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Application of Patent Law to Software in the IoT Context

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Article

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Abstract

The Internet of Things (IoT) is a promising field. It is estimated that around 75.44 billion devices will be connected by 2025. Undeniably, IoT will deeply impact the current intellectual property system. Many issues will be revisited and examined. This article addresses software patent protection in light of IoT. Software patent protection criteria are still embroiled in controversy. The authors examine the patentability of software in general and in the IoT context in the US, EU, UK, and Malaysian legal systems to determine the appropriate protection mechanism for software that perplexes the idea-expression dichotomy as the main premise of the copyright-patent distinction. The research is a theoretical qualitative study which traces law-related articles on IoT and software patents from multiple databases such as Hein Online and LexisNexis. The study also discussed court cases related to software and computer program patents. Furthermore, it relies on an analytical discussion of statutes and legislations in the US, EU, UK, and Malaysia, concluding that there is a conflation of computer programs and software. If the two terms are interpreted precisely in accordance with their meanings, IoT software inventions will not be at the centre of the controversy about the applicability of patent law.

INTRODUCTION

The Internet of Things (IoT) is a promising field and life-mode-changing technology. As of late 2024, about 17 billion devices were active, with the potential to reach over 32 billion by 2030.[1] The Asia Pacific region has the largest share of the IoT market[2]. To enhance the public

[1] Choudhary, "A. Internet of Things: A Comprehensive Overview, Architectures, Applications, Simulation Tools, Challenges and Future Directions," *Discov Internet Things* 4, no. 2 (2024).
[2] "Asia-Pacific Internet of Things Market, 2019," 2019.

awareness of IoT, 9th April was declared the annual day of IoT[3]. In response to the increasing prominence of IoT, Malaysia's National Applied Research and Development Centre (MIMOS), an agency of the Ministry of International Trade and Industry (MITI), launched the National IoT Strategic Roadmap in 2014. The Roadmap has three main goals. The first is to establish an IoT ecosystem. The second is to further enhance Malaysia's position in the IoT industry by boosting technopreneur capabilities to facilitate the innovation of IoT products and services able to compete in the global market. The third goal of the Roadmap is to establish Malaysia as a regional hub for IoT. Each of the three goals has a strategy for attainment. In respect of the first goal, the mid to long-term strategy is to "enhance the regulatory framework to cater for IoT technologies."

Nonetheless, the Roadmap would not achieve its target if there were no appropriate legal response to the regulatory issues pertaining to IoT. Hence, several studies have addressed these issues. A comprehensive legal framework of IoT was on the table of discussion by Kim, who emphasised it is vital to establish a legal framework before the full implementation of IoT to address potential legal barriers and support the inclusion of developing countries in global trade[4]. Vojković et al address data protection, privacy, and consumer protection in the context of IoT; they concluded that the current regulatory framework needs enhancement to address these concerns effectively.[5] This includes strengthening consumer education, fostering government-industry-civil society partnerships, and ensuring industry accountability. According to Hassanin et al and Dhali et al, Personal Data Protection Act in Malaysia (PDPA) requires amendment to address new challenges brought by AI and IoT.[6] This amendment is necessary to have trustworthy ubiquitous technologies[7]

It is worthwhile to note that the intellectual property issue related to IoT has not been addressed in all studies reviewed. The intellectual property laws will be a concern in the context of the Internet of Things[8]. In particular, the Internet of Things will leverage patents, as there would be an increase in patent applications in the field of IoT[9]. Many topics within patent

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3 Peter van Waart, Ingrid Mulder, and Cees de Bont, "A Participatory Approach for Envisioning a Smart City," *Social Science Computer Review* 34, no. 6 (December 2016): 708–23, https://doi.org/10.1177/0894439315611099.

4 Y. Eui Kim, "Internet of Things and the Implication of Legal Risks and Solutions," *Beobhag Yeon'gu-Cungbug Daehag'gyo*, 2022, 123–68.

5 T. Vojković, G., Milenković, M. Katulić, "IoT and Smart Home Data Breach Risks from the Perspective of Data Protection and Information Security Law," *Business Systems Research Journal* 11, no. 3 (2020): 167–85.

6 Z. M Hassanin, E. M. R. E., Ismail, N., & Faizee, "From Connectivity to Prosperity: Government Initiatives for Malaysia's Success in IoT," *IEEE 21st Student Conference on Research and Development (SCOReD)*, 2023, 622–31.

7 Hassanin, E. M. R. E., Ismail, N., & Faizee.

8 Ali Kamali Mohammadzadeh et al., "A Fuzzy Analytic Network Process (FANP) Approach for Prioritising Internet of Things Challenges in Iran," *Technology in Society*, 2018, https://doi.org/10.1016/j.techsoc.2018.01.007.

9 P Campanile, L., Faralli, C., Marozzo, F., Talia, D., & Trunfio, "An AI-Driven Methodology for Patent Evaluation in the IoT Sector: Assessing Relevance and Future Impact," *In Proceedings of the 10th International Conference on Internet of Things, Big Data and Security*, 2025, 501–508.

law will have to be revisited and re-examined[10]. One of the most challenging issues is the patentability of software[11].

Although IoT relies much on software inventions, the extension of patent protection to software remains controversial[12]. Software poses characteristics that perplex the idea-expression dichotomy, which is the main premise of the copyright-patent distinction[13]. Software has both expressive and functional features, making it hard to separate the idea (patent-protected value) from the expression (copyright-protected value). This undermines the traditional legal distinction between copyright (expression) and patent (function/invention). The authors examine the patentability of software in general and in the IoT context to determine the appropriate protection tool for software.

The study concisely outlines the potential debated subject matters of software and computer programs' patent eligibility in general. The section was divided into four parts according to the patent systems: US, UK, EU and Malaysian patent systems. The study found that the exclusion in the US system was non-statutory and was based on the notion of laws of nature. On the other hand, the exclusion in the EU, UK and Malaysia was legislative and based on the fact that computer programs *per se* are devoid of the meaning of inventions. In all patent systems, the exclusions were confined to computer programs and software as such. Technical applications of computer programs would be patentable. Thus, when the study moved to the discussion part, it concluded that IoT will be out of the patent eligibility dilemma. However, the study presents reasoning that the protection of software should be patent-based rather than copyright-based.

RESEARCH METHODS

The study adopts a qualitative approach as it examines the attitudes toward software patents in the context of IoT. Research data will be collected from primary and secondary sources. Multiple databases will be utilised, e.g., CLJ, LawNet, Lexis legal research for academic and HeinOnline. Lexis legal research for academics and HeinOnline. In terms of data analysis, the paper will espouse the content analysis method.

Theoritical Framework

Patentable Subject Matter Doctrine

In order to meet the patentability criterion, the alleged invention must not lie within the meaning of non-patentable matters - matters which are excluded from being protected by a patent. Regarding domestic legal treatment of exclusion, two legislative attitudes can be observed across the world. First, some domestic statutes do not list non-patentable subject matters, the most popular example of this category being the US Patent Act, although the US

[10] Christopher S. Storm, "Standard Essential Patents Versus the World: How the Internet of Things Will Change Patent Licensing Forever," *Tex. Intell. Prop. LJ* 30 (2021): 259.

[11] Arun Rai Lin, Yu-Kai, "The Scope of Software Patent Protection in the Digital Age: Evidence from Alice," *Information Systems Research* 30, no. 2 (2024): 657–72.

