribution, broadcast or communicate to the public, without authority, works or copies of works knowing that electronic rights management information has been removed or altered without authority"

In this Article, "rights management information" refers to data that identifies the work, its creator, the rights holder, the terms and conditions of its use, and any associated numbers or codes that characterize this information. When a copy of a work is linked to one of these pieces of information or is presented in conjunction with the public dissemination of a work (Okediji 2009).

A sequence of acceptable declarations exists for the WCT as well. These are crucial instruments for treaty interpretation. Regarding Article 1(4), it has been determined that the conversion of data into digital format constitutes a copyright regulation pertaining to reproduction. In the digital realm, specifically regarding digital works, the right to reproduction as delineated in Article 9 of the Berne Convention, along with the associated exemptions, will be fully applicable. Preserving a protected work in digital form in an electronic format is regarded to constitute a reproduction within the terms of Article 9 of the Berne Convention.

Regarding Article 4, the contracting nations concurred that the protection of computer software under the WCT is consistent with existing international treaties. The extent of computer program protection outlined

[2] Wipo Copyright Treaty 1996, Articles 1 and 3.

[3] Ibid, Article 2.

[4] Ibid, Article 4.

[5] Ibid, Article 7.

in Article 4 of this Treaty aligns with Article 2 of the Berne Convention and corresponds with the pertinent sections of the TRIPS Agreement.
Concerning Article 12, it was acknowledged that rights management systems may also safeguard the remuneration right. Moreover, the rights management systems should not impose excessive procedures that obstruct the exercise of acquired rights. The phrase "infringement of any right covered by this Treaty or the Berne Convention" include both exclusive rights and rights to reimbursement.
It is additionally stipulated that Contracting Parties shall not rely on this Article to establish or implement frameworks for rights management that would impose formalities prohibited by the Berne Convention or this Treaty, obstructing the free movement of goods or impeding the exercise of rights under this Treaty. This Treaty primarily serves as the framework for national legislation in the United States, the European Union, China, and Pakistan (Dinwoodie 2010).
The inaugural copyright in China was established by the Qing Dynasty government in 1910 with the enactment of copyright law. Copyright protection was mostly nonexistent from 1911 until 1949. China initiated the establishment of its copyright protection system following the adoption of the reform and openness policy in 1978. In April 1979, the government publishing office submitted a report to the State Council regarding the formulation of China's copyright law in relation to joining international copyright agreements. In China, Article II of the Order of the Council of State defines "computer software" as "computer programs and their associated documentation". After many years of growth, China has gradually established a system of copyright protection laws that complies with China's facts and applicable international standards while completing the primary legal system of the country while maintaining the mechanism of law enforcement in its promotion and with the improvement of the legal service system, contributing to provide legal support and environmental guarantee to establish and publish literary, artistic and scientific works (Yang 2003; Hong, Edler, and Massini 2022).
The Copyright Ordinance of 1962 governs copyright protection in Pakistan. The ordinance grants the copyright owner the sole authority to create and permit the reproduction, publication, duplication, or transmission of the copyrighted work. Pakistan is a signatory to the Berne Convention of 1886, the Universal Copyright Convention of 1948, and the Trade-Related Aspects of Intellectual Property Rights Agreement of 1994, as established by the World Trade Organization.
Computer software is usually written in a programming language. There were many conflicts regarding the protection of computer software in the 1970s and 1980s. Copyright law protects software expression, and patent law protects software operations or other functions. If innovators can obtain more extended protection of intellectual property from copyright law without applying for a patent and, among other things, submit their claims to scrutiny for novelty and non-obviousness, ensure that the copyright does not indirectly protect technological innovations—a patent that promotes competition in beneficial arts and constant innovation (Samuelson 2017).

Limitations and Methodological Consideration

This analysis pertains exclusively to legal rights concerning computer software under intellectual property law across different jurisdictions and administrative protective measures. The influence of the World Intellectual Property Organization Copyright Treaty, the Copyright Law of the People's Republic of China 2020, and the Regulation for the Implementation of the Copyright Law of the People's Republic of China (2013 Revision). The Pakistan Copyright Ordinance of 1962, international conventions, and the Digital Millennium Copyright Act are elucidated. This study relies on documentary evidence as the primary source of data collection. The study's literature comprises books, journals, credible reports, articles, and pertinent case law.

How China Protects Computer Software: A Look At Legal And Administrative Approaches

The Chinese government prioritizes the safeguarding of intellectual property rights. President Xi Jinping clearly articulated the importance of "promoting the protection of intellectual property rights" as one of the four primary strategies to enhance the accessibility of the internal market during his opening remarks at the annual Boao Forum for Asia in April 2018 (Liangyu 2018).
Safeguarding software is a crucial component of preserving intellectual property rights. The Chinese government has made efforts to promote the use of legitimate software to improve the culture and environment of innovation, intellectual property rights protection, and the software industry's development.

A multitude of laws, rules, policies, and procedures have been instituted to encourage the utilization of lawful software. Commenting on copyright protection in China, Dr Arpad Bogsh[6] said that China spent less than 20 years completing the course, while developed countries spent up to 100 years finishing it.

Protection of Computer Software under Copyright Law

Chinese Copyright Law provides that copyrightable works include computer software.[7] Computer software must exist in a tangible form to qualify for copyright protection, similar to other forms of art. Any individual utilizing the computer software without the copyright owner's authorization concerning the copyright of said software shall incur civil liability. Remedies include cessation of the infringing act, rectification of consequences, public apologies, or compensation for damages. Copyright owners may submit claims or complaints to copyright management bodies to safeguard their rights against the purported usage of pirated software. When a software copyright violation constitutes an offence, the culprit is subject to criminal liability (Huijia 2018). The regulations for computer program protection are determined independently by the State Council, contingent upon the circumstances.[8]

In the landmark case Tencent v. Qihoo 360 (2010), Tencent, one of China's largest internet companies, sued Qihoo 360, a software security company, for copyright infringement. The dispute centred around Qihoo 360's software that allegedly modified Tencent's QQ instant messaging service. The court ruled in favour of Tencent, highlighting software protection under Chinese copyright law.

