The Social Sciences 12 (6): 919-924, 2017
ISSN: 1818-5800


# The Roles of Technology Transfer Offices to Facilitate Intellectual Property Commercialisation in the University: Issues and Challenges

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**Abstract:** Innovation is main agenda in trailing vision 2020. Yet, it left 5 years more to achieve the target while various steps have been taken by the Malaysia government. The role of universities in developing the national innovation and growing the economy is well recognized but the transforming of research outputs into marketplace has not been as good. Recognizing commercialisation of research output can generate university income, in the creation of new business and jobs. Transferring the research output for commercialisation involved many stakeholders such as academic researcher, Technology Transfer Offices (TTOs) and industry. Among these players, TTOs are commonly considered to be key stakeholders to determine a university's overall success at technology transfer process. Thus, universities start to establish their TTOs to encourage the commercialisation activities. Establishment of a TTO within the university is often viewed as tool for helping the researcher to turn their research output into Intellectual Property (IP) commercialisation and developing relations with industry and other interested parties. In this study, we focus on the issues and challenges of TTO in assisting the university IP commercialisation. It was found that issues and challenges arise from the aspects of insufficient resources devoted to TTOs, bureaucracy and inflexibility of university administrator, poor link with the industry, the size of TTOs itself, IP policy and the motivation of the researcher of working together with TTO.

**Key words:** Intellectual property, research output, technology transfer office, commercialisation, insufficient resources

## INTRODUCTION

The government has strongly emphasised transforming the Research and Development (R&D) to commercial applicable thus, universities are playing an important role in this regard. This argument can be further supported by the announcement of the prime minister in the Tenth Malaysian Plan (2011-2015). Towards that, the universities are working to improve their R&D activities through publication, patents, commercialisation and cooperation with industry to acquire external funding. These efforts made by the universities are in line with the objectives set by the government in an effort to bring the R&D to an international level.

The importance of universities and their research, development and commercialisation activities has been widely recognised recently. Previously, the focus had been primarily on research and development, however more recently there is an increasing shift towards the commercialisation activities. Researchers in the universities produce innovations as a result of their research activities which in turn can be commercialised. However, the transformation from research and development into commercialisation is a complex process with many pitfalls.

Research outputs need to have Intellectual Property (IP) protection before it can be commercialised while securing the IP is costly and a complex process. Technology Transfer Office (TTO) in Malaysian public universities are responsible to facilitate the activities of IP protection and also commercialisation. However, there is significant issue to address that the academic research faces problem to transfer the IP product into commercial applications. There are also difficulties and challenges for TTO to facilitate IP commercialisation in the university, including the low level of funding scheme, lack of incentives for the researchers and lack of expertise and ability of the academic researchers to commercialise their IPRs.

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Table 1: Issues and challenges of TTO

| Dimension | Issues and challenges | Author (s) |
|---|---|---|
| Competency | Lack of trained staff and handling ability | Breznitz and Ram (2013), Swamidass and Vulasa (2009) |
| | Individual relationship with faculty members | Jensen and Thursby (2001) |
| Management | TTO bureaucracy | Siegel *et al.* (2003a, b) |
| | Incentive compensation for TTO staff | |
| | Unclear policy for royalties | Wang *et al.* (2012), Ismail (2008) |
| Disseminating information | Ineffectively ways to approach researcher | Comacchio *et al.* (2012) |
| Networking | Cultural barriers | Ustundag *et al.* (2011) |

The aim of this study is to investigate the problems and challenges that encountered by TTO to facilitate the IP commercialisation in the universities. Hence, in this case, this study conducted a review on the common role of TTO as a major stakeholder to the commercialisation of IP in the universities. Beside to find the problems and challenges of TTO in assisting the IP commercialisation, the process of transforming the research output into commercial applicable were included in the investigation. This is to show the flow on how should the TTOs act in supporting the IP commercialisation from the university to the industry.

