Evaluation Framework for Assessing University-Industry Collaborative Research and Technological Initiative

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Abstract

The purpose of this paper is to propose an evaluation framework for university-industry collaborative research and technological initiative at Universiti Teknologi Malaysia, by identifying the success criteria of university-industry collaborative research and technological initiative as perceived by academics. Five type of research collaboration mechanisms, which are; Consultancy and Technical Services Provision, Cooperative R&D Agreement, Licensing, Contract Research, and Spin-off Companies discussed and success criteria for each mechanism adopted from previous models in other countries. Based on these data, initial framework proposed. This study provides a framework to assess success of research collaboration activities from perception of academics. It’s useful for improving management of research collaboration activities in universities.

Keywords: University-Industry Collaboration; Technology Transfer; Research Collaboration Mechanisms; Success of Research Collaboration; Malaysia

1. Introduction

As commonly agreed, universities are considered as a vital source of new knowledge for industry. This somehow demonstrates that the idea and concepts related with university-industry partnerships is not something new. Back at the late of 19th century, the German pharmaceutical firm, Bayer formed relationships with universities [1]. During World War I, the National Research Council of the United States had got together scientists in the research-oriented universities with those in industry to support the war effort. However, today, there are several other reasons for both industry and university looks for to set up close relationships with each other. With such relationship, highly trained students, professors, facilities, and new technologies are accessible to industrial firms. According to [2], industrial firms might as well build up their reputation and image. Additional funds raise were detected to be a prime reason of the universities interaction with industry, which is normal for basic research. Since funding from industry includes less bureaucratic red tape than from the federal or state governments, this kind of relationship is preferable. Moreover, universities would like students and
faculty members to be revealed to practicable problems, generate employment opportunities for university graduates and as well as to get more access to applied technological areas [3].

Universities are looking for new ways to remain relevant actors in the knowledge economy which means that they need to secure funding sufficient to cope with the huge costs of research. On the other hand, industrial firms are exploring ways of keeping abreast of technological progress in this highly uncertain competitive and rapidly changing environment. So the universities can consider as one of most important partner for industry. This partnership can form in different approach such as consultancy and technical service, cooperative R&D agreement, licensing, and contract research. An important point, which both university and industry are concerning about, is success of the research collaboration [19]. Defining success in academic technology transfer is a function of defining what outcomes are desired, then tracking and measuring performance in light of those desired outcomes. Outcomes are a function of institutional mission. Evaluation of university-industry research collaboration activities is very critical for identification of level of success of teams, groups and individuals which contribute in research collaboration activities. But, because of high level of unpredictability and difficulty in identification of outputs, evaluation of research collaboration activities become complex. In recent years, different research organizations tried to design evaluation metric models to assess success of university-industry collaboration activities. However most of those models are appropriate to apply in only counties’ which they select as their scope of study. Based on previous models, to assess the success of industry-university research collaboration, determining indicators is essential. So for every mechanism, special indicators should define to finally design a framework to evaluate the success of industry-university research collaboration.

This paper focus on mechanisms of research collaboration between university and industry to propose evaluation framework for university-industry collaborative research and technological initiative at Universiti Teknologi Malaysia, by identifying the success criteria of university-industry collaborative research and technological initiative as perceived by academics.

2. Background

The integration of science and technology, improvement in relationship between science and technology, the appearance of industries based on science, and the use of science as a means to generate competitive advantages, are some of the reasons to justify collaboration and cooperation between research organizations and industry sector [4]. Make strength interaction between research institutions such as universities and colleges and industry increasingly have been seen as a strategic instrument for national and regional innovation, competitiveness, and economic growth over the last years. Governments’ research policies strongly emphasize on cooperation between universities and industries as a key public policy for fostering innovation in their societies. For example policy-makers implemented laws which provide commercialization incentives to universities by granting them ownership of intellectual property arising from their research. They also try to encourage universities and firms to engage in partnerships and personnel exchange, for instance via university-industry centers or science parks [5], [6], [7], and [8]. On the other hand for several reasons universities and industries are interested in having strong collaboration with each other. In a survey of both the university and industry participants in approximately 400 research joint ventures, [9] found that industry participants ranked their reasons for participating in these alliances in the following order: access to new research, development of new products, maintaining a relationship with the university, obtaining new patents, solving technical problems. In fact university -industry collaboration is a win-win strategy for both sides. In a professional area such as engineering, the symbiotic relationship between academics from institutes of higher learning, and their counterparts in industry, is essential. However, this relationship, especially in Malaysia, is still in its infancy stage [10]. In Malaysia, the development of Research and Development (R&D), and concurrently, the fostering of the relationship between industry and universities are very closely tied to government policy. In recent years Malaysian government tried to support both universities and industries. During the Seventh Malaysia plan, the development of programs for R&D had the objective of broadening the Science and Technology(S&T) base. During the Eighth Malaysia Plan, three new schemes were introduced to enhance private sector R&D and in Ninth phase emphasis was on developing Malaysia’s economy into high value added, high technology, and knowledge based economic activities in agriculture, manufacturing and services sectors. All these policies and activities require commitment and contribution from both academic
institutions and industry, which need to work together to consolidate knowledge based economy in Malaysia.

