

WHAT FACTORS AFFECT UNIVERSITY RESEARCH  
COMMERCIALIZATION IN CHINA? A CASE STUDY ON  
NORTHEASTERN UNIVERSITY

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*To my beloved parents,  
Sisters  
&  
Friends,  
Thanks for your support....*

*Dr. Kamariah Ismail,  
Thanks for your guidance....*

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## ABSTRACT

University-based research plays a central role in the innovation process. Basic research that leads to fundamental discoveries provides the underpinning of more applied technologies. Generally, universities can contribute to economic development both by interaction with existing industry and by other types of commercialization of knowledge, like the establishment of new firms. In China, A reform plan that has been carried out since the mid 1980s at colleges and universities which enables the university can commercialize more inventions. The university commercialization forms in China are primarily existed through patents and licenses, publications and conferences, collaboration between universities and companies, and university start-offs. This study was conducted to explore the critical factors and issues which affect the commercialization at Northeastern University in China. The general process of university commercialization can also be presented. Six major factors such as market demand and potential, the roles of Technology Transfer Offices/Centers of university, intellectual property management, support from industry enterprises, fund scenario, motivation of spin-off university activities and entrepreneurial university were investigated using face to face and telephone interview which involved ten respondents from institutions such as faculties and TTO at Northeastern University. The data was analyzed using NVivo computer software version 2.0. As the result from the research, the most crucial factor was fund scenario. This study was concluded with a discussion of the implications and recommendation for practitioner and researcher to improve the development.

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**LIST OF ABBREVIATIONS**

AUTM	-	Association of University Technology Managers
CAQDAS	-	Computer assisted qualitative data analysis software
GDP	-	Gross Domestic Product
MOE	-	Ministry of Education
NTTC	-	National Technology Transfer Centers
NEU	-	Northeastern University
MIT	-	Massachusetts Institute of Technology
OECD	-	Organization for Economic Co-operation and Development
R&D	-	Research and Development
SBIR	-	Small Business Research
S&T	-	Science and Technology
TT	-	Technology Transfer
TTO	-	Technology Transfer Office
UCF	-	the University Challenge Fund or Proof of Concept Fund

UK - United Kingdom

## **CHAPTER 1**

### **INTRODUCTION**

This chapter describes the context of the research. It begins with an introduction followed by problem statement, research questions, research objectives, research model, scope, importance and organization of the research.

#### **1.1 Introduction**

The rise of the knowledge economy has underscored the essential role and the importance of promoting university research that technological innovation plays in economic development. Within this context, universities are increasingly considered to be vehicles for commercialization and a channel through which knowledge exchange is made more effective. They are thought of as places where knowledge is generated and commercialized, where specialized research is housed, and where scientists and industry work together on product commercialization (D'Este and Patel 2007; Poyago-Theotoky et al. 2002).

Chinese universities contribute significantly to social well-being and economic growth. Through basic and applied research, universities expand the boundaries of knowledge in all disciplines and develop concrete solutions to the challenges we collectively face as a nation. Universities in China are becoming the key driver of national research and development (R&D). In the past time, the central government often neglected university research. This period is called pre national scientific and economic policy reform period. However, when the reform has been implemented, university experienced the key change that the central government university promotes the academic research and commercialization through providing more research fund. The technology transfer activities of universities have generated considerable license income, created new jobs, and promoted local economies. In China, According to official statistics, 786 chinese universities signed a total of 7321 technology transfer contract in 2008 and the value for the contract has reached to 2.215 billion yuan in which the contract number for 211 project universities are 3756, accounting for 51.31%. Statistics by region, the contract with the highest area is Beijing, followed by Shandong, Shanghai, Liaoning, and Anhui province (MOE, 2008).

It is widely known that many countries have adopted their versions of Bayh-Dole Act (OECD 2003). In theory, the Bayh-Dole Act of 1980 was supposed to make commercialization easier by clearing the way for universities to claim legal rights to innovations developed by their faculty using government funding. China hopes to use the leverage that can be gained from research universities to acquire design and technological capability in its high-tech industry. The advantages of this strategy include the rents gained from technological innovation, gains from higher productivity, the potential to carve out international brand names, and the scope for diversifying away from labor-intensive assembly operations (Yusuf and Nabeshima 2007).

At present, the ways which public research transfers technology to the private sector are primarily through patents and licenses, publications and conferences,

collaboration between universities and companies, and university start-ups (spin off). It has been proved that the government and industry investors offer the fund for the research which is finally commercialized via through the technology transfer process, there is a plausible if not convincing case to be made that the results could be better. It still seemed differentially successful and concentrated in some universities when university research has been commercialized through patent, licensing and spin-off (Rogers, Yin, and Hoffmann 2000). One would not expect such a consequence from a nation rich in scientific talent at many universities.

