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Decision making process in the commercialization of University patent in Malaysia

Ismail Kamariah*, Aslan Amat Senin, Soong Wai Mun, Wong Seow Chen and Ajagbe Akintunde Musibau

Department of Management, Faculty of Management and Human Resource Development, Universiti Teknologi Malaysia, 81310, Skudai – Johor, Malaysia.

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Commercialization of university patent has become a major issue around the world, where many universities are moving into technology and entrepreneurial based universities. Even though the university possessed a number of patents, still a big portion of them are yet to be commercialized. This may be as a result of the complexity of the process involved and also the commitment of the parties involved in the decision making process. The purpose of this research is to find out how the commercialization process is done and understand why just a few of the university patents are commercialized. The study uses qualitative method incorporating a case study approach. Interviews were conducted with the relevant respondents from faculty of mechanical engineering, faculty of chemical engineering and natural resources, faculty of science and faculty of electrical engineering who have registered their inventions with Research Management Centre (RMC) of University Teknologi Malaysia (UTM). The study finds that the commercialisation process is influenced by: first, the motivation and opportunity recognition of the inventor and industry; second, the royalties and funding opportunity; and lastly, and most importantly, the role played by the RMC and Innovation and Commercialization Centre (ICC) in the whole process. The study concludes with suggestions on how the decision making process in commercialising university patents could effectively be carried out. Further study should adopt multiple cases from two or more universities and could also consider patents that have not been exploited.

Key words: Licensing, commercialization, research and development, university patent, decision making process, Malaysia.

INTRODUCTION

In this era, there are managerial believes that a strong regulatory environment should be maintained at the work place in order to control and manage the employees. Recognizing universities as producers of knowledge and the important contribution they generate to the economy of advanced nations through innovation support (Kiston et al., 2009). The interrelationship between university researchers and industry have been found to facilitate knowledge transfer and further ginger the production of more innovative research products (Bjerregaard, 2010;

Boardman and Ponomariov, 2009). However, there is need to facilitate this transfer process through commercialization of university research products (Agrawal, 2001; Gertner et al., 2011) seeks to understand how university knowledge is transferred to industry in order to support innovation by focusing on licensing and other measureable forms of university-industry linkage and also considering other wider range of available options. In the past, in our education system, particularly in universities their main focus were teaching and learning; however, with the growth of a new era, things tend to change. This is true when there is an emergence of biotechnology, globalization as well as the role of the university in the system of knowledge production.

*Corresponding author. E-mail: m-maria@utm.

As a result of federal government of several countries reducing the amount of funding to their universities (Bower, 1992; Etzkowitz, 2002) as cited in Ismail et al. (2008). A quite majority of the universities across Europe, America and most recently Asia and a few African countries have begin to adopt the entrepreneurial university model (Etzkowitz, 2003). The greater encouragement from government to universities to become competitive and improve on their research and development in order to succeed in exploiting their intellectual properties through licensing to established companies or to spin-offs.

The movement into more globalized economies led countries to experience changes in innovation and this enhances universities to become versatile in their education system because they have to cope with the involvement of a larger global enterprise of creating, applying and commercializing knowledge. In the US, the government had for several years played a significant role in championing and encouraging commercialization activities in universities. The American government believes that institutions of higher learning need to be creative and be involved in local economic development and growth (Young, 2004) in Ismail et al. (2008). This thinking led to the introduction and passing of the Bayh-Dole Act of 1980 to increase private sector commercialization of university innovations derived from research and development (Etzkowitz, 2002) Most research universities around the world are embracing entrepreneurial dimensions where they have leveraged on the natural complementarity between creating, applying and imparting knowledge. Also creating spin-off companies as well as product licenses and patents such as a few world premier entrepreneurial universities like Stanford, Berkeley and Pennsylvania, which have learnt how to balance their academic and entrepreneurial roles and harvest these benefits well ahead of their counterparts in other countries.

