THE FACTORS TO IMPROVE COMMERCIALIZATION RATE: A CASE STUDY IN UNIVERSITI TEKNOLOGI MALAYSIA (UTM)

TAYEBEH KHADEMI

A dissertation submitted in partial fulfillment of the requirements for the award of degree of Master of Management (Technology)

Faculty of Management
Universiti Teknologi Malaysia

MARCH 2013
DEDICATION

This dissertation is dedicated to my mother and father, whose love, understanding, and patience provided tremendous support and encouragement to me throughout the period of my master study.
ACKNOWLEDGEMENT

As the author of the thesis, I would like to thank to all the people for the contribution for me to complete this research successfully.

Firstly, I would like to thank my supervisor, Assoc. Prof. Dr. Kamariah Ismail, for her guidance and support throughout this study. Without her support this dissertation would not have been possible. I appreciate all my lecturers and the staff of Faculty of Management, University Technology Malaysia.

I would like to thank all those respondents from University Technology Malaysia. Very big thanks for the cooperative participations for the interview and providing valuable information.

Finally, my utmost gratitude goes to my dear friends Maryam and Nader for their generous guidance and helps. The learning experience with all of you will always be in my memory.
The aim of this study was to improve the commercialization rate in Universiti Teknologi Malaysia (UTM), for achieving this goal variety factors and issues were examined to identify how they effect on the procedure of university commercialization. These factors include role of technology transfer office /center, availability of finance, availability of potential licensee and entrepreneurial orientation (EO) among university researcher. Among these four factors, this study focused more on the entrepreneurial orientation (EO) among academic researchers and its effect on the commercialization rate in UTM. This study was based on a qualitative research method and was designed to use a case study approach. For investigating the factors and issues in this study, a total of ten face-to-face interview was conducted. The respondents were chosen from inventors, researchers, academic entrepreneurs, and Technology Transfer Office staff in 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, the must critical factor was availability of finance. This study also addressed the implications and recommendation for research and practitioners.
ABSTRAK

# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DECLARATION</td>
<td></td>
<td>ii</td>
</tr>
<tr>
<td>DEDICATION</td>
<td></td>
<td>iii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td></td>
<td>iv</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td></td>
<td>v</td>
</tr>
<tr>
<td>ABSTRAK</td>
<td></td>
<td>vi</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td></td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td></td>
<td>xiv</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td></td>
<td>xvi</td>
</tr>
<tr>
<td>LIST OF ACRONYMS AND ABBREVIATIONS</td>
<td></td>
<td>xvii</td>
</tr>
<tr>
<td>LIST OF APPENDICES</td>
<td></td>
<td>xx</td>
</tr>
</tbody>
</table>

