

TEACHING INTELLECTUAL PROPERTY AT AN ENGINEERING UNIVERSITY: A PERSPECTIVE FROM MONGOLIA

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Abstract: At present, law students are the main focus of Intellectual Property (IP) law education and courses in Mongolia. However, the inclusion of IP law in non-law curricula and programs is necessary for a successful interdisciplinary higher education. In particular, the teaching of IP can be important for future engineers, offering them more career options upon graduation. Still, it remains challenging for non-law academics and non-lawyers to teach IP law as an interdisciplinary component of the engineering curriculum at the Mongolian University of Science and Technology (MUST). More specifically, there appears to be an insurmountable cognitive barrier for both teachers and students. For example, we have not established a clear methodology or pedagogy on how to incorporate IP knowledge in the engineering curriculum, although efforts to define better teaching pedagogies are ongoing at MUST. In this respect, academic curriculum designers are working to enhance the design of the IP curriculum and delivery of the courses to students. MUST has also adopted the international engineering education framework proposed under the CDIO™ Initiative,¹ since there is a need to adopt the CDIO standards as a practical teaching model to educate engineering students about IP law. As mentioned, knowledge of IP law may be a useful research tool for engineers and entrepreneurs, who can better evaluate IP analysis outcomes and consequently encourage product commercialization efforts once they are equipped with both engineering and IP knowledge. The interdisciplinary non-law curriculum development process depends on the ability of professionals from different disciplines to work together in producing a balanced teaching pedagogy for MUST students. At present, the design, development, implementation and evaluation of IP education in non-law curriculum for interdisciplinary higher education is carried out with academic resources available at MUST with a focus on learning outcomes and assessment strategies.

Keywords: IP in engineering education, teaching IP to non-law students, academic entrepreneurship, IP as a research tool.

1. INTRODUCTION

Incorporating IP knowledge into the engineering curriculum is part of a complex educational challenge to produce innovative engineers with the motivation, competence, and critical thinking skills that will add to Mongolia's socio-economic growth and prosperity. This article addresses the benefits of having IP knowledge as well as the challenges that undergraduate and graduate engineering students at MUST face in learning about IP as a subject taught by law and non-law professors.

MUST is a national engineering university with 39,000 students and over 3,000 academic staff and researchers. MUST's mission is to provide higher education for engineering students to allow them to achieve their professional career goals and aspirations across a range of sectors, ranging from the mining industry to the financial services sector. Producing scientists and engineers with knowledge and skills in our university is vital to our economy and society. Certainly, MUST holds valuable intellectual capital. The university possesses profound engineering knowledge and technological know-how in many different engineering fields. It is also rich in human resources. MUST has recruited numerous young academics who have earned degrees from the world's best universities. Additionally, there is a strong alumni connection, which can facilitate university-industry collaborations or partnerships, knowledge and technological transfers to develop commercially valuable innovations that can boost the nation's economy. Hence, it would be a waste and a tragedy if such intellectual capital remains an untapped resource and an undeveloped potential. While the engineering discipline has always been an important driver of technological innovation, the practical application of engineering principles and research findings is vital for the creation of new technological capability necessary for Mongolia to be effectively engaged in the global economy.

In 2012, MUST's senior management developed a strategic vision for the university's research and development department. It has plans for MUST to become an "Entrepreneur University"² that would provide broader opportunities for entrepreneurial education³ at every level of higher education in engineering. This entrepreneur program is still under development.

MUST's strategic road map represents an ongoing journey to identify and implement institutional support projects to better prepare engineering students for professional practice. MUST hopes to implement an academic program infrastructure that would remain

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¹ CDIO is a trademarked initiative of the Massachusetts Institute of Technology (MIT) for teaching engineering fundamentals and stands for "Conceive Design Implement Operate".

² MUST-2012 Roadmap Strategic Plan, Mongolia University of Science and Technology, Mongolia.

³ Martin Sperrer, Christiana Muller, and Julia Soos, 'The Concept of the Entrepreneurial University Applied to Universities of Technology in Austria: Already Reality or a Vision of the Future?' <
https://timreview.ca/sites/default/files/article_PDF/Sperrer_et_al_TIMReview_October2016.pdf> (accessed 4 March 2017).

sustainable in a period where there are changes in faculty, leadership and funding. The university will continue to promote IP education for MUST engineering students while establishing a culture of entrepreneurship and innovation in order to become an Entrepreneur University in Mongolia.⁴

However, it remains challenging for non-law academics and non-lawyers to teach IP law as an interdisciplinary element of engineering curriculum at MUST. There appears to be an insurmountable cognitive barrier for both teachers and students. In this respect, we have not established a clear methodology or pedagogy to incorporate IP knowledge into the engineering curriculum, although efforts to define better teaching pedagogies are ongoing at MUST. Academic curriculum designers are working to enhance the design of the IP curriculum and delivery of the lessons to students. In particular, the interdisciplinary non-law curriculum development process depends on the ability of professionals from different disciplines to work together in producing a balanced teaching pedagogy for MUST students. At present, the design, development, implementation and evaluation of the IP education in non-law curriculum for interdisciplinary higher education is carried out with academic resources available at MUST with a focus on learning outcomes and assessment strategies.