Qihu 360 Technology Co. Ltd vs. Beijing Jiangmin New Science and Technology Co., Ltd. This case involved copyright infringement, where Qihu 360 accused Jiangmin of copying its software's code and structure. The court ruled in favour of Qihu 360, emphasising the copyright protection of the software's source code and structure.

The governing legislation is The Copyright Law of the People's Republic of China, particularly Articles 10 and 17, which safeguard the expression of ideas in software, encompassing source code and documentation.

Copyright owners of computer software and their rights

Under the law, software created by Chinese individuals, legal entities, or organisations enjoys copyright protection, regardless of whether or not this software has been released (De Perthuis & Van den Bulck, 2005). If initial software is released in China, then software created by foreigners or stateless persons also enjoys copyright protection under the regulation.9

Software created by foreigners or stateless individuals, copyright shall, in the following cases, be protected by regulations:

- Copyright is issued under agreements between China and the country of origin or the developer's habitual residence or
- Copyright granted by China under international treaties

Software copyright begins from the software's development date. Copyright of the software of the natural person, the term of protection is the entire natural life of the person plus another 50 years. After the individual's death, the software's copyright would expire on the fiftieth anniversary. In the case of jointly created software, the period of protection expires on 31 December of the fiftieth anniversary, after the death of the last participant. The software's copyright to a legal party or other entities, the security period is 50 years and expires on 31 December of the fiftieth anniversary after the software's initial launch. If this software remains unpublished within 50 years after its development, it will no longer be protected under the regulation.[10]

A proprietor of software copyright shall have the following rights: [11]

[6] Former Director-General of the World Intellectual Property Organization (WIPO).

[7] Article 3(8), Copyright Law of the People's Republic of China (2010 Amendment)

[8] Article 59, Copyright Law of the People's Republic of China (2010 Amendment)

[9] Article 5, Regulation on Computers Software Protection (2013 Revision)

[10] Article 14, Regulation on Computers Software Protection (2013 Revision)

[11] Article 8, Regulation on Computers Software Protection (2013 Revision)

- The right to alter is to supplement or reduce the software or adjust the sequence of instructions or data.
- Distribution is the right to show the public the original copy or copies of the software by sale or donation.
- The right to disclose is the right to determine whether the software should be made publicly available.
- The right to copy is one or more copies of the software.
- The developer's right is to assert the developer's identity and show the software developer's name.
- The right to translate, that is to say, the right to turn the software's language into another language.
- The right to rent allows anyone to temporarily use the original or copies of the software, except when the software itself is not the main objective of the rent.
- The right to communicate through the information network, i.e., make the software accessible to the public through a wireless network so that the general public can access the software from a site.
- The copyright owner of the software may authorise others to take advantage of their copyright and can collect remuneration. The software copyright owner may transfer ownership of their copyright in whole or in part and is entitled to receive compensation.

In the Guiding case "Beijing Jingdiao Technology Co. Ltd. v. Shanghai Naiky Electronic Technology Co. Ltd,." The court held that for the tie-in sales of software and machines, the computer software copyright owner sets a particular file format for the software's output data to restrict machines of competitors from reading data saved in this particular file format and expand its competitive edge from software to machines. Such acts are not the technological steps copyright holders take to protect software copyright as provided in the Copyright Law. The research and development of software by others to read files saved in a format set by the copyright owner are not considered an infringement upon computer software copyright (Xu 2020).

Limitations and exceptions in the usage of computer software

Part of the software can be used through the installation, visualisation, transfer, or storage to search for ideas or basic principles contained in this software without permission and payment to the software copyright owner. [12]According to the "Cai Hong Xian Case" [13]and other recent cases, the right to alter is not the author's right to change their work; it is the author's right to prohibit anyone from altering their work. The latter is a morality right, while the former is an economic right. Copyright-protected computer software implies a series of code-based instructions. Still, it is not a violation of copyright to modify only the data used in instructions rather than modifying instructions (Armstrong 2006). Users can modify computer software by using tools to improve their function and performance in the software's operating process.

Developing a part of software that resembles a previously established software due to a restriction of alternate expressions does not infringe on pre-existing copyrights.[14] Others can get all the features of genuine software, but a genuine software label does not equal legitimate software. [15] The theft of the label cannot be regarded as larceny. Theft of genuine software labels damages genuine software manufacturers. However, the replication behaviour can explain this theft label behaviour because the behaviour of selling labels cannot be identified as for profit, so it does not constitute a crime of violation of copyright (Manta 2011).

[12] Article 17, Regulation on Computers Software Protection (2013 Revision)

[13] 王迁.论软件作品修改权----兼评“彩虹显案”等近期案例[J].法学家,2013(01):135-147+179-180.

[14] Article 29, Regulation on Computers Software Protection (2013 Revision)

[15] 李高宁.盗窃计算机正版软件标签行为之定性——兼论盗窃罪对象范围的界定[J].黑龙江省政法　管理干部　学院学报,2013(03):113-116.

Contracts of Copyright Licensing

The parties must sign a license agreement if a license exists to exploit the software's copyright. The licensee may not exploit any rights that the owner of the software's copyright in the contract does not expressly confer.[16]

The right to use it is considered a non-exclusive right in the absence of a written contract or an explicit agreement in the contract for an exclusive license.[17] Parties must enter into a written contract while transferring the software copyright.[18]

Any person who enters an exclusive license agreement or a copyright transfer contract for the software can register with the software registration institution recognised by the State Council's copyright department.[19]

The Chinese citizen, legal entity, or any other organisation that permits the exploitation or transfer of software copyrights to a foreigner must comply with the regulations of the People's Republic of China on the administration of imports and exports (Simpson 1995; Hugh 2020).

Legal liabilities and law enforcement measures

The law raised the overall fine for specific actions involving copyright infringement. Under Article 24 of the Law, the following infringement actions, under the circumstances, result in civil or criminal liabilities without the consent of the software's copyright owner.

1) Reproduce fully or part of the copyright owner's software.
2) Sell, lease, or publish the software of the copyright proprietor to the public through the network.
3) Intentionally delete or modify electronic information related to software rights management.
4) Assign or delegate to others to exercise the copyright owner's software's copyright.

