

A Case Study Of R&D Technology Commercialisation: Challenges, Issues And The Way Forward

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Abstract

Successful technology commercialization is a stepping stone in the growth of economy in any country. In Malaysia, the government has invested significant amount in research and development (R&D). However, only 3% has been successfully been commercialized. Thus, the objective of this study is to identify the barriers of technology commercialization in a public university. This study is a qualitative research. A case study has been chosen as the research strategy. A case study protocol was developed and used as an instrument to collect the data. 10 interviews have been carried out among the researchers and administrative staff. The findings indicate that funding, collaborations, internal structure (governance) and external environment such as government policy and leadership have been the main hindering factors in technology commercialization.

Keywords: *Research University, Research and Development, Technology commercialization)*

Background Of Study

In this competitive globalised era, like any other developing nations, Malaysia is compelled to strive hard en route to excellence supported by technological advancement. In order to achieve this, Malaysia needs to create new markets by offering products and services through the mastery of technology, as well as the introduction of new applications for existing technology. At organisational level, the success of research and development (R & D) depends on the ability to develop and produce new products that meet current consumers preferences, for only applicable products or technology can generate income for further and future development.

Therefore, commercialization of new technology derived from long-term R&D bridges the gap between the laboratories and the consumers, by delivering the products to the end users.

In Malaysia, the three main sectors actively involved in developing and carrying out R&D activities are the governmental research institutes (e.g. MIDA, MIMOS and SIRIM), the Higher Education Institutions (HEIs) and the private sector. It is apparent that these organisations are engaged in continuous R&D activities. However the HEIs are perhaps the ones with the most manpower, novel ideas and direct motivation to conduct research. Their contribution does not stop at new products but also human capital development. This would help reduce the nation's dependence on foreign expertise for both sustainable economic reasons.

There is a general consensus among policy makers that universities and research institutions are tools for economic growth, specifically through the commercialization of the products of research, innovation and ultimately, commercialisation [1]. HEIs in Malaysia are clearly aware of this trend and expectations. The universities are currently undergoing rapid transformation, shifting emphasis from pure teaching to equal strength in teaching and research, which would significantly contribute to the generation of revenue and profitable development.

In addition, the Government takes seriously the success of research and development activities. Therefore, the government has provided various facilities such as infrastructure, finance, incentives and support expertise in the commercialization of R&D to encourage such activities. The Malaysian government has allocated 118 million for The Commercialization of Research and Development Fund (CRDF) and Technology Acquisition Funds (TAF) respectively, with the allocation increased to RM110 million and RM 250 million respectively in the Eighth and Ninth Malaysia Plan [2]. The CRDF focuses on the commercialization of R&D findings by local universities, research institutions as well as companies and individual researchers and inventors.

Although the government commissioned various initiatives to accelerate the rate of commercialization, namely, by setting up institutions and special programs or incentives (including grants), there remains a gap in the product delivery that need urgent attention [3]. The commercialization rate and volume of public financed R&D have been low, especially but not exclusively in small and medium-sized companies (SMEs) [4,5]. [6] added that technology commercialization is still low in Malaysia. This is supported by the report on

commercialization outcome of the "Intensification of Research in Priority Areas" (IRPA) projects, the largest funding system for public R&D, which demonstrated only 5.1 % R&D outcome being commercialized under the 6th and 7th Malaysia Plan (1991-1999). More worryingly, the commercialization trend has registered a decline, i.e. 3.4%, during the 8th Malaysia Plan (2000-2005) [7].

Much past study has reported R&D as a whole, but rarely are recommendations made on how to help innovators overcome the barriers to commercialization [8]. Hindrances or challenges to commercialization efforts are thought to include weaknesses in the process of effective technology transfer between research centers and companies [9,10,11] Inadequate infrastructure, lack of market research, and inexperience on the part of venture capitalists are among the problems of commercialization in Malaysia [12].

This paper describes a systematic attempt to examine why technology commercialization of local HEIs is still limited, by identifying the major issues and challenges faced by the university researcher in commercializing their research outcome. Taking an upcoming public university, i.e. Universiti Tun Hussein Onn Malaysia (UTHM), as the case in point, 10 researchers were interviewed and a qualitative data analysis was conducted, with the findings further elaborated and discussed to paint a clearer picture of the matter.