There are two phases in getting the findings to complete this study. For the first phase, the systematic literature review is used to specify the literature search in the field of research output commercialisation. The empirical studies were explored by using search engine like IEEE xplore, Emerald, Elsevier and Google scholar database. The keyword used were "technology transfer office"/ "intellectual property commercialisation"/"university commercialisation"+"problems"/"challenges"/ "difficulties" to ensure all related papers are included. By examining the title and abstract of the identified studies, the irrelevant topic were found and being excluded.

The related studies that similar to the domain of this study were accessed and evaluated by checking the contents of the studies. Next, the required data were extracted from the relevant studies by reviewing the objectives the findings presented. The extracted data were carefully studied to filter possible overlaps. The synthesised data resulted in a combined section of related works are shown in findings section.

In second phase, the classification of the extracted data are insert into tables of comparison as shown in Table 1. The difficulties and challenges of TTO to facilitate IP commercialisation were organised with the listed author(s) for fast review. The findings were reported and discussed based on the literature search in this study.

## MATERIALS AND METHODS

**Role of technology transfer office in university:** Universities are not only a place for disseminating knowledge but they are also playing significant roles in the country's innovation towards contributing to economic growth. It has evolved far beyond the traditional sets where teaching and research have been the common roles in universities. University had produced many research output as government increased the allocation for R&D activities in Tenth Malaysia Plan. It was supported by the establishment of research university among the public high education institutions that these research universities have been directed to upgrade research and development activities as well as towards the commercialisation activities. A previous study highlighted that the successful rate of commercialisation is very small in Malaysia (Ab Aziz *et al*., 2011).

Transferring the research output from universities to the private sector for commercialisation and public benefit involved many stakeholders such as academic researcher, TTO and private industry. Among these players, TTOs are commonly considered to be key stakeholders to define a university's overall success at technology transfer process. Hence, universities start to establish their Technology Transfer Offices (TTO) to encourage the commercialisation activities while at the same time providing knowledge to society.

TTO is a unit within the university, created specifically for the purpose of technology commercialisation. Following the Bayh-Dole Act1 in 1980, many US research universities established TTO to manage the licensing of university intellectual property. TTO responsibilities typically include encouraging faculty members to disclose inventions assisting with disclosure paperwork assessing the invention's potential for commercialisation, obtaining patent protection and finding potential collaborator.

Previous studies have reported several roles for TTO. According to McAdam *et al*. (2012), the TTO is taken as representing the university technology transfer activity in a regional area. In this respect, the TTO has a significant influence as a translator between the two parties (Collier, 2007). TTOs usually have been the more popular approach for commercialisation since it serves as the gateway to university inventions, establish linkages between the university (Decter *et al*., 2007) and industry and allowing university-industry relationships (Muscio, 2010).

TTO also are incorporated with several departments both from public and private sectors working on research and transforming procedures from academia to industry. In fact, they are concentrated on knowledge oriented services at various stages of the innovation process (Sharma *et al*., 2006). According to Filho and Milton, TTO is also responsible for educating academician with the world and language of business through interaction with a network of industrial partners. They should define the guidelines for the commercialisation of research results.

## RESULTS AND DISCUSSION

**Transforming research results to IP commercialisation:** Universities are sources of knowledge creation and have rich research resources. Besides as a teaching centre, the basic research made in universities put a base for following product development which is useful for national long-term productivity and economic growth. Many of the funds of top universities are provided by the government but most research results are limited to publication. How to properly use and effectively commercialise the research results from universities has been a challenge for the new knowledge-based economy.

Many developed countries have established significant systems to transform research results into technology product and commercialisation. For example, the US accept the Bayh-Dole Act in 1980 which grants universities to own the right of invention for research results. The act also actively pushes universities to transfer technology for commercial. This improves academic patent and indirectly enhances the national economy. Taiwan implemented the basic law on science and technology in 1999 which allows the research results funded by the government to be disclosed and applied by organizations and enterprises in order to promote the commercialisation of research results (Wang *et al*., 2012).