The copyright owners take technological protection measures to protect their copyright. These rules, regulations, and guidelines, along with laws and regulations related to intellectual property rights, are the foundation of software's legal protection in China (Raustiala 2019).

Since the enactment of the revised China Civil Procedure Law in 2013, the legal position of electronic evidence has been clarified as a form of direct evidence. The law states that "electronic data can be accepted as evidence in civil proceedings." Under Chinese copyright law, unauthorised use or reproduction of the software violates the copyright. In software copyright lawsuits, courts apply the "Access and Substantial Similarity" test to determine if a complaint is a copyright infringement. "Access" means the accused can access the plaintiff's original work. "Substantial similarity" means that the work resembles the original work. To demonstrate access and any significant similarity between the original and the software in question, the plaintiff is charged with providing evidence related to the defendant's possession of an illegal copy of the plaintiff's software.

However, since plaintiffs are generally not allowed to check defendants' computers. Traditionally, gathering evidence isn't easy. As a result, especially since the approval of the Code of Civil Procedure, some plaintiffs have begun to provide evidence created by Telnet and are trying to persuade judges to accept the evidence as direct evidence (He 2016).

Protection of Computer Software under Patent Law

China's Patent Law has no specific provision for software patenting, but it only excludes 'rules and methods for mental activities' from patentable subject matters under Article 25.1(2)[20]. The Guidelines for Patent Examination ('Guidelines')[21] confirmed that a patent claim directed to 'rules and methods for mental

[16] Article 18, Regulation on Computers Software Protection (2013 Revision)

[17] Article 19, Regulation on Computers Software Protection (2013 Revision)

[18] Article 20, Regulation on Computers Software Protection (2013 Revision)

[19] Article 21, Regulation on Computers Software Protection (2013 Revision)

[20] The law was adopted in 1984, and has so far been amended three times, in 1992, 2000, and 2008

respectively, see http://www.sipo.gov.cn/zcfg/zcfgflfg/flfgzl/fl_zl/index.htm

[21] The earliest version was released in 2001, available at

activities' per se is unpatentable because it is an excluded subject matter and does not constitute a technical solution under Patent Law.[22] Rules and methods for mental activities' are defined as 'human's thinking movements. They originate from human thinking, producing abstract results through inference, analysis and judgment, or, via human's thinking movement, produce results by indirectly acting on nature.'[23] The Guidelines further state that computer programs per se are unpatentable because they belong to the 'rules and methods for mental activities'.[24]

However, the Guidelines also state that 'if a claim contains not only a matter of rules or methods for mental activities but also technical features, then the claim, viewed as a whole, …shall not be excluded from patentability under Article 25'. Part II, Chapter 9 of the Guidelines is directed explicitly to inventions related to computer software and distinguishes the concept of 'computer programs per se' and 'invention relating to computer programs'. Computer programs per se refer to 'a coded instruction sequence which can be executed by a device capable of information processing, e.g., a computer, so that certain results can be obtained, or a symbolised instruction sequence, or a symbolised statement sequence, which can be transformed automatically into a coded instruction sequence. Computer programs per se include source programs and object programs.[25] On the other hand, an 'invention relating to computer programs' refers to 'solutions for solving the problems of the invention which are wholly or partly based on the process of computer programs and control or process external or internal objects of a computer by the computer executing the programs according to the process mentioned above'.[26]

Based on such a distinction, patent eligibility for a software claim can be summarised as a two-step inquiry. Step one determines whether a software claim is directed solely to a computer program per se. If yes, then the claim is ineligible for patent. If not, the inquiry goes to step two to decide whether the claimed invention constitutes a technical solution. If no technical solution is found, the claimed invention is ineligible for patent. Otherwise, the claimed invention is eligible for patent.

Under the Guidelines, a software invention can be considered to constitute a technical solution in the following scenarios:[27]

A. The computer program is executed to control or process external or internal objects, solving one or more technical problems. The claimed invention embodies technical means to achieve technical effects according to the laws of nature.

B. The computer program is executed to adjust the components and configurations of the computer system so that its internal performance can be improved.

Administrative Practices to promote the use of legitimate software

China endorses the principles of "pragmatism" and "gradualism," which consider national conditions and international standards. Concerning enforcing these policies, China introduced the "two-way system," that is, the application of the common law by judicial authorities and administrative bodies. At the same time, multiple departments perform special administrative audits in all regions of the country. These works are an essential and necessary complement to legal software protection in China (Shi, Wang, and Ouyang 2004).

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http://www.cnpat.com/cn_pat/exam_guide_2001.htm. The Guidelines have three official versions,

released in 2001, 2006, and 2010 respectively. The Guidelines were also amended in 2008, 2009 (three

times), 2013, 2014, and 2017 respectively, available at http://www.sipo.gov.cn/zhfwpt/zlsqzn_pt/zlfssxzjsczn/index.htm

[22] Article 2.2 prescribes that 'The "Invention" refers to a new technical solution developed for a

product, process or the improvement thereof.'

[23] S. 4.2 of Cap 1, Part II of the Guideline (2010).

[24] S 3.2 of Cap 1, Part II of the Guidelines (2001); s 4.2 of Cap 1, Part II of Guidelines (2006, 2010).

[25] See the Guidelines , Cap. 9, section 1, para. 3.

[26] Sec. 1, Chapter 9, Part II, of the Guidelines.

[27] Sec. 2, Chapter 9, Part II of the Guidelines. The Guidelines use the term 'invention relating to computer programs'.

A regular working mechanism is created to promote the use of legitimate software. The National Copyright Administration strengthened software regulations to combat pirated software. Several cases of software copyright violations have been addressed (Ma & Gao, 2012).
Since 2000, the Chinese government has made an active effort to address China's problem as a "paradise for piracy". The State Council issued a "Notice on the use of software accredited by government agencies and on the elimination of pirated software" in 2001 and a "Notice on the use of software accredited by local governments" in 2004. In 2012, to improve organisational leadership and public coordination to promote the use of legitimate software, the Chinese government established an inter-ministerial conference to encourage the use of legitimate software (joint conference). The Administration of National Copyright manages it and comprises 15 ministries, including the Ministry of Industry and Information Technology and the Ministry of Finance (Hua 2014).
The joint conference organises, coordinates, and directs government agencies and institutions to use legitimate software. The efforts of the Chinese government have allowed 135 national institutions to install accredited software by May 2011. By June 2012, 31 provinces across the country had installed certified software. However, the private sector has encountered difficulties in encouraging the use of approved software (Kim et al. 2017).