As stated by Etzkowitz (2002), the term "entrepreneurial university" describes universities which have proven themselves critical to regional economic development when knowledge and innovation has become an important production factors beside labour and capital. In view of the foregoing, there is an increased interest in the need to understand the dynamic factors that contributes to the commercialization process of university patent, and how it is carried out. The method adopted in this study is purely qualitative, through the use of interview technique. A select case sample of four faculties; the faculty of mechanical engineering (consist of ten departments), faculty of electrical engineering (consist of nine departments), faculty of chemical engineering and natural resource (consist of three departments) and faculty of science (consist of three departments) (UTM, 2011) are chosen and results analyzed through content analysis. The findings from this research are revealing and recommendations are made to professionals,

academics and policy makers to enhance prompt commercialization of patented inventions to either spin-off or established companies.

SURVEY OF RELEVANT LITERATURE

The background of commercialization of academic research

In as much as, the universities as academic centres of higher learning are performing their role as institutions of learning, inquiry, production and transmission of knowledge. Although, the primary role and responsibility of the university is to carry out long term scientific research, which by definition implies no estimated monetary rewards. In recent times, this traditional role has now been changed to a certain extent and the new and changing role of universities has provided some background on the commercialization of university research in this current generation (Yaacob, 2011). The Bayh-Dole Act as widely cited, encourages commercial development of federally funded inventions in university and government labs (OECD, 2003). 'Academic capitalism' has been defined by Slaughter and Rhoades (2004) as the involvement of colleges and faculty in market-like behaviours; and has become a major characteristic of tertiary education in the United States. This theory of 'academic capitalism' may suitably shed more light on the organizational transformation underway in research universities and influences the ways that academician take part in commercialization.

Research universities

Altbach (2007) reported that research universities (RU) are "academic institutions committed to the creation and dissemination of knowledge in a range of disciplines and fields". The institutions have appropriate laboratories, libraries and other infrastructures that permit teaching and research at the highest possible level. In other words, RUs should direct the flow of knowledge development through investigation on research that guarantee significant impacts not only towards an improved quality of life but also that plays important role in the construction of knowledge society.

Yaacob (2011) identified that the goals of Malaysian research universities (RUs) comprised of: to become leaders of innovation, to produce intellectuals deserving of the Nobel award, to conduct world class research, to become a centre of excellence for the benefit of the country, to produce research which could give maximum impact to societies, to acquire research funds from industry, to produce quality graduates, to attract intellectuals in teaching and research fields and to offer a conducive environment for all the above goals. They

concluded that so far, 5 universities have been awarded the RU status in the country by the ministry of higher education (MOHE); including recently, Universiti Teknologi Malaysia (UTM).

University patent

The US Patent Act (1952), identified that “any person who invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, is qualified to obtain a patent” on that discovery.

Ismail et al. (2008) reported that though patent are a symbol of university innovativeness, on the other hand, they emphasized that un-exploited patent represent an opportunity cost to the university in question. As a result of increasing regulations to favour intellectual property right among university researchers, several universities have jacked up their patent activities and this effort has resulted to a yearly increase in patent portfolios in universities (Etzkowitz et al., 2000; Ismail et al., 2008).

A patent for an invention is a legal right granted by the government, it allows the inventor to stop other people from using an invention during the life of the patent. It can also carry the meaning where the maximum period during which it can be maintained into force and usually represented through number of years. In most of the patent laws, renewal annuities, maintenance fees have to be regularly paid in order to keep the patent in force. In one agreement implemented by WTO's Agreement on Trade and Related Aspect of Intellectual Property Rights (TRIPS Agreement) Article 33, “The term of protection available for patent shall not end before the expiration of a period of twenty years counted from the filing date” (Wikipedia, 2011).

Foltz and Penn (1990) reported that in a global environment, the emerging areas of intellectual property are more closely linked to a new scientific and technological knowledge which has reflected in the growing number of patents granted in high technology areas. Kortum and Lerner (1998) stated that patent counts have been increasing in all technology fields and large part of it comes from domestic applications. One question that has been raised here is; what has determined the recent growth in patents? In a policy statement, it stated that in the US, Japan and Europe, 84% of the patents worldwide have been granted by patent office's (Shane, 2001).