Thus, many universities have established technology transfer offices as known as TTO to protect, promote and commercialize the research results of researcher. Although, the law has been in applied for more than ten years, the effects on patent commercialisation still need to be improved. There are various types of IP rights that are relevant to the university research output. Such are copyright to protect the original of literary and artistic works; patents to protect any invention either products or processes; designs to protect visual appearance of any articles; trademarks to protect any signs that indicates the commercial origin of goods and services and confidential information to protect the secret commercial information that has commercial values and also personal information. It has been debated, the patent protection is the strongest form of protection in particular for new technology thus, the role played by the university to patent the technology has been emphasised. While the method for commercialisation can be through spin off, licensing, consultation and joint venture. Most of the successful method being used by university are licensing but recently spin off have been more practicable since it give a high return.

Besides, the commercialisation can be pursued by following the competitive product market strategy and by cooperating with others. The concept of IP and commercialisation of university's IP is one that has received considerable academic attention (Monotti and Ricketson, 2003) in this recent years. This is because, for example as compared to the industry which tends to be more strategic and applied with direct commercial application, university traditionally tends to be more strategic and applied with direct commercial application, university traditionally tends to answer basic and fundamental questions. In addition, there are tensions occurs between the roles of university as the main centre for dissemination of knowledge and at the same time to pursue their own commercialisation activities.

The general process of commercialisation of research output starts from the discoveries in the university. Generally, researcher disclosed their inventions to the TTO. The TTO then evaluates the disclosures to determine if the research results need patent protections. Based on the information from the researcher, they will evaluate the market potential for the research results and how to get them. If there are potential licensees for the inventions, global protection will be discussed depending on the market for the inventions. If there are still no takers after the filing date, the TTOs and the inventors will continue to try to commercialise the invention for a period of up to 1 year. After that period, attempts to commercialise the inventions would normally be abandoned.

Normally, the decision to commercialise the research product is either through a license to established companies or as a license to spin-off companies. These would normally be the result of join decisions between TTOs and the researcher. According to Ismail (2008), basically for most universities, the decision as to whether to file an IP right's application are generally based on at least three main questions. They are:

- Do the inventions have no prior art?
- Do the inventions have commercial value to attract commercial investments?
- Are there funds available within the institution or prospective licensees to pay for the patenting cost?

If the answers are yes to all three questions above, then TTO will take steps to protect the research output with IP rights, even though at that time they have to make difficult decisions due to the insecurity of the potential markets. It was important to understand the importance of IP and how to protect it, since IP is an asset. If TTO managed the IP strategically and carefully, it will give a competitive advantage in the future for the university. To commercialise university IP, a university has to have a clear IP policy. This will help in smoothing the process of IP commercialisation especially to interested industries as well as universities. A university which does not have a clear IP policy will encounter difficulties in ownership rights of the IP when the IP starts to be commercialise.

**Issues and challenges of TTO to facilitate IP commercialisation in the university:** There are many challenges in commercializing of research product. The results of previous studies have indicated that the efficiency of commercializing research product is quite often due to the weakness of TTO itself. But some other problems may cause from academic inventor and also other parties like industries towards the TTO. Because of the IP commercialisation took a long process, all party need to have same momentum in supporting the IP commercialisation to be successful. Thus, TTO will play the role as intermediaries between the academic inventor and industries.

**Competency of TTO staff:** Breznitz and Ram (2013) agree that the professionalism of a TTO affects its ability to transfer technology. Thus, university administrators should ensure that TTO agents are educated, trained and evaluated on their ability to build relationships with individual faculty members. In addition, because relationship building takes time, reducing TTO staff turnover is also important. This may require extra compensation that gives effective TTO's staffs incentives to remain with the TTO in the universities.

Besides, how supportive TTOs to successfully commercialise the IP are frequently related with the level of resources available and how helpful the TTOs are. They are too narrowly focused on a small set of technical parts and also too concerned with the legal aspects of IP commercialisation. TTOs need to have personnel who are expert and skilful in many areas such like assessing markets, negotiation of an effective agreement and also monitoring the commercialisation performance. But the challenge for TTO is the acquisition and improvements of these skills take time (Swamidass and Vulasa, 2009).

