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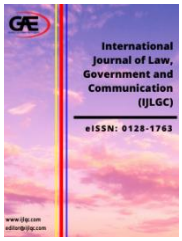

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GLOBAL ACADEMIC EXCELLENCE

FOSTERING INTELLECTUAL PROPERTY AWARENESS IN ACADEMIC ENTREPRENEURSHIP

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Abstract:

The importance of Intellectual Property (IP) in academic entrepreneurship, emphasises a need for specialised knowledge of IP law in university Technology Transfer Offices (TTOs), and general awareness of IP rules amongst university researchers, research assistants, and other university personnel. This helps not only in preventing the inadvertent loss of valuable IP, but also the infringement of IP owned by other parties, which could result in costly law suits. Equally, knowledge of IP law is indispensable to the effective negotiation of licences, and the drafting of contracts that cater for the interests of both universities and industry. The objective of this article is, accordingly, to provide academic entrepreneurs with insights into IP regimes. This should help them in identifying valuable IP, and in ensuring that protection is not compromised. It will also help in determining the modes of protection suitable for particular forms of IP, how to manage acquired rights, and tackle infringements. In the following sections, we discuss these issues from the perspectives of several jurisdictions. Traversing our discussion is an examination of university IP policies, and relevant case law, which should enhance understanding. The last segment of the article concludes and reiterates the importance of IP awareness in academic entrepreneurship. Therefore, this article aims at fostering awareness of IP regimes amongst academic entrepreneurs.

Keywords:

Academic Entrepreneurship, University, IPRs, Bayh-Dole, TTO

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Introduction

The role of entrepreneurship in economic development (Doutriaux, 1991; Troilo, 2011; Hayter et al., 2018) has made policymakers in many parts of the world to take a keen interest in academic entrepreneurship, which is the commercialisation of the outputs of university research (Ndonzuau, 2002; Locket and Wright, 2005; Rothaermel et al., 2007; Siegel et al., 2007; Grimaldi et al., 2011; Abreu and Grinevich, 2013; Kopiec et al., 2019). Academic entrepreneurship generates revenues for universities through the assignment and licensing of intellectual property rights (IPRs), specialist consulting, and the sale of shares in spin-offs (Quintas and Guy, 1995; Grimaldi et al., 2011; Stal et al., 2016). In 2009, patent licensing generated $1.7 billion for universities in the U.S. (AUTM, 2010; Rooksby, 2011). There are similar trends in Europe, Australia, Canada (Siegel at al., 2007), and Asia (WIPO, 2007). These revenues could facilitate further research, and provide incentives for university researchers, research assistants, and other university personnel (Grimaldi et al., 2011; Adelowo and Surujlal, 2020). University IP could be traded for that owned by external parties, through cross-licensing and grantbacks. It could help universities to access industry's technological know-how, and laboratories (Grimaldi and Tunzelman, 2002), just as industry could benefit from expert faculty and state of the art research (Nelsen, 1998; Crow et al., 2020). Yet, IP awareness is lacking amongst academic entrepreneurs (Monotti; 2000; Zeitlyn and Horne, 2002; McCutheon, 2003; Wright et al., 2008a; Davey and Galan-Muros, 2020). Of greater concern is the dearth of specialist technology transfer officers (Zeitlyn and Horne, 2002; Wright et al., 2008a; Kotov et al., 2021) in IP law. The lack of IP expertise partly explains the uncertainty and discord that have plagued universities and their personnel over university generated IP (Siegel, 2013; Lyken-Segosebe et al., 2020).

IP And The Need For Protection

IP is a creation of the human mind, which is unique in nature. In the context of academic entrepreneurship, the results of university research may qualify as IP subject to domestic IP requirements. Indeed, many of the products used today result from academic research (Mansfield, 1998; Siegel and Wright, 2015; Rippa and Secundo, 2019). IP needs to be protected because it is mentally exerting. It also requires considerable time, and financial resources. However, it could be misappropriated easily, thereby depriving innovators due reward for their efforts, and the possibility of recouping expenses (Hou et al., 2023). This could discourage further innovation (Rodrik, 2000), to the detriment of society. That is why governments confer exclusive rights on innovators over their IP for a limited period of time. Thus, the IP institution is meant to ensure that innovators reap returns on their investments and are encouraged to embark on more innovative activities. It also helps in reducing uncertainty, and the costs of doing business (Williamson, 1985; North, 1990). For example, patents enable universities to license research results to industry, whilst also fulfilling their need to publish, without undermining licensees' rights (Nelsen, 1998). The IP institution equally enables entrepreneurs to transfer part of their rights, without the necessity to consume all that they produce (Harper, 2003). In academic entrepreneurship, patents and copyrights are the most important forms of IPRs. Others include trademarks, and trade secrets (Bagley and Tvarno, 2015). These are considered in turn below.

Patents

Patents are IPRs granted for inventions. They entitle inventors to exclude unauthorized parties from making, using, selling, or importing their inventions within the country granting such rights. In most IP systems, an invention must be a patentable subject matter, to qualify for a

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patent. Another requirement for patentability is novelty. In the U.S., novelty means that a claimed invention has not been in public use, on sale *within the country*[1], or described in a printed publication anywhere in the world, including the U.S., more than one year before a patent application is filed. An additional requirement is that the invention must be non-obvious to someone ordinarily skilled in the relevant field of technology at the time of the invention. This means that the claimed invention must involve an inventive step (Section 15 Malaysian Patent Act 1983). For example, a new product, which is functionally equivalent to an existing one, with only a minor difference, in size, or colour, cannot qualify for a patent, even if novel. In other words, if based on the prior art (existing knowledge), the purported invention would have been obvious to a person of ordinary skill, then it is not inventive. Following the U.S. patent reforms under the America Invents Act 2011, the definition of prior art has widened. Therefore, the determination of novelty has also changed. Unlike before, prior art now covers the prior use, or offer for sale taking place *anywhere in the world*, not only in the U.S. This aligns the U.S. patent law with that of other jurisdictions.