Protection of computer software: Challenges and implications for Pakistan

In Pakistan, the Copyright Ordinance 1962 is the law that deals with copyright protection. The ordinance gives the copyright owner the exclusive right to make and allow the copyrighted work to be reproduced, published, copied, or forwarded. Pakistan is also a member of the "Berne Convention of 1886", "the Universal Copyright Convention of 1948," and "the Trade-Related Aspects of Intellectual Property Rights Agreement of 1994" under the "World Trade Organization".

Amendment of copyright ordinance for the addition of software

The ordinance provides that "the copyright shall apply throughout Pakistan in the following classes of works: original literary, dramatic, musical, and artistic works, cinematographic works and records."[28]To include the requirements of the TRIP Agreement, the existing law was properly amended by the "Copyright (Amendment) Ordinance 2000" instead of repealing the previous law, "the Copyright Ordinance 1962".
The main features that appeared after the Copyright Ordinance was amended are:

- The rights to audiovisual works, plays, cinemas, and musical works have been accepted.
- The concept of literary work has been updated to include physical science work, data collection, and computer software.
- Copyright owners have received protection over computer software, and cinematography has been recognised for rentals.
- Effective border measures have been taken to prevent copyright violations when importing and exporting infringing material.
- Effective provisional measures have also been taken.

In Pakistan, the software is protected within the copyright field. For this purpose, the definition of "literary work" is modified by the "Copyright Act (Amendment) 1992" to include computer software under the copyright system (Ahmad and Saghir 2008). The ordinance specifies the literary work to include computer software in section 2 (p): "software recorded on any disc, tape, perforated medium or another storage device that if entered or placed in a computer or computer equipment capable of producing any information." Under copyright law, the functionality of any computer software or what the software does cannot be covered; it only gives the owner the right to prohibit anyone from repeating the expression or showing the collection of instructions that make up the software.
The ordinance has distinct provisions for Pakistani and foreign works. "a work published in Pakistan shall be deemed to be first published in Pakistan, notwithstanding that it has been published simultaneously in some other country unless such other country provides a shorter term of copyright for such work and work is deemed to be published simultaneously in Pakistan and another country if the time between the publication in Pakistan and the publication in such country does not exceed thirty days."[29]

[28] Section 10, copyright ordinance, 1962

[29] Section 6(1), copyright ordinance, 1962

"A corporate body is to be considered domiciled in Pakistan if it is incorporated under any law in force in Pakistan or has an established place of business in Pakistan."[30] Although the ordinance has clauses for issuing compulsory licenses, such a license can only be obtained for Pakistani work, and no compulsory license can be issued for any work whose author is not a Pakistani citizen or whose 'proof' is not produced in Pakistan.

Rights of computer software owners and users

The author of the work is the first owner of the copyright. Authorship refers to the individual creator or "contract work." When an independent individual does the original work, he will be the first copyright owner. While a worker works at work and as part of the employee's regular duties, the company's owner may be the principal copyright owner.[31]

Suppose the computer software is available on the market. In that case, the applicable license agreement can restrict the permissions given by the copyright owner about how the software is used and any accompanying content, such as text or graphics. Even software buyers cannot modify, adapt, or produce copies of updated software for their use or that of their employees in compliance with the restrictions placed by the ordinance. Unapproved use of software on your computer often constitutes copyright infringement.

Additionally, if a person who does not have a license to use it receives a replica of computer software, the copyright owner is entitled to forbid its use. The ordinance also prohibits software rentals from unauthorised users. The purpose of copying computer software is not an essential component of the infringement; copying the same medium is not needed. Consequently, computer software installed on a CD or some other magnetic medium can be violated when copying to paper or taking a printout.

Effectiveness of the registration of the computer software

The ordinance does not support mandatory registration of copyrights, but registration gives certain rights and is strongly recommended. Rights under copyright law are generated when the author produces the work in some tangible form. For example, computer software is protected from the moment it is placed on a CD or paper in a material form (Leaffer 2014). However, a copyright registration certificate is provided when registering the copyright, which proves that there are copyrights at work and that the person identified as the copyright owner on the certificate.

As mentioned above, Pakistan is a member of the Berne Convention 1886 for the Protection of Literary and Artistic Works. According to the Convention, literary and artistic works are protected without any formality in countries that are part of this convention (Badlani 2024).

Upon receiving the application, the registrar must enter the work information in the copyright register and give the applicant a certificate of that registration. This entry is not considered to be done for any work unless he records it in writing for this purpose,

Legal liabilities and law enforcement measures

Pakistan has two forms of copyright infringement liabilities: civil liability and criminal liability. Civil remedies include injunctions, penalties, accounts, unauthorised copies issued, and conversion penalties. In the case of unintentional infringements, a few of these remedies are not available. Innocent infringers are not allowed to compensate the copyright owner for any damages. Still, they must stop the infringing conduct or compensate the owner in an amount reflecting the fair commercial value of that usage.

Under the law, an employer is vicariously responsible for the offences that his servants and agents may commit in the course of their duties and under their jurisdiction, although he does not know the act of violation and even though he has issued his servants a general order preventing actions which may result to a violation. When a copyright owner is unable for sufficient cause to launch immediate legal proceedings against the infringer, the ordinance provides special remedies for such holders. An application for urgent restraining orders to deter copyright infringement and protect any proof of such infringement shall be brought before the Court (Bashir and Khan 2015).

Criminal remedies allow for the detention of the convicted or the imposition of fines or both, the recovery of infringing copies, and then the return to the copyright owner of infringing copies. The newly revised portion

[30] Section 8, copyright ordinance, 1962

[31] Section 13, copyright ordinance, 1962

of the law now gives the police more extraordinary powers to confiscate copies of infringing work anywhere they are without a court order, and all seized copies, labels, and recording devices must be brought before the judge as soon as practicable.