Although, the availability of skilful TTO personnel, some faculties have been hesitant to disclose their research output to their university TTOs. Based on study by Thursby *et al.* (2001), they concluded that convincing faculty members to disclose inventions is a major challenge for TTO. Most of the faculties have limited time for non-academic research. TTO have to increase their productivity by shortening the commercialisation time of the research output. Hence, it back to the importance of skilful personnel that should be provide by TTO to prove that they can facilitate the IP commercialisation in the university.

**Management of TTO:** University bureaucracy and inflexibility also has led some firms from industry to avoid working with TTO. Hence when an invention is publicly disclosed, some firms will contact the researcher and arrange to work with them via informal technology transfer, through consulting or a leave. Study of Siegel *et al.* (2003a, b) also discussed the issue the need for incentive compensation for TTO staff. This was relevance because IP commercialisation activity will fully depends on the effort of TTO staff to elicit research output disclosures and market them to firm and industry effectively. Thus, they expect that IP commercialisation activity will be higher at the TTO that implement some kind of the incentive compensation to their staff.

A study by Wang *et al.* (2012), found that researcher sometimes refuse to get the advice from TTO because of the perceptions towards the royalties shared which are not equally fair. They did not have clear understand of how the royalties is share between researcher and university. In some cases, some researchers had directly negotiating with the industry without referring to the TTO. They would only get back to TTO once they encountered problems. In most cases, they are failed to legally protect themselves (Ismail, 2008).

**TTO's role in disseminating information:** There is an issue in the dimensions of disseminating information about IP commercialisation to the researcher where the researcher unsatisfied towards the TTO encouragement and consultation conducts. Commachio *et al.* (2012) studied TTOs providing the seminar, road show, exhibition, in order to meet up the industry and inventor. Though, the approach are not satisfied by researcher since they both, cannot used the chance effectively because of unrelated or less potential industry are in the events. Despite, it becomes the challenges of TTO when the researchers do not prefer the ways and less are interested to participate for more.

One of the most significant current issues in dissemination of information is how the other party like industry recognised TTO as a middle party to get the

technology and invention from universities. The industry might approach directly to the researchers who are potentially to invent what they need. The existing and the role play by TTO are not really acknowledged by the third party. The issue will arise when the industry are not aware of the IP protection and how it affect them in collaborating with the researcher in universities.

**Networking of TTO:** In a dimension of networking, Ustundag *et al.* (2011) had identified the challenges for TTO in supporting the commercialisation is the cultural barriers between university and industry. The gap between university and industry is arising from the lack of understanding between them. The industries and TTO have a conflict in understand or appreciate each other goals, culture and constraints in commercialisation process. Hence, TTO had to persuade the industry and make them interested to collaborate though industry might request a high return to benefit them more than the university. This results in difficulties to negotiate and failure to realize the unrealistic expectations and sufficient payoff.

For example, the industry have to research faster, to follow the market trend and customer demand but TTO have to wait and follow for all the procedures especially in application of IPRs. But for the TTO, getting the potential industry that interested towards their IP products are very precious. Hence, they have to make a good linked to get the industry trust and wait for the IP products to be sold to them. The issue also arise if TTO are not having a good relationship and broad networking with the industry, some major problems are bulk of IP products are not being commercialise. This was not a good situation since the IP protection requires quite a much amount of charge but the TTO cannot gain the return for that investment.

## CONCLUSION

Commercialisation of IP in university has made a significant contribution in terms of financial returns in a long term and enhancing the image of the institution. But the process are very complex and need full of effort. It is said that the IP protection may not be adequate to encourage for commercialisation process. There should be a linkage between commercialisation process and the IP protection, thus TTO are the unit that responsible to give support and encouragement throughout the process.

How supportive TTOs are in these commercialisation of IP frequently relate to the level of resources available and how helpful they are. TTO also need skills to evaluate the research product and give full support to the inventors/researchers. Besides, TTO need a very good relationship with the industry in order to being recognize as a middleman to successfully commercialise the IP.

As being discussed, the issues and challenges of TTO in assisting IP commercialisation arise from some different dimension like competency, management, disseminating information and networking.

## SUGGESTIONS

In future research, the suggestion for TTO to improve their role in facilitating IP commercialisation can be done considering to overcome the difficulties and challenges that have been investigate in this study.

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