UNIVERSITI TEKNIKAL MALAYSIA MELAKA

IMPLEMENTATION OF KAP IN TECHNOLOGY TRANSFER AND COMMERCIALIZATION

This report is submitted in accordance with the requirement of Universiti Teknikal
Malaysia Melaka (UTeM) for Bachelor Degree of Manufacturing Engineering

by

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ii

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I hereby, declared that this report entitled "Implementation of KAP in Technology Transfer and Commercialization" is the results of my own research except as cited in reference.

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of Universiti Teknikal Malaysia Melaka as a partial fulfilment of the requirement for Degree of Manufacturing Engineering (Hons). The member of the supervisory committee are as follow:

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(Principal Supervisor)

IV

ABSTRAK

Untuk terjadinya inovasi, model inovasi *"Triple Helix"* menunjukkan bahawa terdapat hubungan di antara tiga pelaku utama iaitu kerajaan, universiti, dan industri. Salah satu jenis interaksi yang sering berlaku di antara universiti dan industri adalah pemindahan teknologi. Di Malaysia, pemindahan teknologi merupakan salah satu daripada tumpuan utama universiti awam yang membawa kepada penubuhan Pejabat Pemindahan Teknologi (TTO) di semua institusi pengajian awam tinggi untuk meningkatkan bilangan penyelidikan yang dikomersilkan di pasaran melalui pemindahan teknologi. Walau bagaimanapun, laporan daripada beberapa universiti awam tempatan menunjukkan sebaliknya. Kajian ini bertujuan untuk mengenal pasti faktor-faktor bukan teknikal yang mempengaruhi penyelidik universiti secara individu yang menyebabkan jumlah pengkomersilan penyelidikan yang rendah. Untuk mengkaji faktor bukan teknikal ini, kaji selidik KAP digunakan. Kajian KAP mengukur pengetahuan, sikap, dan amalan individu dalam isu tertentu. Individu yang terlibat dalam kaji selidik ini ada pascasiswazah (50%) dan penyelidik (50%) di universiti – university yang terpilih. Keputusan yang diperoleh dari kaji selidik KAP menunjukkan bahawa markah KAP yang diperoleh pascasiswazah dan penyelidik di Malaysia masih mempunyai banyak ruang untuk penambahbaikan dengan markah pengetahuan pada 54.90%, sikap pada 51.31%, dan amalan pada 51.96%. Rangka kerja baru dicadangkan pada akhir kajian ini untuk mengatasi isu ini dalam jangka masa panjang.

i

ABSTRACT

For innovation to occur, the Triple Helix model of innovation shows that there must be a relationship between the three main actors which are government, university, and industry. One of the most common type of interaction that occurs between the university and industry is technology transfer. In Malaysia, technology transfer has always been one of the focus for the public universities which led to the establishment of Technology Transfer Offices (TTOs) in all the institution to boost the number of research to be commercialized in the market through technology transfer. However, reports from some of the local public universities indicate otherwise. This study is to identify the non-technological factors affecting the university researchers individually which led to the low number of research being commercialized. To study the non-technological factors, KAP surveys are used. KAP surveys measures the knowledge, attitude, and practice of individuals on a certain issue. The respondents of the survey are postgraduates (50%) and researchers (50%) from selected universities. Results derived from the KAP survey shows that the KAP scores for postgraduates and researchers in Malaysia still has a lot of room for improvements with the score of knowledge at 54.90%, attitude at 51.31%, and practice at 51.96%. A new framework is proposed at the end of this study to overcome this issue in the long run.

DEDICATION

To my beloved family and friends,

Especially my family,

Thank you for all the moral support, encouragement, resources and prayers,

This is for all of you.

III

ACKNOWLEDGEMENT

I wish to express my sincere gratitude to my friends and family that have stood beside me through thick and thin up until the completion of this study. It has been a rough journey but your presence made it bearable till the end.

I also would like to sincerely thank my supervisor for this study, Professor Ir. Dr. Sivarao Subramonian for his time and wisdom shared throughout this study. Because of him I have a deeper knowledge on conducting researches properly as well as a sense of respect to the researcher community and their efforts in pushing the boundaries of innovation. Also because of him I was always motivated to perform better in this study and challenge myself.