In one of the reports of OECD (2003), it was observed that the general trend is now to grant ownership institutions and accompany those legal measures with broader reforms to support technology transfer. This was also corroborated in the sweeping reforms going on in several other countries across the world. The Bayh-Dole Act of 1980 also elaborated on the need to grant intellectual property rights to universities and give them title to inventions emanating from such institutions

researchers (Wikipedia, 2011).

Commercialization of university research

Several authors have proposed that research commercialization means intellectual property transfer and development (Australian Research Council, 2000). Zhao (2004) on the other hand broadens it to mean the provision of consulting services that rely primarily on technological innovation. Downie and Herder (2007) emphasized that it is the conversion of academic research results into products, services, and processes that can be the object of commercial transitions. Li and Morgan (2010) find that although the main mission and strengths of universities are still education and research, and recognized that there occur certain boundary between universities and industries. Kamariah et al. (2011) find in their study of UK Universities that universities are different in how they decide to patent and in their decisions of which route to exploit their technologies. Universities that practice very intense selection in their patenting and firm formation may discourage commercialization activities. On the other hand, being less stringent, the universities may encourage the inventors towards more disclosures and patents, but they might not be successful in commercializing the patents. This wastes university resources such as time, manpower and money. It is inexpedient that enterprises are supposed to play a major role in commercialization while universities act as high-quality upstream suppliers. However, presented in the figure are the underlying steps to follow in the commercialization of university patents especially in University Teknologi Malaysia.

The process of commercializing patent in UTM

Five stages were identified in the process of commercializing university patent. The flow of the process is shown in Figure 1. The figure shows that the researcher will conduct a research and then disclose the findings to the research management centre of University Teknologi Malaysia for filing (RMC, 2011); subsequent upon which innovation and commercialization centre will conduct a meeting with both the inventor and representative of the potential company regarding discussions on patent that they intend to commercialize (ICC, 2011).

Ferriani et al. (2008) exposed that licenses carry the meaning to give permission. It may be granted by a party (licensor) to another party (licensee) as an element of an agreement between those parties. A license may be granted under intellectual property to do something without the fear of a claim of intellectual property infringement brought by the licensor. The licensee will make payment to the licensor usually in the form of royalties. The right is thus, conferred temporarily to the

