

# Intellectual Property Education Towards Graduates' Employability

Janatul Adni Hishamuddin, Md. Razib Arshad, Farrah Merlinda Muharam

**Abstract:** *The essential of intellectual property (IP) related courses in the Management of Technology (MOT) curriculum has severally discussed by international scholars. However, the impact of IP education in MOT degree program towards the graduates' employability is a study gap which has to be addressed necessarily in Malaysian higher learning institutions. This paper reviews the current context of education which highlights the past studies on IP education and suggests future research to seek the best approach of IP related courses have to be delivered in order to improve the employability of MOT graduates. Future research's findings initiated by this paper are believed will be useful to recommend innovative approaches in academic fields, technology and innovation related industries and responsible bodies respectively. In fact, it helps the stakeholders in drafting strategies and implement initiatives to enhance IP education and raise the credibility of MOT program offered by universities. Thus, suitable human capitals that well-versed in IP management and purely understand about technology and innovation issues in technology-based industries can be well addressed.*

**Index Terms** - Big Data, MapReduce, MRBIG, Top-k. Dominance

## I. INTRODUCTION

The key excellence of education via right program design and enriched curricula are the focus of higher education institutions performance (Asif and Searchy, 2013). Crucial viewpoint from the experts and researchers aim to uncover new learning approaches and emphasizes the technology knowledge. It is to influence and enhance academia by providing experiences that lead to deep learning.

Deep learning is designed to allow students to learn collaboratively (Gordon and Debus, 2002; Baeten et al., 2010). It is also affecting students' comprehension on how they retain and receive new materials that are constantly evolving. Presence of fourth industrial revolution (4IR) is taking place to accelerate the technology revolutionary. In conjunction, it gives academia exciting opportunities to shape interactive learning experience and achieve learning goals that future graduates require especially in Management of Technology (MOT) education (Horwitch and Stohr, 2012). The International Association of

Management of Technology (IAMOT) has outlined a template for MOT program curriculum which includes intellectual property (IP) as one of the required body of knowledge. However, IPs in this context may have been addressed mainly from legal perspective rather in a wider angle including their management.

Keeping pace with current education requirement, MOT education for the university students basically compensate future economic growth through competent workforce as well as determines national and organisational competitiveness (Khalil and Ezzat, 2005). MOT framework itself contains five related-processes; identification, selection, acquisition, exploitation, and protection (Cetindamar et al., 2016; Phaal et al., 2009; Gregory 1995). Besides, global and fiercely competition due to disruptive mindset, enhanced technologies and industrial revolution urges firms to find skilled workers on the management and protection of technology (World Economic Forum, 2017). World Economic Forum claims current change forces and competitiveness are the consequences of 4IR. In order to brace the global impacts of 4IR, it is characterized to create challenges and opportunities for global IP system as well.

Generally, IP is entrusted to provide a robust incentive for innovation and technology development (Rowe, 2009). Moreover, the impact of 4IR appears to be accompanied by shifting popular attitudes toward patent rights, as well as shifting IP policies of nations relative to one another (World Knowledge Forum, 2017). Soetendorp (2003) commented it is impossible to think of IP rights in isolation from creativity and innovation outputs as it involves IP specialist and commercial interest; as example when technology transfer is conducted in university, at least one IP person is employed to ensure project's viability. Thus, the knowledge on IP have to be disseminated and the concerning pathway is through formal education in higher learning institutions. Soetendorp (2006) opined collaborative teaching via integration between academia and professionals from industry seem practical for this effort specifically in MOT course.

There are several justifications on the relevancy of IP education for MOT graduates who will work in technology and innovation industries. Firstly, IP education is essential for future technology managers that will devote to the continuity of technology-based firms (TBFs) operation. By having good management of technological resources through patented technology assets and competent managerial team of IP, TBFs can gain competitive advantage as well as enhance firms' performance (Jolly, 2012).

Manuscript published on 28 February 2019.