Another requirement for patentability is that the invention must have utility (also known as industrial application in Europe). This requirement is relevant to the biotechnology field where the direct benefits of certain genetic inventions may be unclear (Commission on Intellectual Property Rights Report, 2002). Hence, the United States Patent and Trademark Office (USPTO), and the European Patent Office (EPO) require that, in DNA sequences-related cases, a patent application must demonstrate convincingly the utility derivable from a claimed invention (EPO Opposition Decision, 2001; USPTO Utility Examination Guidelines, 2001). The last requirement for the grant of a patent (essentially a procedural one) is enablement and best mode. This requires the inventor to clearly and fully detail out in the patent application, the best-known method of making and using the invention, so that an ordinarily skilled person can make and use the invention simply by following that detail. In *Biogen Inc v. Medeva Plc* (1997), the House of Lords emphasised that the disclosure of a single mode of practising the invention may not suffice. Instead, the disclosure should be such as to enable every aspect of the invention to be practised. Governments impose the disclosure requirement on inventors in return for the exclusive rights conferred on them by the grant of a patent.

In addition to the above types of patents, a plant patent is also obtainable. This is granted for the invention, or asexual reproduction of distinct and new plant varieties. Under TRIPS, Member States may grant patents for such inventions, although they are equally free to exclude the patenting of certain living things. The U.S., however, allows the patenting of living things, including plants and animals. In *Diamond v. Chakrabarty* (1980), the U.S. Supreme Court endorsed this practice. Nevertheless, in parts of Africa, Asia, Europe, and Latin America, the patenting of living things is generally forbidden. Academic entrepreneurs, especially those in the biotechnology field, should also note that, where an invention utilised the genetic resources and traditional knowledge (TK) of indigenous communities, many developing countries in Africa, Asia, and Latin America require their origin to be disclosed in a patent application (Article 3, African Model Legislation for the Protection of the Rights of Local Communities, Farmers and Breeders, and for the Regulation of Access to Biological Resources, 2000; Article 26, Decision 486 of the Andean Community; 2000; Section 10, Patent Act of India, 1970 as amended in 2002). Those developing countries further require proof of the prior informed consent of the indigenous owners, and a fair and equitable benefit-sharing agreement. Although these are non-TRIPS requirements, they are supported by such international legal instruments

[1] But the law has now changed under the America Invents Act (2011).

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as the Convention on Biological Diversity (CBD, 1992), and its enabling protocol, Nagoya Protocol (2010). These instruments affirm that countries have sovereignty over their genetic resources, and related TK, and can, therefore, stipulate the conditions on which foreigners may access them (Zainol et al., 2011b). Relevantly, even TRIPS (Article 62) permit Member States to insist on applicants complying with some reasonable procedures before being granted IPRs.

For the above reasons, a patent may be denied, or where one is issued inadvertently, an application for its revocation may be made. If an invention utilised genetic resources and, or TK historically known to, and used by an indigenous community, the relevant patent could also be challenged for lack of novelty. In the *Tumeric* case, the USPTO granted a patent to two researchers at the University of Mississippi Medical Center on the "use of tumeric in wound healing." The Indian Council of Scientific and Industrial Research (CSIR) petitioned the USPTO to review the patent because the use of tumeric in wound healing was a historically established practice in Indian traditional medicine, and, therefore, not novel. The USPTO upheld that petition, and cancelled the patent.

Once a patent has been granted, the owner has the right to exclude unauthorised persons from making, using, and selling the invention in the country where the patent was granted. This does not mean, however, that the owner enjoys an exclusive right to make, use, and sell the invention. They cannot enjoy such an exclusive right because, in making their invention, they may have used another inventor's IP (Lee and Davidson, 1993). Therefore, allowing them an exclusive right to make, use and sell the new invention could result in an inventor using other inventors' IP without compensating them. In order to avoid this, the law only grants the new inventor the right to exclude others, including those whose IP they have used, from making, selling, and using the invention, just as the others can exclude them from using, making and selling their own inventions, without permission. A patent owner's right to exclude unauthorised parties from making, using, and selling their invention also covers products that are functionally equivalent to that invention (products that are a trivial modification of the invention, which perform substantially the same function, in substantially the same manner). The right to exclude would apply even where an invention was made independently by another party, without knowledge of the original invention.

An application for a patent should be directed to the IP office in a country where protection is sought, since patents are territorial in nature. The application should indicate the defining elements of the invention ("claims") over which protection is sought. Patent officers qualified in various disciplines, including law, science, and technology will determine whether the invention fulfills the domestic legal requirements for patentability (Cantu-Ortiz et al., 2017). Generally, only the inventor (the person who originally conceived the invention) can file a patent application. Nonetheless, in academic entrepreneurship, university TTOs may perform this task on behalf of their inventors, saving them time, expense, and inconvenience, in addition to compensating for their general lack of IP expertise (Carrick, 2016; Kusio and Makowiec, 2015; Adelowo, 2021). For example, in the U.S., The University of Iowa Research Foundation (UIRF), a TTO's equivalent, prosecutes patent applications on behalf of inventors (UIRF, 2011). At the National University of Singapore (NUS), the Industry and Technology Relations Office (INTRO) plays a similar role (WIPO, 2007). But in some universities, such as those in Sweden, there are no TTO equivalents. Consequently, university researchers individually prosecute patent applications (Managing Intellectual Property, 2008).