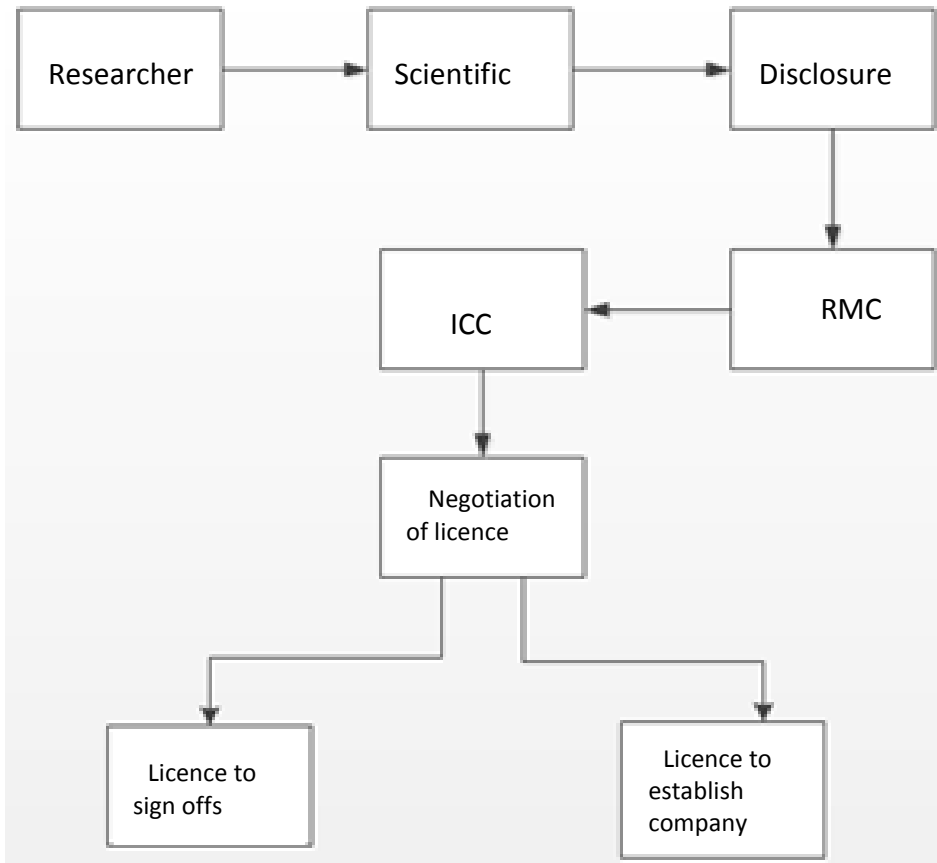


Figure 1. Flow chart of patenting process. Source: Modified from Ismail (2007).

licensee to exploit the invention while the right itself remains within the jurisdiction of the original licensor (Foltz and Penn, 1990).

Spin-off company

“Spin-off” in general terminology is the formation of a new organization or an entity from the split of a larger and well managed organization. However, the “spin-off” term in this research means a situation where a new company is formed from a university research group which is as a result of the findings of members of that research group at the university. Zhang (2008) insist that technology transfers through spin-off formations contribute immensely to economic growth of every nation. Rubin et al. (2003) in Ismail et al. (2008) go further to add that Japan commenced the acceleration of spin-off formations from universities after government policy in 1998 removed university ownership of intellectual property rights. However, (OECD, 2003; Ismail, 2007) definitions of spin-off would mean:

(a) Any new firm which include a public sector or university employee as a founder.

(b) Any new firm which licenses technology from a university or public research institute.

(c) New firms in which a university or national laboratory has made an equity investment.

Spin-off can otherwise be categorized into two;

Early stage

In the early stage, the company is entering a *relationship agreement* with the university where it is in a developmental stage towards becoming “ready for business”. At this stage, the companies may be pursuing collaborative partnerships, financing, technology development, a management team and appropriate facilities.

Active company

In an active company, it has acquired private or rental space for its operations where one or both criteria have been met, such as: (a) A management team in place; (b) Financing or sustainable revenue system in place.

Another definition of spin-off by Elizabeth (2000) in

Ismail (2007) emphasized that a spin-off is a new company that is formed:

- (a) By individual who were former employees of the parent organization.
- (b) A core technology that is transferred from the parent organization.
- (c) Spin-off is one important mechanism for technology transfer where it is typically founded around the core technological innovation which was initially developed at the parent organization.

Factors that influence spin-off formation or licensing to established company

Government policies

Government directly influence all components of national innovation system where they set the fiscal, monetary and trade policies that have an indirect influence on the system within which innovation operates. Li and Morgan (2010) examined the term institution as been interpreted from a variety of perspectives and North (1990) views it as rules of the game in a society, or more formally the human devised constraint that shape human interaction. He considers institutional rules as been a very complicated process whereas formal rules could change overnight as the right of political or judicial decisions, informal constrains embodied in customs, traditions, and codes of conduct are much more impervious to deliberate policies. (Li and Morgan, 2010; Campbell, 2004) tried to explain the meaning of the term institutional change by emphasizing that it is an uneven process where change in one dimension may lag change in another. They go further to propose that multi-dimensions, such as regulative, normative and cultural-cognitive dimensions should be considered together in order to better understand and evaluate what pattern of institutional change has occurred. Government influence can be done through the funding support of research institutions and industry policies aimed at specific industry groups. Li and Morgan (2010) further argued that institutional change encompass governmental regulative initiatives that have affected commercialization of university research and particularly concomitant changes in individual universities. Table 1 lists the actions government takes to support institutions.

Motivation

Ismail et al. (2008) identified that the presence of champions are the most significant factor when establishing a new venture. They consider champions to be investors, entrepreneurs, or inventors who were found to have played a significant role in the exploitation of research output in universities through the creation of a new

company or sale of an idea to an existing firm (Shane and Venkataraman, 2000; Ismail et al., 2008). They go further to report that non-psychological factors that influence them towards the formation of entrepreneurial ventures are educational background, family background, and work and professional experience.