[12] W. Keith Robinson, "Patent Law Challenges for the Internet of Things," *Wake Forest Journal of Business and Intellectual Property Law* 15 (2014).

[13] Manisha Toliwal, "Copyright Protection for Computer Software: Critical Analysis," *Jus Corpus Law Journal* 3, no. 1 (2022): 1041–52.

courts have ruled multiple times on exclusions from patentability. Conversely, the more common approach worldwide is to list some of the matters that are, *per se*, excluded from being patentable inventions based on the provisions of the relevant statutes.

It is well-known that computer programs are one of the excluded subject matters from patent protection. Patent systems exclude mathematical or business methods or a computer program per se, or algorithms, from the patentability arena. This exclusion has been used to reject the patentability extension of software patents in patent legal systems. The common justification for such exclusion is that software is "just math". They are not physical objections. Software is profoundly related to mathematics, which are undeniably out of the patent realm.[14] However, the exclusion is not extended to the technical application to such exclusion. Many software-based patent applications were approved as they produce a "technical effect" or are tied to a specific machine or process[15]. This persuades commentators to argue against software patentability. According to Lemley, software patents are creating many problems for the patent system. It is hard to identify the concept of these patents despite the large number of patents in the market.[16] Toliwal argued that Software-based breakthroughs should be protected under a sui-generis system.[17] There was a struggle in the US Patent Office over whether to issue a patent for such applications. Some doubts were raised on whether machine-executable forms of programs were indeed copyright-protectable[18].

On the other hand, patent protection is essential for economic growth. Patents energise competition. Without such protection, rivals in industry may hesitate to disclose their findings due to the possibility of competitors copying their competitors[19]. Moreover, patent protection draws investment to the market. In the context of computing technology, IP legal systems have played a key role in equipping developers with a significant portion of the innovation market value[20]. Lastly, the implication of patent protection will indirectly influence competitors of the inventor to find unpatented solutions to their problems to remain competitive.[21]

Hence, the industry needs to end the uncertainty surrounding the software patent. The patent system should provide a stable legal environment that drives investment into the market. The controversy pertaining to patent eligibility for software should be redefined. A more effective approach is needed, especially with the emergence of IoT and AI technologies, which are contingent upon software. At the end of the day, the patent legal system should drive investment without inadvertently stifling the very progress it is designed to promote.

By rebalancing the scales between protecting function and demanding form (in terms of disclosed implementation), patent law can better serve its fundamental purpose: to incentivise

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14 A. K Acharya, "Abstraction in Software Patents (and How to Fix It).," *J. Marshall Rev. Intell. Prop. L*, 2018, 18.

15 M. A Lemley, "Software Patents and the Return of Functional Claiming," *Wis. L. Rev*, 2013, 905.

16 Lemley.

17 Toliwal, "Copyright Protection for Computer Software: Critical Analysis."

18 Pamela Samuelson, "Staking the Boundaries of Software Copyrights in the Shadow of Patents," *Florida Law Review* 71, no. 2 (2019): 243–302.

19 Stephen Lindholm, "Marking the Software Patent Beast," *Stanford Journal of Law, Business & Finance* 10, no. 2 (2005): 82–128.

20 "Software Patent," *Court Uncourt* 8, no. 5 (2021): 34–37.

21 Samuelson, "Staking the Boundaries of Software Copyrights in the Shadow of Patents," 2019.

creativity, foster competition, and drive technological advancement for the benefit of society as a whole[22].

Software Patents and Functional Claiming

Traditionally, patents have been understood to protect novel and non-obvious inventions, often focusing on the specific form or structure of a technological advancement. However, a concept known as "functionalism" has long permeated patent discourse, advocating for the protection of an invention based on what it does rather than merely what it is.

The origin of functional claiming dates back to the 1940s. However, US courts took issue with such a claim. Prior to the US Patent Act, the Supreme Court rejected the functional approach as it was inconsistent with the statutory language of the US Patent Act. In the 1952 US Patent Act, Congress tried to compromise the espousal when patentees were permitted to draft their claims in functional terms. However, when they did so, the patent would not cover the goal itself, but only the particular means of implementing that goal described by the patentee and equivalents thereof."[23]

This distinction, while seemingly subtle, carries profound implications, particularly in rapidly evolving fields like software. That is due to the functional nature of software design. The software orders devices to perform tasks and does not instruct them on how to perform these tasks. Hence, the software patent claims are normally functional in their terms[24]. Their classification does not determine the abstract nature of software claims. All software claims are inherently functional in nature. However, these claims may meet patent eligibility requirements if sufficient implementation details are provided to render them concrete.[25]

Combined with the fact that there is an apparent innovation in software, the abstract nature of such innovation has been perplexing the patent offices, as it is, in essence, within the excluded matters, while they reflect the sort of innovation we usually encourage with patent protection[26]. The problem of perplexity led to the solution of “functionalism”, wherein the software patent application is examined according to the utility and purpose of an invention. Instead of meticulously detailing every structural component.

Nonetheless, the functionalism of software patents is a double-edged sword. The inherent abstraction can lead to a vague scope of the issued patent that may hinder future development. This will undermine the patent system's intended goals of promoting innovation and providing clear boundaries for intellectual property. Broad functional claiming of software inventions is often cited as a primary factor contributing to the commonly discussed issues with software patents. [27] Software patent claims frequently extend beyond claiming specific implementations of an idea on a computer. These so-called "capability claims" seek to assert rights over any

[22] Lemley, “Software Patents and the Return of Functional Claiming.”
[23] Acharya, “Abstraction in Software Patents (and How to Fix It).”
[24] Acharya.
[25] Acharya.
[26] Acharya.
[27] Lemley, “Software Patents and the Return of Functional Claiming.”

device capable of implementing that idea, regardless of whether the device actually performs such functions.[28]

The digital age, particularly the rise of software, has witnessed a significant resurgence of this practice. Software patents, by their very nature, present unique challenges to traditional patentability doctrines, and this has inadvertently created avenues for patentees to claim functions rather than specific implementations, often circumventing the intended limitations of means-plus-function claims.

ANALYSIS AND DISCUSSION

The Concept of IOT

Smart and connected devices were first achieved in 1982 when a Coke machine designed at Carnegie Mellon University became the first Internet-connected appliance. This technology was coined as the Internet of Things (IoT) by Kevin Ashton in 1999 when he introduced the idea of linking the Internet with Radio Frequency Identification (RFID) technology[29]. However, there has not been a consensus on the definition of IoT.

Some definitions have been proposed:

1. "The Internet of Things (IoT) is an evolving ecosystem of interconnected physical objects that are embedded with sensors, software, and other technologies to exchange data with other devices and systems over the internet or other communications networks."[30]
2. "IoT refers to the pervasive presence around us of a variety of things or objects—such as RFID tags, sensors, actuators, mobile phones—which, through unique addressing schemes, are able to interact with each other and cooperate with their neighbours to reach common goals."[31]
3. "IoT is a computing paradigm that envisions a world in which all objects are connected and able to communicate and process data autonomously or cooperatively, creating context-aware and intelligent services for users and environments."[32]
4. The American Federal Trade Commission (FTC) defines IoT as "devices or sensors other than computers, smartphones or tablets that communicate or transmit information with or between each other through the internet."
5. "[T]he embedment of technology in objects in a physical environment to facilitate their interaction."[33]

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[28] Lemley.