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Timing of Patents Application

The date a patent application was filed is important, particularly where different parties are claiming the same invention. In such a situation, patent will be granted to the first applicant. In the U.S before 2011, the emphasis used to be on the date of invention, and patent was granted to the party determined to be the first inventor. However, under the American Invents Act (2011), patent will now be granted to the first inventor to file a patent application.

Patent Ownership

Some domestic laws vest employers with patents for inventions made in the course of employment. An example is the UK Patent Act (1977). Although patents are usually granted to the actual inventors, in practice, employees generally agree, upon employment, to assign patents for inventions made in the course of employment to their employers. But in academic entrepreneurship, jurisdictions vary on the ownership of patents for inventions made in the course of employment. In the U.S., under Bayh-Dole Act (1980), university ownership of patents for inventions made by researchers from public funds, is a widely held assumption. Upon employment, researchers sign standard forms acknowledging university ownership of inventions, and agreeing to disclose same to their university.

Universities in the UK also claim ownership of IP generated by their researchers, who are, however, under no disclosure obligation (Lockett and Wright, 2005). In Australia, universities similarly claim ownership of IP created by their personnel in the course of employment, or involving a significant use of university resources (Monotti, 1997). By contrast, in some other countries, university researchers own patents for their inventions. In Sweden, for example, the "Professor's Privilege," allows university researchers to own patents for their inventions, absent any agreement to the contrary (Managing Intellectual Property, 2008; Astebro et al., 2016). As a result, they are under no disclosure obligation.

Asian countries also exhibit differences on the ownership of university generated IP**.** In Japan, universities own patents for inventions made in the course of employment by their researchers, who are required by university IP policies to disclose their inventions (WIPO, 2007). But some other Asian countries lack discernible ownership rules. For example, in India, at least, until recently, ownership was, in some cases, determined by contracts between universities and funding agencies, whereas in other cases, ownership vested in the universities (WIPO, 2007). However, The Protection and Utilization of Publicly Funded Intellectual Property Bill introduced in parliament in 2008, provides that, subject to certain exceptions, universities own IP generated from publicly-funded research (Sampat, 2009). This survey shows that the ownership of university generated IP is not a straightforward matter.

Moreover, the courts have not always endorsed domestic laws, and university IP policies, which provide for university ownership of IP. In *University of Western Australia v Gray* (2008), the Federal Court of Australia held that when university academics are employed expressly to conduct research, this does not impose on them the duty to invent. The Court, therefore, concluded that *UWA* could not claim rights in Gray's inventions and patents simply because he was the university's employee. Likewise, the U.S. Supreme Court held in *Stanford v. Roche* (2011) that, unless there was an express agreement to the contrary, Bayh-Dole Act (1980) did not automatically divest university researchers of inventions made by them from publicly-funded research. In practice, university researchers are hardly hired to invent. It means

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that, contrary to domestic laws and university IP policies, the mere fact that inventors are university employees is not enough to vest their university with ownership.

The nature of university IP policies put in place, particularly, their legal validity, is critical, as well. In *Gray*, the Court found the university's IP policy to be defective, and therefore, incapable of giving it any ownership right in the employee's invention. In *Roche*, the Court also found that the agreement signed with the researcher failed to effectively assign ownership of the contested invention to the university. Therefore, universities should be careful in preparing their IP policies, as well in drafting assignment agreements, if these are to serve their aims.

Profit Sharing

Irrespective of which party owns university inventions, the individual inventors would still be entitled to a share of the royalties earned from the commercialisation of their inventions. In the U.S., Bayh-Dole Act (1980) requires that the net income from a publicly-funded invention be shared with the relevant inventor. For example, under the IP policy of The University of Iowa, inventors share the first $100,000 of net licensing revenues, and 25% of subsequent net revenues. At NUS, 50% of net revenues accrues to inventors; 30% to their department, and 20% to the university (WIPO, 2007).

Disputes may arise between a university, on the one hand, and its faculty, or students, on the other, concerning the sharing of royalties. Most universities have a dispute resolution process for addressing grievances. But, where that fails, resort to the law courts may become inevitable. In *Singer v. The Regents of the University of California* (1993), two university inventors signed standard forms assigning their rights to the university on the understanding that they and the university would share royalties equally. Before royalties were shared, however, the university deducted a substantial portion, purported to be "research fees," significantly reducing the amount to be shared with the inventors. The appeal court held that the university was bound by the agreement to share royalties with the inventors equally. It observed that the assignment agreement incorporated the university's policy, which provided for royalties to be shared equally with inventors. The university could, therefore, not unilaterally alter the agreement by purporting to set aside the so-called "research fees."

Often, dispute over royalties may arise from an amendment to a university's IP policy, and the retroactive application of that amendment. In *Rutgers v. AAUP American Federation of Teachers* (1996), Rutgers amended its IP policy, resulting in a reduction of royalties payable to faculty members and their departments. AAUP contested this unilateral measure, arguing that Rutgers should have negotiated with faculty members. The New Jersey Superior Court Appellate Division held that, even though faculty members were bound to assign their patents to Rutgers, the latter had a duty to negotiate the rate of royalties upon which they were to do so.

