

The Status and Characteristics of University-Industry Collaboration in a Research University

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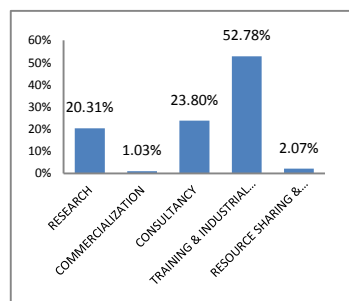
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Graphical abstract



Abstract

The increasing reliance on knowledge in industry and services is generating strong incentives to develop more efficient ways to transfer the discoveries made in academia to business. This paper mainly focuses to identify the status and characteristics of university-industry (UI) collaborations at a research university. Moreover a quantitative research method was adopted in this study. The sample was selected from Universiti Teknologi Malaysia (UTM). A total of 42 UTM centers participated in this survey. The findings demonstrate the type of existing UI collaborations and mobility at UTM. Furthermore, the result indicated the characteristics of university partners.

Keywords: University-industry collaboration; collaboration mechanism; mobility; Research University

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1.0 INTRODUCTION

The university's role is progressively changing: universities not only have to cope with research and teaching, but also are having to become poles of potential economic and social development [1]. A new range of activities, described as technology transfer and research exploitation is gaining ground and leading to increased interactions with the industrial sector [2, 3]. In the last twenty years, the effort of universities to collaborate with industry and foster knowledge transfer has progressively increased [4]. Links between university and industry are an important mechanism to develop and commercialize the fruits of university research. Such links are also seen as contributing to technological progress and economic well-being [5, 6]. University-industry linkages (UILs) offer an array of benefits for the parties involved and the economy at large [7].

The contribution of knowledge to social welfare and sustained growth through improved competitiveness is now widely recognized. Such recognition has focused attention on the role of universities. In the context of developing countries, the role of

universities is important for two reasons. First, these countries cannot rely on rich endowments of natural resources and cheap labour without any contribution of local 'intellectual added value'.

Second, a strong local knowledge base is necessary for local firms to take advantage of the world's information riches [8]. In leading developing countries like China and India, the role of universities has been quite dynamic, especially university-industry linkages (UILs). In China, a survey by [9] illustrates that more than 60 per cent of Chinese professors perceived that UILs improved after 2004. At the same time, most Chinese firms appear to be very positive in evaluating their own experiences of collaboration with universities. In India, though the contribution of universities to gross expenditure on R&D (GERD) and higher education enrolment ratio are relatively low and universities have been quite conservative in collaborating with industry, some universities have emerged as important actors in India's leading innovation clusters in India's big cities [10]. Indian Institutes of Technology, in particular, have provided bright and skilled students to industry. Also after the year 2000, there was a notable rise of spin-offs from campuses [11]. In this regard, Malaysia is falling behind and

Malaysian UILs are relatively weak. In Malaysia, university-industry links, particularly through commercialization of research results, has been put higher in the national science and technology policy agenda since the mid-1990s [12].

However, the closer involvement of universities with the market is highlighting the need for a restructuring of the internal organization and management of research activities [13], and this is promoting forms of organizational and cultural resistance to change. Problems related to communication and interaction between universities and industry are based on the different languages spoken by these two spheres, which are resulting in misunderstandings [14].

The main purpose of this paper is to determine the status of university-industry interactions at the research university. Furthermore this study aims to identify types of industry linkage and mobility at a research university.

■ 2.0 MODES OF UNIVERSITY-INDUSTRY PARTNERSHIPS

2.1 Research

a. Contract Research

Contract Research refers to research commissioned by industry and undertaken only by university researchers (D'Este and Patel, 2007). The R&D contract that performed by research centre is followed a contract prepared between research centre 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 (Lee and Win, 2004). The industry wants to utilize and gain the benefits from the exclusive ability of research centres in term of commercial aspect through contract research (Rast *et al.*, 2012). There is some evidence that increased contract research often follows from patents and academic entrepreneurship (Gulbrandsen and Smeby, 2005).

b. Joint Research

Joint Research projects refer to collaboration agreements between university and industry that involve research work undertaken by both parties (D'Este and Patel, 2007). 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 (Esham, 2008).

2.2 Consultancy

Consultancy work refers to work commissioned by industry which does not involve original research [15]. In this mechanism, one or more members from the university or research center provide guidance, information or technical services to other parties. They have a formal written contract, which is generally short term and specific. Senior researchers or faculty members can be hired to consult during their free time to work outside the universities [16]. Advice is a key characteristic of a consultancy rather than a written

report or any original research that distinguish contract (or commissioned) research [17].