1 INTRODUCTION

1.1 Introduction 1

1.2 Research Background 2

1.2.1 Background of UniversitiTeknologi Malaysia 5

1.3 Statement of Problem 7

1.4 Research Questions 9

1.5 Research Objectives 9

1.6 Scope of study 10

1.7 Importance of Research 10
2 LITERATURE REVIEW

2.1 Overview of Literature Review 13

2.2 Definitions of Commercialization/Technology Transfer 13

2.3 Stages and Processes of University Research Commercialization 15

2.3.1 Success Factor of University Commercialization/Technology Transfer 21

2.3.1.1 Researchers’ perception 21

2.3.1.2 Time 22

2.3.1.3 Entrepreneurial Team 23

2.3.1.4 Networking 24

2.3.1.5 Funding 25

2.3.1.6 Technology Stage 26

2.3.2 Barriers to University Commercialization 27

2.4 Licensing 30

2.5 University Spin-Offs 32

2.6 Overview of University Research Commercialization in Malaysia 34

2.6.1 Processes and Results of University Commercialization in Malaysia 35

2.6.2 Problems of Commercialization in Malaysia 36

2.6.3 Support for Commercialization in Malaysia 37

2.6.4 Venture Capital in Malaysia 40

2.7 General Introduction of Universiti Teknologi
Malaysia (UTM)

2.7.1 Strategic Orientation for Research, Development and commercialization

2.7.2 The structure to Drive Research and Development

2.7.3 The structure to Drive Commercialization

2.8 Factors Affecting University Research Commercialization

2.8.1 Role of Technology Transfer Offices/ Center of University

2.8.2 Availability of finance

2.8.3 Availability of potential licensee

2.8.4 Entrepreneurial Orientation (EO) among Academic Entrepreneur

2.8.4.1 Dimensions of Entrepreneurial Orientation (EO)

2.8.4.1.1 Innovativeness

2.8.4.1.2 Proactiveness

2.8.4.1.3 Risk-taking

2.8.4.1.4 Autonomy

2.8.4.1.5 Competitiveness

2.8.4.2 Entrepreneurial Orientation - Environment

2.8.4.3 Entrepreneurial Orientation - Performance

2.8.4.4 Stevenson’s Entrepreneurial Management Model
3 RESEARCH METHODOLOGY

3.1 Introduction 66
3.2 Research Process 66
3.3 Research Questions and Strategies 68
3.4 Research Method 68
3.5 Case Studies 70
3.6 Research Design 71
3.7 Sampling and Unit of Analysis 72
3.8 Data Collection Methods 73
  3.8.1 Interview as a technique for data collections 73
  3.8.2 Actual Interview 74
3.9 Methods of Data Analysis 76
3.10 Reliability 77
3.11 Validity 78
3.12 Conclusion 78

4 ANALYSIS AND FINDINGS

4.1 Introduction 79
4.2 Background of Respondents and Information for Inventions 80
4.3 Factors Affecting University Research Commercialization 84
  4.3.1 Role of Technology Transfer Offices/Center of University 84
    4.3.1.1 The General Patenting Process at UniversitiTechnologi Malaysia 91
4.3.2 Availability of Finance 92
4.3.2.1 Research Funding 92
4.3.2.2 Commercialization Funding 95
4.3.2.3 Funding Limitation 102
4.3.2.4 Royalty Share 107
4.3.3 Availability of potential licensee 108
4.3.4 Entrepreneurial Orientation (EO) among Academic Researchers
   4.3.4.1 Innovativeness 118
   4.3.4.2 Proactiveness 123
   4.3.4.3 Risk-taking 129
   4.3.4.4 Autonomy 133
   4.3.4.5 Competitiveness 137
4.4 Summary of the Findings 143
4.5 Conclusion 144

5 DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS
5.1 Introduction 145
5.2 Discussion 145
   5.2.1 Summary on Findings from In-depth Interview 146
   5.2.2 Addressing the Aims and the Finding themes
      5.2.2.1 Role of Technology Transfer Offices/ Center of University 149
      5.2.2.2 Availability of Finance 150
      5.2.2.3 Availability of potential licensee 151
      5.2.2.4 Entrepreneurial Orientation (EO) among Academic Researchers
         5.2.2.4.1 Innovativeness 153
5.2.2.4.2 Proactiveness 154
5.2.2.4.3 Risk-taking 156
5.2.2.4.4 Autonomy 157
5.2.2.4.5 Competitiveness 158
5.2.3 Factors relating to the inventions 160
5.3 Conclusion 168
5.5 Recommendation to University 170
5.5 Limitation 170
5.6 Recommendation for Future Research 171

