University-Industry Collaboration: A Catalyst towards Entrepreneurial University

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ABSTRACT

Universities have been identified as the key to wealth creation of a country since they are the centre for the best mind of a country. University’s profile as a non-profit organization has made the experts of certain fields of knowledge unknown to the industry and thus, their expertise were not fully utilised for the betterment of the society. This has been the case for the developing countries. However, there has been dramatic increase in awareness of the importance of university’s involvement in production of new technologies and later on directly involved with commercialization of their research output. This development has called forth the emergence of entrepreneurial university.

However, the cost of research and developing new technologies and later on presenting it for market purpose is a long-term process and needs an exorbitant fund. Therefore, collaboration between university and industry is seen as a better and faster approach to realize country’s innovation spurt. Thus, industries are actively seeking to harness long-term research and development collaboration with the local universities.

The purpose of this paper is to examine the university-industry collaboration framework and the barriers posed towards long terms and successful university-industry collaboration. This includes discussion on the ownership of intellectual property since this issue present as a fundamental factor that contributes towards disputes between parties. Best guidelines of university and industry collaboration practiced by few successful universities is also analysed as a guide for other universities to achieve similar success and thus precipitate the process towards entrepreneurial university as a hub for country’s productivity through innovation and creativity.

Keywords: University-industry Collaboration, Intellectual Property, University Commercialisation

INTRODUCTION

Traditional university system was built for the purpose of disseminating knowledge which later on evolve to have dual mission of dissemination of knowledge and production of new knowledge through research (Morphew, 2003), (Atkinson &Blanpied, 2008) and (Cheng, 2011). Recently universities have again expanded to embrace ‘third mission’ (Wong, Ho & Singh, 2011) as laid down by (Etzkowitz, 2002) that is university involvement in regional economic development through capitalization of knowledge produced at the university. However, commercialization of university research is a risky investment and required big funding for developmental stages since university research outcomes are normally at the embryonic stage and not ready marketable product (Yusuf, 2008). Thus universities need to secure funding in order to cope with the high cost of research and development while industries are also in need of university linkages in order to keep abreast of new technological development to maintain competitive measures with their rival (Yusuf, 2006). Therefore university and industry collaboration is seen as a strategic approach that can benefit both parties to achieve their missions.

University and industry collaboration can be defined as “bi-directional linkages between university and industry entities, established to enable the diffusion of creativity, ideas, skills and people with the aim of creating mutual value over time” (Plewa et al., 2013). Although university and industry collaboration is seen as a strategic approach to achieve university mission in entrepreneurial activities and industry mission to appear as champion in the new era of rapid technology development, still this cross-sector collaboration is difficult to manage because of different culture and mission hold by both
parties. Accordingly, this paper aims to discover the framework of university and industry collaboration and the effect of such collaboration. Then in the next section, barriers towards successful collaboration are discussed with special reference to the issue of intellectual property ownership, which posed as an important factor towards successful collaboration. Few provisions under Malaysian intellectual property law are referred to for illustration. Later on there will be few tips on approaches taken by few institutions on the best guidelines to be applied in order to ensure successful and sustainable university and industry collaboration.

UNIVERSITY-INDUSTRY COLLABORATION FRAMEWORK

University and industry collaboration takes multiple forms. (Lind, Styhre&Aaboen, 2013) laid down four types of university and industry collaboration. First form is where the industry provides research funding for the university and takes no part in decision making of the research direction. Second form of collaboration is where industry is more involved with the research collaboration, for example by taking part as members of the board of research. However industry do not involve in day-to-day work of the project. Third form of collaboration is also known as ‘contract research’ where industry dictates the direction of the research for a specific research area and thus university researchers have little freedom in the final say of the research direction. This form of collaboration is normally in favour of industry and university researcher usually found themselves restricted by confidential information to publish their findings in the journal or conference. While the fourth form is where parties, university and industry decide on the direction of the research, which is relevant for both parties and will benefit both parties in the end.