Networking

Networking is important for both routes of commercialization. Inventors together with RMC and ICC networking with the external and internal worlds are important in their effort towards the route to commercialization. Networking can be referred to as: (1) networking with industries; (2) networking with private investors' potential customers; (3) networking with parent organization that support early coaching of a business venture up to seed funding stage.

Inventors that have a strong informal networking with industry normally end up licensing their technologies to established companies, and on the other hand, inventors who do not have strong networks tend towards creating spin-offs to commercialize their patents (Ismail, 2007). Studies in the past identified that industrial contacts enhance universities ability to license particular technologies to established companies (Audretsch et al., 2006; Ismail, 2007). A particular study by Colyvas et al. (2002) also finds that only one out of eleven patents that was not exploited was solely a result of lack of contacts with industry members by the academic inventor.

Geographic locations

Previous researchers like DiGregorio and Shane (2003) argue that the geographic location of academic institutions influences spin-off activities because some economic, legal and cultural environments are more supportive of spin-offs than others.

Scott (2005) believe that there is a positive influence of the geographic location on spin-off activities and provides evidence to this environmental influences as being focusing on access to capital, locus of property rights, rigidity of the academic labor market and the industrial composition of the area.

METHODOLOGY

This study adopted a semi-structured open-ended qualitative approach to interviewing respondents; this is to ensure that participants open up their mind on issues to be discussed during the interview. This method was adopted because authors have previously condemned the closed ended approach to interview as it limits the respondent's responses to a predetermined set of answers (Kelinger, 1964; Sandberg et al., 1988). Hence, a case based research strategy using a qualitative approach to data collection was involved. The researchers considered 4 faculties with a total of 25 departments, and from the list of sample frame obtained from the Research Management Centre (RMC), the list

Table 1. Government action to support institutions.

Institutions	Direct policies	Examples
Research institutions	Direct funding	Budget funding
	Establishment of specialized institutions to focus on particular technical area	Competitive research grant scheme
Firms	R&D promotion policies	R&D tax concessions
	Technology attractions	Direct incentives
Support services	Regulatory systems	IP information packages
	Registration systems	Innovation fund Investment fund

Source: (Ismail et al., 2008)

contain names of academic inventors who have registered a total of 89 inventions with RMC to date. Majority of these innovators are PHD holders and Professors. Of the total filed inventions, only 7 of the inventors agreed to partake in our survey. This method is most preferred in order to ensure a deeper insights into phenomena that influence the decision making process of commercializing university patent in Universiti Teknologi Malaysia.

These cases were divided into two sub categories: patent exploited through spin-off companies and patent licensed to established companies. The interviews were conducted with three main groups involved in the whole exercise of commercialization, the protocol with each respondent lasted between 1 to 1.5 h on the average. To conceal the true identity of the interviewees we assign a pseudonym in this paper. The first interview was conducted with 2 top management officials of RMC responsible for evaluation and disbursement of funds to have an understanding of RMC's role in the commercialization process. The second group were 2 directors of ICC in charge of innovation and commercialization, because they are key to the decision making process of the commercialization of university patents. The last groups interviewed are 7 inventors who agreed to participate in our survey and have patented technologies.

The data were transcribed and content analysis method used in analyzing the data. Further analysis was made through a case by case and cross case basis as proposed by Eisenhardt (1989). These participants were orally interviewed with an already prepared list of interview schedule and the responses tape recorded, data were transcribed and the findings discussed. The researcher made use of case by case analysis which typically involve detailed case study write up for every case. Eisenhardt (1989) notify further that case by case analysis often involve pure description to help researchers to have an insight of the early analysis process. Beside, in case by case analysis, each of the cases is compared within its own group.

FINDINGS AND DISCUSSION

Type of innovations

Academic Inventor A: Membrane base technology.

Academic Inventor B: Biotechnology (molecular enzymology and molecular genetics).

Academic Inventor C: ultrasound wave process and oil base process.

Academic Inventor D: Thin film composite membrane.

Academic Inventor E: Marine technology majoring in ship

design (has 2 inventions, government project which is confidential and another product boat design).

Academic Inventor F: Product and project design.

Academic Inventor G: A chemical formulation (electroplating).

