ABSTRACT
Role and importance of economic development based on knowledge is roaring so that universities and educational hub are playing critical roles interacting with the business community, which assist technology transfer from university to industry. Commercialization in research context is risky and costly. The aim of this study was to investigate the effect of technology transfer office (TTO) on the procedure of university commercialization. This study was based on a qualitative research method and was designed to use a case study approach. For exploring the issues in this study, a total of ten face-to-face interviews were conducted. The respondents were chosen from inventors, researchers, academic entrepreneurs, and Technology Transfer Office staff in Universiti Teknologi Malaysia (UTM). The researcher utilized the content-analysis approach to analyze the data obtained from the semi-structured interviews of the respondents. The results indicated that, TTO accelerates the commercialization process by providing services in several aspects.

Keywords: Commercialization, technology transfer office, university, research output

INTRODUCTION
Due to significant role of regional development and knowledge based economy, universities are playing different roles in their communications with business community while they transfer technology to the industry (McAdam et al., 2012). Nowadays studies on commercialization, research in university and introducing various models for university technology transfer are receiving more attention (Jolly, 2011; Siegel et al., 2003). Present research also desires to examine commercialization of the research in Malaysian universities.

Since 1970s Malaysia started as middle-income country through expanding economic activities. Later in 1980s Malaysia changed its economy from raw materials producer into electronics exporters (Wonglimpiyarat, 2011). In Malaysia, the commercialization and innovation development has been assigned as ‘Niche 1’ by the Malaysian Ministry of Higher Education, which implies the emphasis and urgency (MOHE, 2010) under the Tenth Malaysian Plan. In terms of commercialization activities in education sector, the trend had been; i) setting up private universities, ii) creating consultancy centers, iii) concentration on research identification of research agenda, and iv) emphasizing research commercialization. However, transforming technology into wealth is usually accompanied with potential risks that may decline degree of success in project development or may affect investment in such projects (Drof & Worthington, 1990; Eldred & McGrath, 1997). In additional, the amount of funding that allocated to the certain project is limited. Then, the success of research commercialization is critical issue for government and universities. On the other hand, under financial crisis that government may encounter funding shortage, universities must seek various sources for funding and revenue, which make them more ’entrepreneurial’ (Todorovic et al., 2011).

In order to manage the knowledge transferring process in terms of skills and governance structure matter, technology transfer centers are playing a critical role (Swamidass and Vulasa, 2009). Such centers seem to be the main place that any invention would be disclosed for the first time. These centers indicated great capabilities for commercialization as well. It is clear that they finance researches in inventions, helping business planning, opening to venture capitalists, helping in recruiting startup teams, and incubator space (Wu, 2007). Despite their great attention to support the
invention yet they are suffering from insufficient resources and competencies (Swamidass & Vulasa, 2009). Furthermore, they also have problems with insufficient skills and budgets to support their programs. Time also is another issue for staff whom are working in these centers. In short, they may succeed in patenting and inventing but they may have insufficient resources for commercializing them (Wright et al., 2008).

We conducted this study to explore how TTO activities affecting commercialization process. Current study is conducted at Universiti Teknologi Malaysia (UTM) as a case study, which is a leading university in Malaysia (Aziz et al., 2011).

II LITERATURE REVIEW

A. University Commercialization

Commercialization and technology transfer have been defined in a variety of way. Crabb (2002) defined commercialization as “the development of an idea to the point at which it may be sold as a standard product or service in quantity to an open and competitive market for the purpose of creating revenue (and hopefully income) for the organization”. This definition also confirmed by Zhao (2004) who defined research commercialization (RC) as the process in which an idea or research finding would be changed into commercial products and services that produce wealth. Moreover, Thika (2010) mentioned “Research commercialization” and “Technology transfer” are the processes of changing academic findings and inventions into marketable products and services. So, the most important here is development process.