## **1.2 Problem Statement**

China has experienced a period of rapid development in terms of both GDP and technological advancement over the past 20 years. Most technology is developed in research institutions, especially for universities. Commercializing technology, therefore, from universities to industry has always been a strategic issue for the Chinese government. In the last few years, as it has focused on economic development as part of central government policy, the Chinese government has paid attention to the role of the transfer of technology from universities to industry in economic development. During technology development and commercialization in China, there are some problems and characteristics as well as similar patterns or problems to those experienced by industrialized countries in the past and present.

Technology transfer is a high-risk process since there is no guarantee that a technology development project will result in successful product launch or the investment will generate sufficient return (Dorf and Worthington, 1990; Eldred and McGrath, 1997a, b). Huang (1998) has pointed out the following factors to technology transfer and commercialization existed from an academic perspective: (1) attitude and motivation of many professors and Entrepreneurs (2) incentives for national government policy (3) lack of observation toward the market (4) fund

problems (5) support from enterprises (6) roles of intellectual property management (7) roles of Technology Transfer Offices/Centers of university.

In China, Colleges and Universities are playing an important part as a national scientific and technological innovation system with advanced research apparatus and equipment, R&D strength and a large research team. Scientific research, technological innovation, scientific, technological technology transfer and technology-based industries made a great contribution to national economic development. However, the number of research discoveries which have been pushed into markets is quite low. Another study revealed that China obtained over 20,000 research projects every year and only 10% of them can be commercialized to industry or markets effectively (Li and Hu, 1998).

Many research ideas and results generated in university often can not satisfy firms' business strategies or it is not a proper time to launch the product. Xu (2007) argues currently China's universities and their scientific and technological resources are not directly proportional to promote social scientific and technological progress, economic development. There are still a lot of scientific research results remain in the laboratory or shelved which have caused great scientific and technological waste of resources due to various reasons.

Meanwhile, the evaluation of performance at universities is quite different from that in enterprises. Universities pay more attention to the amount of R&D funds and academic value while enterprises stress economic benefit more. A large amount of R&D or high academic value might not lead to excellent economic performance. On the other hand, R&D results with significant economic benefits might be considered as having lower scientific value. Many universities are mainly interested in conducting academic orientated research programmes which are not necessarily linked to market demand.



Industry companies are usually regarded as the receivers of university the target of commercialization. Particular problems existed for small and medium sized enterprises, where commercialization is much more tend to be problem solution oriented rather than strategic (Corsten, 1987). Top management often introduce incomplete technology into the product development process, fail to view technology development as a separate process from product development, and underestimate the time and effort required to accomplish the transfer and incorporation of new technology into a product development effort (Eldred and McGrath, 1997a,b).

Relating to intellectual property (IP) in China, it is a new concept which was first introduced in the 1980s and was later strengthened. Following a set of IP rules relating to commercialization, universities now usually own the IP that is from government fund research. The number of patent filed by Chinese universities has increased over these years, it is estimated to be more than 13,000 in 2007 (Xue, 2007).

However, the management of intellectual property rights is a major problem in China. The tendency reflected by the patent applications is that researchers use patents as a way of enhancing their reputations, rather than for actually transferring or commercializing technology. Most universities still lack institutional IP policies and Technology Transfer Offices responsible for IP management. It is illustrated that the commercialization rate of university is still very low (Xue, 2007). Considering industry companies, they attach importance to the market orientated environment. Although China has issued several laws on the protection of intellectual property rights, these laws can not satisfy needs of commercialization. The IP laws are still need to be proved. Disputes about intellectual property rights have always happened between universities and companies in the last few years. Furthermore, universities find themselves in a disadvantage position because of their relatively fewer resources, and thus most research staff would prefer to contact industry through commercialization of technology by themselves.

Technology Transfer Offices/Centers play important roles managing university commercialization process (O'Shea et al. 2008, Swamidass and Vulasa 2008; Woolgar 2007). They often are regarded as the place where inventors disclosed invention to and assess the commercialization potential. In addition, many Technology Transfer Offices/Centers provide fund for further work on research inventions, assisting business planning, introducing invention to venture capitalists, (Wu 2007). But it is a fact that most Technology Transfer Offices/Centers lack the necessary resources and capabilities (Swamidass and Vulasa 2008). Except the Besides problems relating to staff skill and budget shortages, stress can be brought to Technology Transfer Offices/Centers staff on the time. As a result, they may succeed in patenting/contracting inventions but may have limited resources for marketing them to potential licensees and investors (Swamidass and Vulasa 2008; Wright et al. 2008). Except the problem relating to skill and fund shortage, pressure from the Technology Transfer Offices/Centers staffs is also stressed. Hence, they can patent and commercialize the inventions successfully. However, resources are limited for marketing them to potential licensees and investors (Swamidass and Vulasa 2008; Wright et al. 2008).

