Available online at
www.sbm.itb.ac.id/ajtm

The Asian Journal of Technology Management

Volume 2, Number 2, December 2009, 50-56

Technology Commercialisation in a Developing Country: Current Condition and Its Challenge in Indonesia

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Abstract

Innovation is considered the main engine of economic growth in both developed and developing countries. Despite the important role of innovation, little has been understood about technology transfer becoming a commercial success in developing countries, especially in the Indonesian context. The purpose of this paper is to identify technology commercialisation activities in Indonesia. Based on secondary data sources, an analysis of the current state regarding the issue is constructed. The findings in this paper suggest that technology commercialisation in Indonesia is initiated at the levels of university, government research institution, and corporate. This study provides insights for policy makers, business leaders, and university administrators into the appropriate roles of institutions and organisations in promoting and assisting technology commercialisation activities of their respective inventors.

Key words: Technology commercialisation, developing country, university, government research institution, corporate

1. Introduction

1.1 The Importance of Technology Commercialisation for Reducing Indonesian Poverty

The Knowledge Based Economy (KBE) has become dominant in the 21st century, proving to increase a nation's competitiveness. KBE refers to the use of knowledge and technologies as the main driver for growth and sustainability to produce economic benefits. The degree of KBE in a particular country is reflected in its Knowledge Economy Index (KEI). One of the main indicators for KEI is the economic regime and its performance (Ristek, 2008). UNDP (2008) shows that although Indonesia's Poverty Index is steadily declining, the people of this republic still lag behind neighbouring countries. Indonesian Poverty Index in 2005 is 18.2%. The World Bank Institute (2008) exemplifies the fact further. Though recorded average economic growth gains more than 4% each year, 9.9% of the Indonesian workforce is unemployed.

The World Bank Institute (2008) has developed a methodology known as Knowledge Assessment Methodology (KAM) which can be used to benchmark countries, and to identify potential strengths and weaknesses of their transition towards KBE. The four pillars of KAM are similar to those of KEI, namely i) regime and economic performance, ii) education and human resources, iii) information and communication technology, and iv) national innovation system (NIS). Based on this methodology, we could make an initial observation that the slump in Indonesia's regime and economic performance can be attributed to deficiency in each of the next three pillars, especially the final pillar (NIS) concerning innovation. Indonesia's budget for research is approximately 0.07 percent of GDP, providing stark evidence of this

deficiency (Media Indonesia, 2008). A study by Levit (2001) concludes that there to be no doubt that NIS is an important factor which determines national competitiveness. A functioning NIS in a country can be evaluated from the intensity and effectiveness of interaction and interconnection among its elements i.e. R&D institutions, universities, and industries, and the performance of supporting organisations such as those providing venture capital.

1.2 Research Questions

The following key questions are addressed in this study:

- Who are the key players of technology commercialisation in Indonesia?
- What are the main relevant initiatives/activities of technology commercialisation in Indonesia?
- What are the challenges of technology commercialisation activities in Indonesia?

1.3 Methodology

The present study was primarily based on a desk research of relevant existing studies, statistics, selected articles, policy documents, and expert opinions. A search for data regarding the current Indonesian condition in technology commercialisation by means of the internet with various keywords was done. Some Indonesian organisation websites which might relate to technology commercialisation were reviewed. The data collected were organised on the basis of key players as their activities related to technology commercialisation in Indonesia. The actors' analysis was undertaken to describe the current state of technology commercialisation in Indonesia and its challenges. Next, technology commercialisation activities in India and China were presented as a benchmark.

2. Indonesian Technology Commercialization Mapping

Based on our desk research, three main sources of innovation think-tank in Indonesia can be identified, which are universities, government research institutions and corporate. Their technology commercialisation activities are described below.

2.1 Universities

One of the general policies of Indonesian universities is that research be conducted to develop knowledge in areas that are prospective and universal in order to improve the welfare of mankind. More particularly, the research should develop technology applicable to the building of the national economy's strength. Aside from their '*Tri Dharma*' mission (education, research and society empowerment), universities are now expected to produce *technopreneurs* who are able to develop competitive industries in the country for this era of globalisation.

Four of Indonesia's leading universities, which are University of Indonesia (UI), University of Gajah Mada (UGM), Bogor Institute of Agriculture (IPB) and Bandung Institute of Technology (ITB), have already started their technology commercialisation activities. IPB and ITB have established their Intellectual Property Right (IPR) office (IPB, 2009; ITB, 2009), while UGM includes IPR activities within their Institute for Research and Society Empowerment (LPPM) office (UGM, 2009) and UI includes these activities within their office in the Directorate for Research and Society Empowerment (DRPM) office (UI, 2009). IPB, ITB and UGM also have their business incubator for accommodating their students, alumni and staff who are challenged to start their own businesses. Furthermore, UI started to realise its long-term vision of developing science parks since 2007. The science park will integrate all of its research, development and commercialisation activities.