After analyzing the result of the interview, the result from findings were summarized and grouped under the following five themes for easy understanding. Because of the voluminous and detailed report recorded and transcribed it could not be presented in this paper in such a manner. However, discussions under these headings answer the objectives for which the research was carried out.

Funding for research and spin-off company

Patents that are developed from the research undertaken with industry funding are more likely to be exploited through both spin-off and licensing to established companies (Robert and Malone, 1996; Powers and McDougall, 2005; Ismail, 2007). A good networking between the industry, inventor and innovation and commercialization centre will likely increase the chances that the research output will quickly be commercialized. The study identified that the inventor is an important factor to gain sources of funding and motivate them to commercialize their patent. Two of the patents were licensed to established companies while two was licensed to spin-off companies, three inventions are yet to be commercialized but still at the patent pending stage, all the seven inventions are based on industrial and government funding.

The funding from government sources such as Ministry of Science, Technology and Innovation (MOSTI) and Science Fund, was a source of motivations which encouraged academic inventors from conducting more research. As for industrial funding it is released as a contract terms for spin-off companies to carry out its technology development.

The willingness of venture capital companies to fund spin-off companies is very crucial and depends on initial support from government to research and development. Academic entrepreneurs confessed that although government played a significant role in providing initial funding for research which led to the actual innovation, the need for venture capital financing to provide follow on funding and support working and expansion capital is more important (Ismail et al., 2011a, b).

Motivation and opportunity recognition

In order for a patent to be commercialized, the inventor plays a very crucial role in identifying the opportunity to commercialize the patent. This is specifically important for inventors setting up Spin-off Companies. The inventors desire to see that their invention is transformed into products used by the public was an important motivating factor for majority of the inventions.

The inventor is more motivated to see that their invention is commercialized through established companies rather than through spin-offs. This is as was reported that, academic entrepreneurs do not have the guts to take up challenges involved in managing a new venture. They confessed that since they are not trained to be business managers and most of them are currently not interested in quitting their job as lecturers and researchers as they are holding comfortable positions in the university, they prefer to license their patents to established companies who have what it takes to develop the products.

Marketing strategy, management strategy and inventor involvement

A good marketing and management system will lead to the success of the commercialization of the patents. Inventor involvement in the marketing strategies leads to higher chances for the patents to be commercialized. Inventors possess more knowledge of the patent and are able to identify suitable investors who can adopt the patent. Inventors who have informal ties with industries are more likely to have their inventions quickly exploited. Early participation of inventors in recognizing potential licensees increase the speed at which inventions enter the market (Markman et al., 2005).

Inventor's commitment in the development of the research is important to enable the patent to be commercialized. With the possession of good management skills and a good team, it enables the inventor to commercialize their patents into the market.

The rewards and university culture

In the research, most inventors indicate that their commercialization activity and the forming of spin-offs are

driven by the hope to see their inventions being commercialized and be of benefit to the society rather than monetary rewards. Although, some of the academic entrepreneurs reported that monetary gains is not their main aim of creating innovative products, a few of those interviewed accepted the fact that monetary benefits is one of the significant reason they developed their inventions and preferred to license to established companies as a way of securing a regular and uninterrupted flow of returns in form of royalties.

Business culture and academic culture is different. Inventors who are also lecturers in the university feel that they are not trained for business. They said they are trained to be teachers and researchers and not as entrepreneurs (Gcuna and Nesta, 2006). The thought of quitting the academic profession once they are involved as full time managers in their start ups company brings fear to them. Therefore, they are not likely to be involved in spin-off businesses. Other alternatives to commercialization such as consulting, sponsored research, research funding and their students working in the companies are thought to be more important and appropriate (Ismail, 2007).

The role and capabilities of ICC and RMC

Innovation and commercialization centre, and research management centre play a very significant role in identifying commercialization potentials and opportunity for patents. ICC take the initiative to commercialize patents where the inventor did not indicate an interest in commercializing their patent. Lowe (2003) suggested that in a university there are technology originators and technology harvesters. The ICC and RMC in this study are also considered as technology harvesters, because they recognize opportunities and work on them (Lockett et al., 2003; Ismail, 2007). However, this study is not consistent with the above suggestion. Since the role of ICC and RMC is marginal in this study.