Issues And Challenges

There are several barriers against commercialization of technology developed by local HEIs. The hindrances could arise at various stages of the marketing process. The relevant issues and challenges are discussed in the following sections.

Funding

The commercialization activity is a long and complex process. It involves initial investment before success. Initial investments are normally for intellectual property filing, company registration, hiring qualified entrepreneur and marketing the R&D outcomes. [3] argued that current weaknesses of funding channels in Malaysia include the lack of pre-seed and seed funding, market funding, prototype funding and also the lack of funding and incentives to support private sector research and commercialization.

In addition, due to the high failure rate of new firms in Malaysia, obtaining conventional loans from local banking system is difficult. Furthermore, the funding problems of commercialization include the gap between producing research findings and getting commercial partners. The lack of pre-seed finance beyond the "proof of concept" stage that

precludes smooth translation of potential research findings into tangible commercial outputs is also identified as a funding factor against successful commercialization [14].

University – Industry Collaboration

[15] noted that the difficulties to R&D commercialization can be seen from the industry and legal perspective (Table 1).

Table1. Difficulties in R&D commercialization (adapted from [15]).

Perspective	Difficulties
Industry	<ul style="list-style-type: none"> ▪ Lack of interest on R&D matters on the academic s part. ▪ Reluctance to conduct additional R&D work for further details. ▪ Short attention span on the academia (possibly due to lack of confidence).
Legal	<ul style="list-style-type: none"> ▪ Ownership of intellectual properties. ▪ Mismatch between public-funded R&D and market needs (market survey was probably not carried out) ▪ Poor diffusion of knowledge.

[3] found that collaborative R&D activities among industries are low in Malaysia for a number of reasons, i.e. a weak system of knowledge assimilation, insufficient human capital and insufficient focus on R&D, recruitment policies and innovation activities. Also, [16] reported that the setback in university-industry collaboration is due to the lack of in-house R&D, companies shortening product life cycles, cutbacks in R&D budgets and the changing nature of organizational research priorities.

Skills Requirement

The lack of qualified staff, the absence of sufficient practices for technology management, inadequate experience of the people involved and insufficient attention given for particular elements result in the low efficiency of commercialization management structures systems [17]. Shortage of quality research skills could be a major hindrance in successful commercialization as outputs or outcomes of a project may not adequately address the practical implications or requirements. For example, government-driven spin-off companies tend to encounter failures because the research staff lacks suitable qualifications and entrepreneurial motivation [18].

Spin-off companies

A primary outcome of research activities in HEIs is the establishment of spin-off companies. This helps boost the economic activity and income generation of a university [19, 20]. The new companies also create new job opportunities for the local community [20, 21]. This in turn generates new wealth, contributing to the overall economic development.

Nonetheless there are other issues which could arise from these spin-off companies, such as overlapping responsibilities and roles which inadvertently affect quality of work, products and performance.

Academic – Commercial Demand

Tensions that exist between academic and commercial demands can affect individual researchers more severely than their counterpart who produces academic outcomes [22] This can be attributed to the difficulties and challenges in commercializing research outcomes. There is a need to constantly move forward in agendas of commercialization despite the fierce competition among other national competitors. The organisation is required to equip and familiarize itself with academic research, in order to gain an edge in commercializing R&D technology.

Methodology

The study was conducted as a qualitative research, where emphasis was placed on the quality of data sources in the information collection process [23]. Data and information were obtained from interviews, observation and review of existing documents. The data was next analyzed and presented in a descriptive manner, i.e. description in real-life context a phenomenon or interference [24].

The research was being approached using a case study strategy, where the investigation method is commonly used in social sciences study [25]. A single case study was chosen for the present project, following the standard Case Study Protocol. Interviews were carried out for data collection. The target population was limited to 9 researchers and an administrative officer (designation: technology transfer officer) a public university. Using the matrix analysis method, matrix tables were drawn up to execute a logical analysis of the data obtained. The matrix helps paint an approximate picture of the correlation between cause and effect, before being refined and developed into a complete map or chart that explains all the threads of the study [26].

