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Intellectual property teaching as part of an engineering degree

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ABSTRACT

Undergraduate teaching of engineers should prepare graduates for designing processes and making products to solve real-world problems. As such, an engineering course should enable the development of engineering knowledge, skills, imagination and experience. On the other hand, intellectual property rights cover topics such as patents, utility models and registered designs among others. These tools are granted for inventions, form and appearance of objects and can be found in every single product available to a lesser or greater extent. This paper reports on teaching aspects of intellectual property rights to undergraduate and postgraduate engineering students as part of the syllabus at a technological university in the Greek island of Crete. The courses are described in terms of goals and procedures which teach students IP rights so as to prepare them to benefit the maximum in today's knowledge-based economy.

Keywords: Intellectual property, higher education, engineering course

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1. INTRODUCTION

In advanced economies and developing alike, an important factor that affects economic growth is knowledge. According to Alan Greenspan, a previous Federal Reserve Chairman,[1] "... Over the past half century, the increase in the value of raw materials has accounted for only a fraction of the overall growth of U.S. gross domestic product. The rest of that growth reflects the embodiment of ideas in products and services that consumers value. This shift of emphasis from physical materials to ideas as the core of value creation appears to have accelerated in recent decades."

Intellectual property or industrial property is a family of rights that include the protection of exclusivity for inventions, copyrights, trademarks, trade names, artistic designs, and industrial designs. As inventions are new solutions to technical problems and industrial designs are aesthetic creations which form the appearance of industrial products, these depend on properties or laws of nature, for if they did not obey them they would not be feasible. These rights are granted by a State to an inventor to exclude others from commercially exploiting the invention for a limited period of time, while the inventor has to reveal his invention to the public in detail.

2. THE PATENT SYSTEM

The first account of a patent[2] appeared in the ancient Greek city of Sybaris in Magna Graecia where cooks were protected for a year from others copying their new recipes. The justification for this exclusivity was to "... motivate others to work hard and compete in such inventions."

The next example of grants of exclusive rights by kings and rulers to private inventors and innovators appeared in Venice in 1474 where protection to inventions extended to 10 years. The main goal of early patent laws was to encourage investment in technology in the country concerned, and required that inventions had to be new to that particular country, and not to the whole world. In 1624 the English Parliament declared that all monopolies granted by the Crown were void except for inventions, as the Crown historically granted diverse monopolies on inventions, salt, playing cards etc. The first patent granted in England was on making and distributing precise maps of the major cities of England.

For an invention to be legally valid, it has to meet certain criteria, while specific jurisdictions may impose further. An invention must have industrial applicability and should be applied for practical purposes and not be purely theoretical. Novelty is a fundamental requirement for a patent and is an undisputed condition of the ability of an invention to be patented. This cannot be confirmed or established; only its absence can be proved. An invention is new only if it is not described by prior art. "Prior art" is all the knowledge that existed before the date of a patent application and it can be written or oral or in any other form. The inventive step or non-obviousness requires the existence of an inventive step. This criterion in effect asks whether a person having ordinary skills in the art would consider the invention obvious. These last two criteria, of novelty and inventive step, are different from each other, as novelty exists if there is a difference between the invention and prior art and following a positive answer then the question of whether there is an inventive step arises. The "inventive step" criterion states that the invention has to be new and to be the result of a creative idea, while this advance or progress must be significant and essential to the invention.

The right to exclusivity granted to an inventor requires a trade in where the application must disclose the invention in a manner sufficiently clear for it to be carried out by a person skilled in the art. This disclosure should include examples, where appropriate, and reference to drawings.

The heart of any invention is the claims section, as it defines the scope of the exclusive right provided by the patent. Claims define the technical features disclosed in the description and do not contain any reference to commercial advantages.

As the Intellectual Property system is based on territory and patent rights are granted by individual countries, fee payments are required to maintain the patent in effect. A register for each country contains the patent details, like the claims and the drawings, as well as financial details of when such fees have been paid, and may also list any details of licenses or assignments which may have been recorded. Thus this register may be useful to third parties like competitors of the patentee, as it reveals the actual status of the patent, as well as the specific technologies that he is interested in.

