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Research Article

Comercialising of Innovative Research Product in the Malaysian Public University: Challenges and Ways for Improvement

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Abstract

Commercialisation of an innovative research product has been perceived as a platform to increase the wealth for a country including Malaysia. Although many efforts have been emphasised to encourage for commercialisation activities, the rate of success is still less encouraging. Thus, the purpose of this study is to examine the challenges faced by academic researchers in commercialising their innovative research products and to suggest ways for improvement for commercialisation activities particularly in the university. Interviews were conducted with five academic researchers who have successfully commercialised their innovative research products. This study identified that there are main challenges with respect to intellectual property protection and commercialisation policy, producing innovative research products and gaps between academics and industry collaborators. The most challenging factor is the intellectual property protection and commercialization policy.

Key words: Academic researchers, commercialization, innovative research product, intellectual property

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INTRODUCTION

Commercialisation involves the process of translating research knowledge to new and improved products or services to enable them to enter into the market place (Isabelle, 2004). Many countries have provided many supports to improve and effectively commercialise especially university innovative research products, including Malaysia. It is interestingly to note that although there are many kinds of supports to improve the commercialisation activities, however, commercialisation is still new and less encouraging. There are also little findings to support for commercialisation activities, especially relevant in the Malaysian context. Moreover, commercialisation is a complex process and this issue has not been properly addressed. The role and functions of the university have been expanded to include in facilitating the creation of commercialisation of research products and intellectual property (Siegel and Wright, 2007). It has been emphasised by the policy maker that universities and research institutions are treated as an engine for wealth creation through commercialisation tools (Markman *et al.*, 2008).

In participating in a global race towards commercialisation activities, research universities have been considered as the pioneer and catalyst for research commercialisation in Malaysia (Ramli *et al.*, 2013). The continuous creation of research product for commercialisation has given rise to the recognition of new function of the university known as "entrepreneurial university" (Ramli *et al.*, 2013; Karlsson, 2004; D'Este and Perkmann, 2011). This recognition has given an opportunity to the university to become an independent body to create their own income (Ramli *et al.*, 2013; Howitt, 2013; Han and Heshmati, 2013).

It is a prevalence role for academic researchers to conduct study and disseminating knowledge to the society (Rasmussen *et al.*, 2006). After all, the utmost important motivation is that the creation from the university reaches and benefits the society as a whole. There are many ways in which the university should set its own strategies for commercialisation. Some universities have adopted internal, quasi-internal and externalisation approaches (Markman *et al.*, 2008) in order to identify novel intellectual property with commercial potential and to strategise their financial to maximise the chances of success (Siegel and Wright, 2007). This also can be done by encouraging collaboration between regional universities, research centres and other organisations (Siegel and Wright, 2007). Another strategy that the university could adopt to encourage for research products commercialisation is through strong

collaboration with the industry. Collaboration between university and industry is considered one of the strategic approaches to the success of research product commercialisation (Ramli and Zainol, 2013). To effectively collaborate, universities should produce innovative research products that meet the market requirement and consider the technology trend in the industry to have a competitive advantage (Yusuf, 2006). Thus, it is said that commercialisation will be treated as successful if manage to collaborate effectively between university and industry and able to tackle all issues and challenges along the process of commercialisation (Karlsson, 2004). Furthermore, rewards system should be encouraged for academic researchers to develop and improve more commercialisation activities (Siegel and Wright, 2007).

Effectively for research product commercialization, university will adopt commercialization policy and other key legislations to promote rapid diffusion of technology from universities to industry (Markman *et al.*, 2008). For example, intellectual property commercialisation policy has been designed to consider the ownership rights, profit sharing and other rights (Ab Aziz *et al.*, 2011). These policies are important to establish proper management of intellectual property rights and protect research product commercialisation related processes (Ramli *et al.*, 2013). Moreover, these policies are intended to provide support, guidance and framework to enhance researcher's productivity (Ab Aziz *et al.*, 2011). Other than research commercialisation policy, research management centre or technology transfer office plays an important role to develop, coordinate and facilitate commercialisation in universities (Sastry *et al.*, 2007; Jensen and Thursby, 2001).