In particular, the ordinance contains an express clause that deals with the offences committed by corporations. It provides that "where a company commits an offence under the ordinance, every person who at the time was in charge of, and was responsible to the company for the conduct of the business of the company as well as the company is deemed to be guilty of such offence and is liable to be proceeded against and punished accordingly.[32] Except in the circumstances where the accused proves that the offence was committed without his knowledge or that he exercised due diligence to prevent such offence, he is deemed guilty" (Hardy 2002).

Administrative measures include empowering the copyright registrar to prevent importing and exporting infringing copies in Pakistan. An application[33] for inspection and seizure of any consignment planned to be imported or exported from Pakistan suspected of containing infringing copies of any work subject to copyright may be submitted to the customs officer under the "Customs Act, 1969."

Inadequate legislation leads to piracy

Although the Copyright Ordinance of 1962 has been in this field for many years, with litigation related to copyright infringement, it is still rare in Pakistan. Superior courts have not had the chance to learn about the principles and difficulties of copyright litigation. Pakistani people are unaware of the potential solutions available under copyright laws today.

Since Pakistan is a member of the Berne Convention, copyright registration is not compulsory, and given the copyright protection itself, copyright registration remains voluntary. However, "a certificate of copyright registration in work is apparent evidence that there are copyrights at work and that the person described in the certificate as the owner of this copyright".[34]Sometimes, this presumption in the law harms the plaintiffs and the actual copyright owner in a violation case (Samuelson and Wheatland 2009). Today, there is a need to get the public and law enforcement officials acquainted with the new tools available under the legislation to bring infringers to account.

Developments in recent years have resulted in a massive expansion of capabilities backed by conventional computer software and industrial control systems to various personal devices, widely implemented sensors, smart devices, connected vehicles, automated systems, and more. These innovations create a new and connected digital economy and can achieve enormous economic and social benefits. However, since these technologies also have the potential to create economic, legal, and even physical risks, software developers must have common goals to develop software safely and ensure that they can be safely maintained throughout their life cycle (Hoekstra et al. 2013).

Problems of implementation

Patent laws exempt computer software from patent protection in Pakistan. Like other literary works, Pakistan's copyright law protects the software. For the computer software industry, protection under copyright laws is the only protection available. Many developing countries have been compelled to amend their copyright laws to solve the challenges raised by the emerging technology available to trade and the public (Gachago 2011). The main aim of copyright law is to protect the work and creativity of people in different artistic fields. Without adequate protection and an effective implementation mechanism, such creative production will be reduced at the expense of the general public in Pakistan. There is a need to educate people and law enforcement authorities about the latest ways to deter offenders under the law.

Even though it has been claimed in recent years that source code and algorithms have to be patentable, in some cases, patents have already been issued, and several software patents remain controversial. Amid the progress, some of the exceptions to copyright infringements are set in a myopic manner. Although the language sounds rational, it does not extend to situations of familiar facts.

[32] Section 71, copyright ordinance, 1962

[33] Section 60(a) (4), copyright ordinance, 1962

[34] Section 42, copyright ordinance, 1962

In general, legislating new IP laws to deal with the ambiguities created by software would reduce the uncertainty in the tech community between legal and illegal practices. However, any legislation passed will only be beneficial if it is meant to promote innovation and enhance public knowledge and not to set up unnecessary paywalls and prevent industry standards from being reached. This is a high standard to be met, but it can only be accomplished by reconsidering current perspectives on intellectual property.

Comparison of legislation on computer software protection in China and Pakistan

As mentioned, China has adopted "pragmatic" and "progressive" principles to protect computer software. It tries to balance the existing conditions in China with adopting international standards. The developments made in China in recent years are noteworthy. Competing in this field in China is challenging for any other country. Considering the implementation of policies, China implements a "two-way framework" referring to joint legal compliance activities of legal and administrative authorities while engaging in proper management audit activities that periodically ensure multiple departments' participation in every region of the country. Such policies are effective and necessary. These complement the legal process of software copyright protection in China.

It should be noted that the Chinese legal system differs significantly from the Pakistan system. However, The legislation in China and Pakistan is substantially similar. Domestic legislative reforms for the copyright protection of computer software were obtained from a joint base, namely the Berne Convention and the WIPO Copyright Treaty. Here, the difference is in the implementation of the legislation. How to effectively control piracy by adopting both administrative and judicial methods. The judicial interpretation of legislation by higher courts is the most effective guide for lower courts. China adopted practical steps to reduce the piracy of computer software. The rapidly growing software industry needs strong IP protection for administrative protection measures.

Under the TRIPS agreement, the protection of computer software seems to bring benefits to the software sector. The result will depend on how countries formulate national laws. The Cisco v. Huawei case was Sino-U.S. 's biggest-ever case. Disputes over IPR during 2002. It indicates that protecting software as a patent is the trend in software protection technology. This issue draws attention to China's software protection policies and poses new challenges for the software industry's legal protection. In summary, protecting computer software by protecting rights related to innovation through patent law is the potential future path for protecting Chinese software, as well as the law of many other developing countries.

Copyright restriction on computer software reverse engineering in China and Pakistan

The business of attaining technical information about software known to others by separating, measuring, and testing their software can be defined as reverse engineering. In certain circumstances, reverse engineering is justifiable. Companies in emerging economies gain the opportunity to produce new goods and processes from developed economies and ultimately transition from imitation to innovation, a technology catch-up strategy that many emerging economies follow.

Reverse engineering is a sort of legal disposal of software. It is a kind of fair use of current technology, with the experimental work performed by the applicants. It prevents innovators from monopolising technologies. It promotes technological advancement. They also invest in testing and securing the benefits of customers. Reverse engineering can be legally applied in conventional industries when applicants receive reverse-engineered goods by legal means, have compliance requirements, are not allowed to hold other people's trade secrets, and recognise others' trade secrets through reverse engineering. Reverse engineering is relatively inexpensive (Zhang and Zhou 2016).