The making of the invention in particular, and its development for industrial application, usually involve considerable expense for the applicant and for the future owner of the patent. The inventor has to assess the product itself and identify a market for the product covered by his invention. This analysis is difficult to make but is one of the keys to product success. Statistics on local populations and potential market segments as well as surveys can provide the basis for a study of the proposed market

areas by age group, marital status and so on. At the end of the day the inventor can either sell or license his product idea to a company equipped to manufacture it, or alternatively he can become a manufacturer himself, by establishing a factory or contracting out production to a job shop.

Another kind of intellectual property right available in certain countries is the "utility model", which is mostly in the mechanical field. Utility models differ from inventions for which patents are available mainly in two respects. The technological progress required is smaller than that required for an invention, and the maximum time of protection is much shorter than that of a patent.

A third kind of intellectual property right is the industrial design, which in a lay sense refers to the appearance for mass-produced items that satisfies both the need for the item to appeal visually and the need for it to perform its intended function efficiently. Many such items are not themselves novel, and are produced by a large number of different manufacturers, like belts, shoes, screws and piston rings. If a design for such an article, like screws, is dictated purely by the function which it is intended to perform, then such protection would exclude all other manufacturers from producing these items. This is not warranted, unless the design is sufficiently novel and inventive to qualify for a patent.

3. TEACHING INTELLECTUAL PROPERTY LAW

3.1. Courses

Higher education undergraduate students are not usually offered courses on Intellectual property to any great depth, with the exception those who study law. In 2002 a questionnaire[3] was administered on the National Union of Students, the confederation of students' unions in higher and further education in the United Kingdom, in partnership with the Intellectual Property Awareness Network (IPAN) and the Intellectual Property Office of UK, which received over 2000 responses. Of those, the vast majority of 70% felt that IP is relevant to their future career and a bigger share 80% that it was important to know about IP. A further 82% believed that IP was relevant in their higher education, while a 43% of respondents had heard about IP prior to their current study. Findings like these have led the EU to advocate that "every student in science, engineering and business should receive at least a basic training on intellectual property . . . ".[4]

Such courses should combine theoretical ideas with practical knowledge. When presenting IP concepts one should bear in mind that some of these ideas are counter intuitive and not easy to grasp, while some of the practical aspects are overwhelmingly technical and not easy to learn.

First degrees in Law usually have IP courses, which sometimes take the form of elective courses or seminars, whereas there are a number of advanced degrees in Law at a postgraduate level on IP.

Another group which receives formal training in IP is patent agents or patent attorneys as they may be called in some countries. The patent agent typically represents inventors at national or international patent offices. In every country, they are certified following an examination. The prerequisites for certification typically include a strong technical background in science and engineering coupled with specific legal training in the field of patents. The legal training is further subdivided to training courses on one hand, and "on the job" training on the other.

Each course for perspective IP students needs different objectives. Engineers and scientists need to familiarize themselves with the basic concepts of IP, so that when they engage in any creative undertaking, they will be aware of the interaction between their intellectual work and the IP system. At the end of such a course the engineer or the scientist needs to possess a general awareness of what IP is and how to utilize it beneficially while understanding the hazards of infringing other people's IP assets. In addition, nowadays technology professionals in hi-tech industry, will most likely face some legal issues in IP law. A good example of that is the Non Disclosure Agreement (NDA), which many engineers and scientists are required to sign or the assignment of IP assets from the employees who authored or invented them to the employer. This last aspect is usually described in law prescribing who, by default, owns the rights to such assets depending among other things on whether they were authored or invented while employed. In all cases, a scientist should also be aware that his need to communicate with the scientific community by publishing innovative findings may have a damaging effect on the patentability of an invention if published too soon. It is therefore imperative that engineers and scientists should be instructed on these topics which are profoundly relevant to their careers.

Such courses aim to provide a broad introductory level overview of the entire intellectual property law domain. They usually introduce students to Patent law, Trademark law, Copyright law, Trade Secret law and Industrial Design law, and detail the advantages and disadvantages of each form of protection.

This bird's eye view of IP is accompanied by real patent and IP examples that engineering and science students can relate to, depending on their specialization. In addition, these courses should emphasize practical aspects of using the IP system to obtain information from patent searches, the fair use of copyrighted material, avoiding infringements while providing guidelines for protecting one's own IP assets. Ideally such a course should be taken no earlier than the last year of the studies where students have adequate experience in their discipline.

3.2. Teaching at the Technological Education Institute of Crete

The TEIs, a Greek acronym for state educational establishments of technology, have an undergraduate course of four years, following the Bologna accords. A typical course formally and rigorously teaches students with the principles of the discipline to be studied in its first two years. Following this, students may have a choice of areas of specialization to choose from. In addition, students have to complete a final project, where a thesis has to be submitted and have to be orally examined on it at the end.