[29] et al Elgazzar, Khalid, "Revisiting the Internet of Things: New Trends, Opportunities and Grand Challenges," *Frontiers in the Internet of Things* 1 (2022).

[30] Elgazzar, Khalid.

[31] S. E Bibri, "The IoT for Smart Sustainable Cities: From Theory to Practice.," *Journal of Big Data* 8, no. 1 (2021): 47.

[32] A Yousefnezhad, M., Souri, A., & Anjomshoaa, "Secure Context-Aware Architecture for IoT Environments," *Computer Standards & Interfaces*, 2023, 84.

[33] Mike La Marca Paez, Mauricio, "The Internet of Things: Emerging Legal Issues for Businesses," *N. Ky. L. Rev* 43 (2016): 29.

Despite the differences among the definitions, they can be utilised to derive the elements of IoT. First, there are connected items which are identified as objects or devices. Second, sensors, actuators, and information technology are inserted into these items. Third, a network facilitates the interaction between these items. Interestingly, there is an exclusion of computers, smartphones, and tablets from the IoT definition. Moreover, the steps by which IoT works have been demonstrated. The starting point is when IoT sensors capture data from the surrounding environment. Then, this data is transmitted over a network using cloud-based applications. Lastly, it is analysed to take action.

Software Patents

In this section, the article outlines the legal status of the patentability of computer-related inventions. This article begins by reviewing the state of the law in the US, UK, and Malaysia.

The US perspective

The current US Patent Act provides that patentable subject matters comprise a process, machine, manufacture, or composition of matter which are new and useful. According to Section 101 thereof, "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, subject to the conditions and requirements of this title." The US Congress interprets the above provision to include anything made by man.[34] Nevertheless, the patentability issue in the US is not sufficiently regulated by Section 101, which leaves many concepts undefined. In the absence of a statutory exclusion, US courts have developed an attitude that potentially excludes raw materials, natural phenomena, and abstract ideas from patentable subject matter. A series of US cases have repeatedly held that "the law of nature, physical phenomena and abstract ideas are not patentable subject matters."[35] "Phenomena of nature, even though just discovered, mental processes, as well as abstract intellectual concepts, are not patentable. They are the basic tools of scientific and technological work."[36] Patent law was intended, instead, to protect devices and things[37]. Another rationale for this exclusion is that allowing patent protection for abstract ideas would hinder innovation because patentees could preclude others from using essential concepts[38].

Nonetheless, the judicial exception was granted to computer programs as patentable subject matter. In 1968, the US Patent Office and Trademark Office (USPTO) issued guidelines that excluded computer programs from patent protection, labelling them as mental steps. However, this exclusion did not last long. By its *In re prater* decision, the US Court of Customs and Patent Appeals (CCPA) turned its back on those guidelines by ruling that computer programs may be patented[39]. Still, the US Supreme Court would subsequently deem computer

[34] Saurabh Vishnubhakat, "Patentable Subject Matter and Institutional Choice," *Harvard Journal of Law & Technology* 34, no. 1 (2020).

[35] Diamond v. Chakrabarty, 447 US 303 - Supreme Court (1980).

[36] Gottschalk v. Benson, 409 US 63 - Supreme Court 1972 (n.d.).

[37] Burstein, Sarah R. (2021). *Patent Law's Origination and the Problem of Abstract Patents*. Harvard Journal of Law & Technology, Vol. 35, No. 1 (Fall 2021).

[38] "Alice Corp. Pty. Ltd. v. CLS Bank Intern., 134 S. Ct. 2347 - Supreme Court 2014," n.d.

[39] "Application of Prater, 415 F. 2d 1393 - Court of Customs and Patent Appeals 1969," n.d.

programs as algorithms. It ruled that algorithms and mathematical formulas are comparable to laws of nature and, thus, out of the patentability domain[40].

Again, in *Praker v. Flook*, the US Supreme Court ruled that computer programs are like laws of nature and not patentable subject matter. It concluded that "thousands of processes and combinations had been patented that contained one or more steps or elements that themselves would have been unpatentable subject matters"[41]. In the leading case of *Diamond v. Diehr*, the US Supreme Court changed direction when it held that computer-related programs are patent-eligible if there is a novelty in the post-computer program process, which can be deemed as applications of laws of nature, rather than the laws themselves[42].

In 1994, the US Federal Circuit ruled against the USPTO's 1989 decision that rejected the application of Kuriappan Alappat, an employee of Tektronix, a US company. Kuriappan and two of his colleagues had filed an application to protect "[a] rasteriser for converting vector list data representing sample magnitudes of an input waveform into anti-aliased pixel illumination intensity data to be displayed on a display means."[43]. The reason for that rejection was that the claim "reads on a general-purpose digital computer `means' to perform the various steps under program control." The Federal Circuit, however, overruled that decision, stating that a "computer operating pursuant to software may represent patentable subject matter."[44]

In *State Street Bank & Trust Co. v. Signature Financial Group,* the Federal Circuit attempted to conceptualise the meaning of the application of the programming process. According to the Court, the practical application of a mathematical algorithm can be patentable if it leads to "a useful, concrete and tangible result."[45]. This decision was affirmed in *Bilski et al. v. Kappos*. [46]

In 2008, the Federal Circuit held that computer-related inventions are patentable if they meet a two-fold criterion. The first fold is that the computer program should be tied to a machine or apparatus. The second is that the program should transform a particular article into a different state or thing.[47]In 2012, the same Court examined in *Mayo Collaborative Services v. Prometheus Laboratories Inc.,* whether a claim that set forth a natural relationship between specific metabolites in the blood and the probability did more than the said relations and reached a negative conclusion. According to the Court, an invention is patentable when it does more than routine and conventional activity of informing the laws of nature to the people. "simply appending conventional steps, specified at a high level of generality, to laws of nature, natural phenomena, and abstract ideas cannot make those laws, phenomena and ideas patentable."[48]

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40 Gottschalk v. Benson, 409 US 63 - Supreme Court 1972.
41 Parker v. Flook, 437 US 584 - Supreme Court 1978 (n.d.).
42 Diamond v. Chakrabarty, 447 US 303 - Supreme Court.
43 "In Re Alappat, 33 F. 3d 1526 - Court of Appeals, Federal Circuit 1994 -."
44 "In Re Alappat, 33 F. 3d 1526 - Court of Appeals, Federal Circuit 1994 -."
45 "State Street Bank & Trust Co. v. Signature Financial Group, 149 F. 3d 1368 - Court of Appeals, Federal Circuit 1998 -."
46 Bilski v. Kappos, 561 US - Supreme Court (2010).
47 In re Bilski, 545 F. 3d 943 - Court of Appeals, Federal Circuit 2008 (n.d.).
48 Mayo Collaborative v. Prometheus Labs., 132 S. Ct. 1289 - Supreme Court. (2012).