\* Correspondence Author (s)

**Janatul Adni Hishamuddin**, Faculty of Management, Universiti Teknologi Malaysia (UTM) Johor Bahru, (ahjanatul2@graduate.utm.my)

**Md. Razib Arshad**, Faculty of Management, Universiti Teknologi Malaysia (UTM) Johor Bahru, (m-razib@utm.my)

**Farrah Merlinda Muharam**, Faculty of Management, Universiti Teknologi Malaysia (UTM) Johor Bahru, (merlinda@utm.my)

© The Authors. Published by Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP). This is an [open access](https://creativecommons.org/licenses/by-nc-nd/4.0/) article under the CC-BY-NC-ND license <https://creativecommons.org/licenses/by-nc-nd/4.0/>

Second, IP education is one of the knowledge fields that could be leveraged by TBFs through employees who have IP knowledge and capable in handling technology resources for exploitation (Lin and Tang, 2016). Also, Harroch (2017) acclaimed that though getting IP is a costly procedure, hiring competent employee in IP can less the business' cost and also IP assets can be an essential tool to obtain venture capital funding.

Third, the integral of IP education to technology managers in TBFs is seen to enable the firms to decide the right protection schemes of IP for their costly technological assets either they produce internally or acquire from external through licensing from being imitated by their rivals (Allarakhia and Walsh, 2011). Therefore, internal IP employee is required to advise the best action-to-take in mitigating that dilemma.

**II. INTELLECTUAL PROPERTY EDUCATION IN MANAGEMENT OF TECHNOLOGY AND GRADUATES' EMPLOYABILITY**

This paper suggests important components in intellectual property (IP) education. A multi-disciplinary approach in teaching of IP has been highlighted by World Intellectual Property Organization (WIPO) that involved a number of knowledgeable professionals in IP such as Joseph Straus, Mihály Ficsor, Jeremy Phillips, William T. Fryer III, Thomas Cottier, Christophe Germann, Keith E. Maskus, Susanna H.S. Leong, Heinz Goddar, Ruth Soetendorp, Phillip Griffith, and Charles R. McManis. Indeed, IP educators and trainers are crucially important catalyst to ensure the learning continuity of IP systems and growing receptive of the learning in order to keep pace of technological, social and commercial (WIPO, 2008). Therefore, IP education need to be more specifically attuned to the practical and day-to-day fact realities that will be faced by businesses; opportunities and threats.

Adapted from Hamzah (2012), generation of IP values and ecosystem entails the components; 1) IP creation, 2) IP protection, 3) IP management, 4) IP financing, and 5) IP exploitation. Thus, this study highlights the five essential components which are believed to be essential in the wider field of Management of Technology (MOT) studies in order to enhance the marketability of graduates.

MOT program offered in universities seem rapidly evolve and diverse. Horwitch and Stohr (2012) mentioned current emphasize in MOT education is more regard to interchange connection between academia and industries by tailoring the employers' expectation from new breeds of MOT program from higher education institutions. Globally economic realities that initiated continue to demand MOT education for managers, analytic professional, entrepreneurs and integrators. Upon that, MOT educators are responsible to develop all necessities capabilities in its graduates. Table 1.0 below lists the emerging capabilities that need to be equipped in the MOT graduates (Horwitch and Stohr, 2012).

	economic and social systems at all levels of society in both developed and developing societies.
2. Globalization	Globally aware managers who are able to manage virtual organizations that span diverse regions, nations and cultures.
3. Service Orientation	Relationship managers able to understand and manage value chains supplying customer-oriented, knowledge-intensive services in finance, entertainment, healthcare, and government.
4. New Technologies and Sciences	Technologists able to recognize important, possibly disruptive, science and technology trends and develop an integrated long-term technology strategy for their firm.
5. New Geography of Innovation	"Extrapreneurs" able to recognize and develop sources of ideas and innovation not only within the firm but from external networks of other firms and consumers in both developed and emerging markets.
<b>6. Importance of Intangibles</b>	<b><i>Analysts who are to develop the knowledge based assets of the firm, value intangible assets, technology inventions, process knowledge, patents and trade secrets and commercialize innovative ideas.</i></b>
7. Importance of Analytics	Analysts with mathematical and computer skills in areas such as risk management, machine learning, data mining and social network analysis, who are able to exploit the analytics-innovation connection.
8. Ubiquitous Technology	Technology-savvy managers who can sense new consumer trends and imagine new technology interfaces that combine esthetics and utility and are able to manage interdisciplinary teams of technologists, designers and artists.