Last but not least, I would like to thank my classmates from BMFG-3/1 that has journeyed together with me in the completion of this study and helped me in areas that I am lacking.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

TTO   -   Technology Transfer Office

KAP   -   Knowledge, Attitude, and Practice

RU   -   Research universities

GCI   -   Global Competitiveness Index

WHO   -   World Health Organization

CHAPTER 1

INTRODUCTION

1.1 Background of Study

The subject of technology transfer and research commercialization in universities is a broad topic to talk about. It includes a wide range of activities such as collaborative research, consultation services, licensing of technology, advanced training and exchange of research staff, and other forms of information exchange both formal and informal. With the universities currently undertaking a new set of roles in terms of technology transfer, more studies have been made to identify the factors that affects the rate of technology transfer and commercialization among the universities and how the collaboration between university and technology can be strengthened.

It is a known fact that the collaboration between university and industry are the ones pushing the boundaries of innovation in any country (Safiullin, Fatkhiev, & Grigorian, 2014). Because of this, the concept of technology transfer has been the focus of governments everywhere since it contributes to the development of a country's economy. Many theories and models have been proposed to further understand how this concept works with one of the most famous model being the Triple Helix model devised by Etzkowitz & Leydesdorff (1998). The triple helix model symbolizes the union between the three actors in innovation for any countries which are government, university, and industry.

Before the triple helix model exists, the model commonly used to represent the scene for technology transfer and commercialization was the double helix model. The double helix explains how the universities interconnect with the public authorities and entrepreneurs using its old traditional values. With the roles of the university starting to change, the triple helix model steps in and the three individual actors in the previous model are now interconnected with the other two. Other than the interconnection between the three actors, the triple helix model can also be defined as the interaction that the universities went through

1

at every stage in the innovation process. The innovation process starts from the conceptualization of the idea up until a finished product is made.

As for Malaysia, the triple helix model has undergone a transition process to adapt with the local environment. This change is the transition of the model from a phase where the government had absolute authority over the other actors in the model to a phase where each actor operates on its own distinctively and are able to assume the roles of one another when needed (Etzkowitz, 2003: 302). As for evidence for entrepreneurial behaviour in the local universities, there have been establishment of technology transfer offices (TTOs). The aim of TTOs are to help the universities with the commercialization process of their academics researches as well as generate external income to help build up the internals of the institutions.

In the local scene, it has been the governments interest to encourage the universities to be more entrepreneurial in their researches. Evidence of this are the change of policy and increased amount of funding for the public universities (Razak & Saad, 2007; Amran et al, 2014). In this aspect, the universities are encouraged to form more strategic collaborations in terms of technology transfer and commercialization. Globally, the trend shows that the funds given out by each country for their universities have been gradually decreasing, however that is not the case here in Malaysia. From the year 2006 until 2011, statistic shows that the funds given out by the government to the universities have been increasing steadily (Amran et al, 2014). Figure 1.1 shows the Malaysian ranking in the Global Competitiveness Index (GCI) for Innovation.

Country/Economy	INNOVATION AND SOPHISTICATION FACTORS		PILLARS			
			11. Business sophistication		12. Innovation	
	Rank	Score	Rank	Score	Rank	Score
Libya	102	3.16	101	3.51	100	2.82
Lithuania	49	3.87	49	4.39	55	3.35
Luxembourg	24	4.51	25	4.87	23	4.15
Macedonia, FYR	105	3.16	107	3.45	99	2.86
Madagascar	97	3.22	102	3.49	87	2.96
Malawi	101	3.20	104	3.46	94	2.93
Malaysia	23	4.63	22	4.99	22	4.28

Country/Economy	INNOVATION AND SOPHISTICATION FACTORS		PILLARS			
			11. Business sophistication		12. Innovation	
	Rank	Score	Rank	Score	Rank	Score
Latvia	58	3.71	58	4.06	64	3.36
Lebanon	52	3.79	50	4.18	58	3.40
Lesotho	112	3.22	110	3.50	111	2.95
Liberia	91	3.42	90	3.67	91	3.16
Lithuania	43	4.01	42	4.28	39	3.75
Luxembourg	16	5.07	15	5.21	16	4.93
Macedonia, FYR	84	3.64	75	3.83	51	3.44
Madagascar	114	3.21	120	3.32	97	3.11
Malawi	121	3.05	122	3.28	120	2.81
Malaysia	20	4.94	20	5.16	22	4.72

Figure 1.1: GCI Ranking for Innovation 2008-2009 (left) and 2016-2017 (right) (Global Competitiveness Index Report)

2

Figure 1.1 shows that since 2008 up until 2017, Malaysian's ranking for innovation have remained at 22 with a score increase of 0.44 in that duration. This shows that innovation in Malaysia have remained stagnant and not much improvements have been made. One of the ways to spark innovation is through technology transfer and commercialization. Even though the funding for research universities in Malaysia have been increasing steadily from 2006 until 2011, the ranking in the GCI have not changed that much. This shows that technology transfers and commercialization are not happening in the universities.