The European Union Court of Justice appears to be very soft about reverse engineering, as the principles or ideas are not secured by copyright (Liakopoulos 2018). Legal platforms tend to receive less coverage on reverse engineering-related copyright infringement. The definition of software copyright was modified in the European Union after the "SAS Institute V. World Programming Ltd" decision (Case, 2012). This decision has direct and consequential consequences for software and litigation. With rule C-406/10, we can learn the following suggestions for software creators (Ciancarini et al. 2016): "It is possible to reproduce principles or ideas of other people's software. The revenue can be obtained from the principles or ideas of others since it is not protected by copyright. The principles or ideas are not protected by copyright, so they can fully inspire everyone. Legal forums are not the place to defend principles or ideas because no legal

model protects them. European courts can only intervene if the software code itself has been copied. The software's source code can be studied without permission from the study's licensor".
The ability to analyse computer software is essential. In the real sense, the basic principle of copyright protection is that it only protects the expression of an idea, not the idea itself. So it is possible to analyse computer software for your research. Reverse engineering can be permitted in specific circumstances where it is necessary to achieve compatibility with other programs. This is generally understood as an exception for interoperability, and such use should not interfere with the legitimate interests of the copyright holder.[35]
Limited decompilation is allowed if necessary to achieve interoperability with other independently created software. This provision reflects China's recognition of the need for compatibility in software development but restricts it to specific purposes.[36]
Unlike some other jurisdictions, in Pakistan, the Copyright Ordinance 1962 does not include any specific exceptions for reverse engineering or decompilation for purposes like achieving software interoperability or research. The ordinance, even after amendments, does not address reverse engineering of computer software, making Pakistan's copyright law restrictive in this context.

The stance of China and Pakistan on the relationship of source code and object code

The object code is derived automatically from the source code. The object code is, therefore, copyrighted, as it is an automatic development of human creative work, and that is the source code (Ralph D. Clifford 1996). In Shi Honglin v. Taizhou Huaren Electronic Information Co., Ltd case, when the defendant refuses to provide the source code or the object code of the alleged infringing software, and the object code cannot be read directly from the alleged infringing product due to technical restrictions if the defendant's software is the same as the plaintiff's software in terms of design flaws. Still, if the defendant refuses to provide the source code or the object code of his software for comparison without any valid reason, the court may, given the plaintiff's practical difficulty in providing evidence that the defendant's software is very analogous to the complainant's software and the offender is responsible for the infringement (Ren 2016).
This means the Chinese courts can only accept electronic evidence as fact and support the claim or defence underlying the truth. However, the law does not define electronic evidence. Later, in 2015, the Supreme Court also listed that this "electronic data" includes information created or stored in an electronic medium by email, electronic data exchange, copies of online chat, blogs, microblogging, text messages, electronic signatures, domain names, etc. However, the Civil Procedure Law of China clarifies electronic evidence as direct evidence, particularly for Telnet-generated evidence. In current legal practice, Chinese judges perform a case-by-case review of the validity of evidence. It is suggested that this would be an essential step in the right direction. This is crucial legislative supervision. However, most cases in which the data is provided in academic journals must be covered by the requirement that the information is used, sold, or supplied to anyone with a different intent.
While in Pakistan, the ordinance does not specifically mention source and object code, the general treatment of software as literary work provides them with copyright protection. This is consistent with international standards under agreements like TRIPS and the Berne Convention, which also recognize source and object code as copyrightable literary works.

Conclusion

In short, One would consider taking the first step to hold a balance between the rights of copyright owners and the rights of computer software consumers with fair use laws and implied licensing doctrines and their international equivalents. Computer software must still be protected by how widely these doctrines apply and if they will be applied consistently in different countries. Nations are recognised for their contributions to the international community. The Government of Pakistan should take some of the most effective legislative, judicial, and administrative measures to improve the legislation and its recognition and reputation in the world. Legislation should meet the present requirement for computer software protection.
TRIPS obligations, as introduced by the World Trade Organization, the agreement makes protecting intellectual property an essential part of the global trading system. The agreement is one of the three pillars

[35] "Copyright Law of the People's Republic of China," Article 24, as amended.

[36] "Regulations on the Protection of Computer Software," State Council, Article 8.

of the WTO and is subject to the WTO dispute settlement mechanism. Pakistan is developing the agreement by revising the legislature and creating new laws if necessary. At this point, it is vitally essential for Pakistan to research the different aspects of the agreement and its consequences for Pakistan.

Reverse engineering in the software must meet the following requirements: First, applicants can obtain reverse engineering software legally and accept no confidentiality obligations. Second, they can't receive the requisite software knowledge except reverse engineering. Third, reverse engineering should be based on acceptable reasons. Applicants should restrict their access to only the necessary portions of software for their purposes and perform an actual study. Finally, they can not disseminate the information obtained by reverse engineering to anyone, and they can not manufacture or sell infringing software. The copyright law of China includes a few requirements applicable to reverse engineering that are far from the needs of judicial practices. The reverse engineering legislation should be strengthened and perfected by perfecting its concept, precisely specifying its enforcing requirements for the software industry, and denying the validity of "reverse engineering prohibitions."

Besides being expressive, computer software is fundamentally practical. For functional elements, the general defence of intellectual property is patent defence. Patents are proprietary rights to a form of innovation. It is available if the approach is novel or innovative. If a patent is granted (when the application has been reviewed and found to be original and innovative enough), the patent's protection duration is shorter. TRIPS offers a minimum of twenty years' defence. Protection through the patent is known as a form of monopoly. No doubt computer software can be patented. Greg Aharonian is best known for his preference for patent rights over copyright law. He contends that copyright law, which protects the expression of ideas (such as source and object code), does not adequately safeguard the functional and inventive aspects of software, whereas patents provide stronger legal recognition of the underlying technical innovations. Similarly, Dan L. Burk said US courts are "struggling with the paradox of applying intellectual property protection that does not explicitly extend to functional elements in a functional component in the first place."

Article 25(2) of the Patent Law of the People's Republic of China precludes 'rules and methods of mental operation from patent protection.' Patent protection for computer software once had been an obstacle. However, since the U.S. and several other countries have accepted software patent rights, almost all states have also recognised them. The Patent Examination Guidelines issued by the State Intellectual Property Office of China. It provides software protection with general principles and particular cases. These guidelines do not grant patent protection to standard computer software. However, if it is innovative, it falls under the category of patent protection. In Pakistan, patent law should also apply to computer software. The relationship between law and innovation is dynamic. Law is constantly evolving, and technology is continuously progressing. Copyright law has a far-reaching effect on computer software and data uses that are allowed; its breadth will change as technology and laws change.