Intellectual property exploitation has played an increasingly important role in the global economy over the past decades (Aplin and Davis, 2013) and this is evidenced by the growth of the economy and government revenues in some developed countries. For instance, the United States Commerce Department in 2012 reported that intellectual property intensive industries contributed more than USD5 trillion to the US GDP in 2010 while, the European Union (EU) in 2013 reported that intellectual property intensive industries contributed almost €4.7 trillion for the period between 2008 and 2010 (Oswald and Pagnattaro, 2015).

Recognizing the importance of intellectual property contribution towards economic growth and in parallel with its aim of becoming a high-income economy by the year 2020, the Malaysian government introduced the National Intellectual Property Policy (NIPP) in 2007 aimed at strengthening the national intellectual property landscape so

as the economic, social and cultural prosperity of the nation could effectively be enhanced (NIPP., 2007). The NIPP generally emphasized on the promotion of commercial exploitation of intellectual property. In terms of its relevancy with the universities, it entails among others the strategies to identify intellectual property creators in Malaysia and to promote exploitation of commercially potential intellectual property so that a vibrant intellectual property industry could be developed to sustain country's economic growth in the new era.

This is particularly important given the fact that universities conducted research producing some innovations potentially to be commercially exploited, thus the role of intellectual property is significantly crucial to protect the rights of the universities. In fact, innovation sits at the top of the government's policy agenda (11th Malaysian Plan 2016-2020 which was launched in May, 2015) providing policy makers with opportunities to create initiatives that support innovation, including measures to enhance the performance of the national intellectual property system.

In line with this effort and to support the universities to seek intellectual property as a way to commercialize their research, the Ministry of Science, Technology and Innovation Malaysia (MOSTI., 2014) in June, 2009 formulated and introduced Intellectual Property Commercialisation Policy (IPCP) for Research and Development (R and D) Projects Funded by the Government of Malaysia. The aim of the IPCP is to establish a common framework to regulate the ownership and management of intellectual property from the creation, protection, innovation, exploitation and technology transfer activities carried out by ministries, government agencies and research institutions which use research funds provided by the Government of Malaysia. The term "commercialisation" under the IPCP is defined to mean the taking of an idea to an outcome-whether a product, service, process or organizational system in order to market by way of licensing, assignment, spin-off or joint ventures. The IPCP also generally provides that, the recipient of a government R and D fund is the owner of any intellectual property resulting from the research (MOSTI., 2009). This paves the way for more robust commercialization of academic research output as the academic institution has full disposition over its intellectual capital (Azmi, 2014).

Starting in 2015, Malaysia's public universities must provide 25% of their own operating budgets (OECD., 2015) that create if not urge incentives for universities to commercialize their research findings. This financial pressure makes it more crucial for universities to exploit their intellectual property as one of the sources of income. Indeed,

the patent applications among universities and public research institutions for instance, has increased 5-fold from 2005-2012 and in 2010, these institutions accounted for 60% of all Malaysian patent filings, most of them were filed by universities (MOSTI., 2014). Regardless of the increasing number of intellectual property applications, the commercialisation rate of research from public institutions has until recently remained limited (Thiruchelvam *et al.*, 2011). It is a known fact that, universities have faced a variety of challenges that are relevant to intellectual property and its commercialisation.

Many initiatives have been set up by the government to accelerate the rate of commercialization, but there still exist gaps that need to be considered (Govindaraju, 2010). There are certain challenges to transfer research products into the market. In the agricultural based research for example, although there are many potential for universities to be actively involved in commercialization, it showed that farmers are not easily convinced to consider using technology developed by universities (Yaakub *et al.*, 2011). For small firms, it was difficult to pursue commercialization because they are not aware of intellectual property rights system and the high cost involved when using the system (Siegel and Wright, 2007). Furthermore, due to the tacit nature of knowledge, there was a problem to link between the academic and industry (Etzkowitz, 1998). The industrie's perception that the university is not a source of innovation should be changed (Rasiah and Govindaraju, 2009). Other related challenges for research product commercialization including lack of funding, lack of collaboration between academic and industries, lack of emphasis on innovation and lack of human capital (Govindaraju, 2010). Although there have been variety of incentives and rewards available for academic researchers to pursue their research commercialization, these provisions have not been systematically organised (Yaakub *et al.*, 2011). Academic researchers have difficulties to identify the right incentives and rewards relevant to their research product. This proved to be less motivational for researchers to undertake the commercialisation activities. Lack of expertise in the relevant field and lack of expertise in management skills are also identified as challenges for successfully commercializing research products (San *et al.*, 2012).