In *Chou v. University of Chicago* (2001), Chou, who was a postdoctoral student, co-discovered a vaccine, which she thought was patentable. However, her supervisor, Dr. Roizman, advised otherwise. It emerged that Dr. Roizman had proceeded secretly to procure a patent for the invention, claiming sole inventorship, Although the patent was ultimately assigned to the university under its IP policy, Dr. Roizman continued to enjoy royalty payments. The Court of Appeal for the Federal Circuit (CAFC) held that, although Chou had no ownership interest in

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the patent, which she was required to assign to the university under her employment contract, this was irrelevant to a suit challenging the patent's inventorship. The CAFC emphasised that under U.S. law, an inventor whose name had been omitted from a patent was entitled to sue in order to be listed. Ownership interest in a patent is not a condition for bringing such a suit. However, the party suing must demonstrate some other interest in the patent, such as a financial stake. Chou met this condition, because as an inventor, she was entitled to 25% share of royalties under the university's policy.

Additionally, the CAFC held that Dr. Roizman had a duty to inform Chou as to the patentability of the invention. Also, according to the Court, Chou could have recourse against the university because Dr. Roizman's action arose from his employment with the university, and specifically with respect to the implementation of directions contained in the university's employment handbook on the patenting of inventions. Dr. Roizman was, therefore, the university's agent on the implementation of the directions, including those relating to the ownership of, and compensation for inventions. In light of this decision, research supervisors must endeavour to uphold their fiduciary duty of care toward their research assistants, and avoid any conduct inimical to the interest of such assistants. Failure to do so may expose them to law suits.

Patent Tenure

Patents last for 20 years from the date of application. Once a patent is issued, some maintenance fees may remain payable intermittently in order to prevent it from lapsing into the public domain during it tenure.

Remedies for Patent Infringement

The owner of an infringed patent has certain remedies in law. In the U.S., they could sue the infringer for damages, or a reasonable royalty**.** Damages may be tripled where the infringement was intentional. In exceptional cases, the infringer may also be ordered to refund the money the patent owner spent in hiring a lawyer. In addition, the patent owner could obtain an injunction. In the U.S., infringement actions can be instituted in the federal courts. Some Asian jurisdictions, such as Thailand and Malaysia, have special IP courts that handle such matters.

Copyright

Whilst a patent is granted for inventions, a copyright is granted for original works of authorship. Works of authorship are modes of expression, such as words, voices, and images. In order to be copyrightable, a work of authorship must be original. Moreover, it must be affixed to a tangible medium from which it can be reproduced, such as a book. It can also be affixed to a tangible medium from which it can be perceived, such as a videotape; or affixed to a tangible medium from which it can be communicated, such as a compact disk, or cassette tape (Lee and Davidson, 1993). Without fixation to a tangible medium, these works cannot be copyrighted. For example, a professor's oral lecture is not copyrightable, because it is not affixed to a tangible medium. However, if that lecture were reduced to the pages of a book, it would be copyrightable, because the book is a tangible medium from which the lecture can be reproduced.

A copyright entitles the owner to reproduce, and distribute the relevant work; make derivative works from it; publicly display; adapt; and perform it. This means that the owner can exclude unauthorised parties from engaging in any of these acts. However, these rights are subject to the doctrine of "fair use" (U.S.), alternatively called "fair dealing" (U.K). This doctrine allows

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others to make limited uses of a copyrighted work, without obtaining the owner's permission. Professors and students may, therefore, be able to use parts of a copyrighted book for academic purposes, such as teaching and research. But such uses must not substantially devalue the relevant work. Furthermore, it should be noted that copyright only protects expressions, not the ideas expressed. This means that copyright does not protect the content of a relevant work, but the expression of it. Therefore, others can use an expressed idea to create their own works, without infringing the copyrighted work.

Copyright Ownership

Although a copyright is normally registered in the name of an author, the right is protected as "work made for hire," if the particular work was created in the course of employment. Therefore, this right accrues to the employer. For example, under the U.K. Copyright, Designs and Patents Act (1988), employers own copyright in creative works made by employees in the course of employment, unless there is an agreement to the contrary. In academic entrepreneurship, universities usually ask their personnel to sign agreements relinquishing their rights in such works, as a condition for employment.

However, some universities do not claim copyright ownership in every case. For example, The University of Iowa, permits academics to take ownership of copyright in their scholarly articles, even if such articles were written under grants, or involved the use of the university's computers and supplies (UIRF, 2011). But it is usual, in such cases, for publishers to seek ownership of copyright as a condition for publication. In other cases, such as pedagogical and artistic works, The University of Iowa generally does not claim ownership of copyright. This concession applies to faculty, and postdoctoral appointees. It equally applies to students, who create works in the course of their educational endeavours. For example, the university will not claim copyright in a dissertation written by a student whilst serving as a research assistant, since the dissertation is an academic requirement. However, the university will claim copyright in any work created by a student in the course of formal employment with the university.

For works created with a significant use of university resources, The University of Iowa will also claim copyright ownership. "Significant use of university resources" excludes "salary, developmental assignment or award, library resources, computers, communications technologies, secretarial services, assigned offices, laboratories, and utilities" normally provided to researchers in their fields and departments (UIRF, 2011). For example, the university will not claim copyright in a painting created by a faculty member, which involved the use of facilities normally provided by the university to other faculty members. Copyright in works created outside employment with the university will not be claimed by the university. Where the university claims copyright ownership, employees may still be granted a non-exclusive licence to use the assigned work for creative, scholarly, or research purposes, without paying any royalty to the university. These policy provisions must, however, be read in light of the case law on the ownership of university IP considered earlier.