In general, university technology transfer is process of converting research discoveries from university to industry into useful products or practical applications (Rahal, 2005). It usually involves two or more organizations, for example, university, industry, and government agencies. Common results of technology transfer are invention disclosures, patent filed, patents issued, licenses executed, and number of spin off companies generated, among others (Rahal, 2005). Hence, commercialization does not an easy through process and needs to be actively worked out.

B. Technology Transfer Offices/ Center of University

Technology transfer centers (TTC) 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 (Howells, 2006). In addition, Technology Transfer (TT) infrastructure intends to be part of a technology transfer, which finally enhance and simplify alliance operations in a given context. Therefore, they are incorporated with regional economies, and their corporate governance intends to include stakeholders from the local public and private sectors (Barge-Gil and Modrego, 2011).

Comacchio et al. (2011) in their study draw attention to the multiple roles undertaken by TTC in a local innovation system. In this regard, they categorize TTC into several groups include experimental station, science park and technology hub, technology transfer office, business incubator, business innovation center, chamber of commerce special agency and laboratory, territorial development enterprise, topic Centre, multi-sector center, public research organization, and laboratory.

Previous studies have reported several roles for technology transfer office (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 (Franklin and Lockett, 2001; Collier, 2007). TTOs traditionally have been the more popular mode for commercialization since it serves as the gateway to university inventions, establish linkages between the university (Rothaermel et al., 2007; Dai, 2007) and industry and validating university–industry relationships (Muscio, 2009). Other services that are provided by TTO include handling and stimulating patent application issues (Hauksson, 1998; Dai, 2007), labor assistance on multifarious paperwork, educating and encouraging faculty members about patenting opportunities, managing licensing and all other patents related legal tasks, introducing and reinforcing university intellectual policy, building personal connections with faculty members, informing them about university policy changes, federal policy trends (i.e. Bayh-Dole
Act), and industry technology requirements (i.e. licensing demand) (Dai, 2007). Moreover, TTO serves as a filter by helping faculty decide whether the technology seems commercializable or not (Powers, 2000).

Numerous studies have shown the positive correlation between TTO existence and the increase of the university patent (Thursby et al., 2001). It means the efficiency of the TTO effects on faculty patent intention, motivation, and experience to a large degree (Dai, 2007; Matkin, 1990). Anyway, private sectors feel it is easier and faster to build a research joint venture with a university TTO that had worked on a cooperative research before (Hauksson, 1998; Thursby, 2001; Hertzfeld et al., 2006).

III RESEARCH METHODOLOGY

This study was based on a qualitative research method and was designed to use a case study approach. Creswell (2007) compared the use of case studies to other designs and suggested that case studies were unique because they focus on a clear boundary of activity that can be studied, and that can provide different perspectives on the problem.

This research is motivated to take one of the Malaysian universities to examine how TTO improve the commercialization rate. The decision to choose the Universiti Teknologi Malaysia (UTM) as a single case study was mainly because of the nature of qualitative research that urges to have a smaller sample size (Patton, 2000). ICC or Innovation & Commercialisation Centre is a unit established by UTM which is committed on developing and commercialising UTM’s research products via its newly formed and diversified units which include innovation point, incubation, innovation prototype development, business training and IP development units. Universiti Teknologi Malaysia has a strategic orientation for research, development and commercialization that centered on an entrepreneurial culture, collaborative effort and engagement of parties beyond the university (Aziz et al., 2011).

The research population includes inventors, researchers, academic entrepreneurs, and technology transfer office staff, which are operating directly and indirectly in the commercialization of university research output at UTM. Creswell (1998) observed that it is often necessary to gain access to data via a gatekeeper. Units of analysis were chosen from the list of portfolio IPRs provided by the Innovation and Commercialization Centre (ICC) at UTM and among categories of patent pending, patent granted, utility innovation pending, utility innovation granted, industrial design application and industrial design registered. In the current study, the Director of ICC plays the role of gatekeeper, which provided sufficient information regarding to innovation commercialization process.