The case of *Alice Crop. v. CLS Bank*[49] fuelled debates about the patentability of computer programs. There, the US Supreme Court stated that the applications "claim laws of nature, natural phenomena and abstract ideas from those that claim patent-eligible applications of those concepts."[50] The Court set forth a two-phase examination to identify whether a claim is directed to a patentably protected invention. In the first step, it must be decided if the claim is directed to an excluded concept, such as an abstract idea (Step 2A)[51]. If so, the claim could be patentable if the Court were able to determine the claim's inventive concept (Step 2B)[52]. According to the Court:

> "there is no dispute that a computer is a tangible system (in § 101 terms, a "machine"), or that many software claims are formally addressed to patent-eligible subject matter. But if that were the end of the § 101 inquiry, an applicant could claim any principle of the physical or social sciences by reciting a computer system configured to implement the relevant concept. Such a result would make the determination of patent eligibility "depend simply on the draftsman's art."[53]

The overwhelming 9-0 decision, led by Justice Clarence Thomas, provides a strong signal from the US Supreme Court that an applicant for patent protection ought to know that "gamesmanship" or "draftsman's art,"[54] which means resorting to technological-sounding terminology to describe existing abstract ideas in the invention in question, is inadequate to obtain a patent. The Court practically reprimanded the party in question for complete failure to comply with the substantive legal requirements of patentability.

Alice was recognised by the majority decision in *DDR Holdings LLC v. Hotels.com L.P.,* which acknowledged the patentability of an invention driven by computer-implemented claims. The Federal Circuit set out a twofold test of patentability, which was subsequently coined the *Alice/Mayo* test. First, the Court must determine if the claim at issue is directed to one of those patent-ineligible concepts. A negative answer will end the matter. In the case of an affirmative answer, another question will ensue: does the claim have a sort of practicality that pushes the invention out of a patent-ineligible subject matter? The second part of this test requires the consideration of "elements of each claim, both individually and as an ordered combination, to determine whether the additional elements transform the nature of the claim into a patent-eligible application."[55] In the final analysis, the Court concluded that the claimed findings were non-patentable subject matter.

In response to the post-*Alice* controversy[56], the USPTO issued the 2019 Revised Patent Subject Matter Eligibility Guidelines (RPEG).[57] The guidelines are directed at the exceptions to laws of nature, natural phenomena, and abstract ideas, as established by case law. First, they clarify the phrase "directed to" in Step 2A and then set forth two prongs that elaborate on the meaning of that phrase. In prong one, it shall be evaluated whether the claim recited a judicial

[49] "Alice Corp. Pty. Ltd. v. CLS Bank Intern., 134 S. Ct. 2347 - Supreme Court 2014."
[50] "Alice Corp. Pty. Ltd. v. CLS Bank Intern., 134 S. Ct. 2347 - Supreme Court 2014."
[51] "Alice Corp. Pty. Ltd. v. CLS Bank Intern., 134 S. Ct. 2347 - Supreme Court 2014."
[52] "Alice Corp. Pty. Ltd. v. CLS Bank Intern., 134 S. Ct. 2347 - Supreme Court 2014."
[53] "Alice Corp. Pty. Ltd. v. CLS Bank Intern., 134 S. Ct. 2347 - Supreme Court 2014."
[54] Joe Mullin, "Supreme Court Smashes 'Do It on a Computer' Patents in 9-0 Opinion | Ars Technica," *Ars Technica*, 2014.
[55] "DdR Holdings, LLC v. Hotels. Com, LP, 773 F. 3d 1245 - Court of Appeals, Federal Circuit 2014."
[56] "Software Patent: Everything You Need to Know," n.d.
[57] "Federal Register : 2019 Revised Patent Subject Matter Eligibility Guidance," n.d.

exception, such as laws of nature, natural phenomena or abstract ideas. Suppose the prong one enquiry yields an affirmative answer. In that case, prong two will ensue: the examiner will evaluate whether there is a recitation of additional elements that integrate the exception into a practical application.[58] However, it is asserted that the RPEG is not a game-changer in the context of patentable subject matter. There is still a need for legislative change regarding Section 101 of the US Patent Act.[59] Not surprisingly, a congressional draft bill was released in May 2019 to revise that section of the Act. The draft states that:

> "No implicit or other judicially created exceptions to subject matter eligibility, including 'abstract ideas,' 'laws of nature,' or 'natural phenomena,' shall be used to determine patent eligibility under section 101, and all cases establishing or interpreting those exceptions to eligibility are hereby abrogated. The eligibility of a claimed invention under section 101 shall be determined without regard to: the manner in which the claimed invention was made; whether individual limitations of a claim are well known, conventional or routine; the state of the art at the time of the invention; or any other considerations relating to sections 102, 103, or 112 of this title."

The UK perspective

The UK Patent Act of 1977 does not deal with computer programs as inventions, at least, for the purposes of its provisions. It is asserted that the stance of the drafters of the legislative text was that the proper instrument for the protection of computer programs is copyright law.[60] Section 1(2)(c) of that Act states that:

> "(2) it is hereby declared that the following (among other things) are not inventions for the purposes of this Act, that is to say, anything which consists of:… (c) a scheme, rule or method for performing a mental act, playing a game or doing business, or a ***program for a computer*** (emphasis)."

Ostensibly, the UK Patent Act excludes "a program for a computer" from the patentability arena. There have been multiple decisions in this connection. The English Court of Appeal held that computer programs *per se* are not protected by patent law. It is, however, crucial to note that the UK Patent Act of 1977 excludes the non-subject matters therein listed to the extent that a claimed invention relates to them as such. Therefore, it should be possible to obtain a patent on the industrial application of a scientific theory. Thus, the exclusion in the UK case law has a narrow scope. It has been espoused that all industries are dependent on computer programming. As a result, no challenge on the ground of subject matter exclusions should be invoked in the computer programs context, unless the claimed invention falls within the excluded subject matters as such. Further, some commentators assert that you can patent a computer program if it has a technical character, which is not a mere computer operation[61].

In *Vicom*, a progressive step was taken to grant patent protection for computer programs. In that case, it was held that "an invention which would be patentable in accordance with conventional patentability criteria should not be excluded from protection by the mere fact that, for its implementation, modern technical means in the form of a computer program are used". This position was supported and adopted by the English Court of Appeal.

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58 "Federal Register : 2019 Revised Patent Subject Matter Eligibility Guidance."

59 Sapna Kumar, "Abandoning the Exception: Rewriting Patent Eligibility," *Northwestern Journal of Technology and Intellectual Property* 19, no. 1 (2021): 55–93.

60 P Bently, L., Sherman, B., Gangjee, D., Johnson, "No Title," *Intellectual Property Law. Oxford University Press*, 2022.

61 Helen Norman, *Intellectual Property Law Directions*, 2nd ed., 2014.

In 2007, the leading case of *Aerotel* changed the law concerning computer program-related inventions. The Court set forth a four-step test according to which the eligibility of inventions has to be determined in four phases. This requires a court "to: 1) properly construe the claim; 2) identify the actual contribution; 3) ask whether it falls solely within the excluded subject matters; and 4) check whether the actual or alleged contribution is actually technical in nature." In the first step, a court must interpret the claim. If it introduces one or more of the excluded subject matters, then the application would be invalid. If the claim does not include one of the excluded subject matters, the application would be patentable. Obstacles will arise in respect of applications, which consist of parts falling within non-patentable subject matter. The UK case law tends to lean towards what has been described as "the whole content approach." This requires the whole content of the claim to be a composite of non-patentable subject matter[62]. The second step for determining eligibility is to ascertain the claim's contribution. This contribution should answer the question as to what the purported invention has added to human knowledge. The third step determines whether the claim falls within one of the categories of excluded subject matters. According to the Court of Appeal, this step should be "carried out without bias either in favour of or against exclusion." The last step is to determine whether the nature of the contribution is technical. This four-step test has been widely applied in computer-related inventions in UK case law.