REFERENCES 172
APPENDICES 200
<table>
<thead>
<tr>
<th>TABLE NO.</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Problems associated with commercialization of research result Thailand</td>
<td>28</td>
</tr>
<tr>
<td>2.2</td>
<td>Government Financial Programs</td>
<td>37</td>
</tr>
<tr>
<td>2.3</td>
<td>Characteristics of technology and innovation financing schemes in Malaysia</td>
<td>39</td>
</tr>
<tr>
<td>2.4</td>
<td>Research Grant</td>
<td>44</td>
</tr>
<tr>
<td>2.5</td>
<td>Typologies of TTCs mapped and mission statement</td>
<td>47</td>
</tr>
<tr>
<td>2.6</td>
<td>TTOs’ views on factor impeding the creation of university spin-off companies</td>
<td>51</td>
</tr>
<tr>
<td>2.7</td>
<td>Sources of external finance for new and existing spin-offs, financial year 2002</td>
<td>52</td>
</tr>
<tr>
<td>2.8</td>
<td>Stevenson’s perspective on entrepreneurial management</td>
<td>63</td>
</tr>
<tr>
<td>3.1</td>
<td>Latest statistics on IPR UTM until September 15, 2011</td>
<td>73</td>
</tr>
<tr>
<td>3.2</td>
<td>Departments for inventors and unexploited Inventions</td>
<td>75</td>
</tr>
<tr>
<td>3.3</td>
<td>Departments for Inventors and Inventions that has been licensed</td>
<td>75</td>
</tr>
<tr>
<td>3.4</td>
<td>Departments for Inventor and Invention that start spin off companies</td>
<td>76</td>
</tr>
<tr>
<td>3.5</td>
<td>Departments for TTOs</td>
<td>76</td>
</tr>
<tr>
<td>Section</td>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>---------</td>
<td>------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>4.1</td>
<td>Respondent’s Background</td>
<td>82</td>
</tr>
<tr>
<td>4.2</td>
<td>Information for Inventions and Commercialization</td>
<td>83</td>
</tr>
<tr>
<td>4.3</td>
<td>Summary of the Findings</td>
<td>144</td>
</tr>
<tr>
<td>5.1</td>
<td>Four Major Themes</td>
<td>147</td>
</tr>
<tr>
<td>5.2</td>
<td>Factors relating to the Inventions and inventors (exploited through spin-off companies)</td>
<td>161</td>
</tr>
<tr>
<td>5.3</td>
<td>Factors relating to the Inventions (unexploited inventions and invention that exploited through licensing to established companies)</td>
<td>164</td>
</tr>
</tbody>
</table>
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURE NO.</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>How a technology is transferred from a university to a firm or entrepreneur</td>
<td>17</td>
</tr>
<tr>
<td>2.2</td>
<td>Project Review Process</td>
<td>18</td>
</tr>
<tr>
<td>2.3</td>
<td>The process of technology commercialization</td>
<td>19</td>
</tr>
<tr>
<td>2.4</td>
<td>The University model of research commercialization</td>
<td>20</td>
</tr>
<tr>
<td>2.5</td>
<td>The Process of University Technology Transfer (Rogers, E.M)</td>
<td>21</td>
</tr>
<tr>
<td>2.6</td>
<td>Model of emerging patterns in perception of feasibility</td>
<td>22</td>
</tr>
<tr>
<td>2.7</td>
<td>The spectrum of R&amp;D funding and commercialization in Malaysia</td>
<td>38</td>
</tr>
<tr>
<td>2.8</td>
<td>Main VC investments by stages in Malaysia</td>
<td>41</td>
</tr>
<tr>
<td>2.9</td>
<td>UTM’s Strategic Orientation for Research, Development and Commercialisation</td>
<td>42</td>
</tr>
<tr>
<td>2.10</td>
<td>The Conceptual Model</td>
<td>64</td>
</tr>
<tr>
<td>3.1</td>
<td>The research wheel</td>
<td>67</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Form</td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>AR</td>
<td>Academic Research</td>
<td></td>
</tr>
<tr>
<td>AUCC</td>
<td>Association of Universities and Colleges of Canada</td>
<td></td>
</tr>
<tr>
<td>AUTM</td>
<td>Association of University Technology Managers</td>
<td></td>
</tr>
<tr>
<td>EO</td>
<td>Entrepreneurial orientation</td>
<td></td>
</tr>
<tr>
<td>GERD</td>
<td>Gross Expenditure on R&amp;D</td>
<td></td>
</tr>
<tr>
<td>ICC</td>
<td>Innovation and Commercialization Centre</td>
<td></td>
</tr>
<tr>
<td>IP</td>
<td>Intellectual Property</td>
<td></td>
</tr>
<tr>
<td>IPR</td>
<td>Intellectual Property Rights</td>
<td></td>
</tr>
<tr>
<td>IRPA</td>
<td>Intensification of Research in Priority Areas</td>
<td></td>
</tr>
<tr>
<td>MASTIC</td>
<td>Malaysian Science and Technology Information Centre</td>
<td></td>
</tr>
<tr>
<td>MAVCAP</td>
<td>Malaysia Venture Capital</td>
<td></td>
</tr>
<tr>
<td>MOA</td>
<td>Ministry of Agriculture and Agro-Based Industry, Malaysia</td>
<td></td>
</tr>
<tr>
<td>MOHE</td>
<td>The Ministry of Higher Education, Malaysia</td>
<td></td>
</tr>
<tr>
<td>MOSTE</td>
<td>Ministry of Science, Technology and Environmental, Malaysia</td>
<td></td>
</tr>
<tr>
<td>MOSTI</td>
<td>Ministry of Science, Technology and Innovation, Malaysia</td>
<td></td>
</tr>
<tr>
<td>MP</td>
<td>Malaysia Plan</td>
<td></td>
</tr>
<tr>
<td>MPIB</td>
<td>Malaysian Pine Apple Industry Board</td>
<td></td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Form</td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>MTDC</td>
<td>Malaysian Technology Development Corporation</td>
<td></td>
</tr>
<tr>
<td>MyIPO</td>
<td>Intellectual Property Corporation of Malaysia</td>
<td></td>
</tr>
<tr>
<td>NIE</td>
<td>Newly Industrializing Economies</td>
<td></td>
</tr>
<tr>
<td>NIS</td>
<td>National Innovation System</td>
<td></td>
</tr>
<tr>
<td>NSDC</td>
<td>The National SME Development Council</td>
<td></td>
</tr>
<tr>
<td>OECD</td>
<td>The Organization for Economic Co-operation and Development</td>
<td></td>
</tr>
<tr>
<td>PMSEIC</td>
<td>Prime Minister's Science, Engineering and Innovation Council</td>
<td></td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
<td></td>
</tr>
<tr>
<td>R&amp;D&amp;C</td>
<td>Research, Development and Commercialization</td>
<td></td>
</tr>
<tr>
<td>RC</td>
<td>Research Commercialization</td>
<td></td>
</tr>
<tr>
<td>RM</td>
<td>Ringgit Malaysia</td>
<td></td>
</tr>
<tr>
<td>SME</td>
<td>Small and Medium Enterprise</td>
<td></td>
</tr>
<tr>
<td>SMI</td>
<td>Small and Medium Industry</td>
<td></td>
</tr>
<tr>
<td>TT</td>
<td>Technology Transfer</td>
<td></td>
</tr>
<tr>
<td>TTC</td>
<td>Technology Transfer Center</td>
<td></td>
</tr>
<tr>
<td>TTO</td>
<td>Technology Transfer Office</td>
<td></td>
</tr>
<tr>
<td>UCF</td>
<td>University Challenge Fund</td>
<td></td>
</tr>
<tr>
<td>USO</td>
<td>University Spin-Off</td>
<td></td>
</tr>
</tbody>
</table>
USPTO - United States Patent and Trademark Office
UTM - Universiti Teknologi Malaysia
VC - Venture Capital
# LIST OF APPENDICES