Data Analysis And Discussions

Semi-Structured Interview

From the interview conducted, it was established that the 3 primary constraints to research output and commercialization are funds, human capital and time. Only 2 out of the respondents claimed to have sufficient funds for their respective work. The research projects were found to be non-exhaustive financially as only basic data processing hard- and software were required. When limited by the approved funds, researchers reported to have modified the original research scope and direction to make the projects viable within the budget given. In terms of human capital, several respondents

lamented on the difficulties in engaging full-time graduate research students, especially if the owner of a research fund belongs to a supporting faculty or school which has no intake of

students (e.g. language department, religious studies unit, etc.). The lack of interest for certain research topics was also reported to be a factor in sluggish progress.

Collaboration with the industries was undertaken by all the respondents except one, as the particular project was intended to explore fundamental knowledge with no plans for commercialization in the immediate future. Such contribution to the existing body of knowledge is not uncommon for research projects in HEIs, which is essentially a knowledge powerhouse, entrusted with the responsibility of pushing the frontiers of knowledge.

3 respondents had collaboration ties with the industry through recommendation by friends while the rest took the initiative to involve the industrial players in their studies. 7 respondents have come to the concluding stage of their respective studies with potential for commercialization, but were hindered by the lack of funding opportunities. However at least 1 respondent managed to penetrate an overseas market with possibilities of local development in future.

From the industries while the others personally approached and sought permission from the industries. The research of respondent 2 was successfully carried out on Hainan Island while respondents 3, 4, 5, 6, 7, 8 and 10 hoped to come to the stage of commercialization but insufficient funding prevented the commercialization.

The majority of the respondents saw the need to increase the human capital for researchers and commercialization work. Respondent 1 concluded that it would be more effective if there were a team that could be formed specifically for commercialization works. Respondents 2, 4, 8 and 10 saw the significance of upgrading the education level of the staff and undergraduates while respondents 3 and 5 realized that the undergraduates are not interested to further their studies in UTHM.

Respondents 4, 7 and 10 expressed that it was pressurizing in the research progress for them whereas respondents 2, 3 and 9 did not experience any tension within their research period of time. The source of pressure came from the time constraint. For respondents 1, 5, 6 and 8, they did not mention anything about tension yet they highlighted the stagnancy that hindered the progress of their research.

For the facilities usage, all the respondents did not face any problem about that because their projects did not need costly machines. They could secure and use the facilities in the university or from the research institutes and companies. In addition, respondent 1, 2, and 10 highlighted that it was slow with difficulties countered to set up a company in the university to sell their own product because the product did

not cater to the needs or the product might not supply the demand of the marketplace.

Discussions

According to the analysis of the gathered interview data, funding is the main reason that posed as a challenge to the researchers and technology transfer officer. Indeed, technology

commercialization works only if the research management office can be reorganized and improves its performance. The respondents pointed out that the lacking of the experts in the field of commercialization was an obstacle.

All the respondents realized the need to increase human capital to assist the researchers who were academic staff to lighten their workload. However, from the analysis, the involvement of postgraduates was minimal. This shows a certain degree of reluctance from most of the undergraduates to further study in this public University. This may be due to better offers of other universities and companies.

Next, the respondents indicated that it was very important to have a strong internal structure of the administration team for the research management office. People who have the knowledge of the field in engineering, business and marketing should be recruited, especially those who have the essential and necessary industry experience. The knowledge, expertise and work experience will build a strong partnership between industry and university.

In addition, the external and environment structure is a main hindrance for technology commercialization. It is very common for the academic staff to undergo stress as they are bounded with many responsibilities and workload from the academic and their own research. The pressing dateline to hand in the research reports might affect their productivity and quality. The environment for the the progress of research will be tough. Accessibility of transportation and the distance traveling to-and fro the university to the spinoff company can be hindrances to carry out the research and the transportation of the products.

Conclusions

The main challenges of commercialization faced by all 10 respondents are funding, collaboration, internal structure and external or environment structure. Insufficient funding and expert advisers are to be the middle man between the industry and the researchers, preventing a better research job. Most of the respondents agreed that the need to improve the commercialization activities by the active involvement of industry concerning the researchers work in university and also the inspiration of the entrepreneurship spirit in the researchers.

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