**Table 1.0: Emerging Capabilities of MOT graduates**

With the growing importance of intangible assets and their management to an organization, MOT program has included several related courses in its curriculum. One of them is technology commercialization, whereby IP knowledge is regarded as the main component. In fact, MOT graduates' career prospect particularly in the field of technology commercialization is further enhanced with the IP knowledge being instilled (The Malay Mail Online, 2017).

Global force	Corresponding capabilities
1. Societal Threats	Socially conscious managers able to respond to challenges that require the integration of sustainable technologies into



Technology transfer is a process of commercialization or transmitting technologies to the marketplace in which IP is the object being traded. Also, Fishman (2010) claimed that IP is more important to the value of the firm when it comes to technology transfer and commercialization. At the same time, it is becoming more difficult to control if firms' operation were slowed down due to lacked skilled-personnel in managing IP. Thus, topics such as IP valuation and sourcing, selecting, configuring, patenting, and marketing new technological solutions are crucial in the syllabus of MOT (Fishman, 2010).

**III. ANALYTICAL RESULTS & DISCUSSIONS**

World Intellectual Property Organisation (WIPO) defined Intellectual Property (IP) education as a process that supports learners in becoming future IP managers and posted that youth's creativity should be developed, and they need to be functionally educated in respect of IP matters. Previous literatures on IP education have been contributed by the professionals (Soetendorp, 2003; Soetendorp, 2006; Uchida et al., 2005; Lakhan and Khurana, 2007; Soetendorp, 2008; Uchida et al., 2008; Fishman, 2010; Mok et al., 2010; Barazza, 2016). Intellectual property is commonly be thought as a legal subject. However, with current circumstances, IP subject has to evolve to a new path, where the role of education and collaborative from experts need to be integrated. Soetendorp (2006) claimed that IP education is regarded as an academic IP agenda which it has been taught across the disciplines for more decades, while the design guidelines for IP education was developed by Mok et al., (2010) that entail perspective from the respective parties consisted of researchers, employees in university, private and public institution researchers and others. Soetendorp (2006) professed that there is no specific methodology stated or pedagogy used in IP educational delivery to non-lawyers. While Takagi et al. (2008) claimed about the teachers of IP can be any person who has major responsibility in technology protection involving IP and who be able to refer to examples based on latest technology developments. According to Hamzah (2012) and Soetendorp (2006) on IP knowledge, it is found that principal component of IP education in Management of Technology (MOT) and the industries should understand the IP ecosystem in order to reap values like competitive advantage, profit and growth. Like other physical assets, IP are important for every business especially when their presence in the marketplaces were established. Thus, participation in the IP marketplace specifically in Technology-based firms (TBFs) requires IP personnel who are competent in managing intensively the processes of IP from the creation, protection, management, financing to its exploitation. According to Lim (2011), development of IP competency to suit specific industry needs requires a nuance framework. The objectives of the IP competency framework structured by Lim (2011) are as follow; 1) Articulate competencies for IP job functions, 2) Bridge gaps with relevant training programs, 3) Define competencies standards, 4) Develop training and assessment guides, 5) Propose suggested career roadmaps, and 6) Provide recognition for competencies obtained.

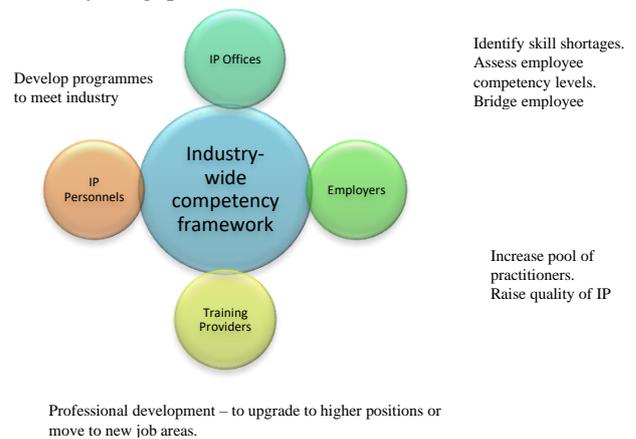
Competency program through proper education and development supports enable the MOT students to be exposed to the real activities in future employment

specifically technology transfer career. Table 1.1 lists the activities that involved in each process of IP ecosystem as suggested by Hamzah (2012).