<table>
<thead>
<tr>
<th>APPENDIX</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>International Gross R&amp;D Expenditure (GERD)</td>
<td>200</td>
</tr>
<tr>
<td>B</td>
<td>University Research Commercialization until August 2008</td>
<td>201</td>
</tr>
<tr>
<td>C1</td>
<td>Top Ten Countries for Patent and Utility Innovation Applications, 2010</td>
<td>202</td>
</tr>
<tr>
<td>C2</td>
<td>Top Ten Countries for Patent and Certificates of Utility Innovation Granted, 2010</td>
<td>202</td>
</tr>
<tr>
<td>D</td>
<td>Mechanism of Commercialization in Malaysian Universities</td>
<td>203</td>
</tr>
<tr>
<td>E</td>
<td>Interview Questions</td>
<td>204</td>
</tr>
</tbody>
</table>
CHAPTER 1

INTRODUCTION

1.1 Introduction

Due to the significant role of regional development and knowledge based economy, universities are playing different roles in their communications with the business community while they transfer technology to the industry (McAdam et al., 2012). The commercialization of academic studies is treated to be as “the process in which ideas, knowledge, and innovations would be conveyed to tangible assets” (PMSEIC, 2001) including benefits that satisfy society and economy at large scale.

Nowadays studies on the university research commercialization and the 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 output in Malaysian universities and it would attempt to explore notable factors affecting commercialization process.

The current study is conducted at Universiti Teknologi Malaysia (UTM) as a case study, which is a leading university in Malaysia (Aziz et al., 2011). In this study
main motivation is to investigate university commercialization procedures acted in Universiti Teknologi Malaysia and to introduce the major players in the commercialization process at the University.