The current international trend in software protection is to put safety requirements within the framework of copyright legislation. Patent regulations also protect software. Because computer software is an exclusive combination of expressions and functions, it is possible to presume that it should be secured by a distinctive form of intellectual property or sui generis. A combination of patent rights and copyright protection for a brief time. It must be either automatic or semi-automatic. Significantly, creative innovations could have extended protection, allowing the author to get a creative income stream. Computer software can get realistic and practical protection in this way. Despite doctrinal and realistic demands for special computer software protection, copyright is genuinely ingrained in international and national laws. As such, it is unlikely to be enforced, although the latest opinion is that it will be helpful for innovation.

Governments are the world's biggest consumers of software. They will benefit from reduced risk, improved technical management, and the implementation of standards as in other organisations. Governments may also encourage using software entirely approved by state-owned enterprises and between contractors and suppliers. Governments, accounting and auditing firms, industrial contractors, industry associations, and corporate organisations should inform organisations about software licensing enforcement and the risks of unauthorised software installation and use. With the emergence of cloud computing and networked mobile devices, information is being stored, linked, and used in new and creative ways. Policymakers should ensure they are safe, irrespective of the organisation or distribution means. Governments must ensure that regulatory mechanisms have fair means of enforcement and promote stakeholder collaboration to minimise software infringements.

In conclusion, software plays an increasingly important role in today's world. It is time and necessary for computer scientists and policymakers seeking to centralize and build an architecture that is legal, technological, and socially sound for future innovation.

Abbreviations Used in Study

EU: European Union
US: United States
DMCA: Digital Millennium Copyright Act
WCT: WIPO Copyright Treaty
FOSSFP: Free Open Source Software in Pakistan
FOSS: Free Open Source Software
IT: Information Technology
ICT: Information and Communication Technology
FIA(Pakistan): Federal Investigation Agency (Pakistan)
MS: Microsoft
IIPA: International Intellectual Property Alliance
CDs: Compact Discs
WTO: World Trade Organization
TRIPs: Agreement on Trade-Related Aspects of Intellectual Property Rights
DVDs: Digital Video Discs
EULAs: End-User License Agreements
RAM: Random Access Memory
WIPO: World Intellectual Property Organization
IPR: Intellectual Property Right
CCA: Copy Control Authority
CCA: Content Scrambling System
DeCSS: Decrypting Content Scrambling System

References:

1. Ahmad, and Saghir. 2008. “Legal Protection for Computer Programmes in EU, US and Pakistan & Software Piracy as a Challenge in Pakistan.” UNIVERSITY OF OSLO. https://www.duo.uio.no/handle/10852/21985.
2. Alex, Bassett, Beek Christiaan, Minihane Niamh, Peterson Eric, Samani Raj, Schmugar Craig, Sims ReseAnne, Sommer Dan, and Sun Bing. 2018. “McAfee Labs Threats Report.”
3. Armstrong, Timothy K. 2006. “Digital Rights Management and the Process of Fair Use.” *Computer Fraud & Security* 10 (7): 3–20. https://doi.org/10.1016/S1361-3723(10)70078-6.
4. Badlani, Gautam. 2024. “Berne Convention in IPR .” *Rachit Garg*, February 6, 2024. https://blog.ipleaders.in/international-conventions-which-shaped-intellectual-property-rights/.
5. Bashir, Sobia, and Ghalib Khan. 2015. “CAUSES OF BOOK PIRACY IN PAKISTAN: A STUDY OF KHYBER PAKHTUNKHWA.” *Journal of Law and Society Law College* XLVI (67).
6. BSA. 2018. “Software Management: Security Imperative, Business Opportunity.”
7. Ciancarini, Paolo, Daniel Russo, Alberto Sillitti, and Giancarlo Succi. 2016. “Reverse Engineering: A European IPR Perspective.” *Proceedings of the ACM Symposium on Applied Computing*, April, 1498–1503. https://doi.org/10.1145/2851613.2851790.
8. Dinwoodie, Graeme. 2010. “THE WIPO COPYRIGHT TREATY: A TO THE FUTURE OF INTERNATIONAL COPYRIGHT?” *TRADE AND DEVELOPMENT* 10 (January):61. http://ssrn.com/abstract=1601235Electroniccopyavailableat:https://ssrn.com/abstract=1601235Electroniccopyavailableat:https://ssrn.com/abstract=1601235.
9. Gachago, Roger. 2011. “The Effect of Technology on Copyright.” https://doi.org/10.13140/RG.2.2.24252.28803.
10. Hardy, I. 2002. “Criminal Copyright Infringement.” *William & Mary Bill of Rights Journal* 11 (1). https://scholarship.law.wm.edu/wmborj/vol11/iss1/10.