Similarly, in 2007, the computer program exclusion was addressed in *Raytheon Co. v. Comptroller General of Patents, Designs and Trade Marks.* The English Court of Appeal considered an invention relating to an inventory management system, which utilised images and texts to determine the contents of machines. The Comptroller rejected the application on the grounds that it was a computer program as such. Eventually, the case came before the Court of Appeal following an appeal by the applicant. Although the Court dismissed the appeal, it pointed out that, to patent a contribution relating to a computer program, there shall be "anything technical."

In 2013, the Court of Appeal in *HTC Europe Co. Ltd. v. Apple Inc. and Apple Inc. v. HTC Europe Co. Ltd.* undermined the *Aerotel* test when it held that it is preferred, but not necessary. The Court also outlined some useful guidance for the application of the fourth step for determining the patentability of software-related inventions. This includes:

> "(i) whether the claimed technical effect had a technical effect on a process which was carried on outside the computer; (ii) whether the claimed technical effect operated at the level of the architecture of the computer; (iii) whether the claimed technical effect resulted in the computer being made to operate in a new way; (iv) whether a program made a computer a better computer in the sense of running more efficiently and effectively as a computer and (v) whether the perceived problem was overcome by the claimed invention as opposed to being merely circumvented."

The European perspective

The debate of software patentability in the EU has been two-fold. Whether or not we should protect computer-implemented, second, what is the appropriate approach to protect them[63]. Article 52 (2) (c) of the European Patent Convention (EPC) precludes the grant of patents for

[62] Brad Sherman, "SCP/15/3 ANNEX II 2. Computer Programs As Excluded Patentable Subject Matter," n.d.
[63] Guido Noto La Diega, "Software Patents and the Internet of Things in Europe, the United States and India," *European Intellectual Property Review* 39, no. 3 (2017): 173–84.

"programs for computers" *inter alia.* The wording of the article was clear that computer programs are devoid of the meaning of the invention. The exclusion, however, is confined to the cases wherein the applications related to these subject matters "as such". In 1978, the European Patent Office (EPO) issued examination guidelines that addressed the patentability of computer programs by denying protection when the contribution falls completely in a computer program. Consequently, the practice and EU case law granted limited protection to software patents. This protection did not extend to the codes and was confined to software with a technical effect[64]. The exclusion of computer programmers used to be applied to many cases wherein a software program is under discussion[65]

The EU espousal changed in the mid of 1908s to be more tolerant with the change of the US legal system towards more patent protection for computer programs[66]. The first case which addressed the term "as such" and its application in the computer programs context was *Vicom/Computer Related Invention*[67]. In this leading case, the Board of Appeal in EPO developed the so-called "technical contribution" test. The claim was related to methods for image processing by a computer program. The Examination Division in EPO held that the claim fell with excluded matters and was devoid of the meaning of the invention. The Board overturned the decision holding that the claimed process, which was implemented under the control of the program, cannot be deemed relating to a computer program "as such". Significantly, the Board pointed out that inventions should not be excluded from protection on the ground of being in the form of a computer program. Decisive is what technical contribution the invention, as defined in the claim, when considered as a whole, makes to the known art. The technical contribution approach was used as a test for computer program patentability until the 1990s.

In its decision T 1173/97 (Computer program product/IBM), which was decided in 1998, the Board turned its back on the technical contribution test as a yardstick to determine subject matter patent eligibility. It held that this approach is more appropriate for novelty and inventive step tests. Instead, the Board introduced the so-called technical effect test, which requires computer programs to bring a technical effect that is not a mere interaction between programs and computers.[68] The technical effect test has remained the main criterion to examine the patent eligibility of software.[69] However, Li and González argue that some ill-defined legal concepts have led to controversy and inconsistent applications in the EU case law.[70] EPO has been trying to eliminate the vagueness by multiple amendments to its Examination Guidelines. Part G (3.6) of the guidelines states that there shall be a "further technical effect" produced by a computer program to avoid the excluded matters–based rejection. The technical effect can be derived from a mere design that causes a computer to perform the programme. The Guidelines require a

64 Andrés Guadamuz González, "The Software Patent Debate," *Journal of Intellectual Property Law and Practice* 1, no. 3 (February 2006): 196–206, https://doi.org/10.1093/jiplp/jpi046.
65 La Diega, "Software Patents and the Internet of Things in Europe, the United States and India."
66 M Välimäki, *The Rise of Open Source Licensing: A Challenge to the Use of Intellectual Property in the Software Industry*, 2005.
67 European Patent Office, "T 0208/84 (Computer-Related Invention) of 15.7.1986," n.d.
68 European Patent Office, "T 1173/97 (Computer Program Product/IBM) of 1.7.1998," n.d.
69 Garrett Tobin, "Is the USPTO Turning Alice into EPC Article 52?," *Arizona Law Review* 62 (2020).
70 González, "The Software Patent Debate."

"further technical consideration"[71]. In 2016, EPO amended the Guidelines for the sake of more clarification in the process of computer program invention. The 2016 amendment linked Part G (3.6) with Part F (3.9).[72] Part F (3.9) differentiates between three situations. The first situation, in the steps of the method claimed, can be fully implemented by generic data processing means. In this situation, both method and product claims may be acceptable.[73] The second situation is when the method is claimed to be implemented by a device other than generic data processing means. In this case, an objection may arise during the application of Article 84 of EPC. Thus, the mere reference to the method claim would not be satisfactory. More elaboration is needed to overcome the objection. The third and last situation where the invention is realised a distributed computing environment. In this situation, claims may be directed to multiple entities of the distributed system. Each of them must meet patentability criteria and must be sufficiently elaborated.[74] In 2018, a thorough revision of Part G (3.6) was introduced. The main goal of this revision was to clarify what constitutes technical effect by multiple examples, so that the practice can be harmonised. Last and most recent revision has been introduced in 2021, the EPO amended Part G (3.6) and elaborated those technical considerations, which were required to reflect technical effect, are related to the internal functioning of the computer.[75]

The Malaysian perspective

In Malaysia, an invention which is patentable ("patentable invention") qualifies for patent protection. So, what is a patentable invention? Applications for patents (and utility innovations for that matter) are subject to full compliance with the following three key requirements for patentability set out in Sections 14, 15 and 16 respectively of the Patents Act 1983, namely: novelty, inventive step, and industrial applicability (see figure 1).

An invention, which incorporates any element of "software" or "programme" or computer implementation or any IoT-related components in any manner, is still subject to the basic legal requirements of Sections 14, 15 and 16 of the Patents Act 1983, without exception.

However, not all inventions qualify for patent protection. According to Section 13 of the Patents Act, certain inventions are not patentable at all. Such inventions are excluded from patentability on the basis that they are not patentable subject matter. That section excludes the following subject matters from patentability:

> "(a) discoveries, scientific theories and mathematical methods; (b) plant or animal varieties or essentially biological processes for the production of plants or animals, other than man-made living micro-organisms, micro-biological processes and the products of such micro-organism processes; (c) schemes, rules or methods for doing business, performing purely mental acts or playing games; (d) methods for the treatment of human or animal body by surgery or therapy, and diagnostic methods practiced on the human or animal body: Provided that this paragraph shall not apply to products used in any such methods."