This chapter includes a background, problem statement, research questions, and also research objectives. Later issues such as the scope of the study and the importance of the study will be discussed.

1.2 Research Background

The university R&D output is an important source of significant technological innovations. According to Florida and Choen (1999), universities are known as talent promoters in the knowledge economy, which are operating as an important infrastructure towards building such capacities for nations and regions to survive and succeed in the knowledge economy. Hence the commercialization of technological and scientific knowledge generated within universities, research centers, laboratories that are publicly funded research organizations, is increasingly regarded via policymakers as input for regional economic growth to be sustainable and developed (Ndonzuau et al., 2002).

Traditionally, teaching and research have been the university’s main objectives but recently the commercialization of research results or ‘entrepreneurial science’ has emerged as a new role for universities in society (Rasmussen et al., 2006). Therefore the universities are required to adopt with new roles in regional and national economic development. In this regard universities treat this challenge as threefold issue: one is to promote the domain of commercialization, another is to make more visible its contribution to economic development and finally is to address
the relationship between commercialization and other related operations (Rasmussen et al., 2006).

According to OECD (2000b) recently universities are gaining more autonomous, more funding, and therefore more commercialization activities. The developments in research commercialization, patenting and licensing activities in the U.S. universities have resulted from Bayh-Dole act issued by US (1980), and became effective on July 1, 1981 (Carlsson and Firdh, 2002). It created exclusive rights to universities to commercialize publicly funded research. Therefore, the business sector needed intellectual property (IP) rights to select, promote and commercialize university research. Prior to this Act, universities weren’t interested in commercializing research, mainly because it imposes notable fixed costs (Bozeman, 2000).

Goldfarb and Henrekson (2003, pp. 644-651), who conducted an exploratory study on the two national policies (US and Sweden) towards commercialization of university research, state that:

“The US model is mainly concentrated on offering (economic) incentives for universities to commercialize their research output and then allowing them to experiment to find the best means by which to do that. In contrast, the Swedish model, which is similar to most European Union countries’ models in some respects, is very much an attempt by the government to directly create mechanisms that facilitate commercialization.”

The Australian government has introduced various policies in order to provide universities with the ground work for enhancing research commercialization. Emphasize was made on the notion to universities to be more entrepreneurial in technology transfer activities. As university research commercialization activities in
Australia improve in collaboration with industry and community at large, UCCs (University Commercialization Companies) have to promote university research without compromising the university’s mission and academic values. The objective is to increase national innovation and economic growth (Thika, 2010).

The study of research outcomes commercialization at the Iranian technology park shows that there are five groups of factors affecting the commercialization including: 1) research-oriented factors, 2) industry-oriented factors, 3) government, 4) technology parks and growth centers, and 5) environmental issues (Jalili et al., 2011). They also point out that the most important factor in the commercialization process is government role. For them government’s main important role is to provide research market through productive capabilities, stimulating other parts, and also through expanding this market to a nationwide (Jalili et al., 2011).

As an example in Saudi Arabia universities are taking a critical role in changing the economy from a resource based to knowledge-based. In this case universities are serving not only as sources for knowledge creation but also they act as sources for entrepreneurial activities (Audretsch et al., 2011). While most studies about identifying the scientist entrepreneurship have been done in the OECD (The Organization for Economic Co-operation and Development) countries, work of Alshumaimri et al. (2011) that was done in the context of the Middle East (Saudi Arabia) indicates academic entrepreneurship in this area different from what already have been revealed from studies in OECD countries. In contrast to OECD, insufficient skills among younger scholars in Saudi Arabia make them to more open to entrepreneurship.

Since 1970s Malaysia has started as a middle-income country through expanding economic activities. Later in 1980s Malaysia changed its economy from a raw materials producer into electronics exporters (Wonglimpiyarat, 2011). Malaysian Gross Expenditure on R&D (GERD) of RM 3.6 billion placed it 37th in the world ranking in 2005. Among the GERD of the East Asian Newly
Industrializing Economies (NIE), Malaysia was ranked fourth after South Korea, Singapore and Hong Kong (MOSTI, 2008) (See Appendix A).

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. The last one has received more budgets (i.e. 191.5 billion RM in 2010). The budget was allocated for developing innovation in Malaysian economy where it is found that university R, D & C is one of the key success factors (Aziz et al., 2011).