Copyright Tenure

In the U.S., copyrights last for 70 years from the date they came into being, if held by a legal person, such as a university. In the case of natural persons, TRIPS provides for copyright to be protected for an author's entire life, plus 50 years after their death. This position is followed in jurisdictions such as Japan and Malaysia. In other jurisdictions, for example, the U.S., due to

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pressure from the copyrights industry, copyright is protected for a longer tenure; an author's entire life, plus 70 years after death.

Remedies for Infringement

A copyright owner whose right is being infringed can apply to a court of law for appropriate remedies. Under the Malaysian Copyright Act, 1987 (Section 37), the copyright owner may obtain an order of injunction prohibiting the infringer from further reproducing, selling, displaying, or performing the work. The copyright owner may also claim any profits that the infringer may have made. In addition, the court may order the infringer to pay damages to the copyright owner. As indicated previously, in the U.S., a copyright owner may also claim statutory damages, provided the right was registered with the U.S. Copyright Office. Statutory damages would be awarded regardless of whether, or not, the copyright owner did suffer, or is able to prove actual damages. The infringer may further be ordered to reimburse the money spent by the copyright owner as court fees, as well as in hiring a lawyer. Moreover, the infringing copies of the work, including the machines used to produce them, could be impounded and destroyed. Copyright infringement may also result in penal consequences, such as fines and imprisonment particularly, where the infringement is of a blatant nature.

Trademarks / Service Marks

Another possible form of IPR obtainable is a trademark (for tangible products), or a service mark (for services). This is any distinctive fanciful word, symbol, slogan, colour, scent, logo, personal name, shape, geographical term, and any combination of these, or other devices, which are used, or intended to be used to differentiate a company's goods, or services from those of rival companies. In a nutshell, a trademark, or service mark is a sign meant to identify the actual source of the marked goods, or services, in order to avoid confusion amongst consumers. Examples include the cover of The Economist magazine (visual appearance), Toshiba's "Leading Innovation" (slogan), Dell (personal name), Irish potatoes (geographic term), and Apple Computers (fanciful word).

Trademarks / Service Marks Ownership

Unlike patents, marks can be registered directly in a company's name, rather than in the name of the employee who designed the mark. However, universities claim rights in marks in limited cases. For example, The University of Iowa typically claims trademark protection for the university's name, mascot and symbols (UIRF, 2011).

In the U.S., marks are governed by both state laws, and a federal enactment called the Lanham Act (1946). But registration of marks under any of these laws is not necessary. This is because, at common law (judges made law practised in the U.K. and its former colonies), a mark that is already being used publicly is automatically protected. Common law protection is, however, limited only to the geographical area where the mark is being used (Lee and Davidson, 1993). On the other hand, registration under a state law protects the mark in the entirety of that state, whilst registration under the Lanham Act (1946) offers nationwide protection, and is incapable of being defeated by any other competing rights (Lee and Davidson, 1993). However, a pre-existing user of that mark with a common law right, can continue to use the mark within the normal geographical area of its use, whilst a subsequent user whose right is registered under the Lanham Act (1946) can use the mark throughout the rest of the U.S. (Lee and Davidson, 1993).

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Requirements for Protection

A mark should be in actual and continuous public use, in order to enjoy protection. For protection under the Lanham Act (1946), such use must be in interstate commerce, and where the mark is not already in use, a sincere intention to do so within a reasonable time after the filing of an application for protection must be demonstrated (Lee and Davidson, 1993). Furthermore, the mark should be affixed to the product, or the package containing it, so that consumers can see it clearly, and be able to distinguish the product from rival ones. A mark should also be distinctive in that it is able to identify the source of particular goods, or services. Examples of distinctive marks are words that are fanciful, arbitrary, or suggestive. Fanciful words are those that are simply made up, such as Kodak, Google, and Yahoo! Arbitrary words bear no relation to the marked product, such as Apple for computers. Suggestive words hint at the attributes of the product, such as Jaguar, which evokes speed.

Words that merely describe the characteristics of a product, such as "Salty," and "Sweet," are not distinctive. This is also true for generic words (words that are the real names of the relevant products) such as computer, car, and phone. Under the Lanham Act, non-distinctive words do not qualify for automatic registration. In order to qualify for registration, they must be shown to have attained a secondary meaning. In other words, consumers must have come to identify those words with the relevant goods, or services after a certain period (usually 5 years under the Lanham Act) of continuous and exclusive use. In that way, they may be considered as distinctive. An ordinarily non-distinctive word may be proven to have attained a secondary meaning through consumer surveys and testimonies showing that they associate that word with a particular producer.

Another requirement for the protection of a mark is that it should not be similar to an existing mark so as to be confusing, and difficult for consumers to differentiate between goods and services in the marketplace. Determining whether two marks are confusingly similar involve considering whether they are both similar in appearance, sound, or meaning; whether the goods, or services to which both marks relate are similar in nature, or are traded through similar channels; and whether the existing mark is a famous mark. In most cases, an affirmative answer to this enquiry would result in the denial of protection for a subsequent mark. An additional requirement for the protection of a mark is that it should be non-functional. For example, if a particular shape is essential in order for a product to perform a certain function, or to reduce the cost of producing it, that shape cannot qualify for protection as a mark (Lee and Davidson, 1993). The courts use this mechanism to avoid an overlap between marks and patents. However, the mere fact that a shape has a particular utility, for example, the Coca Cola bottle, which also serves for the carrying of cola drink, does not bar it from protection as a mark, if that shape is distinctive (Lee and Davidson, 1993).

Remedies for Infringement

One remedy for trademark infringement is an order of injunction. In addition, damages may be awarded plus the cost of maintaining the suit, and the profits earned by the infringer. In the U.S., the sum awarded may be tripled if the infringement was intentional. In very serious cases, the award may include the fees paid by the owner of the mark for the services of a lawyer. The court may also issue an order to impound and destroy the infringing labels, signs and other materials, as well as the equipment used in making them.