With regard to the process that take place in university and industry collaboration, according to (Plewa et al., 2013) there are five phases in the university and industry collaboration:

1. Pre linkage
2. Establishment
3. Engagement
4. Advancement
5. Latent Phase

First is ‘pre linkage’ phase where at this stage parties to the collaboration are determined and align their interests and thus lead to agreement to work together (Haour&Mieville, 2011). This stage is where foundation for university and industry collaboration is created and thus it is important for both parties to take into consideration several factors that could determine success percentage of the collaboration. Among the factors is trust between parties, credible collaboration agents from both parties and that both parties own the right expertise to ensure successful collaboration (Plewa et al., 2013). Then the second phase is ‘establishment’ which consist of meetings and negotiations of the terms and conditions of the collaboration thus lead to formation of contract (Haour&Mieville, 2011) and (Plewa et al., 2013). The second stage is an important stage where all consideration must be taken into account such as the financial support, technology transfer mechanism and also ownership of intellectual property that will be created in the project. Often, parties to the collaboration find themselves without clear understanding of who has the right to decide on the direction of the research and publication time, or who has the right to royalties, or who has the right to access research materials for future research and whether they has right to work on the research findings for further improvement (Dreyfuss, 2000). While the third stage is ‘engagement’ where the collaborators are actually working together and deliver the project (Haour&Mieville, 2011). (Liew, Shahdan&Lim, 2012) pointed out that parties often neglected follow up on the project deliverables upon completion of the project and thus cause difficulties to industrial personnel to engage on the research results. Later on, with a successful collaboration, will lead to the stage of ‘advancement’ where parties have built trust among each other and lead to sustainable relationship with more research collaboration in the future. The last stage is called ‘latent phase’ where parties are in good terms but without any formal relationship. These stages illustrate the process occurred within university and industry collaboration.

Interaction between university and industry usually requires some sort of technology transfer from either side or each side of contracting parties. According to (Lee and Win, 2004) among the mechanisms of technology transfer are as follow:

1. Collegial interchange, conference and publication. This is an informal and free exchange of information among colleagues.
2. Consultancy and technical services provision. This is where members from the university or research centre provides advise, information or technical advise. This is a form of informal contact between industrial personnel and university researchers (Haour&Mieville, 2011).
3. Exchange program and expertise or employee secondment.
4. Joint venture of research and development. This is where university and industry share the cost of the program.
5. Cooperative R&D agreement where there are more than one university or industry in this agreement.
6. Licensing (transfer of intellectual property rights to a third party) of university intellectual property to the industry (Haour&Mieville, 2011).
7. Contract research by the industry to university or research centre and usually industry provides the fund.
8. Science Park, Research Park, Technology Park or incubators.
9. Training/ Internship 
   Practical training where students are exposed to the working methods and requirements of jobs at industry and according to (Haour&Mieville, 2011) this is the most effective way of technology transfer.

CONSEQUENCE FROM COLLABORATION

Research cooperation and linkage between university and industry produce equal benefits for both parties. Research collaboration between university and industry can be initiated either from industry side or university side. Normally when industry start looking for an interaction with university, there is an unresolved problem at their hand and through this collaboration they found cheaper and faster solution to their crisis. University also sometimes seeks cooperation with industry and this is when they have brilliant invention and there is need to commercialize it. University, though they have vast collection of knowledge, they are not well verse in business management. Thus collaboration with industry is a good step to commercialize their invention. Among other benefits gained by the university from this collaboration are access to sources of research funding (Dooley and Kirk, 2007) assistance received with experimentation, exposure of skill in new technique, access to research equipment and research material (Rappert et al., 1999) and increasing university expertise (Rappert et al., 1999). According to (Dooley and Kirk, 2007) collaboration with the industry will enhanced the university status when competing for public funded research due to the university capabilities to demonstrate channels which are proven through vast linkages with industries and firms and thus research outcomes can be disseminated effectively to the public at large. Besides that, successful research collaboration will also generates university income through licensing and spin-outs thus can help to improve university research facilities and fund future research (Yusuf, 2008).

While on the other side, industry will also gained benefit where they are able to sustain competitiveness from the networking and keeping abreast of university research (Rappert et al., 1999) and (Yusuf, 2008). Industry is also able to access the base scientific competence established within the university through public research funding, access to knowledge that has been developed within the research centre through publicly funded research, acquire competitive advantage by gaining access to better leads through university research centre compare to their competitor and also access to rich sources of highly skilled researchers (Dooley and Kirk, 2007). In other words, industry understands that university researchers are the principal channels through which new technology enters the market (Yusuf, 2008). Besides that industry will also benefit from recruiting trained graduates as future workers (Fabrizio,). Lee and Win, has added few benefits to the industry. Among others, the linkage can help to improve public image of the industry in the society which will surely attracted talented students to join in the industrial sector. It also provides new markets, improve quality of the products, cost savings and manufacturing time reduction (Lee and Win, 2004).