3. Other Practices in Evaluation of University-Industry Collaboration

As an important part of the ecosystem of innovation, knowledge transfer from university research to industry has great economic and social impacts. Governments and research agencies are seeking ways to evaluate the results of interactions between universities and industries with. Different approaches to knowledge transfer measurement have been developed around the world. In this part we review in brief, three technology transfer evaluation models; AUTM, HEFCE, and UNICO.

3.1. AUTM

One of the initial approaches was, the survey of licenses, which is held annually by the Association of University Technology Managers (AUTM), gathers information about licensing the technology and information on the performance of U.S. academic institutions and Canada and non-profit for each year since 1991. Instrument of the AUTM Licensing Survey is being used by the report to present the quantitative data from AUTM members. Respondents are members of the AUTM. More than 350 universities include research institutes, hospitals, government agencies and hundreds of companies that represented by AUTM's global network of members participate in management and licensing innovations. It is derived from academic and non-organizations. The measurement of income from IP has been recognized recently as incomplete and poor measure of knowledge transfer performance. Thus, new approaches have been developed [11].

3.2. HEFCE

In another experience in the UK, the approach to knowledge transfer measurement has been widened with the Higher Education- Business and Community Interaction (HE-BCI) Survey. The higher education-business and community interaction survey (HE-BCI) is managed by the Higher Education Funding Council for England (HEFCE) [12]. It is an annual survey that the first survey published in 2001 provided data on academic year 1999-2000. The ninth survey for academic year 2008-09 was published last year (2010) and is used as a source of information on knowledge exchange in the UK as well as to inform funding allocations awarded to UK universities to reward their third stream (say third mission) activities. The knowledge exchange covered in the survey takes place not only between higher education institutions and the wider world of business and the community but also between universities and colleges themselves.

Data are gathered on a wide range of third stream activities. These cover commercial and strategic interaction with businesses and public sector organizations and activities in working with the local community. The first survey was commissioned by the HEFCE to the Centre for Urban and Regional Development Studies (CURDS) at the University of Newcastle in 2001 [13]. The survey was originally designed as a single questionnaire. Because of ease and efficiency, the data from 2002-03 onwards were collected through complementary processes: part A for strategic and infrastructural data and part B for financial, numeric (time-bound) data. Data from part A are a snapshot taken at the same time as financial data are collected (after they have been formally signed off by the chief accounting officer), meaning that data from part A are presented as being a picture of the following academic year (that is, the year in which the report is published).

3.3. UNICO

Library House, UNICO (UK), AUTM (US), the Alliance for Commercialization of Canadian Technology (ACCT) and a range of funders including the Department for Innovation, Universities and Skills (DIUS), Research Councils UK (RCUK), the Scottish Funding Council (SFC) and the Higher Education Funding Council for England (HEFCE) were started the discussions in 2008 to describe and define new metrics for the evaluation of technology transfer at universities. New metrics for the knowledge transfer activities evaluation in universities is defined by project conducted through UNICO commissioned Library House. Kevin Cullen, Director of Research and Enterprise, University of Glasgow defined the aims of the project as follows:
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• To establish an understanding for knowledge transfer in UK in term of what is currently being measured and the definitions of the currently metrics usage.
• To conduct an investigation among stakeholders to identify their view on knowledge transfer, ways to achieve, and measure knowledge transfer both quantity and quality aspects.
• To design metric framework that cover majority of needs in measuring knowledge transfer in UK by using feedback from the focus group.
• To determine the effectiveness of the developed framework and identify any gaps in the availability of knowledge transfer data by conducting an initial benchmarking for UK universities using both public and private data.
• To perform an international comparison of UK universities with US and Canada in determining ways UK compares internationally with regards to knowledge transfer by using this particular framework.

Thus, the development of metrics for evaluating the knowledge transfer in UK universities has been set by the market leader of UNICO Technology Transfer Association. Primarily, key players in knowledge transfer are identified such as the research funders who fund the research that creates the knowledge to be transferred; the senior university management that represent the academics who perform the research and the business community that are the recipients of the knowledge. After they are invited, the currently used definitions of knowledge transfer, their views on the objectives and mechanisms of the process, and ways to measure the success and impact of these knowledge transfer activities will be discussed. The participated stakeholders defined in step three a framework of the key mechanisms of knowledge transfer and associated measures of their quantity and quality in the particular discussion. In order to perform an initial benchmark analysis that focusing on a subset of 20 universities, they populated the new framework with available data accessibly from UK universities and commercial data. Finally, An international comparison with the US and Canada is conducted to determine how UK universities implement at knowledge transfer relative to these countries [12].