1.2   Problem Statement

With various efforts made by the government, the rate of technology transfer and commercialization among the public universities still remains unchanged. Statistic shows that from the year 2006-2011 the funding given out by the government for the research universities in Malaysia have been increasing steadily unlike other countries (Amran et al, 2014). The efforts made by the government does not tally with the results produced in the technology transfer and commercialization department. Some have pointed out that the problem lies in the policy made by the government. The roles set by the government for both the university and industry are still unclear, some have even suggested that TTOs are not functioning as well as they are supposed to and that their roles should be made clearer (Razak & Saad, 2007).

Even though intensive studies have been made regarding the roles of TTOs, the true roles that should be undertaken by these offices remains unclear for both the university and government. The TTOs are not equipped with a proper framework of policy and sufficient numbers of manpower that are credible enough to run the office. Instead of becoming the pioneer in pushing the limits of technology transfer and commercialization in individual universities, TTOs have sometimes become a bottleneck in the whole process and became a reason in discouraging the researchers from making the effort to commercialize their research or collaborating with the industries.

An example of this issue can be seen in the case of Universiti Teknologi Malaysia (UTM). Established in 1972, the university have a number of world class laboratories. Some examples of these world class laboratories are Chemical Engineering Pilot Plant, Marine Lab Institute of High Voltage which are used to conduct high level of research and development

3

efforts while improving their capability in other various scientific fields such as nanotechnology, biotechnology, and advanced electronics. With fundings given to UTM at the time amounting to RM86 million and RM130 million for the 7th and 8th Malaysia Plans respectively, only 724 number of research projects are carried out. Upon closer inspection, from those number only 34 are filed for patents, 1 intellectual property granted, and only 2 projects achieving a fully commercialized status. Even then, both projects are said not to meet up with the expectations of the university (Rasli, n.d).

A possible reason for this is due to the tendency of the university to hold on to its old traditional values whereby priority is given in the development of their curriculums within the university which causes them to lose focus on their responsibility to interact with the industries and engage themselves on research efforts. According to Mazurkiewicz & Poteralska (2017), the barriers related to technology transfer and commercialization in university can be segregated into three categories which are organizational-economic barriers, technical barriers, and system barriers. In Malaysia, Razak & Saad (2007) have segregated the identified barriers into seven categories which are technological factors, policies, procedures and processes within universities, commercialization issues, work culture, intellectual property (IP) issues, government policies, and interaction issues between university and industry.

When viewed from a broader perspective, all the factors which hinders the technology transfer within universities as suggested by the academicians can be considered as technological factors. Malairaja (2003) claimed that universities in Malaysia have good, credible and capable researchers. However, the industries seem to think otherwise than the claims made. According to a representative of the industry, one of the biggest factors that discourages the industry from making collaborations with the university is the attitude of the researchers and their work culture. The researchers are inflexible and are unable to adapt to changes (Razak & Saad, 2007). To confirm this as a fact have proven to be difficult since no studies have been made on the subject matter.

4

1.3 Objectives

The aim of this study is to implement the concept of KAP in measuring the non-technological factors associated with technology transfer and commercialization among postgraduates and researchers in Malaysian universities. More specifically it aims to:

    (i)   Study the KAP contribution on technology transfer and commercialization.

    (ii)   Analyse the input from the KAP results.

    (iii)   Propose a framework according to the KAP results.