Interestingly, Section 13, which was derived from Section 1(2) of the UK Patent Act, does not include software among excluded subject matters. It has been argued that, based on the ordinary meaning of the wording of the Malaysian Patent Act 1983, software is a patentable

[71] European Patent Office, "Guidelines for Examination in the European Patent Office" (2021).
[72] European Patent Office, "Guidelines for Examination in the European Patent Office" (2016).
[73] Office, Guidelines for Examination in the European Patent Office.
[74] Office.
[75] Office.

subject matter[76]. Despite the absence of express exclusion of software patents, the Intellectual Property Corporation of Malaysia (MyIPO) listed computer programs among excluded subject matters in the 2011 Guidelines for Patent Examination.

Although the Malaysian Patent Act does not provide for "computer program," it is mentioned in the MyIPO guidelines. The guidelines define a computer program as "a set of instructions for controlling a sequence of operations of a data-processing system." According to the guidelines, the listing of computer programs among non-patentable inventions is justified because they are comparable to mathematical methods, which are expressly excluded under Section 13(1) of the Malaysian Patent Act. The guidelines insist that computer programs *per se* lack patentability. The content of computer programs does not bring them within the patent arena. Further, the guidelines undermine data processing by deeming them void of inventiveness.

In that regard, it is interesting to refer to the 2011 MyIPO guidelines, which provide the following textual guidance for critical observation, *to wit*: "a computer programme claimed by itself or as a record on a carrier is not patentable, irrespective of its content. The situation is not normally changed when the computer programme is loaded into a known computer...."

However, the technical effect, which contributes to prior art, could be patentable. That effect can be embodied in a product or process. The guidelines end the section dwelling on computer programs by stipulating that "the claims must be so drafted as to include all the technical features of the invention which are essential for the technical effect. Where patentability is admitted, then, generally speaking, product, process and use claims would be allowable."

Section 13(1)(a) of the Patents Act 1983 specifically excludes from patentable subject matters "discoveries, scientific theories and mathematical methods" and paragraph (c) thereof excludes "schemes, rules or methods for doing business, performing purely mental acts or playing games."

With technological advances, copyright laws cannot provide an effective solution for programmers who invent new software. Patent law will be a sufficient alternative. In Malaysia, there is no room to construe the foregoing sections of the Malaysian Patent Act to insert software on patentable subject matters. Nevertheless, with *Symbian*, the Malaysian courts can espouse an attitude which relies on the position of English and Commonwealth decisions, which support, to some extent, the patentability of software.

The 2011 MyIPO Guidelines guide in respect of inventions involving software or programs in the following rule:

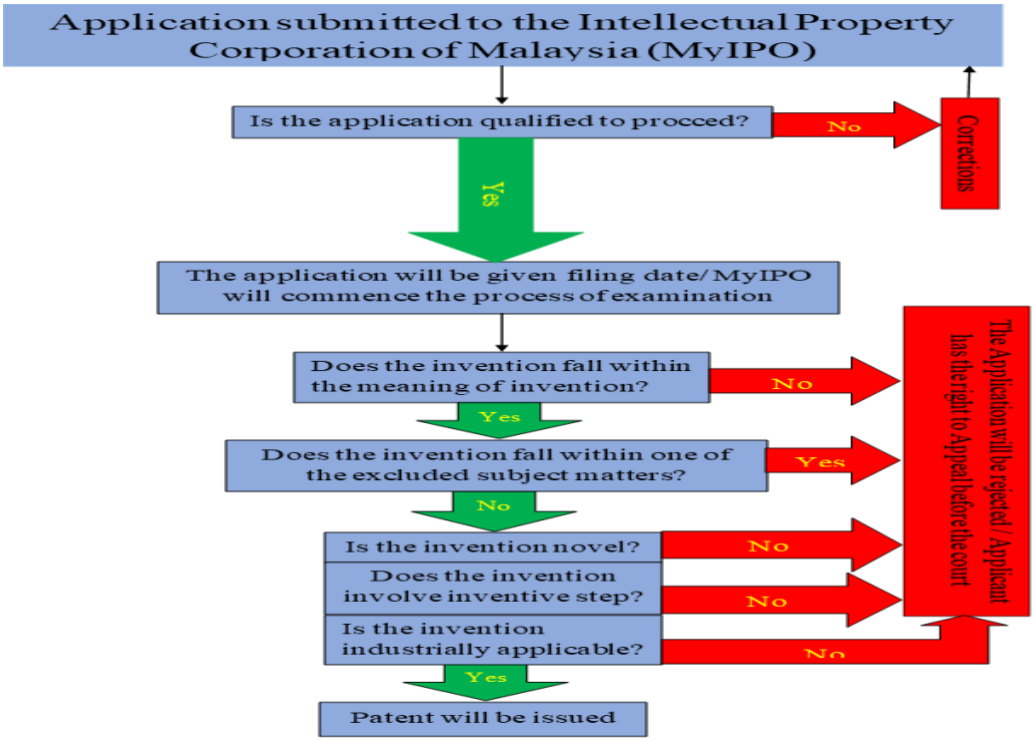
> "A computer programme claimed by itself or as a record on a carrier is not patentable, irrespective of its content. The situation is not normally changed when the computer programme is loaded into a known computer. If, however, the subject matter as claimed makes a technical contribution to the prior art, patentability should not be denied merely on the ground that a computer programme is involved in its implementation. This means, for example, that programme-controlled machines and programme-controlled manufacturing and control processes should normally be regarded as patentable subject-matter. It also follows that, where the claimed subject-matter is concerned only with the programme-controlled internal working of a known computer, the subject-matter could be patentable if it provides a technical effect."

[76] C. P. Azmi, A. G., Madieha, I., & Jeong, *Patent Law in Malaysia: Cases and Commentary* (Sweet & Maxwell Asia, 2015).

It is worth noting that the guidelines do not exclude all inventions incorporating elements of "software" or "program" or computer-implemented elements within the embodiment of an invention. According to the guidelines, "if, however, the subject-matter as claimed makes a technical contribution to the prior art, patentability should not be denied merely on the ground that a computer programme is involved in its implementation." The point of emphasis here is that an invention incorporating an element of "computer programme" may be patentable, if it "makes a technical contribution to the prior art." In other words, an invention that involves a "computer programme" component may be patentable, if it complies with the "technical effect" requirement. A closer analysis indicates that, if patentability relies on "a technical effect, the claims must be so drafted as to include all the technical features of the invention which are essential for the technical effect."

Nevertheless, the MyIPO Patent Guidelines are arguably outdated. There is an urgent need to revise them in line with patent practices around the world, as reflected, for example, in patent updates by the Trilateral Offices. In the meantime, it should be noted that, according to the MyIPO guidelines, inventions incorporating software, program or computer-implemented elements may be patentable, if they comply with the legal condition set out therein, that is, if they make a technical contribution to the prior art. In such a case, "patentability should not be denied merely on the ground that a computer programme is involved in its implementation."