MATERIALS AND METHODS

There are many challenges that university face in commercialising their innovative research products. This study addresses the following research questions:

- What are the challenges for commercialising innovative research product among academic researchers in the Malaysian public university
- What improvement can be made to ensure for an effective commercialisation in the Malaysian public university

In order to answer these questions, this study adopted a qualitative research using semi-structured interview questions. Five academic researchers have been purposely selected for the interview. They were chosen based on these criteria, (a) Different technical and scientific background, (b) Extensive experience in commercialising research products, (c) Extensive experience working with industry, (d) Represent the Malaysian public university and (e) Experienced for being attached to the centre of research and commercialisation unit. In this study, the five academic researchers are identified as male interviewees, that are TO, SH, RS, BH and CH for the purpose of anonymity.

The face-to-face semi-structured interview questions were design based on the structure developed by Patton (2002). The interviews were conducted by the researchers and the sessions lasted approximately 1-1 ½ h. The interviews were recorded and then transcribed in verbatim. All information gathered from interviews were analysed based on axial coding.

RESULTS AND DISCUSSION

There are considerable academic discussions on the challenges for commercialising research products. At the early stage of research development, it has been highlighted that researchers faced uncertainty in the technical and market segment, availability of the funding and lack of collaboration between academics and industries (Govindaraju, 2010). It has also been emphasised that the challenges for research products are due to lack of expertise to deal with commercialisation activities, lack of incentive provided by the institution to encourage for more commercialisation activities and failed to see the commercial potential of the research products (Christie *et al.*, 2003). Furthermore, it has been

reported that the university should adopt a clear intellectual property management in promoting, acquiring, protecting intellectual property rights (Mengistie, 2010) and intellectual property management should be set up to secure the outcome from the commercialisation activities (Ramli *et al.*, 2013). Further emphasised has been put forward that another there is no clear intellectual property policy that specifically designated for research product commercialisation (Gadallah, 2010). Swamidass and Vulasa (2009) have reported that lack of staffs, tight budgeting and market readiness are among the challenges for commercialising of research products. Other studies found the challenges regarding that commercialisation is still treated new and only enter into its infancy level recently (Yaakub *et al.*, 2011) and some universities are still focusing on the traditional teaching and researching (Galushko and Sagynbekov, 2014). This study has identified and examined the main challenges for innovative research product commercialisation which can be categorised into three aspects namely, (i) Intellectual property protection and commercialisation policy, (ii) Producing innovative research products and (iii) Gaps between academics and industry collaborators. This study also tends to suggest ways for improvement for an effective commercialisation of innovative research products. These aspects are discussed further in the following part of this section.

Intellectual property protection and commercialisation policy: All of the five academic researchers (the interviewees) agreed that understanding intellectual property protection and commercialisation policy is the most challenging aspect for research product commercialisation in the university. Intellectual property related-determinants, for example confidentiality of the technology, the strength of intellectual property protection and the exclusivity rights conferred by intellectual property found to be one of the significant determinants for a successful licensing and commercialising of university technologies (Rahal and Rabelo, 2006). Intellectual aspects related to intellectual property protection and commercialisation policy are highlighted by the five academic researchers are summarised in Table 1.

Table 1: Aspects of intellectual property rights and commercialisation policy

Aspects	TO	SH	RS	BH	CH
Academic researchers are less concerned about intellectual property protection and commercialisation policy	✓	✓	✓	✓	✓
Intellectual property application is not an easy task and involves a complex process	✓	✓	✓	✓	✓
Different products requires different types of intellectual property protection	✓	✓	✓	✓	✓
Misconception and understanding about intellectual property rights	✓	✓	✓	✓	✓
The fact that all intellectual property policy have been written in a legal terms make it even more difficult for academic researchers to understand	✓	✓	✓	✓	
Incentive and rewards should be promoted to encourage for research product among academic researchers	✓	✓		✓	

Commercialisation of innovative products requires a well informed and understanding of the intellectual property rights and commercialisation policy, as highlighted by all interviewees. Almost all universities in Malaysia have adopted at least both policies in governing the intellectual property rights and commercialisation activities. This was highlighted by interviewee to that his university adopted both policies and he said that “basically we are covered by few policies. The first policy is intellectual property policy that covers from the research output, how to get a research output patented until commercialisation. And then there be another policy called commercialisation policy. That are two main policies that we are having here”.