2.3 Commercialization

a. Licensing

Licensing refers to a contractual method of applying intellectual property (IP) by transferring rights to other firms while retaining ownership. A license is also defined as a grant to another firm allowing it to use that specific IP. This license is usually made based on mutual contract and requires the licensee to pay fees to the licensor [20, 19]. Normally the decision to commercialize is either through a license to established companies or as a license to spin-off companies. These would generally be the result of joint decisions between technology transfer offices (TTOs) and the inventors [21]. According to [20], many firms have a large number of unexploited IP or underexploited patents that a licensee may be able to exploit. IBM, for example, widely grants licenses and its royalty income amounts to more than \$1 billion each year.

b. Spin-off Companies

Spin-off or start-up companies are new companies that commercialize a university technology research result through a license agreement [17]. Zhang [22] defined university spin-offs as companies founded by university employees and refer to their founders as academic entrepreneurs. On the other hand, Wright *et al.* [23] defined university spin-offs as new ventures that are dependent upon licensing or assignment of an institution's IP for initiation. It often involves a new high-risk research area [24]. Spin-off companies are a tool that can be used to quantify one impact which can be directly and causally attributed to one country's funding [25]. Companies that are spin-offs from university research programs will also have a formal linkage with the university in terms of facility sharing and hiring of graduate students [26].

■ 3.0 RESEARCH METHODOLOGY

This study was based on a quantitative research method and was designed to use a case study approach. This research is motivated to take one of the Malaysian universities to determine the status of university-industry collaboration in a research university. Universiti Teknologi Malaysia (UTM) was selected as a single case study in this research.

In this study, data was collected through a survey questionnaire. The survey was carried out between September and October 2014, which targeted university faculties, schools, Research Alliance (RA), Centre of Excellent (COE), Other PTJ1 (OP). Questionnaires were addressed to the department directors of 42 UTM experts and respondents were asked to provide information on university-industry interactions. The prepared questionnaire used for this study consists of three parts. In the first part, the respondents were asked about the kind of services which they offered to industry. In the second part, questions about the types of university-industry partnership were asked. Finally, in the third part, respondents were asked to answer questions about types of mobility. Table 1 reports the composition of sample.

Table 1 Composition of sample by UTM expertise

Departments/ Centres/ Divisions		
Faculties/ Schools (FC)	Faculty of Science (FS)	16
	Faculty of Electrical Engineering (FKE)	
	Faculty of Chemical Engineering (FKK)	
	Faculty of Petroleum and Renewable Energy Engineering (FPREE)	
	Faculty of Mechanical Engineering (FKM)	
	Faculty of Civil Engineering (FKA)	
	Faculty of Geoinformation and Real Estate (FGHT)	
	Faculty of Computing (FC)	
	Faculty of Education (FP)	
	Faculty of Built Environment (FAB)	
	Faculty of Islamic Civilization (FTI)	
	Faculty of Biosciences and Medical Engineering (FBME)	
	Faculty of Management (FM)	
	Advanced Information School (AIS)	
UTM Perdana School of Science Technology and Innovation Policy		
School of Graduate Studies (SPS)		
Research Alliance (RA)	Sustainability	6
	Nanotechnology	
	Infocomm	
	K-Economy	
	Construction	
Centre of Excellent (COE)	Materials and Manufacturing	10
	Institute of Ibnu Sina Fundamental Science Studies (IIS)	
	Institute for Oil and Gas (MPRC)	
	Institute of Environmental & Water Resource Management (IPASA)	
	Centre for Artificial Intelligence and Robotics (CAIRO)	
	Centre for Automotive Development (ADC)	
	Institute of Bioproduct Development (IBD)	
	Centre for Fiqh Research In Science & Technology (CFIRST)	
	Advanced And Membrane Technology Research Centre (AMTEC)	
Institute of High Voltage & High Current (IVAT)		
Other PTJ (OP)	Centre for Electrical Energy System (CEES)	10
	Kolej Tun Fatimah (KTF)	
	Office of Student Affairs and Alumni (HEMA)	
	Counselling Centre	
	UTM Technology Entrepreneurship Centre (UTM-TECH)	
	Security Department	
	Register Human Capital Development (HCD)	
	UTM Library (PSZ)	
	OSHE	
	Equine Park	
Sustainable Campus		
Total		42

4.0 FINDINGS AND DISCUSSIONS

4.1 Characteristics of university partners

The findings demonstrate that the highest percentage of collaboration with industry at UTM belonged to Small and Medium-sized Enterprise (SMEs) with 35.53% followed

respectively by Local Malaysian Organizations (NC), Government-Linked Organizations (GLC), Multinational Corporations (MNC), and Non-Governmental Organization (NGO) (see Figure 1).

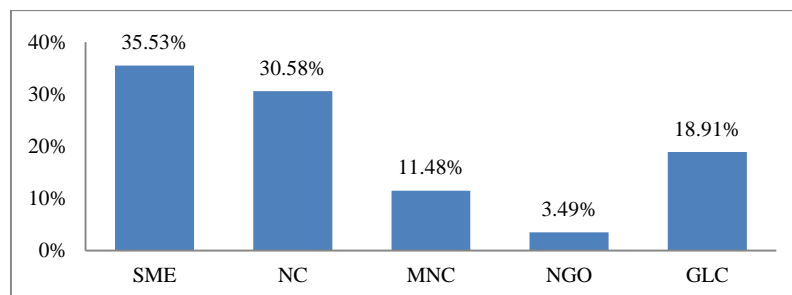


Figure 1 Natures of industrial partners at Universiti Teknologi Malaysia (UTM)

4.2 Types of University-industry Partnership

Data from the questionnaires reveal that UTM expertise offered service to industry through five different modes including research, commercialization, consultancy, training/ industrial attachment, resource sharing and knowledge transfer (Figure 2). According to the findings, training and industrial attachment was the most popular mode of university-industry (UI) partnership at

UTM (52.78%) followed by consultancy (23.80%), research (20.31%), resource sharing and knowledge transfer (2.07%), and commercialization (1.03%) respectively.