In this study, a total of nine inventions was chosen. To answer the research question, three sub-samples (unexploited inventions; inventions that were exploited through spin-off companies and inventions that were exploited through licensing to established companies) were purposely chosen. Three inventions were unexploited and six inventions were exploited (four inventions that were licensed to spin-offs and two inventions that were licensed to established companies). Overall, a total of ten interviews conducted including nine inventors and one officer from ICC. Respondent’s academic backgrounds were from electrical engineering, mechanical engineering, photogrammetry and laser scanning, civil engineering, Chemical Engineering, Biomedical and Physics. Moreover, the position of ICC staff was IP manager. Overall, the respondents were divided into four groups.

Ten interviews were conducted for investigating role of technology transfer office /center on the university commercialization. Interview guides used with a standardized open-ended question for each group. The decision to apply semi-structured interview method and open questions was needed since this study required both specific information as well as broader views of the phenomenon under study. The interviews were recorded and transcribed for further analysis.

In this study, the researcher adopted Miles and Huberman’s (1994) qualitative analysis method as the leading framework in analyzing the qualitative data. According to Miles and Huberman (1994), a qualitative data analysis consists of three stages: data reduction, data display, and conclusion drawing.

IV FINDINGS AND DISCUSSIONS

From the interviews, it was found university commercialization have been affected by role of Technology Transfer Office /Center which
Present research found that TTO in UTM manages and facilitates IP application issues by giving awareness about IP protection, providing the IP disclosure forms to inventors, motivating academic and also assisting researchers in bureaucracy and paperwork related to IP application process. After that, TTO handles all the university IPs. The findings reveal the same issues as stated by Comacchio et al. (2011); Dai (2007); Hauksson (1998) and Siegel et al. (2001). In addition, TTO assists inventors to identify the potential products for commercialization through establishing an innovation-commercialization committee for evaluating inventions. The finding is consistent with the suggestion by Comacchio et al. (2011); Powers (2000). Moreover, TTO help researchers in negotiation with industry, especially in the business aspect because inventors are lacked of business knowledge. This finding is appointed by Collier (2007); Franklin and Lockett (2001). They concluded TTO works as a translator between two parties. Furthermore, TTO works as an effective bridge between the industry sector and academia. TTO collaborates with industry to find out their requirement and doing modification and improvement on university IPs to be matched with industry requirements. Afterwards, TTO coordinates licensing to industry. The findings support the study by Dai (2007) and Siegel et al. (2001). In sum, out of nine inventors, only five inventors (56%) were satisfied with ICC’s services.

V CONCLUSION

Technology Transfer Office/Center of the university has an effect on the university commercialization. In fact, TTO accelerates the commercialization process by providing services in several aspects. Some of these services are facilitating IP application issues, motivating academic, coordinating licensing, organizing spin off company, and marketing the inventions. TTO can be considered by many scholars as an effective bridge between the industry and academia. Furthermore, the establishment of ICC is considered as a long-term strategy for enhancing the commercialization rate in UTM.

REFERENCES


Table 1: Sub-Themes

<table>
<thead>
<tr>
<th>Main Theme</th>
<th>Sub-Themes</th>
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<tbody>
<tr>
<td>Role of Technology Transfer Offices/Center of University</td>
<td>➢ Bridge between the industry sector and academia</td>
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<td></td>
<td>➢ The establishment of Innovation and Commercialization Centre</td>
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<td></td>
<td>➢ Mediator between the inventor and venture capitalist/investor</td>
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<td></td>
<td>➢ Facilitate the IP application process</td>
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<td>➢ Identify and evaluate potential product for commercialization</td>
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<td></td>
<td>➢ Motivate the inventors</td>
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<td>➢ Assist to make prototype and to have business plan</td>
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<td>➢ Find a way to commercialize</td>
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<td>➢ Marketing the patent</td>
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<td>➢ Coordinate licensing to established companies</td>
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<td>➢ Organize spin off formation</td>
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<td>➢ Organize course training</td>
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<td>➢ Negotiation at business aspect</td>
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<td>➢ TTO need to be better staff with professionals</td>
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(Source: Compile from the interview)