Theoretically and practically, there are well established policies to govern intellectual property rights and product commercialisation in the university, in which they provide some rooms for academic researchers to understand their rights. Similarly, interviewee CH has also shared the same experience where he said that in his university, intellectual property policy is applied to assist the protection, commercialisation and exploitation of intellectual property created by the university. However, this is not always being the case where academic researchers are less concerned and aware about the importance of intellectual property rights and commercialisation policy. Interviewee TO emphasised that “I do not think that researchers are concerned about the policy because everything they still refer to us [research and management centre] and asked us so many times. In fact we have told them many times also”. On a similar vein, interviewee BH stated that “to be honest with you, when I was a lecturer and researcher [...] prior to that, I did not know much about intellectual property policy, whatever policy. This is because, it is not required for us to know in terms of our research [...]. The thing is not important at all [...]. So I do not bother about the awareness of policy as such”. Based on their answers, it is safe to claim at this point that academic researchers generally may think that intellectual property rights and commercialisation are not of their concerned, since they think that this is the responsibility of the research and management centre¹, However, by leaving responsibilities on the research management centre alone may not solve the issue.

Interestingly, however, this may seem possible for certain academic researchers, as claimed by interviewee RS that “from the start I know my product needs to be protected by intellectual property”. Thus, this is a good sign for academic researchers who are showing some interest in knowing and understanding the importance and function of intellectual property rights and commercialisation policy. Thus, as advised

from RS that researchers need to be aware of the importance of intellectual property rights and its commercialisation policy, he however admitted the challenge on how to make them well informed on this issue. Lack of knowledge and awareness about intellectual property rights and commercialisation policy may affect their rights as researchers, innovators and employees of the university in a sense that they might face difficulties to differentiate opportunities available to them, what rights involve, types of subject matter of protection and requirements for a protection available to them. This finding is in line with the previous study where Christie *et al.* (2003) for instance emphasised that lack of expertise to deal with commercialisation activities coupled with the failure to identify commercial potential of the research products may hinder the overall process of research commercialisation.

All of the five academic researchers admitted that application for intellectual property rights is not an easy task as researchers need to understand from the scratch until the end of the process. Along the way, it gives them the opportunity to learn many things regarding intellectual property rights and commercialisation process. For this reason, interviewee RS shared his story when he wanted to apply for a patent by saying that “it is no secret that commercialising research product is not as easy as one, two or three. One important lesson I learnt is that to ensure that each patent file originates from a great novel idea”. On a similar note, interviewee TO stated that “I would say that the process for intellectual property application is not an easy but the problem was not came from the research management centre. It always comes from reviewing panels where it took quite a long time. What we could do is to explain to the researchers how actually the processes are. It is something that out of our control. This is because there was a time when we received a lot of application by the researchers”. He further added that even if filing for a patent was a possible one, nonetheless, it would be a huge challenge to commercialise the innovative products. However, with the help of the research management centre in securing and protecting novel ideas through intellectual property protection and identifying different commercial strategies for the innovative products, the burden would be much lessened. Similarly, interviewee CH clarified that the commercialisation process in his university starts with capturing and screening potential R and D and products by adding value to the product through the commercialisation management unit.

Although many steps have been put forward to assist academic researchers in understanding the application procedures of intellectual property protection not all researchers willing to understand the flow of the intellectual

¹For the purpose of this study, all centres for research and management or commercialisation activities or any technology transfer offices will be referred as research management centre

property application. For example interviewee CH stated that “particularly, the issues usually come from researcher [...] not all put an effort to understand the flow of intellectual property application until it is granted”. Not only that, some academics may find even more difficult of the process for being the pioneer in commercialisation, as shared by SH where he said that “research management centre did not have any experience in commercialisation yet at that time, so it was a hard work because we need to do everything from the scratch”. This statement is fairly true especially for new and young university in which academic researchers need to figure out the application and commercialisation process by themselves. He further clarified “even to commercialise, it is not an easy process. Especially we are developing product with specific target [...]. But to get the prototype is one thing, to continue refine the product is one thing. Like me, when I come out the product my motivation with just to help others. So due to that I don’t have the pressure to commercialise. But it does not mean that we don’t have the urgency to commercialise”. This finding is significant in terms of assisting the universities to realise the importance of adopting a clear policy on intellectual property as stressed in earlier studies to assist the universities in securing the outcome from the commercialisation activities (Mengistie, 2010; Ramli *et al.*, 2013).