Currently, for university, the research and development funds mostly derive from all levels of government, but funds are very limited. Universities usually depleted most of funds at the stage of laboratory research achievement. As the universities themselves do not have the financial strength of self-transformation. If without the investment from government and industry enterprises, it will be difficult to carry out technical development for the next step. Also, colleges and universities do not have the capacity and channel for financing from financial institutions (Liu, 2004). In terms of the financial institutions themselves, they cannot loan the funds to projects which are considered to be long technology transfer cycle, high technical risk and market risk. While financial institutions are willing to loan the funds of large, medium enterprises, but enterprises are facing the pressure of competition and survival at present. Enterprises usually concern with technology achievements by many colleges and universities. But they do not plan to be involved in investment or consider divestment at the middle stage of commercialization. Relating to university

patents and technological achievements, universities and enterprises find it difficult for new product development.

### **1.3 Research Questions**

There are two constructed research questions considered for this paper:

- 1) How has the commercialization process of university output been made?
- 2) What are the factors affecting the commercialization of university output?

### **1.4 Research Objectives**

The objectives for this paper are:

- 1) To identify the factors affecting university technologies commercialization.
- 2) To understand how the commercialization process has been made.
- 3) To help the university in refining its commercialization strategies.

## **1.5 Research Model**

To answer the research questions and objectives of the study, the framework of the study is illustrated through the Figure 2.2 as proposed By Huang (1998) model. The framework can be shown in chapter 2. Based on my research, six factor issues can be considered and proposed.

## **1.6 Scope of the Study**

The study was conducted at Northeastern University, technology transfer Offices/Centers. The respondents for the study consist of the scientists, Technology transfer Offices/Centers staffs, technical, administrative personnel and the University entrepreneurs who related direct and indirectly in the commercialization of university research technology.

## **1.7 Significance of the Study**

The importance of technology in economic development and the development can be emphasized. The evidence can be shown that universities have been a major players of technological advancement in many developed and developing countries. It is a main concern for government and companies to consider making an effective commercialization from universities to industry over two decades.

Despite considerable researches on technology transfer and commercialization in western countries, there have been a few researches found on this issue in the context of China. This paper is intended to lay a foundation for future research by providing a framework for technology development and transfer in China and provide some practical guidelines for enterprises and universities concerned.

The framework developed in this paper tends to identify that what factors influence Northeastern University research commercialization in terms of technology development in China. As long as the importance of universities commercialization is concern, this study is significant in order to improve the effectiveness of universities technology commercialization while looking straightly to the factors that have a possibility to affect the commercialization of universities technology.

In China, the central government policy and other issues determine the economy system which affects the features university technology transfer and commercialization. The reform has been made from the planned economy to market orientated economy. Hence the transition towards the management structure and system of universities has been implemented. (Huang, 1998) illustrated that China's economic system is still experiencing a transition with the combination of market-orientated and government controlled economy. Hence, China can follow and study the western theories, experiences and policies for improvement.

It appears that such a research can regularly be regarded as the best practices of technology transfer at universities in China and disseminate these practices among all universities. The case study of commercialization at Northeastern University indicates that successful and unsuccessful examples. An overview of commercialization from universities to industry in China has shown that universities are important component of China's science and technology system and a major resource of new technology. At present, the commercialization rate in chinese universities seems lower, and thus achieved methods which can increase the effectiveness of university can generate strategic implications. China suffers from a

low rate of commercialization of new technology, and thus finding ways of increasing the effectiveness of technology transfer has strategic implications for both Chinese and foreign governments. (Zhang, 2001).

## **1.8 Organization of the Thesis**

The thesis was organized into five (5) chapters. In Chapter 1, the background of the study, brief information on university research commercialization, problem statement, research questions, research objectives, research model, scope, significant and limitation of the study and terms definition have been introduced. Chapter 2 describes the literature review of the relevant research and the theoretical framework of the study. Chapter 3 is with respect to the methodologies, which contain research design, research method, sampling procedures, data collection and methods of data analysis. Chapter 4 is dedicated on data analysis and summary of the findings and finally chapter 5 contains the discussions of the findings, conclusion and recommendation for practitioner and future research.