Figure 1. ***The Process of Patent Application in the MyIPO***



Source: *Created by author based on Malaysian Patent Law*

IoT software patentability

Patenting in the field of IoT has been increasing in the last decade. Granted patents have been tripled between 2016 and 2018, and between 2018 and 2020[77]. The Japanese Patent Office was the first patent office to address the significance of IoT by creating a New classification for IoT (ZIT)[78]. In 2019, the Cooperative Patent Classification (CPC) introduced an IoT-related subclass (G16Y) entitled "information and communication technology specially adapted for the internet of things" which entered into force in 2020 [79]. In this classification, IoT was defined as "a system that consists of three main components, namely: (a) physical objects ("things"), (b) network and (c) function". Subsection G16Y was subdivided into G16Y 10/00, G16Y 20/00, G16Y 30/00 and 40/00. G16Y 10/00 encompasses all applications in economic sectors. All applications related to the information sensed or collected by the things will be classified under G16Y 20/00. G16Y 30/00 and G16Y 40/00. G16Y 30/00 is entitled "IoT infrastructure" and includes the construction, control, maintenance or management of IoT systems *per se.* G16Y 40/00 covers IoT characterised by the purpose of the information processing.

It is believed that IoT will refuel debates about software patentability[80]. As already mentioned, software patentability has proven problematic and controversial. Although many software-implemented patents have been issued, there is still uncertainty and inconsistency in the application of patent law to software inventions. This is evident by the number of patent infringement lawsuits in the US, which increased from 2000 to 5000 between 2007 and 2015. Most of these cases were related to software, computer, and communication patents[81]. Moreover, US courts invalidated most of the disputed patents in recent years. Some courts invalidated all software patents that were brought before them[82]. As aforementioned, software poses a challenge to the idea-expression dichotomy. The distinction between copyright protection and patent protection lies in the dichotomy of idea/expression. The Supreme Court, in its 2021 decision of *Google LLC v. Oracle America*, outlines this principle by stating that "unlike patents, which protect novel and useful ideas, copyrights protect 'expression' but not the 'ideas' that lie behind it."[83] Intellectual property regimes have historically classified subject matters as either writing or a machine, but could not be both at the same time[84]. This perhaps resulted from the absence of a clear, relatively undisputed definition of software[85]. Unlike other subject matters, scientific communities were divided regarding the software concept. Hardware

77 "Lens Patent Search: 'Internet of Things '," n.d.

78 "World-First and New Patent Classification Created for IoT-Based Technologies（METI）," n.d.

79 "G16y Information and Communication Technology Specially Adapted For The Internet of Things," n.d.

80 Mauricio Paez and Mike La Marca, "The Internet of Things: Emerging Legal Issues for Businesses," *Northern Kentucky Law Review* 43 (2016).

81 Jonathan Stroud and Derek M. Kim, "Debugging Software Patents after Alice," *South Carolina Law Review* 69 (2017): 177–220.

82 "AliceStorm Update for Q1 2017 | Fenwick & West LLP," n.d.

83 Supreme Court, Google LLC v. Oracle America, Inc. (2021).

84 Pamela Samuelson, "Staking the Boundaries of Software Copyrights in the Shadow of Patents," *Florida Law Review* 71 (2019): 243–302.

85 Brad Sherman, "Intangible Machines: Patent Protection for Software in the United States Special Issue-Technologies of the Law/ Law as a Technology," *History of Science* 57, no. 1 (2019): 18–37, https://doi.org/10.1177/0073275318770781.

manufacturers and software product companies had very different understandings of what the software is[86]. Software patents have divided legal communities.

Antagonists of software patents justify their rejection of software as a patentable subject matter on numerous grounds. First, software is a copyrightable subject matter. The most potent rationale used to justify the exclusion of computer programs from patentability is that they are protected under copyright law[87]. Multiple reasons tempt software developers to seek copyright protection rather than patent protection. First is the automation of copyright protection. Secondly, the modest originality that copyright protection requires. Third is the long-term of the copyright protection. Fourthly, there is no requirement for disclosure in the copyright protection[88]. The Second ground for excluding software from the patent realm is that computers are considered to be no more than algorithms, applications of mathematical formulas and matters which are comparable to mathematical methods. They, therefore, do not fit within the meaning of invention. Third, the adversaries of software patent protection fear the issuance of excessively broad patents that block the road to innovation[89]. The fourth justification to deny the patentability of software is the concern about insufficient disclosure.[90]. Fifth, they opine that patent protection would be fruitless as software innovation requires little investment[91]. Lastly, Seaman contends that patent protection is necessary due to the rapid pace of the software industry, which is confronted with a lengthy patent issuance process. The short life of software renders patent protection inappropriate[92].

About the justifications above, borderlines should be drawn between copyright and patent protection to ascertain their appropriateness as means for protecting software. In respect of the second rationale, attention should focus on the essence of algorithms, computer programs and software. Another significant observation worthy of attention is that patent law and copyright law are the most technology-touched legal sub-disciplines. As such, all concepts within their domains should be tested in light of the state of technological knowledge. Copyright law is an area of law that regulates the ownership of cultural goods. Such goods include computer programs. Copyright protection is directed at the interest of authors. Patent law, on the other hand, protects technical findings in return for their disclosure[93]. Consequently, many differentiating points distinguish the two areas of law. Undeniably, these borders have recurrently been reshaped due to technological, economic and legal changes that cast their shadow on the subject matter categories in both sub-disciplines of intellectual property law. The last version of the map is that software *per se* is a copyrightable subject matter, whereas its

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86 Sherman.

87 B. Bently, L., & Sherman, *Intellectual Property Law.* (Oxford University Press, USA., 2014).

88 Samuelson, "Staking the Boundaries of Software Copyrights in the Shadow of Patents," 2019.

89 Peter Slowinski, "Rethinking Software Protection," in *Artificial Intelligence & Intellectual Property* (Oxford: Oxford University Press, 2020), 615–25, https://doi.org/10.1016/S1387-1609(00)01175-0.

90 Reto Hilty and Christophe Geiger, "Patenting Software? - A Judicial and Socio-Economic Analysis," *Intellectual Property and Competition Law* 36, no. 6 (2005): 615–47.

91 Robert E Thomas and Robert E Thomast, "Debugging Software Patents: Increasing Innovation and Reducing Uncertainty in the Judicial Reform of Software Patent Law," *Technology Law Journal* 25 (2008).

92 Conrad Delbert Seaman, "Osgoode Hall Review of Law and Policy Contextualizing the Software Patent Debate in Canada: A Practical Approach to Policy Development," *Osgoode Hall Review of Law and Policy* 3, no. 1 (2010): 97–132.

93 Bently, L., & Sherman, *Intellectual Property Law.*

creative applications are patentable subject matter. The dichotomy between software and its applications is like the idea-expression dilemma. Both of them are easy to elaborate on but difficult to apply. Thus, it has been argued that this distinction between an abstract idea and patentable inventions is even more blurred in the computer program context. It can be argued that the application of copyright protection to software will have undesired implications for the IoT industry, which relies heavily on software inventions. The scope, duration and autonomy of the protection will affect the tendency of software companies to develop their sector. First, if the software is protected by copyright, it will be possible for other competitors to use the core idea of the software, which is unprotected by copyright law[94]. Additionally, applications of the software will fall outside copyright protection. Second, duration is a key factor. Copyright protection lasts longer than patent protection. This will cast a shadow on the freedom of competition in the market. Third, the autonomy of protection in the copyright field will cause uncertainty in the software market. The courts will determine eligibility in the case of an alleged infringement. Automatic copyright protection is appropriate for the traditional categories of copyrightable subject matter, but it might be a litigation generator in the context of software.