Academic researchers may find it difficult to differentiate between different types of intellectual property available for different subject matters. Some of academic researchers may think that patent is the only weapon which they can rely on to protect their own innovative products. This wrong assumption may deny their own rights to consider other types of intellectual property rights. However, the real challenge is that when academic researchers need to identify which type of intellectual property right is appropriate for their creations. Protection through intellectual property right is not necessarily the last stage to guarantee that the innovative products will enter the market successfully. A misconception is that, academic researchers may claim that they have reached the success level of commercialisation by getting their products safely secured through intellectual property rights. This is the challenge that the research management centre and the university faced because while intellectual property and commercialisation are intertwined with each other, they are however separated. This was observed by interviewee SR which stated that “intellectual property is just an intellectual property. But to sell it totally another different thing. And I think only people that have been commercialised their products can understand that. People that have never done it yet and want to do it might say it would be a nice

thing to commercialise their products. But in reality, it is not like what they thought. Because I think, it needed a lot of hard work” and he further stated that it was quite hard to find the success stories for commercialisation of the innovative work especially in Malaysia (Rasli, 2005).

It is also worth to note here that in most cases, convincing academic researchers that their creations belong to the university is quite challenging as misconception always revolve around the ownership right of the innovative products created in the university. In this context, the finding of this study confirmed the previous one (Ghafele, 2012), where academics may claim that their rights have been denied when university owns of their creation. Furthermore, literatures also proved that difficulties arise in term of determining intellectual property ownership where the policy has not made it in a clear manner (Farsi *et al.*, 2011; Decter *et al.*, 2007; Bruneel *et al.*, 2010). Nonetheless it is important to note that they still can claim for any rewards in term of incentives or profit sharing. This has been made clear by interviewee SH “we cannot simply commercialise it by our own because all the research products under the research grant are university properties, own by the university. It was not ethical”.

In resolving this issue, attention should be drawn into what legal provisions pronounce. As regards to patents for instance, section 20 of the Malaysian Patents Act 1983 clearly states that inventions made by an employee or pursuant to a commission shall belong to the employer but the employee shall be entitled to equitable remuneration which may be fixed later if the invention acquires an economic value much greater than the parties could reasonably have foreseen initially. Interviewee BH shared his own stories regarding this issue and said that “sometimes, researchers are always suspicious of the university. I do not know why but I think it is a culture [...]. Let’s say that they want to start up the company, I don’t want 30%. I want 60% because this is my company. This is all my ideas”. This issue is always become a heated debate because it involves profits gain from the activities as claimed by interviewee to that:

“When we talked about commercialisation, we relate it to the profit. I will not mention about the figure, but the big portion of the profit we return back to the researcher. The university is only taking a very small portion. The intellectual property is belong to the university, but you are the inventor of the commercial product. You have the right to get the profit. I think that is the big encouragement. I don’t know how other university divide the ratio of the profit but ours is so big. Definitely if they are able to set a spin-off company, towards the end of the year their Key Performance Index (KPI) is also counted. Since they have a product that successful to be

commercialised. They score a higher performance index. That was also a good point. But I think the good point is the return. They have the licensing fee, royalty. I would say again nearly all of the return will go to the researcher, not the university”.

This is very encouraging and promising statement made to boost for the commercialisation related activities in the university. University will provide rewards to the academic researchers by giving them incentives or profit sharing. This incentives and profit sharing may vary from one university to the other university.