Since 2014, following the CDIO™ Initiative, MUST has adopted the CDIO's international engineering education framework and standard in teaching engineering students IP law. Educating MUST students and graduates in IP law ensures that there are enough skilled engineers to meet future demands for students who have entrepreneurial skills and are also competent in IP. Furthermore, MUST graduates equipped with IP knowledge will be in greater demand within the engineering industry.

2. IP LAW AND MONGOLIA'S INNOVATION POLICY

It is widely accepted that IP is an intangible property, a product of creativity, which plays an important role in capital accumulation. IP is also undoubtedly fundamental to the success of the economy as it fosters business growth and enhances competition in the market.

As such, the Intellectual Property Office of Mongolia ("IPOM") was established in 1996. Patent, copyright and trademark laws were legislated⁵ a year after Mongolia became the 131th member of the WTO in 1997. Recently, the IPOM and the National Registration Authority of

Mongolia merged to form the General Authority for Intellectual Property and State Registration of Mongolia (GAIPSR) with restructured Departments of Copyright and Industrial Property⁶ that enforce and implement the government's policy regarding the protection of IP rights (IPRs) in Mongolia.

During the past three decades bridging the last century and the beginning of the 21st century, we have witnessed dramatic changes as developing economies previously focused on industrial manufacturing transform into knowledge-based economies. In a knowledge-based economy, competition is driven by scientific knowledge, technological know-how, innovation, entrepreneurial initiatives and heavy financial investments in both research and production capacities.⁷ In such economies, IPRs would be effective legal instruments that offer creators of IP, economic rights, which indirectly creates intangible wealth for the country. Thus, the government of Mongolia has implemented pro-innovation and pro-IP policies, such as the Innovation Law of Mongolia 2012, which promotes IP-protected innovation within the country.⁸ Additionally, IP education has been incorporated into selected modules of higher education curriculum in Mongolia.⁹

As one of the best national universities, MUST bears responsibility in contributing and enhancing society's socio-economic progress. MUST should encourage the building of industrial capacity and facilitate the implementation of existing national development plans by creating jobs and generating national wealth to improve our economy and the standard of living for the nation in the near future.

MUST has a vision to undertake all the necessary measures to establish a culture of innovation in the university with IP and technology transfer infrastructures to become an Entrepreneur University. The university has also formulated an innovation friendly policy by facilitating the process of obtaining IP protection for innovative initiatives within the university to foster a spirit of entrepreneurship. This will help to transform engineering knowledge into valuable social and economic assets for the Mongolian society.¹⁰ Most importantly, licensing of these exclusive rights through

⁴ D. Purevdorj, "Contemporary Intellectual Property Issues for Universities and Research Institutions" in *Pro-innovation IP policy of the Mongolian University of Science and Technology* at p19-22.

⁵ Mongolia: IP laws and Treaties-WIPO. <http://www.wipo.int/wipolex/en/profile.jsp?code=MN> (accessed 15 May 2017).

⁶ Resolution №4, dated on 27 July, 2016 of the Mongolian Government.

⁷ D. Purevdorj, "Innovation and Intellectual Property Rights Issues in Knowledge Based Economies" in a training manual for professionals working in the field of mining engineering, School of Mining Engineering (2013) at p130-143.

⁸ D. Purevdorj, "Patenting of biotechnology inventions", *Journal of the 7th MUSTAK International Conference MIC-* at p137-141(2016).

⁹ Order No A/241 of the Ministry of Education, Science and Culture of Mongolia, dated 16 May 2012.

¹⁰ D. Purevdorj, "Intellectual Property Rights Issues in Promotion of Innovation under TRIPS Agreement: A Mongolian Perspective. Building a World Class University: Challenges and Initiatives", Conference proceedings (2012) at p172-174.

university-industry collaborations and technology transfer activities is expected to contribute to the socio-economic development of our society. Engineering or technological innovation has widely been recognized as a catalyst for economic growth. Thus, the Entrepreneur University aims to produce generations of successful entrepreneurs competent in IP and knowledgeable in economics, sociology as well as politics, to foster excellence in research and innovation.