IP Process	Value Creation Activities
1) <b>Creation</b>	R&D, IPR development, IPR acquisition, New IP capability building, Productize/Test-bedding.
2) <b>Protection</b>	Technology assessment and technology audit, Registration of IP (national or international), Risk management system, IPR litigation, IP dispute management.
3) <b>Management</b>	Integration of IP strategy with corporate strategy, Analysis of IPR portfolio, Technology intelligence competitiveness, Strategic planning development, Risk management framework development.
4) <b>Financing</b>	IPR valuation, Collateralization, Securitization, Capitalization, Fund raising from investment agencies.
5) <b>Exploitation</b>	Licensing, Assignment, Divestment, IP replication, Business alliances development.

**Table 1.1: Activities in IP ecosystem**

Furthermore, the impact of IP competency framework suggested by Lim (2011) give potential benefits for stakeholders; IP offices (government agencies), IP personnel or practitioners (graduates), Employers (TBFs and related industries), and Training providers (university and trainers). Figure 1.0 below depicts the potential benefits that will be reaped by stakeholders through the active integration (IP Academy Singapore, 2011).



**Figure 1.0: Potential benefits of IP competency framework to stakeholders**

**IV. CONCLUSION**

In accordance to above review on higher education learning agenda to face fourth industrial revolution (4IR) opportunities and challenges, sensible action to vitalize the intellectual property (IP) education acclaimed by Barazza (2016) for management schools including in Malaysia has to be enriched to prepare competent and excellent Management of Technology (MOT) graduates.



Respectively, MOT related courses should be empowered so as to be a value creation learning in 21<sup>st</sup> century education (Horwitch and Stohr, 2012). Over time, IP learning in MOT has to be reviewed as prerequisite. In fact, IP is regarded as a significant tool in protection scheme in TM framework (Cetindamar et al., 2016).

Above discussions elicit focus on what are the essential components in IP education and the learning importance for graduates' future career. Accordingly, IP education particularly in higher learning institutions needs enhancement in the learning contents, materials and educators' credibility in order to promote MOT career prospects in technology-based and innovation industries. Soetendorp (2006) propounded that IP education is one of important opportunity in the workplaces. It was also recognized by the professional bodies, governmental and international institutions where intellectual property learning as part of lifelong learning and continuous professional development. IP is crucial in managing technology for the purpose of technology commercialization and to sustain business' competitive advantage (Hamzah, 2012; Khalil, 2000; Khalil and Ezzat, 2005; Markman et al., 2008).

Keeping pace with Education 4.0, graduates of MOT have to be prominent rather than other fields graduates so as to grab the limited vacant position offered. In addition, Malaysia Education Blueprint 2015-2025 (Higher Education) released by the Ministry of Education draw on multiple sources of inputs to leaders in higher learning institutions and members of the public for producing quality human capitals that will be wealth for the country; skilled and expert workers in every field of industries especially in managing technologies and innovations (The Star Online, 2017). Besides that, these graduates are targeted to work in technology-based industries (TBIs) and contribute their acquired knowledge and skills in IP related courses in MOT (Khalil, 2000; Hamzah, 2012; Markman et al., 2008; Siegel et al., 2007). In conclusion, the enhancement of IP education towards graduates' employability featuring in this paper aims to generate more studies in improving MOT's syllabus as well as resolve the issues of suitable personnel to handle IP in TBIs.

### ACKNOWLEDGEMENT

This research was supported by an encouragement grant from Ministry of Education, Universiti Teknologi Malaysia, Johor under contract No. Q.J130000.2629.13J36.