The Mechanical Engineering department of the TEI of Crete includes both at the undergraduate and the postgraduate level courses for mechanical and electrical engineering students. These courses are in Greek for the students that attend these courses in Greek and in English for the students from Erasmus EU undergraduate exchange programme. The courses are based on the Patent Teaching Kit which is issued by the European Patent Office. The Patent Teaching kit consists of self-explanatory teaching material about patents and is usable by teachers from all faculties, i.e. mechanical engineering, life sciences. It targets all students in science and engineering, management and business, economics and law. Sections of the kit have been translated into Greek and are used for teaching purposes and they are available online to students through the e-learning facility of the University. The topics covered are: an introduction to intellectual property rights, patents, utility models, industrial designs, claims and concludes with a series of mechanical engineering examples of inventions and their patents. The first invention example is on a ball toy, the second is on a heating element for a clothes washing machine and the third is on an insulated air conditioning tube. The examples describe the initial idea, which the students are familiar with from their course on engineering, and then guide the student to the final accepted submission through a series of questions. Each of these questions is put by the examiners of the patent office and identifies the deficiencies of the submission. These examples help the student understand that a good idea is not enough for a good patent, but the carefully constructed claims section is necessary to reach the end and obtain a patent on their invention.

The courses are accompanied by a series of exercises which take the students through the IP system. Students learn to use the searching facilities provided by the European Patent Office's Espacenet, which is a database of more than 70 million patent records. Its data comes from 85 patent authorities worldwide from 1836 to today and it is a source of technical information available free of charge on the internet. There are also exercises aimed at understanding patent claims and industrial designs. The undergraduate course is for the final semester students of the course and for the postgraduate course on advanced production, automation and robotics systems on the 3rd out of 4 semesters of the course. In both cases, the courses are placed towards the end of the studies so that students have adequate experience in their fields.

4. RESULTS AND DISCUSSION

One of the important aspects of a sound science and technology policy is the support of invention and innovation through the patent system. It is therefore necessary to have a patent system which allows the granting of the exclusive right to an invention for a limited period of time. Such a system provides an incentive to inventive and innovative activities. The limit that is set during which the holder of a patent is entitled to prevent others from using his invention creates an environment which facilitates the efficient development and utilization of patented inventions. The inventor is protected against copies of his invention from those who have not taken the initial financial risk or simply lack the knowledge and experience to produce the invention in the first place. As someone can see in advanced economies this protection creates conditions in which capital can be invested for the development of an invention into an innovation. Further to the protection of ideas the patent system provides a rich source for the collection, classification and dissemination of technological information in the world. As the inventor has to disclose in detail his invention in order to receive patent protection this action disseminates new knowledge to society. This information is available to research and education, with

the limit of restricting commercial use, during the term of the patent. Once the patent expires or the inventor has not paid his fees the information falls into the public domain and becomes free to be exploited commercially by anyone interested.

It is a common misconception among inventors that the patent system is more suitable for large corporations and not the individual inventor, as the process requires a long time to conclude and can become quite expensive. And sometimes researchers do not think in terms of patents or other IP protections, when setting their long-term quest of their research, but view it as another legal requirement which is necessary following the successful completion of their research.

One of challenges that exist in the IP domain is not all stakeholders speak the same language as they come from a completely different background. People with a technical background are in many cases not as trained in language skills as lawyers. As the protection that the patent provides depends on the specific wording that claims have language plays a very important role in the scope and extent of protection that patents provide. In most cases, there is not one "correct" answer but several possibilities yielding different level of protection.

An engineer or a scientist benefits from IP training in a number of ways. The foremost is that he may become an inventor in the course of his life or work and he should be able to protect his ideas with the appropriate tools. At the same time, he will be able to use this vast source of engineering inventions as a source of knowledge, as they are fully disclosed to the public. Although IP is protected through a series of laws in every country the people with the scientific and engineering background need to apprehend and use them.

5. CONCLUSIONS

In modern societies, the right to obtain a patent for an invention encourages the investment of money and effort in research and development; the grant of a patent encourages investment in the industrial application of the invention. At the same an engineer or a scientist is the professional who should be aware of the IP tools, making therefore teaching undergraduates of such disciplines necessary.

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