Moreover, when they first originated, computer programs were just algorithms giving simple instructions to computers. However, many changes have occurred since computer programs were first introduced on the market. Most copyright subject matters are linked with the world of literature, writing and authorship. Software is no longer one of these groups. Patent law categories are more applicable to software than their copyright counterparts. Computer programs are, indeed, "means for causing something to happen; it has a mechanical utility, an instrumental role." The separation between computer programs and their application is akin to the separation between an invention and its technical effect. Inventions, rather than their technical effects, are the subject matter of patents. The utilitarian nature of software outputs confuses efforts at distinguishing between the subject matters of copyright and patent[95].

On the other hand, opponents of software patentability rely on the "laws of nature" rule. They argue that computer programs are no more than abstract ideas, which are not patentable. According to this argument, software is no more than an abstract idea without any physical embodiment. For anti-patent advocates, a perplexing fact about software inventions is that no mechanical or chemical effect appears from the inventions. Instead, the invention is a control over data and signals that releases the effect on the hardware part of the system[96]. A typical example of this fact is the IoT device. The result of every software enhancement is reflected in the hardware devices. As mentioned earlier, the technical effect may be the decisive factor in the abstract idea-invention distinction. However, there is no requirement that the technical effect should appear within the software. Rather, the requirement is that the effect should be a result of the invention claimed. The argument that software is an idea without physical

[94] Peter S Menell, "Rise of The API Copyright Dead?: An Updated Epitaph For Copyright Protection of Network and Functional Features Of Computer Software," *Harvard Journal of Law & Technology* 31 (2018).
[95] Menell.
[96] Michael Xun Liu, "Subject Matter Eligibility and Functional Claiming in Software Patents," *North Carolina Journal of Law & Technology* 20 (2018).

embodiment relies on the traditional view of the meaning of physical embodiment. Research on artificial intelligence, however, has led to new concepts of "physical embedment."[97] The change in facts will definitely lead to a change in the law based on those facts.

All the same, this article argues that the exclusion of computer programs from patentability will not have a significant impact on IoT for two reasons. First, the exclusion is confined to the computer program *per se*. In its essence, IoT is a connection between devices that enables these devices to work collectively. No software will be used in IoT unless it has a substantial technical effect. Mere programming will not be sufficient to meet the patentability criteria. All problems confronting IoT are technical. There are six sorts of challenges that need to be overcome by IoT developers. These are insufficient management of device identification, non-harmonisation of devices with a vast spectrum of manufacturers, unauthorised access to information, potential device damage, the reliability of data transformation tools, and external intervention with transmitted data[98]. Any solutions proposed for these problems will be technical ones. The term "software" suggests a co-existing hardware device that will be affected by any change in the software linked to it. Second, it is useful to note that the excluded category is “computer programs,” rather than “software.” The two phrases might be used interchangeably in the legal profession, but in the scientific context, they are less similar[99]. The confinement of software to computer-implemented software excludes many types of software utilised outside the IT industry[100].

In the above context, it is vital to note that, according to the MyIPO Guidelines, computer programs may be "presented in terms either of software or in combination with hardware." This article takes issue with that position as it ought to be reviewed in light of scientific facts, which deem software as a combination of computer programs. Undeniably, a combination of patent-excluded matters may be patentable provided the three patentability requirements are met. There is no ground to exclude a subject matter based on the exclusion of its components. It was adopted in the US that “ [a]ll machines are made up of the same elements; rods, pawls, pitmans, journals, toggles, gears, cams, and the like, all acting their parts as they always do and always must”[101]. More recently, The US Supreme Court in *KSR International Co. v. Teleflex Inc*. held that the combination of known components according to a known method would not be obvious if it yields unpredictable results[102]. The "Unpredictable result" test has been used as a yardstick for the patentability of a combination[103]. Hence, a new inventive combination of computer programs will result in patentable software.

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97 Minoru Asada et al., “Towards Computational Developmental Model Based on Synthetic Approaches,” in *2009 IEEE 8th International Conference on Development and Learning, ICDL 2009*, 2009, https://doi.org/10.1109/DEVLRN.2009.5175544.

98 Rishika Mehta, Jyoti Sahni, and Kavita Khanna, “Internet of Things: Vision, Applications and Challenges,” in *Procedia Computer Science*, vol. 132 (Elsevier B.V., 2018), 1263–69, https://doi.org/10.1016/j.procs.2018.05.042.

99 Leon J. Osterweil, “What Is Software?,” in *The Essence of Software Engineering* (Springer International Publishing, 2018), 59–76, https://doi.org/10.1007/978-3-319-73897-0_4.

100 “Intellectual Property and Digital Trade in the Age of Artificial Intelligence and Big Data | Infojustice,” n.d.

101 BG Corporation v. Walter Kidde & Co., 79 F. 2d 20 - Circuit Court of Appeals, 2nd Circuit (1935).

102 KSR Intern. Co. v. Teleflex Inc., 550 US 398 - Supreme Court (2007).

103 Sung Hoon Lee, “Non-Obviousness in Combination Patents after KSR,” *Federal Circuit Bar Journal* 26 (2016): 229–76.

Further, software is no longer used exclusively by computers. Many households and industrial devices are increasingly relying on software components. Once again, IoT is a typical example of this fact. In defining IoT, the US Federal Trade Commission (FTC) excluded computers, smartphones and tablets from the devices connected. This potentially puts IoT in a safe harbour from the legal battle over software patentability. The Agreement on Trade-Related Aspects of IP Rights (TRIPS) is essentially an agreement to balance the rights of developed and developing countries. In terms of patentability, each member country is given leeway to determine the scope of patentability in conformity with the spirit of patent protection under the TRIPS superstructure. The spirit of TRIPS is to ensure that inventions in all types and fields of technology are protected under the guidance of its patentability provisions, without discrimination. This, alone, is the foundation for inventions involving software, programs, computer-implemented elements and so on.

CONCLUSION

The study examines the patentability of software in the context of the Internet of Things (IoT) by analysing legal frameworks in the US, UK, EU, and Malaysia. The study relied on the patentability of a combination to assert that computer program exclusion does not extend to software. Moreover, the study concludes that in the IoT domain, software is inherently designed to interact with physical devices, often producing such technical outcomes. Consequently, IoT-related software inventions fall outside the scope of the exclusion and may qualify for patent protection when they meet legal criteria such as novelty, inventive step, and industrial applicability.

The article draws a borderline between software and computer programs. The authors argue that this distinction is vague in legal discourse. This difference must be reconsidered considering the IoT's functional realities. IoT software, due to its integration with hardware and delivery of technical outcomes, merits recognition under patent law. A revision of Malaysia's MyIPO guidelines is especially urgent to ensure legal coherence and support innovation in a rapidly digitising economy. The article also demonstrated significant variations and evolving attitudes among jurisdictions. US jurisprudence, despite judicial exceptions, increasingly recognises software-related inventions, especially through the "technical effect" lens. The UK and EU systems maintain statutory exclusions but permit patents where technical contributions exist. Malaysia, although lacking a statutory exclusion, follows restrictive administrative guidelines, which appear outdated and inconsistent with contemporary global practices.

CONFLICT OF INTEREST AND ACKNOWLEDGEMENT

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