Eventhough university and industry collaboration entails many benefits for both collaborators, still there are scholars who raised concern that such relationship will corrupt the fundamental knowledge creation and transmission of knowledge and that publication of research outcome will be delayed (Atkinson and Blanpied, 2008). This argument however, has been rebutted by (Zeebroeck et al., 2008) who contended that from survey done, although both sides have different objectives they tried to accommodate each other to make sure that the collaboration will be successful and will benefit both sides. Thus, with this approach it will override all the so called negative impact of the relationship (Zeebroeck et al., 2008). However, there is a research finding which shows that approximately 35% of
university-industry collaboration allows the industry to delete information from centre reports and over 50% allow the right to delay publication (Behrens and Gray, 2001). Besides that, there is also some study that provide evidence that university researchers involved in commercialization practice higher degree of secrecy compared to those who are not involve with commercialization (Perkmann et al., 2013). These findings will surely defeat the university mission for knowledge disseminations. Therefore balance should be strike between university mission and industry revenue generated mindset so as not to defeat the purpose of the university.

**BARRIERS TOWARDS LONG TERMS AND SUCCESSFUL UNIVERSITY-INDUSTRY COLLABORATION**

Collaboration between cross-sectoral institution is difficult to manage because of different culture, background and mission posed by each parties to the collaboration. As for university-industry collaboration, (Bruneel et al., 2010) has classified two types of barriers:

1. **Barrier related to different motivation.**

   Different orientation of university and industry posed as a main barrier towards successful collaboration. Industry often conflict with university researchers over direction of research and time for research outcome disclosure. University researchers are always keen to disclose their research findings either through journal publication or conference where as the industrial personnel are more likely to keep the research findings as secret to avoid their rivals from gaining the information (Binns & Driscoll, 1998). Beside that, inexperience of technology transfer office personnel also presented as one of the factor against successful collaboration (Lai, 2011).

2. **Barrier related to conflict over intellectual property ownership and dealing with university administration.**

   The rise of university in the capitalization of knowledge has given motivation to the university to capture formal intellectual property. Adoption of government policy such as Bayh Dole Act of the United States that allow university to retain ownership of intellectual property resulting from research funded by the public funding has also increase university interest in intellectual property ownership. Through ownership, university has an exclusive right to exploit the research finding. However, this is also the goal of industry that is to own intellectual property from research they funded. Conflict over ownership of IP will certainly collapse university-industry collaboration.

   While among the developing countries, another barrier that posed against successful university-industry collaboration is the attitude of the industry who tends to depend on the technology transfer from developed countries rather than developing local technologies through local expertise. For instance in Malaysia, collaboration between university and industry is still to be seen its applicability since Malaysian scenario tends to depend heavily on the technology adopted from abroad rather than taking effort to develop its own research and development project (Cheng, 2011). According to (Shapira et.al, 2006) knowledge generation in Malaysia is generally low and this is proven from Analysis of Malaysian Knowledge Content Survey, 2003. There is also fact that only about 3.4 percent of Malaysian research output that were commercialized during the Eight Malaysia Plan (Cheng, 2011). Many studies have also pointed out that Malaysian manufacturing firms are ‘good adopters and adapters of technology rather than innovators’ (Shapira et al., 2006). However, according to (Cheng, 2011) recent development in Malaysia has shown that university and industry collaboration is flourishing motivated by success demonstrated by universities in developed countries like USA and Japan.

**OWNERSHIP OF INTELLECTUAL PROPERTY RESULTING FROM UNIVERSITY INDUSTRY COLLABORATION**

Issue on ownership of intellectual property that may result from a research collaboration between university and industry is often arise as one of the main obstacles for successful and sustainable
collaboration between these two parties. Ownership of intellectual property will give the intellectual property owner exclusive rights to exploit his/her intellectual property. Exclusivity is indeed important and industry as investors often wants to ensure that they owned the rights before significant costs are incurred in order to ensure that the IP could be exploited to the maximum without any legal ramification later on. While on the university side, ownership is important in order to ensure continuance of the same research in the future. If ownership is held by the industry, then university will be stopped from performing research development on the patented product.

Fortunately intellectual property law has provided a considerable legal safety net to be applied in collaboration scenario that is through joint ownership. For example under Malaysian Copyright Law 1987, Section 3 provides definition of "work of joint authorship" which "means a work produced by the collaboration of two or more authors in which the contribution of each author is not separable from the contribution of the other author or authors." While Section 10 provides qualifications needed for copyright protection that is;

“(1) Copyright shall subsist in every work eligible for copyright of which the author or in the case of a work of joint authorship, any of the authors is, at the time when the work is made, a qualified person.”

However, there is neither explanation on the extent of contribution needed to qualify for joint authorship nor any local cases to illustrate this provision (Azmi, 2012). (Azmi, 2012) is of the opinion that since Malaysian provision on joint authorship is quite similar to the United Kingdom Copyright, Designs and Patents Act 1988, then UK cases will be instructive to illustrate this provision. In the case of Hadley & Ors v Kemp & Ors[1999] EMLR 589, court has laid down four elements for joint ownership:

1. There must be a contribution of some sort from the other author.
2. The contribution must be significant.
3. The contribution must be original.
4. It must be the right kind of contribution.