2.2 Government Research Institutions

The Ministry of Science and Technology (RISTEK) appears as the key government player, with responsibilities including the formulation of relevant national policies and coordination of their implementation. Some other ministries (e.g. Department of Agriculture, Department of Industry and Department of Forestry) have their own research institutes. A clear coordination mechanism among ministries has not yet been developed. It is also important to note that the formulated research priorities previously noted are only partly reflected by their implementation in the research landscape, i.e. it will be difficult to follow the political directions, if the research capacities are limited in certain fields.

Generally Indonesian research has something to offer, its GCI (Global Competitiveness Index) being ranked 39th among 134 countries world-wide for quality of research institutions (World Economy Forum, 2008, p. 204). Among the most relevant research institutions reporting directly to the President, the Indonesian Institute of Science (LIPI) appears most involved in innovation-related activities. It holds a "Centre for Innovation", is responsible for the small and medium enterprise (SME) support program IPTEKDA (Implementation of Science and Technology at Region), organises the "National Young Innovator Awards" and conducts S&T research for sustainable development. One of the most notable innovations from LIPI is *Marmut Listrik LIPI* known by its acronym, "Marlip". Marlip is a battery-powered car which has resulted from extensive research at Centre for Research for Electricity and Mechatronics (P2 Telimek) conducted since 1998. This patented innovation has more than 80% of local content and being available in 8 variants (Kompas, 2008).

2.3 Corporates

Although Indonesia has transformed slowly from its agricultural base to become industrially prominent, industrial development still depends on foreign direct investment and foreign R&D. The majority of foreign companies in Indonesia only develop its manufacturing factories or setup its distribution office using Indonesia as its market. Only a few of them develop its R&D in Indonesia. At the same time only few Indonesian entrepreneurs develop technology based companies which have their own R&D facilities. In the automotive sector, no Indonesian national cars are in the market, all being foreign branded cars whose companies build their factories in Indonesia. While in the personal computer and notebook sector, no Indonesian brands are in the market as well. In the electronics sector, only one Indonesian manufacturer has its product in the market which is PT Hartono Istana Teknologi under the Polytron brand. Whereas in the software development sector, some software house already exists in Indonesia to supply Indonesian internal need.

3. Technology Commercialization Challenges

Transfer of technology from public R&D institutions to industry, especially by means of commercial mechanism, is a challenging task. LIPI (2006) shows the rising trend of patent being commercialised from public R&D institutions in Indonesia (2 patents in 2000, 7 patents in 2001, 6 patents in 2002, 8 patents in 2003, and 21 patents in 2004) although the relative percentage is still lower than that in the U.S.

One of obvious problem is that marketing was not designed from its inception by wide spread research neither did it result from program of an institutions. It is conducted only at the end of research activity, marketing has become an unwanted burden for researchers since it is not within their competency. Many researchers are not aware

of any industry need not related to their activities, since very limited contact has occurred between researcher and industry/market. R&D marketing should become the responsibility for all level of managements in the R&D organisation; it should not become the total responsibility of researchers who produce the technology or the results (Luxmore, 2000).

The effort to protect intellectual property yielded from research activities is very limited, most of research results being published only for benefit of the scientists. Such matters finally cause difficulties for marketing research results (RAMP-IPB, 2006). Lack of government incentives for industries causes them, especially large industries, to be unwilling to attempt utilisation of local research results and local technology, furthermore they have no incentive to invest and conduct research for themselves. They do becoming more willing to buy available technology from other countries (Spurling, 2002, RAMP-IPB 2006). Small and medium industries are more enthusiastic about using local technology and research results, unfortunately their budget is limited license purchase, so they seek free technology (RAMP-IPB, 2006). This causes limited collaborative research funds or limited royalties that could be received and spent by public R&D organisations. In the final analysis, most of the R&D budget should be provided by the government in the interests of results and budgetary efficiency.

4. Lessons from Other Developing Countries

Best lessons regarding the commercialisation of technology arguably come from the United States. Commercialisation of R&D and its results has been an important mechanism for economic growth in the U.S. as well as providing them with strategic advantages (Liu and Jiang, 2000; Wayne, 2003). However this study will focus on its benchmark countries, China and India. These two countries have been selected because they are developing countries which share similar characteristics to Indonesia, have huge number of population and share rapid economic growth over the last ten years.