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Trade Secret

In addition to the IPRs considered above, it is possible to maintain trade secret rights. A trade secret is confidential information of proven economic importance to a company, which is the subject of affirmative steps aimed at protecting it from becoming known to others, who may generally be unable to ascertain it through normal, legitimate means (U.S. Uniform Trade Secrets Act, 1979; Japan Act Against Unfair Competition, 1993; Interpretation of the Supreme People's Court of China, 2007). It is secrecy that makes the information valuable to the company, and places it at a competitive advantage. Trade secret has a wider range of protectable subject matters than the other IPRs considered already, and includes a process, machine, composition of matter, article of manufacture, and computer software. Furthermore, unlike the other IPRs, particularly patents, there is no need to apply to an IP office for the grant of a trade secret right. Instead, the law simply recognises that right in the owner.

In the U.S., trade secret is governed by state laws. Although a federal enactment called the Uniform Trade Secret Act (UTSA) attempts to harmonise all the existing state laws, states are not bound to adopt that Act. Moreover, those states that adopt it do so with some modification. Trade secret laws thus tend to vary across the country. In China, there are similarly several trade secret protection laws. The main one is the Anti-Unfair Competition Law (1993).

Requirements for Protection

A trade secret should be information that is not generally known, or readily ascertainable. It should also have some economic value. Another very important requirement for protection is that the owner should take affirmative (positive) steps that go beyond routine operational procedures, in order to protect the secret. Unless this is done, a claimed secret may not be recognised as one, even if it remains generally unknown to the public (Lee and Davidson, 1993; Aydemir et al., 2022). Examples of affirmative steps include restricting access to sensitive facilities, protecting confidential records, and forbidding employees from divulging proprietary information. It does not mean, however, that a trade secret will automatically be lost once the owner shares it with others. In certain cases, there will be a need for the secret to be disclosed, for example, to the staff concerned with its use, or during negotiations to sell a business. In these situations, the secret will not be lost so long as the recipients are subject to an implied obligation, or preferably, an agreement not to disclose it to other unauthorised parties (Parrish and Myers, 2007). For example, the Chinese Contract Law (Article 43) forbids a party from disclosing, or exploiting a trade secret obtained during the negotiation of a contract.

In *Re Boss* (2003), the Supreme Court of Texas in the U.S. gave 6 factors for determining whether a piece of information is a trade secret namely: (i) to what extent is the information known outside the relevant business?; (ii) to what extent is it known to the staff and other people involved in the business?[2]; (iii) to what extent have steps been taken to protect the secrecy of the information?; (iv) how valuable is the information to the business and its competitors?; (5) how much money and effort have been spent in developing the information?; and (6) how easy is it for others to duplicate, or obtain the information in a proper way? However, according to the Court, it is not mandatory to fulfill all these conditions, which are comparable to those found in the. Anti-Unfair Competition Act of China, as elaborated by the Interpretation of the Supreme People's Court of China (2007).

[2] In the case at hand, access was limited to only 4 employees.

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Unlike patents, which are protected against independent inventions, a trade secret could have multiple owners. The law does not prevent another party from independently discovering a trade secret, provided the means used to make the discovery is proper (Interpretation of the Supreme People's Court of China, 2007). For example, a university researcher could purchase a machine, decouple it, and independently discover the secret of how it works through reverse engineering. It is equally possible for that researcher, who independently discovers the trade secret through this, or other proper means, to make an invention based on that secret, and then patent it, thereby preventing the original trade secret owner from using the invention (Eisenberg, 2000). This is one of the drawbacks of a trade secret.

But the independent discovery of a trade secret does not necessarily lead to its loss, if the independent discoverer also keeps it secret. Nevertheless, the trade secret must remain substantially unknown to others, and the owner must take affirmative steps to protect it (*J.C. Kinley Co. v. Haynie Wire Line Serv.*, 1985). It is also vital for universities and their personnel to know that the filing of a patent application may lead to the loss of a trade secret. In *Clearvalue, Inc. v. Pearl River Polymers, Inc.* (2007), the court held that the plaintiff lost trade secret rights in its technologies when it filed for a U.S. patent in which the trade secret was disclosed.

Trade Secret Ownership and Tenure

Trade secret rights generally vest in employers. They can last forever, so long as they remain a secret. A much-cited example is the Coca Cola recipe, which has lasted for over a century.

Remedies for Infringement

A trade secret enjoys protection against misappropriation through theft, fraud, espionage, telephone tapping, breach of a non-disclosure agreement, inducement of the owner's employees to reveal the secret, or other improper means. Acquiring a trade secret through improper means involves not only illegal acts. According to the U.S. Restatement of Torts (Comment f), improper means also cover acts that are inconsistent with "the generally accepted standards of commercial morality and reasonable conduct." In *E.I. Du Pont de Nemours & Co. v. Christopher* (1970), Du Pont was constructing a new plant for the production of methanol. It took steps to protect the layout of the plant (which was vital to the efficient production of methanol), by erecting a high fence around it in order to protect it from public view. However, a competitor hired a photographer to take an aerial photo of the plant's layout, thus enabling it to know how methanol was being produced. The Court of Appeals for the Fifth Circuit held that, whilst the flying of an aircraft was not illegal *per se*, the underlying purpose rendered it improper. University researchers, research assistants, staff of TTOs, and spin-offs need to be aware of this in order to avoid costly law suits.