4. University-Industry Collaboration Mechanisms

In our proposed model, we follow the UNICO’s framework by identifying a various set of metrics that covers different dimensions of research collaboration activities from universities to industry and in some cases we use definition and indicators from other models that mentioned above. So, we will try to prepare a framework to measuring success of research collaboration between industry and university from perspective of university. Therefore, at first we determined different kind of research collaboration mechanisms and the indicators to measuring success of each mechanism. The proposed research collaboration mechanisms and success criteria are as below:

4.1. Consultancy and Technical Services Provision

In this mechanism, one or more member from the university or research center provides guidance, information or technical services to other party. They have formal written contract, which is generally in short terms and specific. Senior researchers or faculty members can be hired to consult during their free time to work outside the universities [14]. The advice is a key characteristic of a consultancy rather than a written report or any original research that distinguish contract (or commissioned) research. For instance, Business parties may approach the management academics to provide some advice on ways to restructure their operations. In fact, the industry or community advisory committee can be participated by academicians. These activities include several days work by the academic but it does not involve any written report or formal analysis of production operations. Below are the suggested indicators in measuring consultancy and technical supervision.

• Number of consultancy contracts
• Value associated with consultancy contracts
• Number of collaborative research projects generated by consultancies
• Number and value/income of contracts
• Number of client companies
• Length of client relationship

4.2. Cooperative R&D Agreement
The agreement between one or more university research laboratories and one or more firms consists of provision of personnel, facilities, or other resources with or without reimbursement by university. While, funds, personnel, services, facilities, equipment, and other resources to conduct specific research or development efforts are provided by industrial parties that are consistent with the laboratory’s mission [15]. Suggested indicator for measuring Cooperative R&D agreement can be as below:

- Number of R&D agreements
- Value associated with R&D agreements
- Access of industrial high technology equipments
- Number of academic papers published in journal or presented in conferences
- Number of client companies
- Length of client relationship

4.3. Licensing

In order to permit and authorize the third party to use intellectual property, licensing is the method in transferring less-than-ownership rights in intellectual property to a third party. It is preferred by small business and it can be either exclusive or non-exclusive. In fact, plans in commercializing the invention need to be presented by the industry as a potential licensee [15]. In fact, the institution enters into a licensing agreement with another company, which will commercialize the invention. The institution in return receives royalties. Suggested indicator for measuring licensing can be as below:

- Number of licenses
- Income generated from licenses
- Number of products that arose from licenses
- Number of invention disclosures
- Number of complete standard patent applications
- Number of patents granted
- Value of copyright licenses
- Long term relationships created following licensing

4.4. Contract Research

The R&D contract that performed by research center is followed a contract prepared between research center and firm. Industry provides funds in most of the time while the university provides brains for a particular time frame given either in a few months or years [14]. The industry wants to utilize and gain the benefits from the exclusive ability of research centers in term of commercial aspect through contract research. Suggested indicator for measuring contract research success can be as below:

- Number and value/income of contracts
- Number of products that arose from contracts
- Percent of income relative to total research income
- Length of client relationship
- Number of academic papers published in journal or presented in conferences
- Number of contract research projects which led to other flow-on knowledge transfer activities such as collaborative research, licensing, and industry sponsored conferences

4.5. Spin-off Companies

Spin-off or start-up companies are new companies that commercialize a university technology research result through a license agreement. It often involves a new high-risk research area [16]. This company that is a spin-off from university research programs will also have a formal linkage with the university in terms of facilities sharing and hiring of graduate students [17]. Suggested indicator for measuring success of Spin-off companies can be as below:

- Number of spin-offs formed
- Value of revenue generated by the spin-off
- Value of external investment raised
- Flotation/exit value
5. Research Framework

University-industry interaction is seen as the most efficient form through which university inventions can get into practice because university and industry join and overlap research efforts to develop innovations and solve complex problems [18]. In this regard, evaluation of university-industry collaboration activities is one of the most important issues. As mentioned above, our proposed model is based on UNICO model. It’s important to note that UNICO model covers all technology transfer activities between academics and industry. But in our model we only focus on research collaboration activities between university and industry. Based on previous literature review and discussions the proposed model is shown in Fig. 1.
6. Research Methodology

The main instrument of this research is questionnaire. The questions try to determine importance of each indicator in measuring success of research collaboration between industry and university in UTM. In addition to determine if there is any difference between viewpoint of respondents different field of research, academic staff of six faculties of UTM will select as research respondents. To make sure generalization of our model, research respondents’ will select from academic staffs which have experience in research collaboration or have not experience. Based on our data, which collected from each faculty’s website, our respondents will be around 500 people.

7. Conclusion

This study presents an evaluation framework for assessing university-industry research collaboration from perspective of academics. Review of experience of other countries, helped us to use their experience to design a similar model for a developing country like Malaysia. Determining success criteria to assess university industry research collaboration can help universities and industries to get more benefits from research projects. Study’s findings will give insight to universities and industries seeking to initiate, participate or manage research collaborations in the future.

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