4.1 China

China once had a very pragmatic approach: attracting Foreign Direct Investment (FDI) for cheap mass production, then gradually establishing indigenous R&D capabilities, launching pilot operations and scaling up successful operations. China was virtually trading market access for technologies, however that country's competence and industrial vigour has led to it's currently losing the competitive advantage of being a "low cost country". If the country wants to maintain its economic growth, it will have to improve its own innovation capabilities. Being fully aware of the threats, China has taken steps towards building a high-performing innovation system. It has mobilised resources for S&T exceptionally rapidly on an unprecedented scale and is now becoming a major R&D player (OECD, 2007). Fast growth and high savings rates enabled the country achieve this.

Already in 1998 China has established a comprehensive National Steering Group for S&T and Education in the State Council as the highest coordination mechanism of the innovation system (Wang, 2007). The State Council has already established more than 50 S&T Industrial Parks to enhance international competitiveness in selected research priorities. These parks are filled with research centres, incubators and mainly foreign-funded businesses. As they have not yet sufficiently initiated indigenous innovation, Ministry of Science and Technology (MOST) now plans to raise the quality of these parks with the goal of establishing "world class" S&T parks in China by 2010 (MOST, 2007). In China, universities have been given considerable freedom to engage in profit seeking businesses. Such university-run enterprises can be either scientific/engineering

businesses or non-scientific business such as shops. Technology transfer and licensing from universities is also on the rise. In addition to technology transfers, contractual research, consultancy and enterprise incubation are widely encouraged as a means whereby university researchers work with private businesses. What is remarkable about the funding of scientific research in Chinese universities is the high proportion of funding from private companies, a total of 40%. This shows a very high level of readiness on the part of Chinese businesses to pursue University-Industry collaboration (Yujian, 2006).

4.2 India

India wants to be a "knowledge super power" by 2020 and has a fair chance reaching that goal. After the information technology (IT) revolution, the intellectual capital of India has attracted Multi-National Company (MNCs') R&D centres so that 225 of the "Fortune 500 companies" today have their R&D centres in India. The biotechnology revolution could be next because India is fast becoming a top global innovator for high-tech products and services. Growth has been driven by rapid expansion in export-oriented, skill-intensive manufacturing and services, and has seen further rises in local demand due to rising incomes (Herstatt, 2008).

India's innovation infrastructure is growing further, the main institutions include the prestigious and very successful Indian Institutes of Technology (IIT), which have been doubled this year with 8 new IITs. Together with the Indian Institutes of Sciences (IIS), the Indian Institute of Science (IISc) and the recently created Indian Institutes of Information Technology (IIIT), they have largely benefited from the rising investment of MNC in R&D in India through industry-university partnerships, mainly in the field of electronics and IT. Indian academic institutions became aware of the importance of protecting and disseminating their knowledge through patents rather recently and the trend seems to be continuing (World Bank, 2007; Ganguli, 2006).

5. Concluding Remarks

Indonesian technology commercialisation has already occurred in three types of organisations in Indonesia (university, government research institution and corporate). However its performance is relatively low, in term of quantity or value, when compared with that of India and China. The R&D budget available is relatively small, therefore Indonesia should focus on very limited sectors as occurs in India where the current focus is on IT with the future having biotechnology as its focus. Indonesia government should also encourage its corporate sectors to have its own R&D or outsource its R&D needs to an Indonesian university or a government laboratory as has been achieved in China which has successfully established Industry – University partnerships. The government should give incentives to industries which show a willingness to outsource R&D to Indonesian universities or government laboratories. On the other hand, universities and government laboratories should concentrate on researching industry's needs, than researching the preference of particular scientists.

6. Proposed Research Agenda

Various approaches have been used to study the technology development process. Ravasi and Turati (2005) used a case study approach to investigate the development of two inventions by the same corporate entrepreneurs, one successful and the other unsuccessful. Cooper and Kleinschmidt (1986) also analysed a successful and an unsuccessful new product using case studies of 13 generic development activities. A logical step in this developing research area would be to investigate the technology development process and its commercialisation in Indonesia using case studies of two groups of inventor – academic

(university and government) and corporate. Research questions might be asked a prelude to more definitive research, perhaps employing a more generalisable either qualitative or quantitative research methodology: What extent are the steps similar? How do they differ? Can we use them to better understand the similarities and differences of processes followed by corporate and academic inventor? In general, how does the effect of the various elements differ between the academic and corporate arena, since clearly the barriers, challenges, and drivers to create and commercialise innovative technologies also appear to be different?

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