In China, under the Anti-Unfair Competition Act, a plaintiff alleging misappropriation of trade secret must prove the existence of a legally protectable trade secret. This means information possessing economic value and practical utility, which is unknown to the public, and is the subject of confidentiality protection measures (known as affirmative protection measures in the U.S.). The plaintiff must also prove that the secret has been obtained, used, or disclosed in a prohibited manner, for example, through inducement, breach of a non-disclosure, or confidentiality obligation. A third party who obtains, discloses, or uses a trade secret, which they knew, or ought to have known was misappropriated will also be liable. According to the Interpretation of the Supreme People's Court of China (2007), information "unknown to the

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public" is one which is not known to the "relevant person in the relevant field" and is difficult for that person to obtain. This excludes, amongst others, information that is a matter of common sense, or trade practice for those in the relevant field; information that is attainable from the mere observation of a product; or attainable at no great effort, or costs; as well as information that has been disclosed in a publication. "Economic value and practical utility" means information with real, or potential commercial value that is capable of giving its owner a competitive edge. "Confidentiality measures" include, amongst others, limiting access to only those who need to know, limiting public access to facilities, protecting the information through codes and passwords, and executing confidentiality agreements.

The trade secret law of Texas has similar requirements for the institution of a trade secret misappropriation action, and the plaintiff is required to prove that they suffered damage from the defendant's use or disclosure of the trade secret, or that the defendant benefited as a result. In *AMX Corp. v. Pilote Films* (2007), the plaintiff's claim failed because it could not be shown that the defendant benefited from the use of the customer list in question, or that the plaintiff suffered damage as a result. However, mere disclosure may be enough for a defendant to be liable for misappropriation. Moreover, the benefit secured by the defendant need not be a financial one. In *Garth v. Staktek Corp.* (1994), the use of a trade secret to produce a patentable design was held to be a "commercial use." In effect, the defendant benefited from the use of that secret. It is also irrelevant that the defendant made an improvement to the trade secret before using it (Restatement of Torts, Section 757, Comment c)

As a remedy for trade secret infringement, an order of injunction may be obtained to prevent a threatened infringement that would cause an irrevocable loss of the secret. Where infringement has already occurred, the order would prevent the infringer from using the secret for a "head-start" period of time. This is the time it would ordinarily take the infringer to discover the secret through independent discovery (Lee and Davidson, 1993). But in a jurisdiction such as China, Bai and Da (2011) observe that it is more difficult to obtain a preliminary injunction in trade secret misappropriation cases. They also note that although a successful plaintiff may secure a permanent injunction, this is no longer assured. Even if granted, the injunction cannot last beyond the time when the relevant trade secret becomes known to the public. And an injunction, which is found to be unreasonable in length and scope, may be modified by a court. Damages may also be obtained for the loss caused by the misappropriation of a trade secret. Damages will usually be based on the commercial value of the trade secret. In the U.S., damages may be doubled in cases involving intentional misappropriation. Moreover, the infringer could be ordered to pay reasonable lawyer's fees.

In China, under the Anti-Unfair Competition Law, trade secret misappropriation cases may be pursued as administrative, or judicial actions. The Administration for Industry and Commerce ("AICs") can investigate such cases and order the return of materials, such as drawings containing trade secrets, or the destruction of goods made from such secrets, which are capable of publicly disclosing the secrets, if made available. The AICs may also order the infringer to desist from acts of misappropriation, and impose a fine ranging from RMB 10,000, to under RMB 200,000 (Article 25, Anti-Unfair Competition Law). However, AICs cannot award damages to the owner of the trade secret (Bai and Da, 2011). Claims for damages are brought before the People's Court. The determinations of the AICs are also subject to appeal before the People's Court. Plaintiffs may add fees and other sums of money spent on investigation and the collection of evidence to the sums claimed as damages.

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Chinese law also allows criminal actions to be brought against an infringer whose acts caused "serious," or "exceptionally serious" losses (Article 219, Criminal Law). For acts of misappropriation causing serious losses (losses of more than RMB 2,500,000), the infringer can be sentenced to 3-7 years imprisonment, in addition to a fine. In the case of entities, these penalties will be borne by those directly in charge, as well as those directly implicated in the crime.

In GE v. Jiuxiang (2007), Wang, a former employee of *GE* (China), set up a company that offered maintenance services for medical machines, including *GE*'s CT machines. During his employment at *GE* as an engineer, he had access to classified information, including *GE*'s "Red Service Disc" and training materials. In addition, he participated in *GE*'s in-house training programmes. Having resigned from *GE*, he and his new company organised similar training programmes on the maintenance of CT machines. They also disseminated *GE*'s "Red Service Disc." The court, relying on the Interpretation of the Supreme People's Court of China (2007), held that the technical information in the "Red Service Disc" and other materials qualified as a trade secret. This was because the relevant information was unknown to the public because it could not be obtained through a public channel, was unknown to the relevant person in the relevant field, and difficult for such a person to acquire. The court maintained that the "Red Service Disc and other confidential materials resulted from *GE*'s own investment in conceiving, making and sustaining its CT machines.

Moreover, according to the court, the technical information had economic benefit and practical utility. *GE* also took confidentiality measures to protect it by concluding a labour contract with Wang, which imposed confidentiality obligations on him. In addition, *GE* clearly marked the "Red Service Disc" and other materials as "Classified and Confidential," and restricted access to them. The court, therefore, found Wang liable for trade secret misappropriation through the disclosure, use, and permission of others to use the said trade secret, in breach of the confidentiality obligations imposed on him by the labour contract signed with *GE*. The court further held that, by using and disclosing trade secret that it knew was misappropriated, Wang's company was equally liable as a third party for trade secret misappropriation. The sum of RMB 500,000 was accordingly awarded against both defendants, who were also forbidden from further acts of misappropriation until such time that the trade secret became known to the public.