1.4 Scope

This study focuses on assessing the feedbacks of the students and researchers regarding technology transfer and commercialization in selected universities. The assessment will be made using a set of questionnaires. The attributes that will be assessed in the questionnaire are knowledge, attitude, and practice towards technology transfer and commercialization. The data collected will be separated for both postgraduates and researchers to show the difference between both groups

1.5 Significance of Study

The findings of this study will be to reduce the gap between the collaboration of university and industry. With the importance of roles taken by the universities as one of the key actors within the Triple Helix model for innovation have been established and agreed by the government, the need to expand on the knowledge regarding non-technological factors affecting technology transfer and commercialization grows. Once identified, these factors can be tackled individually by the institutions and further study and improvement can be made on each of the factors. Other than identification of the factors, the framework proposed will serve as a guideline for the university, industry and government in encouraging more

will serve as a guideline for the university, industry and government in encouraging more collaborations in the future which aids the economic growth of a country and pushing the boundary of innovations. The framework proposed in the end of this study will also serve as a base framework for further improvements and reference.

1.6   Thesis Outlines

For Chapter 1, it contains the discussion regarding the background for this study followed by a checklist of objective which will be fulfilled throughout this study. This chapter also includes a scope to narrow down the area of study. Significance of this study is also presented in this chapter.

In Chapter 2, the basic theories which covers this study as well as past findings are presented. Information regarding the current scene surrounding technology transfer and commercialization are also here. In this chapter as well, the introduction to KAP and how it can benefit and implemented into this study are presented.

In Chapter 3, the methodology for the whole study which covers the preliminary phase or information gathering up until the formation of the KAP survey, data collection and proposal of a new university-industry collaboration model with implementation of the data from the KAP are described.

Chapter 4 will present the raw data collected from the postgraduates and researchers in selected universities together with the analysis of the data which includes statistical analysis to measure the reliability of the data and KAP analysis to create an overview of the results. Finally, the findings will be interpreted and used to construct a new framework relative to the Triple Helix model of innovation.

For Chapter 5, this chapter will summarize the findings of this study into one conclusion and a recommendation to further improve this study and it's results in the future.

CHAPTER 2
LITERATURE REVIEW

This chapter is organized into three separate section. Each section will describe the three fundamental elements that will be focused throughout this study. The first section will explain the roles that are currently played by the university in the modern society and how it affects the technology transfer between both the university and industry. The second section will cover the results and findings regarding the barriers and efforts made in technology transfer and commercialization alongside the triple helix model. The third section will explain a study method known as KAP (knowledge, attitude, practice) and how it can be implemented into this study. The content of this chapter is possible after reviewing many of the major works related within the field of focus and have been structured to easily understand the concept of this study.

2.1   Roles of University in Society

In the past few decades, the roles undertaken by the university have taken a drastic change. Gunasekara (2004) once described universities as "ivory tower" which focuses only on traditional academic teachings which excludes any relationship with the socio-economic factors. However, Sharma et al. (2006) referred universities as an institution which serves as a powerful drive for innovation for a country especially in science and technology as well as other creative disciplines.

2.1.1 The Need for University

According to De la Fuente (2010), the major issues that is currently faced by the world would not be resolved by itself without the participation of the university since they not only foster knowledge, research and thought in society but instead, the are also the one which foster proposals for social actions. Today, the roles of university are re-defining the two roles traditionally undertaken by them alongside with the industry and government (Etzkowitz & Lesdesdorff, 1997; Gunasekara, 2006).

According to Pavel & Alina (2014), one of the role fulfilled by academic education is to form an elite group which could impact the society wherever they are by bringing innovations through cultural experiences (cultural personalities gathered during education) rather than just showing off knowledge judgement. When correctly applied, this will lead to the creation of a new approach to handle an issue which at the end may produce more questions and uncertainties which once cleared, can be adapted slowly by the society. However in all of this, it must also be remembered that the university also have its own needs. One of the needs is the need for recognition to enable them to have the required credibility to transfer a result from their research to an industry or individual. Universities need to be recognized by the local government for them to be able to foster this practice.

Other than the industry and society, the roles of universities also affect individuals. One of the famous question asked is if individual changes by the university can really make a difference to the society around. It has been recognized that the universities are a crucial institution which covers both educational and social aspect. They play a twofold role in society today which are to stand apart from the society to hold the universal values, be the critics among society, and contribute to the scientific, social, technological, economical, political, and cultural development in society and individual. Another meaning for higher education is a social-forming component which is compulsory to help individuals live together and build a society. According to Mulvihill et al. (2011), universities internationally needs to be more aggressive to show the work that they have done to tackle the complex social issues while partnering with the local communities.

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