Based on the findings from questionnaires, FC and COE had the highest rates of collaboration with industry (45.52% and 44.08% respectively). The lowest rate of interaction with industry belonged to OP (2.64%).

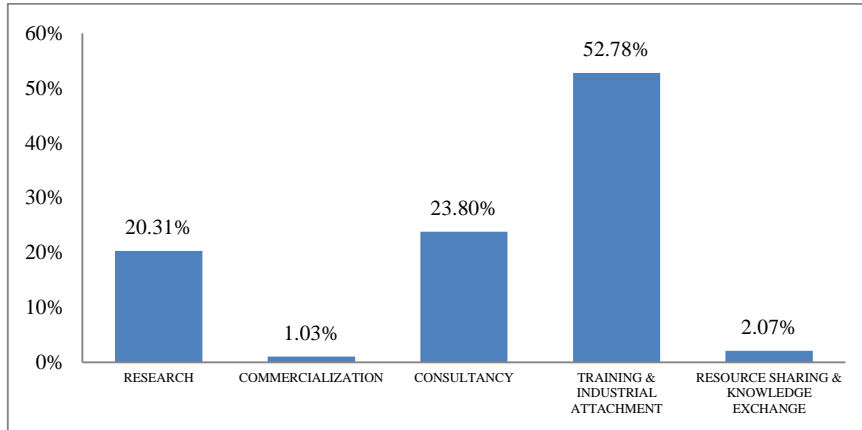


Figure 2 Services offered by UTM expertise

4.3 Types of Mobility

Based on the findings UI mobility in UTM include spin off company, training/ seminar/ workshop/ conference, student internship/ staff attachment, appointment of industry advisory panel (IAP), appointment of adjunct from industry (Figure 3). The most popular mobility in UTM is student

internship and staff attachment (81.79%). In contrast, appointment of adjunct from industry is the lowest mobility mode at UTM.

According to the findings, most of the mobility at UTM comes from faculties and the lowest percentage of mobility belonged to OP.

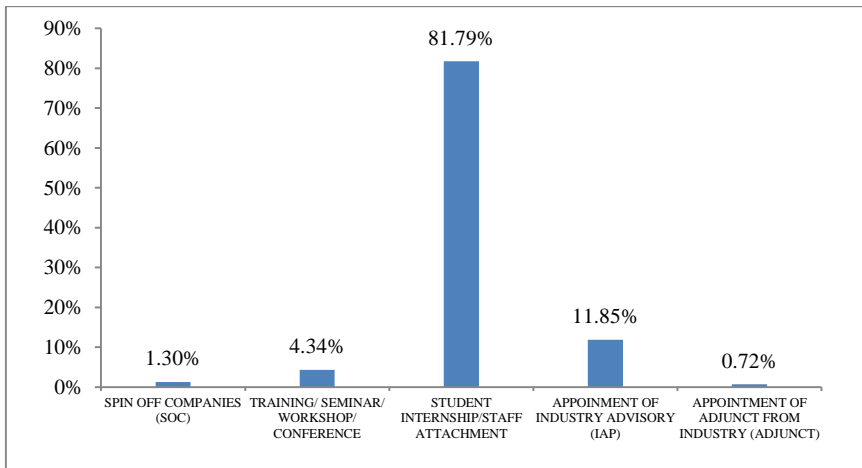


Figure 3 Types of mobility at UTM

5.0 CONCLUSION

This study presents the status of university-industry interactions in UTM as a research university in Malaysia from the perspective of academics. Research, commercialization, consultancy, training/ industrial attachment, resource sharing and knowledge transfer were the five different mechanisms for UI partnerships at UTM. Among these services training and industrial attachment activities are the most popular mode of UI collaboration at UTM. Moreover, there were various type of mobility at UTM including spin off company, training/ seminar/ workshop/ conference, student internship/ staff attachment, appointment of industry advisory panel (IAP), appointment of

adjunct from industry. Student internship and staff attachment were the most popular mobility at UTM.

This study contributes to the existing literature on characteristics of university- industry collaboration in Malaysia. The findings of this study could not be generalized to other research universities in Malaysia since this research was a case study conducted on only one university. The same study needs to be carried out in other research universities to see if there are similarities. In addition, it is suggested that future research explore constraints of industrial linkages. Furthermore, the research indicated that SMEs in Malaysia were more eager to communicate with university rather than other types of industries. Therefore, it will be an opportunity for

university to focus on those research projects which is more suitable with SMEs requirements.

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¹Pusat Tanggung Jawab (PTJ) = Responsibility Centre