Therefore, in a research collaboration, where the main author is the university researcher, then industry must show that, they provide some significant and original contribution to the creation of the work in order to be qualify as joint author.

As for patent, under Malaysian Patent Act 1983, Section18(1) stated that: “Any person may make an application for a patent either alone or jointly with another.” Subsection 3 provides that: “Where two or more persons have jointly made an invention, the rights to a patent shall belong to them jointly.” Thus, under research collaboration both university and industry may filed for the patent jointly and become joint owner for the patent resulting from the research collaboration.

While under intellectual property ownership discussion, it is important to differentiate between foreground rights and background rights in research collaboration. Foreground rights are intellectual property rights arising from the research collaboration output while background rights are intellectual property rights owned by either party collaborator, which are used in the collaboration project. Normally foreground rights are owned jointly by the parties in collaboration while individual party is more likely to retain ownership of their background rights (Binns & Driscoll, 1998).

Besides the statutory provisions, in determining ownership of intellectual property there are certain factors that need to be taken into account.

1. Statutory provisions
2. Place where the research is conducted.
3. Percentage of fund provided by each party to the collaboration.
4. Human resource that contribute to the research outcome.

After all these factors are taken into consideration, then parties to the collaboration could decide amicably on the ownership of intellectual property, profit sharing structures and also other rights and responsibilities of each party. All these factors and decision making must be concluded at the stage of ‘establishment’ where the parties negotiates on the terms of the collaboration agreement.

**ADOPTION OF THE BEST GUIDELINES FOR UNIVERSITY-INDUSTRY COLLABORATION**

There are few factors suggested by scholars that can determine successful collaboration and they are:
1. Trust between collaborators (Plewa et al., 2013)
2. Frequent communication which will help develop understanding of each others mission and vision (Plewa et al., 2013). Thus form understanding of technical mission of the university and business mission of the industry, strategic management could be formed within both institutions (Philbin, 2008).
3. Credible and capable collaboration agent that is the person who is responsible to drive forward the collaboration (Philbin, 2008) and (Plewa et al., 2013).
4. Prior experience with cross-sector collaborations might help both parties to understand each other and influence the outcome of the collaboration (Plewa et al., 2013).
5. Ensure the collaboration does not damage the university reputation in the eyes of public funding agencies.
6. Ensure that the university possesses competence in the area of research.
7. Ensure that high profile academic researchers handle the research.
8. Ensure the presence of provisions that allow knowledge exchange between researchers within university and industry (Dooley and Kirk, 2007).

Besides that, in an article published by World Intellectual Property Organization conducted under RisaburoNezu, there is a checklist of possible actions to be taken by the university to facilitate university-industry technology transfer, which will determine a successful collaboration.
1. Need for the university to have a clear and transparent intellectual property policy.
2. University needs to explain the criteria for ownership. For instance the scenario of inventions and the ownership of the intellectual property in each scenario.
3. Clear distribution of revenue sharing. This is a key element for every collaboration, thus the right distribution of royalty is important to ensure disclosure of all inventions by researchers.
4. Clear guidelines to be used in collaborative or sponsored research contract.
5. Develop policies on conflicts of interest. This is for situation where university researchers might have interest in the licensees of intellectual property resulting from the university research.
6. Capable department to manage university intellectual property.
7. Clear guides on the obligation and responsibilities of university and of the researchers. For instance duty to disclose invention and confidential information.

CONCLUSION

In conclusion, research and development collaboration between university and industry is a strategic approach to boost knowledge-based commercialization. University, with its’ expertise resources and industry with huge funding resources are the best partner to accelerate the growth of university entrepreneurship and commercialization of new technology that will boost regional economic development for the betterment of society. However, cross-sectoral collaboration is not an easy task to be managed and maintained. The fact that both parties represent different cultures, backgrounds and missions are the main factors that work against successful collaboration. However, these differences could be overcome with clear and focus aim to be achieved from university-industry collaboration and thus both parties could work towards understanding of their partner’s institutional settings. There is evidence of successful university-industry collaborations mainly in the developed countries such as United States of America, European countries and Japan. Therefore, universities from emerging economies, such as Malaysia should adopt the best guidelines learned from successful universities to be applied in a university-industry collaboration and thus economic prosperity could be savoried through innovation and exploitation of intellectual property resulting from the successful collaboration.

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