### REFERENCES

1. Asif M. & Searcy C. (2013). Determining the key capabilities required for performance excellence in higher education, *Total Quality Management & Business Excellence*, 25:1-2, 22-35.
2. Baetan M., Kyndt E., Struyven K., Dochy F. (2010). Using student-centred learning environments to stimulate deep approaches to learning: Factors encouraging or discouraging their effectiveness. *Educational Research Review*, 5:243-260.
3. Gordon C. & Debus R. (2002). Developing deep learning approaches and personal teaching efficacy within a preservice teacher education context. *British Journal of Educational Psychology*, Vol. 72:483-511.
4. Horwitch M. & Stohr E. A. (2012). Transformation technology management education: value-creation learning in the early twenty-first century. *Journal Engineering and Technology Management*, 29:489-507.
5. Rowe E. A. (2009). Technology and Intellectual Property: New Rules for an Old Game?. *Journal Technology Law & Policy*. UF Law Scholarship Repository.
6. World Knowledge Forum. (2017). Intellectual Property Innovation in 4IR. Retrieved from <http://www.wkforum.org/>
7. World Economic Forum. (2017). Companies benefit from the fourth industrial revolution, but do countries?. Retrieved from <https://www.weforum.org/>
8. WIPO (2008). Book Review: Teaching of Intellectual Property-Principles and Methods. WIPO Magazine. Retrieved from [http://www.wipo.int/wipo\\_magazine/en/2008/02/article\\_0013.html](http://www.wipo.int/wipo_magazine/en/2008/02/article_0013.html)
9. Education framework for institutions created for fourth industrial revolution (2017, August 27), *The Star Online*. Retrieved from <https://www.thestar.com.my>
10. . Technology transfer as a recognized profession in Malaysia (2017, December 4), *The Malay Mail Online*. Retrieved from <http://www.themalaymailonline.com>
11. Cetindamar D., Phaal R., Probert D. (2016). *Technology Management: Activities and Tools*. London, Palgrave:Macmillan International Higher Education.
12. Khalil T. (2000). Management of Technology: the key to competitiveness and wealth creation. Mac Graw-Hill International Editions.
13. Khalil T. & Ezzat H. A. (2005). Management of technology and responsive policies in a new economy. *International Journal of Technology Management*, Vol. 32 (1-2). doi: 10.1504/IJTM.2005.006820.
14. Soetendorp R. (2003). Intellectual Property Education – in the law school and beyond. Centre for Intellectual Property Policy and Management. Bournemouth, UK.
15. Soetendorp R. (2006). Developing the curriculum for collaborative intellectual property education. Centre for Intellectual Property Policy and Management. Bournemouth, UK.
16. Lakhani S. E. & Khurana M. (2007). The state of intellectual property worldwide. *Academic Leadership: The Online Journal*, Vol. 5 (2).
17. Soetendorp, R. (2008). Teaching intellectual property to non-law students. In Y. Takagi, L. Allman, & M. Sinjela (Eds.), *Teaching of Intellectual Property: Principles and Methods* (pp. 230-267). Cambridge: Cambridge University Press. doi:10.1017/CBO9781139168687.011
18. Uchida H., Ohtsuka A., Sumida M. (2005). Intellectual Property Education for Sustainable Development of the Society. *IEEE*.
19. Uchida H. (2008). Intellectual Property Education as a Means to Nurturing Creativity. Japan Patent Office.
20. Fishman E. A. (2010). The role of intellectual property management education in a technology management curriculum. *Journal Technology Transfer*, 35:432-444.
21. Mok M. S., Sohn S. Y., Ju Y. H. (2010). Conjoint Analysis for Intellectual Property Education. *World Patent Information*, 32(2):129-134.
22. Barazza S. (2016). The future of IP in higher education. *Journal of Intellectual Property Law & Practice*, Vol. 11. No. 10.
23. Hamzah Z. (2012). Technology Commercialization & Intellectual Property Value Creation. *World Intellectual Property Organization*.
24. Lim E. H. (2011). General status and development environment of IP marketplace – a singapore perspectives.
25. Jolly D. R. (2012). Development of two-dimensional scale for evaluating technologies in high-tech companies: an empirical examination. *Journal of Engineering and Technology Management*, 29(2):307-329.
26. Lin X. & Tang H. (2016). A framework for human resource configurations in knowledge-intensive organizations. *IJBA*. 7:1
27. Allarakhia M. & Walsh S. (2011). Managing knowledge assets under conditions of radical change: the case of pharmaceutical industry. *Technovation*, 31:105-117.
28. Harroch R. (2017). 10 Intellectual Property Strategies for Technology Startups. Forbes. Retrieved from <https://www.forbes.com/>
29. Markman G. D., Siegel D. S. & Wright M. (2008). Research and technology commercialization. *Journal of Management Studies*, 45:8, 1401-1423.
30. Siegel D. S., Veugelers R. & Wright M. (2007). Technology transfer offices and commercialization of university intellectual property: performance and policy implications. *Oxford Review of Economic Policy*, 23, 640-660.