The government conducted essential measures to expand commercialization of research findings through providing grants and funds (Chandran, 2010). Grant plans encompass the entire process from the idea to commercialization and marketing (Wonglimpiyarat, 2011). Many agencies and departments including the Ministry of Science, Technology and Innovation (MOSTI), Malaysian Technology Development Corporation (MTDC) and the Malaysian Biotechnology Corporation are involved in addressing things related to grants and funds. In line with these corporations there are other departments that assist in providing startups, financing, loans and venture capital funding.

1.2.1 Background of Universiti Technologi Malaysia (UTM)

UTM with two campuses In Johor Bahru (i.e. Main campus) and Kuala Lumpur (i.e. Small campus), is a leading innovation-driven entrepreneurial research
university working on science and technology. UTM is one of the universities in Malaysia, with 2000 academic staff, 16,000 undergraduate and 9,000 postgraduate students. There are 14 faculties, 1 language academy, 5 schools for graduate studies, and 1 school for continuing education. It has been established in 1904 as the country’s first technical school but later it evolved into a college and later in 1975 it was upgraded to Universiti Teknologi Malaysia. UTM’s main motivation is to handle creativity and innovation processes, which contribute the Malaysian wealth creation (Official website UTM, 2012).

UTM has had the highest commercialization output among Malaysian universities, which is assessed based on four domains, including Patent, Trademark, Commercialized product and R&D with Potential for Commercialized Products (MOHE, 2008) (See appendix B). UTM’s R&D and commercialization activities have been ruled under various policies, including IP Commercialization Policy, Intellectual Property Policy, and R & D Policy (Official website UTM, 2012).

UTM’s has set its R&D with research centers in certain fields of studies. Research Management Centre (RMC) is responsible for handling researches, which also preserves a Directory of Researchers and List of R&D Products. Innovation and Commercialization Centre (ICC) is UTM’s one stop center for technology innovation and commercialization. ICC also carries out intellectual property managing and exploitation.

It’s structure role in driving R&D and commercialization as discussed earlier can be seen in the accumulated IPs until 15 September 2011 that was 2,170 cases, including Patent Pending, Patent Granted, Utility Innovation Pending, Utility Innovation Granted, Industrial Design Application, Industrial Design Registered, Trademark Application, Trademark Registered, Copyright and Layout-Design of Integrated Circuit (UTM source) (See Table 3.1). In addition, UTM was awarded the highest number of intellectual property registered with MyIPO, the Malaysian
Intellectual Property Office, which handles the IP filing in Malaysia (Official website UTM, 2012).

1.3 Statement of Problem

Malaysian government allocated remarkable budget to support R&D and commercialization activities in research institutions, especially universities. It was reported that under the 9th Malaysia Plan (2006 - 2010), a total of RM 3.101 billion has been invested to fund R&D projects. Meanwhile, the 10th Malaysia Plan (2011 – 2015) provided RM 741 million for R&D for the first two years of the five year plan. In addition, global comparisons indicate that Malaysia obtained the third rank among the top 10 countries in 2010 for patent and utility innovation granted (MyIPO, 2012) (See Appendix C). But, it has been asserted that only a small percentage of the Malaysia universities’ R&D outcome have been commercialized (Aziz et al., 2011). Out of 3,707 research projects conducted under the Seventh Malaysia Plans (1996-2000), only 527 have been commercialized (Sadullah, 2005).

According to Jolly (2011), technology-based inventions mainly would not move beyond the conception phase. Ideas always may come to mind but seldom leave a sign. The same situations would be applied for patents, but in many cases they would be as trophies of the inventor or records of technical achievement (Jolly, 2011). Yet the process of commercialization has not gone forward nor it is simple to do. Even in developed nations, for example Europe, success in such processes is limited. Despite its few successes, still Malaysia is at the beginning journey of commercialization (Chandran, 2010). Thus, there are some specific problems in the commercialization pathway of Malaysian universities.
Another issue that must be considered here is that 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 certain project is limited. Then, the success of research commercialization is critical issue for government and universities. On the other hand, under the financial crisis that government may encounter a 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).