11. He, Jiong. 2016. “Admissibility of E-Evidence Generated by Telnet Technology in Software Copyright Litigation in China.” *School of Advanced Study* 13 (November). https://doi.org/https://doi.org/10.14296/deeslr.v13i0.2295.
12. Hoekstra, Matthew, Reshma Lal, Pradeep Pappachan, Vinay Phegade, and Juan Del Cuvillo. 2013. “Using Innovative Instructions to Create Trustworthy Software Solutions,” June, 1–1. https://doi.org/10.1145/2487726.2488370.
13. Hong, Jie, Jakob Edler, and Silvia Massini. 2022. “Evolution of the Chinese Intellectual Property Rights System: IPR Law Revisions and Enforcement.” *Management and Organization Review* 18 (4): 755–87. https://doi.org/10.1017/mor.2021.72.
14. Hua, Jerry Jie. 2014. *Toward a More Balanced Approach: Rethinking and Readjusting Copyright Systems in the Digital Network Era*. *Toward a More Balanced Approach: Rethinking and Readjusting Copyright Systems in the Digital Network Era*. Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-662-43517-5/COVER.
15. Hugh, Stephens. 2020. “Why Is Piracy so Common in China? Confucian Cultural Traditions or Just Plain Commercial Advantage? (A Historical Perspective) – Hugh Stephens Blog,” June 15, 2020. https://hughstephensblog.net/2020/06/15/why-is-piracy-so-common-in-china-confucian-cultural-traditions-or-just-plain-commercial-advantage-a-historical-perspective/.
16. Huijia, Xie. 2018. “Empirical Research on Criminal Copyright Infringement in China.” *Queen Mary Journal of Intellectual Property* 8 (1): 36–49. https://doi.org/10.4337/QMJIP.2018.08.04.
17. Kammerstetter, Markus, Christian Platzer, and Gilbert Wondracek. 2012. “Vanity, Cracks and Malware: Insights into the Anti-Copy Protection Ecosystem.” In *Proceedings of The 19th ACM Conference on Computer and Communications Security, CCS 2012*, 12. https://repositum.tuwien.at/handle/20.500.12708/54456.
18. Kim, Chanwoo, Mao Xuewen, Hyosung Park, and Kwangho Jung. 2017. “What Motivates Software Piracy in China: Q-Methodology Perspective.” *Korean Journal of Policy Studies* 32 (2): 135–66. https://doi.org/10.52372/KJPS32205.
19. Leaffer, Marshall A.. 2014. *Understanding Copyright Law*. LexisNexis.
20. Liakopoulos, D. 2018. “PROTECTION OF COMPETITION THROUGH THE PRINCIPLE OF LEGAL CERTAINTY - THE ROLE OF THE COURT OF JUSTICE OF THE EUROPEAN UNION.” *Meritum- Belo Horizonte* 13:286–334.
21. Liangyu. 2018. “China to Strengthen IPR Protection: Xi.” *Xinhua*, 2018. http://www.xinhuanet.com/english/2018-04/10/c_137099843.htm.
22. Manta, Irina D. 2011. “The Puzzle of Criminal Sanctions for Intellectual Property Infringemen.” *Harvard Journal of Law & Technology* 24 (2).
23. Ma, Zhong-Fa, and Wei-Na Gao. 2012. “Impact of the ‘Tomato Garden’ Software Internet Piracy Case on Combating Copyright Infringement in China.” *Journal of Intellectual Property Rights* 17 (January):27–36.
24. Merete, Ask, Bondarenko Petro, Erik Rekdal John, Nordbø André, Ruthven Pieter Bloemerus, and Piatkivskyi Dmytro. 2013. “Advanced Persistent Threat (APT) Beyond the Hype- Project Report in IMT4582 Network Security at Gjøvik University College.”
25. Mozur, Paul. 2017. “China, Addicted to Bootleg Software, Reels From Ransomware Attack.” *The New York Times*, 2017. https://www.nytimes.com/2017/05/15/business/china-ransomware-wannacry-hacking.html.
26. Okediji, Ruth. 2009. “The Regulation of Creativity under the WIPO Internet Treaties.” *Fordham L. Rev.*, January. https://scholarship.law.umn.edu/faculty_articles/901.
27. Perthuis, Aubin de, and Paul Van den Bulck. 2005. “Software Protection in China: Towards Better Days?” *The Journal of World Intellectual Property* 8 (4): 405–44. https://doi.org/10.1111/J.1747-1796.2005.TB00261.X.
28. Ralph D. Clifford. 1996. “Intellectual Property in the Era of the Creative Computer Program: Will the True Creator Please Stand Up.” *HeinOnline*. https://heinonline.org/hol-cgi-bin/get_pdf.cgi?handle=hein.journals/tulr71&section=46.
29. Raustiala, Kal. 2019. “INTELLECTUAL PROPERTY IN THE INFORMATION AGE: AMERICAN & CHINESE PERSPECTIVES.” *Public Law & Legal Theory Research Paper*, August. https://ssrn.com/abstract=3451389.

30. Ren, Xiang. 2016. “Judicial Cases in China in 2015.” *The Chinese Journal of Comparative Law* 4 (2): 371–86. https://doi.org/10.1093/CJCL/CXW012.
31. Samuelson, Pamela. 2017. “Functionality and Expression in Computer Programs: Refining the Tests for Software Copyright Infringement.” https://papers.ssrn.com/abstract=2909152.
32. Samuelson, Pamela, and Tara Wheatland. 2009. “Statutory Damages in Copyright Law: A Remedy in Need of Reform.” *William & Mary Law Review* 51 (2). https://scholarship.law.wm.edu/wmlr/vol51/iss2/5.
33. Shi, Guifeng, Wei Wang, and Lingnan Ouyang. 2004. “Policies of Software Protection: The Practice in China.” *AMCIS 2004 Proceedings* 88. http://aisel.aisnet.org/amcis2004http://aisel.aisnet.org/amcis2004/88.
34. Simpson, Amy. 1995. “Copyright Law and Software Regulations in the People’s Republic of China: Have the Chinese Pirates Affected World Trade.” *North Carolina Journal of International Law* 20 (3). https://scholarship.law.unc.edu/ncilj/vol20/iss3/4.
35. Singh, Saurabh, Pradip Kumar Sharma, Seo Yeon Moon, Daesung Moon, and Jong Hyuk Park. 2019. “A Comprehensive Study on APT Attacks and Countermeasures for Future Networks and Communications: Challenges and Solutions.” *Journal of Supercomputing* 75 (8): 4543–74. https://doi.org/10.1007/S11227-016-1850-4.
36. Wu, Di, and Teresa Huang. 2023. “Series of Articles on Copyright Protection (1) ─ Works Within the Meaning of the Copyright Law (Mainland China).” September 2023. https://www.leetsai.com/ltp-special-column/series-of-articles-on-copyright-protection-i-works-within-the-meaning-of-the-copyright-law-september-25-2023.
37. Xu, Cong. 2020. *Regulatory Model for Digital Rights Management : Analysis of U.S., Europe and China*. Springer.
38. Yang, Deli. 2003. “The Development of Intellectual Property in China.” *World Patent Information* 25 (2): 131–42. https://doi.org/10.1016/S0172-2190(03)00026-7.
39. Zhang, Gupeng, and Jianghua Zhou. 2016. “The Effects of Forward and Reverse Engineering on Firm Innovation Performance in the Stages of Technology Catch-up: An Empirical Study of China.” *Technological Forecasting and Social Change* 104 (March):212–22. https://doi.org/10.1016/J.TECHFORE.2016.01.010.