The ICC possesses knowledge and skills in negotiation of contract agreements. However, they lack resources to commercialize all patents in their disposal. ICC has limited knowledge compared to a wide field of research in the university. Hence, the inventor also plays a role in identifying the niche market even before ICC can take further action. This study finds that Inventors who licensed their patent to establish companies were found to have minor involvement from ICC. The search for market opportunities and product commercialization were carried out by the technopreneurs and the established companies.

Patent that was licensed to spin-offs in 1995 did not receive support from ICC because during that period, innovation and commercialization centre of the university was yet to be fully set up. They only played a part in the initial stage of setting up the company. It was however, suggested that ICC does not give priority to licensing

Table 2. Breakdown of inventions.

Faculty	Inventions	Licensed company	Patent pending
Chemical engineering	33	1	3
Science	20	0	0
Mechanical	10	2	0
Electrical	12	1	0
Total	75	4	3

inventions to established companies or spin-off companies. What they are more concerned with is that the patent should be commercialized into the market.

Research problems faced by academic inventors

Despite the enormous resources committed by the university (UTM), Malaysian government through the Ministry of Science, Technology and Innovation (MOSTI) and the various quasi-government agencies such as Malaysian Technology Development Corporation (MTDC), Malaysian Biotechnology Corporation (BIOCORP), Multimedia Development Corporation (MDEC) and a host of other supporting agencies. The academic entrepreneurs still face an array of problems in innovating more products, commercializing existing patents and growing licensed companies. The major problems faced as exposed from findings of the study are; inadequate funding for research and development, inadequate support for commercialization of filed innovations, marketing and distribution problems, problems to develop proposal to complete the research for commercialization, problems to develop proposal for product development, prototyping and demonstration plan, too busy schedules for academic inventors, inadequate skilled workers, inadequate business professionals such as marketers, salesmen, accountants and so on, access to required equipment and laboratory materials, problems faced with repeated experiments before suitable results are achieved, advertising and sales promotion, lack of proper training for team members and other workers, problem of convincing people to buy into the concept, the problems are endless.

CONCLUSION AND CONTRIBUTION TO RESEARCH

This study provides more in sight to the decision making process of commercialization of university patents and exposed the main actors involved in this exercise; the real life situational problems encountered by academic inventors/technology entrepreneurs. The study further expanded the knowledge on the commercialization process of university patents in previous literature. It provides evidences that the decision making processes to commercialize patents are very complex and cumbersome involving several participants, it is also time consuming.

LIMITATIONS OF THE STUDY

Although, this study provides a view of the decision making process in the commercialization of university patents. However, it is not without a few limitations. First, the study was carried out as a case study in one university, and not all faculties are covered, this may affect its generalizability. Second, the limited sample used may provide an unknown sample bias. The study involves an in-depth interview of inventors and key officials of the university in question. Majority of the inventors were not willing to participate in the interview due to their very busy schedule as lecturers, researchers, consultants and new venture managers. Hence, the data will be limited to 4 faculties (25 departments) and those who were interviewed were not randomly selected. These limitations notwithstanding, the findings were very revealing and could in other words be generalized (Table 2).

IMPLICATIONS FOR INTEREST PARTIES AND FURTHER RESEARCH

As a result of the daunting nature of responsibility academic entrepreneurs face in their work place, such as teaching various subjects at various levels (undergraduate and master degree students), researching, consulting, supervision of Post graduate research students (PHD's), writing research articles for publication, holding administrative positions (Head of Department, Dean of Faculty, Director of Studies, Hostel coordinators), working in government committees and as well trying to innovate and manage spin-off ventures. Government could consider reducing the roles of academics that have registered and commercialized their inventions so that they could concentrate more on managing the venture to success and further work on designing new products in the future. Government is also advised to provide adequate funding to enable technopreneurs fund more research and commercialize research products, moreover, encouragement of venture capital investors and other form of equity financiers are required to provide follow-on investment either at the early or late stages of new venture development. Venture capitalists too could also be encouraged to support research and development in the universities. It would be of immense benefit for future authors to carry out study involving

multiple cases from several universities. Future study could also consider patents that have not been exploited rather than being limited to commercialized patents.

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