In another example in 2006, a Coca Cola employee attempted to sell the company's trade secret to Pepsi Cola. However, aware of the potential consequences, both civil and criminal, Pepsi Cola prudently informed Coca Cola. The employee eventually received 8 years imprisonment (Parrish and Myers, 2007). Infringement proceedings would normally be held under conditions of secrecy, in order to protect the secret, although leaks cannot be ruled out completely. Hence, it is vital to consider the likely odds before initiating a trade secret infringement case.

Choice of IPR

The fact that any particular form of IP does not qualify for a specific type of protection, for example, a patent, does not mean that it should be discarded. It could still be evaluated to see whether it qualifies for other forms of protection, for example, a trade secret. It may also qualify for a copyright, as in the case of computer software, which qualifies for both a patent and a copyright in a jurisdiction such as the U.S.

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Also, where any IP qualifies for more than one form of protection, universities and their personnel must determine the most suitable form of protection to pursue, having regard to the complexity, cost, and time involved, as well as the scope, and duration of the rights conferred (Halilem et al., 2017; Belitski et al., 2019; Neves and Brito, 2020). For example, a patent lasts for only 20 years, has a high threshold for protection, and involves a complex and expensive application process, as well as the payment of maintenance fees. On the other hand, a trade secret involves no application, and therefore, no rigours and fees. It could also last forever. However, a trade secret could easily be lost forever, if not affirmatively protected.

Moreover, whilst a patented invention is protected against independent inventions, a trade secret is not protected against independent discovery, and could be acquired through reverse engineering. Thus, products that could be reverse-engineered easily are better protected through patents (Eisenberg, 2000). Although no filing, or maintenance fees are paid, trade secret could also involve considerable expenses in erecting protective barriers around plants, restricting access to information, as well as preparing, signing, and enforcing non-disclosure agreements. A trade secret could also be lost by filing a patent application, once the government finally publishes the patent upon approval, along with the information contained it. Licensees may also prefer patents to trade secrets because the rights offered by latter are less certain, and may be lost easily (Eisenberg, 2000). However, where a product is not patentable, such as customer lists, a trade secret would be appropriate (Eisenberg, 2000)

As between a copyright and a patent, a copyright is acquired once a work is created and affixed to a tangible medium, whereas an application must be made and approved before a patent can be acquired. Moreover, a copyright has a longer tenure than a patent. Under TRIPS, patents are also subject to compulsory licences. This means that, under certain circumstances, such as a national health emergency, governments may produce, or authorise the production of a patented drug without the patent owner's consent. Like "fair use" in copyright cases, the use of a patented product for experimental, non-commercial purposes, is also exempted in some jurisdictions. But the courts typically interpret the experimental use exception narrowly.

A final point to note is that, where an IP infringement has occurred, resorting to litigation may not always be an optimal solution. The time, effort, costs, and unpredictability associated with litigation need to be considered. In trade secret cases, for example, the plaintiff may have to disclose the secret, which the defendant misappropriated. Although the court would normally issue a protective order, this may not completely prevent the defendant from subsequently using the secret, especially if the plaintiff loses the suit. Therefore, a prospective plaintiff should make an objective assessment of the gains and losses likely from the suit. In addition, they must be convinced, on a strictly objective basis, that the alleged trade secret is a truly valuable one. Often, in IP infringement cases, negotiating with the infringers, and offering them the option to license the infringed IP, may be advisable.

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Table 1: Summary of Intellectual Property Rights in Academic Entrepreneurship

IPR (s)	Requirements	Ownership when IPR made under the employment / contract	Tenure	Remedies
Patent	Novelty, inventive steps, industrial application	University	20 years	Injunction, damages, award of costs
Copyright	Originality, fixation	University	University: 70 years Natural Person: Author's entire life + 50 / 70 years after their death	Injunction, damages, award of costs, criminal offences
Trademark	Distinctive, not prohibited or offensive, not be identical to another registered trademarks	University	Trademarks can last for as long as they are in public use, subject to renewal	Injunction, damages, award of costs
Trade Secret	Information that is not generally known, have economic value, the owner takes affirmative steps that go beyond routine operational procedures, in order to protect the secret	The owner	Trade secret rights generally vest in employers. They can last forever, so long as they remain a secret.	Injunction, damages, award of costs, criminal offences

Source: Author

Conclusion

The importance of IP in academic entrepreneurship makes knowledge of IP regimes important. Scientific, engineering, or business knowledge alone does not suffice. Specialized knowledge of IP rules is especially required of TTOs. For university researchers, research assistants, post-doctoral appointees, and other personnel, there should be minimum awareness of such rules. This is necessary in order to avoid the inadvertent loss of valuable IP, as well as the infringement of IP owned by other parties, which could result in protracted and costly lawsuits. In this article, we have addressed these issues. Given the vastness of the subject, the article necessarily dwells on the barest essentials. Moreover, most of the issues have been addressed largely from the perspectives of a handful of jurisdictions. Whilst this may be excused, given

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the impracticality of covering every jurisdiction, it should, nevertheless, be remembered that IP law and IPRs are generally territorial. Although TRIPS serves as a reference point for national IP regimes, it only provides minimum standards. As such, Member States have some latitude in designing their IP systems. Thus, it is advisable to always enquire about the IP rules applicable in the particular jurisdiction where protection is sought.

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