Most of literatures that are related to university research commercialization in Malaysia investigate institutional and external factors of technology transfer. But still there is a shortage in the amount of commercialized product in universities. Therefore examining of behavioral characteristics of university researchers can be crucial to enhance the university commercialization rate. Entrepreneurial orientation (EO) indicates the procedures, techniques and decision-making styles researchers utilize to act entrepreneurially (Clausen and Korneliussen, 2012). Lack of strategies like risk-taking, proactiveness, innovativeness that are the dimensions of EO
(Lumpkin and Dess, 1996) among academic researchers prevents them from pursuing entrepreneurial activities.

Hence, they require recognizing critical factors affecting the process of technology development and technology commercialization among Malaysian universities and research centers. Then, the aim of this study is to investigate UTM commercialization activities and to identify factors affecting commercialization in view of academic entrepreneurs. For achieving this purpose, following research questions are designed.

1.4 Research Questions

Question 1: How entrepreneurial orientations among UTM’s researchers affect the commercialization in UTM?

Question 2: What factors influence the commercialization of university research output in Universiti Teknologi Malaysia (UTM)?

1.5 Research Objectives

The present study is an effort toward studying the major factors that affect the university outputs commercialization and also the process of university commercialization. Following are research objectives:
• To examine how entrepreneurial orientations among UTM’s researchers affects the commercialization in UTM.

• To identify those factors affecting the commercialization of university research output in Universiti Teknologi Malaysia (UTM).

1.6 Scope of The Study

The study tries to investigate commercialization factors at Universiti Teknologi Malaysia (UTM). The respondents were selected from the inventors, researchers, academic entrepreneurs, technology transfer office/center staffs, and administrative personnel in UTM. It is hoped, that the result of this study can be used in proposing useful recommendations and strategies that will help those engaged in the university commercialization processes and university (UTM).

1.7 Importance of Research

Technology is a critical issue in national economic development and essential for companies to gain competitive advantage or to improve and maintain their competitive position in the market place. Most technologies are developed in research institutions, especially from university. Transfer of technologies from noncommercial to the private sector is known as major activity that is corporate to new business startup, enhancing current business operations, and also generation of new jobs (Maktin, 1990; Parker and Ziberman 1993; Proctor 1993). Therefore, enhancement of main technologies would definitely lead into greater social wealth.
A number of studies investigates the technology transfer and commercialization by universities, such as studies by Reimers (1999), AUCC (2001), Tornatzky, et al. (2002), Lambert (2003), Miles and Daniels (2007), and Smilor and Matthews (2004). However, most of the studies come from developed nations. A developing country like Malaysia is still behind in terms of its research capabilities. Obviously, Malaysia is taking beginning steps toward research commercialization. In this respect, MOHE is attempting to support universities’ R&D activities since 2006, which intends to drive quality research by period time from 2008 – 2010. However, recently MOHE promoted research excellence through producing innovation and its commercialization for the time period 2011 – 2012 (Aziz et al., 2011).

Therefore, current study desires to investigate research commercialization operations at UTM. The findings of the study increase the body of knowledge on technology transfer and university commercialization particularly in UTM and generally in Malaysia.

It is very important to identify factors affecting research output commercialization in the university. Recognizing these factors is beneficial for several groups. Researchers, academic entrepreneurs and technology transfer office/center staffs obtain a better view on commercialization their research outputs to correct their weaknesses and offer required changes in the performance. In addition, commercialization in research context is risky and costly (Eldred & McGrath, 1997). It is urged to know significant factors in success or failure in the context of university research commercialization. Current research offers important information for universities to be implemented in long-term plans.

Transforming and commercialization together provides a beneficial ground in which universities would have more benefits to the public (Expert Panel on the Commercialization of University Research, 1999), and also it would assist financing more projects (Association of Universities and Colleges of Canada, 2001).
Nowadays, Malaysia is at risk of less effective commercialization therefore enhancement effectiveness of technology transfer is critical for government. Hence, the finding of this study helps government to improve its commercialization policies to enhance the commercialization rate in UTM.
REFERENCES:


in Conducting Federally Sponsored Research. Association of Universities and Colleges of Canada, Ottawa, Canada.


Thiruchelvam K, Chandran VGR, Kwee NB, Yuan WC, Sam CK (2010). Towards effective policies for innovation financing in Asia-Financing innovation: the experience of Malaysia, working in Progress Report submitted to the IDRC Project.