3. IP INFORMATION AS A RESEARCH TOOL FOR ENGINEERS AND ENTREPRENEURS

In order to foster academic innovation and entrepreneurship in Mongolia, MUST, as an Entrepreneur University, is expected to engage in a wider range of commercial activities, such as university-industry cooperation and launch startups. Higher management within MUST has highlighted the multifaceted process of improving the existing entrepreneurial program. MUST faces a great challenge in conducting interdisciplinary research with commercial and business entities, which may require management knowledge on integrated intelligence with different functions in order to boost the academic entrepreneurship activity in the university. Indeed, there is a need to rethink the current university education practices to encourage more entrepreneur skills to meet the increasing labor market demands internationally and domestically¹¹.

In particular, IP knowledge may provide a useful research tool for engineers and academic entrepreneurs. The application to obtain a patent, for example, involves the submission of necessary legal documents including specifications describing and disclosing the technology, so that a person skilled in the art would understand how the product or process works. The scope of protection granted under a patent is defined by its claims, which are susceptible to interpretation by the courts upon an alleged infringement of the patent. Moreover, an important pre-requisite to obtaining a patent right is full and detailed disclosure of the invention. The patent can be revoked if disclosure is found to be incomplete.

Most blockbuster patents come from engineering fields. Intense patent database mining, including claims mapping, patent landscape studies, patent categorization and valuation can be important research tools that also provide useful insights of future innovation. Ideally, before carrying out any research and development project, scientists and researchers should avoid duplicating research on innovation that has already been disclosed, to save valuable time, financial and tangible resources. Having both engineering knowledge and IP capabilities would help engineers perform patent searches to identify and critically

¹¹ Ruth Soetendorp, "Food for Engineers: Intellectual Property Education for Innovators". *Industry and Higher Education* (Dec 2004) at pages 363-375.

evaluate relevant patents, as well as, compile search reports for higher management to facilitate product commercialization efforts¹².

4. IP SYLLABUS AND TEACHING PEDAGOGY IN MUST

An interdisciplinary higher education, which includes IP law in a non-law curriculum, would provide future engineers with more career options upon graduation. Students can undertake an apprenticeship and be involved in technology transfer studies. These academic initiatives will hopefully promote interdisciplinary dialogues and allow IP academics, non-law academics and engineers to appreciate the value of sharing across different disciplines to seed IP thinking for future engineers in Mongolia. According to McLaughlan and Killen, three types of IP curricula are commonly practiced in IP teaching, namely speaking firstly IP law focused, secondly based mainly on legal fundamentals and principles; and the last one or the third approach is directed to social and professional responsibilities of future engineers¹³. However, in our IP teaching practice to the engineering students, we are more focusing on IP thinking rather than IP law. Therefore, we are of the opinion that the MUST IP curricula should not focus heavily on IP law teaching, but IP thinking with emphasis on entrepreneurship responsibilities.

IP is an intangible right, which is territorial in nature. Ownership of an IPR, grants the IP owner exclusive advantages over its market competitors throughout the duration of the IP right.

Traditionally, IP-related legal subjects have been taught to law students in Mongolian law schools. However, since 2012 the government of Mongolia has been promoting IP education at higher education levels. Higher education is expensive in Mongolia. Most people believe that investment in knowledge and skills is important to secure a professional career. Having said that, many social factors, over and above the skills they possess, also affect an individual's opportunities¹⁴.

MUST owes society a responsibility to produce well-educated, skilled scientists and engineers, who are vital to our economy and who offer technical capabilities to effectively diversify the economy. A modern infrastructure is essential for an effective and rigorous education in engineering. An engineering education

¹² D. Purevdorj, "Can the Academic Entrepreneurship Save the Ivory Tower Under the Umbrella of the Innovation Law", *Colloquium Paper* (2012).

¹³ Robert G. McLaughlan and Catherine P Killen. "Engineering Enterprise through IP Education: What is needed?" *Proceedings of the 2005 ASEE/AAEE 4th Global Colloquium on Engineering Education* at page 149

¹⁴ ДЭЭД БОЛОВСРОЛЫН ШИНЭЧЛЭЛИЙН ЗУРАГЛАЛ. /Higher Education Road Map/, Ministry of Education, Science and Culture. 2010 – 2021 <http://www.mecss.gov.mn/дээд-боловсролын-шинэчлэлийн-зураглал> (accessed 18 May, 2017)

requires appropriate infrastructures, a conducive learning environment, laboratory facilities and teaching staff. At present, MUST students take up the following IP courses¹⁵:

- S.IR101 IP Law: 16 lectures (24 hrs.), 11 seminars (16.5 hrs.) for undergraduate students at the School of Industrial Technology (“SIT”)
- G.FE319 Patent Law: 16 lectures (24 hrs.), 11 seminars (16.5 hrs.) for undergraduate students at the SIT
- S.IP810 IPR Protected Innovation: for all MUST Master and Ph.D. students (3 credits)

Academic teaching is a complex process. Its complexity gradually increases with the level of the student’s knowledge. The S.IR101 IP law course was developed in 2013 as a result of a collaborative effort with the Innovation, Technology Transfer Office of MUST. It caters to undergraduate students at the SIT, who may pursue a career in the field of nutrition, biotechnology and textile industries. The course examines IP Law, covering materials on copyright issues, trademarks, utility models, design patents, patent law, patent claim drafting, standard essential patents, engineering ethics, licensing of IPRs, technology transfer and other IP issues. Students who have enrolled in this course are expected to gain:

- the ability to understand how IPRs are enforced;
- the ability to comprehend what constitutes infringement and consequently how to avoid infringing existing IPRs;
- knowledge on drafting patent applications and patent claims; and
- an understanding of the importance of IPRs, especially patent rights in modern engineering and how these rights can be strategically commercialized.

At present, the design, development and implementation of an interdisciplinary curriculum to include IP education in the engineering curriculum is done with academic resources that are currently available at MUST. The success of the curriculum is evaluated based on certain learning outcomes and assessment strategies. Nonetheless, there remains room for improvement in the IP curriculum.

In relation to the IPR.101 IP law course, MUST is working to adopt the CDIO standards to enhance the design of the curriculum. The CDIO standards recognize that IP is an ever-changing art (C) and emphasizes the importance of developing an IP perspective (D), putting IP knowledge to practice (I) and producing generations of engineering entrepreneurs after graduation. The process

depends on the ability of professionals from different disciplines to work together and contribute different perspectives that can enhance the design of an IP education for MUST students.

Ultimately, the MUST strategic road map remains an ongoing journey. Hopefully, higher management will continue to encourage IP education for engineering students, build startups, include IP education in entrepreneurship courses, and collaborate with international IP organizations or other universities. These initiatives will establish a strong foundation to transform this engineering university into an Entrepreneur University.

5. CONCLUSION

Incorporating IP knowledge into the engineering curriculum and equipping engineers with critical thinking skills and legal competence is a challenge. Students at MUST will receive benefits and also face great challenges.

The university’s asset includes a large intellectual capital. This can facilitate the establishment of university-industry collaborations and knowledge or technology transfer activities to boost the national economy. Although engineering disciplines have always driven technological innovation, teaching engineers the practical aspects of patent research, for instance, will give an additional edge in building technological capability that Mongolia needs.

The government has implemented pro-innovation policies by offering IP protection under the Innovation Law of Mongolia 2012. Thus far, IP education has been incorporated in selected modules within the higher education curriculum in Mongolian universities.

As the future Entrepreneur University, MUST is expected to be engaged in a wider range of commercial activities. In working towards the goal of becoming an Entrepreneur University, MUST will face great challenges as business entities may require critical management knowledge on top of engineering knowledge. Nonetheless, competence in IP facilitates the evaluation of search results, compilation of search reports and enhances routine communication of findings to higher management, which may eventually lead to the commercialization of technological ideas.

Since higher education is expensive in Mongolia¹⁶, most people believe that investment in knowledge and skills is important to secure a professional career. Still, having said that, many social factors, over and above the skills they possess, also affect an individual’s opportunities. A modern infrastructure is essential for an effective and

¹⁵ Department of Education and Policy, Curriculums and Education Standards, the Mongolia University of Science and Technology

¹⁶ Resolution №117, Higher Education State Fund. dated on 14 May, 2008 of the Mongolian Government., <http://www.mecss.gov.mn/director-content-80-317.mw> (accessed 20 May 2017).

rigorous education in engineering. An engineering education requires appropriate infrastructures, a conducive learning environment, laboratory facilities and teaching staff.

The interdisciplinary non-law curriculum development process depends on the ability of professionals from different disciplines to work together in producing a balanced teaching pedagogy for MUST students. At present, the design, development, implementation and evaluation of the IP education in non-law curriculum for interdisciplinary higher education is carried out with academic resources available at MUST with a focus on learning outcomes and assessment strategies. MUST has adopted international engineering education framework proposed under the CDIO™ Initiative as a practical teaching model to educate engineering students about IP law. This will enhance the design of the IP curriculum for engineering students in MUST¹⁷.

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