The research management centre offers their assistance in helping the academic researchers from the beginning until the end of intellectual property protection and product commercialisation. Interviewee TO comment that:

“Physically we support them throughout the process of commercialisation. From the start, until successfully commercialise. And we always involve them in whatever we did. I mean they know what we did for them. For example, they have intellectual property and then there are industry interested with the intellectual property. But the researcher don’t know how much the charge for the industry, what is the royalty fee, what is the licensing fee. Then we would involve, evaluate the intellectual property, find the experts for intellectual property evaluation. And then we recommend them how much they should collect for this. We advise. And then if they are agree we will help them with an agreement, get it sign, get it stamp, everything. So I would say that from product until commercialisation, we work very closely with the researcher. Together”.

The fact that intellectual property policy, commercialisation policy and related documents were prepared using the legal terms, create difficulty for academic researchers, who are mostly from engineering and technical backgrounds to understand them. This was admitted by interviewee SH where he found a difficulty to understand and to write the legal terms. Similarly, interviewee BH explained that he has difficulty to convince researchers to take part in activities that make them more informed about the legal terms. He said that “to be honest with you, when we want to educate people, but they don’t really have an intention to learn, it is nothing we can do. But still we should not stop providing the opportunity for people to learn. Maybe we have

to change the strategy somewhere [...] they don’t understand. I had a very difficult time to convince them [...] to be honest with you, basically to me or not only me, I would say other researcher maybe because policy always written by lawyers. The language I mean is not straightforward [...]. I hate reading all this. I just asked somebody to read it and explain to me”. Thus, apart from expecting an assistance from experienced and strong team of personnel, academic researchers also have to play their part in understanding and make themselves fully aware and informed about intellectual property protection and commercialisation policy.

Innovative research products: Producing of innovative research products is another challenge for research product commercialisation in Malaysia. Table 2 highlights aspects related to a complex processes of producing innovative research products.

All of the five academic researchers agreed that research products created should meet the requirement by the respective industry. The products should tap the market requirement to successfully commercialise their research products. It However, it is admitted that it is not that easy to match the product to the market needs, as observed by interviewee TO, where he said that “the major issue is when matching the potential product with the industry [...]. Where the researcher develop the product based on the market demand and industry requirement [...], the collaboration sometimes is not working smoothly. It can be successful but the process, you can have many issues”. Thus, it was difficult for industry to expect that R and D activities are in line with the specific needs of the industry (Teng, 2010; Kaymaz and Eryigit, 2011; Farsi *et al.*, 2011).

There are many ways in which the innovative product meets the market requirement. As emphasised by interviewee TO, academic researchers need to work together with the industry from the beginning to ensure that their products match with the industry. He shared his experienced that research management centre assisted academic researchers in bridging these two worlds, for example through competition which allowed them to advertise the potential university products. In order to match the products to the industry requirement, he said that “we group research in the

Table 2: Aspects of producing innovative research products

Aspects	TO	SH	RS	BH	CH
Innovative products should meet the requirement of the industry	✓	✓	✓	✓	✓
It is quite difficult to determine the marketability of the products	✓	✓	✓	✓	✓
University may lack methods for product screening	✓	✓	✓	✓	✓
There should be a selective criteria for potential products	✓	✓	✓	✓	✓
Only selective products should go for commercialisation	✓	✓	✓	✓	✓

same category, for example biomedical. We group all ten medical products together, then we will invite the biomedical player in the industry, we will held a one day session, present to them, what we have. They will sign the confidentiality agreement. So right after the presentation, whoever interested, on the spot we have the matching room, collaboration with the industry. We found that it was very effective". By doing this method, they will get a prompt response from the industry whether to continue with the commercialisation of the university's product.

Another identified challenge is how to determine the marketability of the product. This is because, university should pursue for commercialisation only for a products that have a commercial value. However, this concerned was highlighted by interviewee CH where he said that "but it is very difficult to determine the marketability of a product, especially right at the start of the project [...] will look into different aspects when making the decision whether to commercialise or not, the market needs all that, we will also look into the viability of the product". Thus, merely producing a research product without carry any value for commercialisation will be treated less significant by the industry. Thus, the appointed panels have to be selective to choose only products which have commercial value as interviewee BH emphasised. He further said that this is because not all products should be commercialised. For example, the practice is his university is that, biotechnology is treated as having the greater potential as compared to the other areas.

Thus it is better to conduct the product screening especially to provide the platform to the academic researchers on how local industries see the potential of their products. This is inevitably important especially when their products are meant for people with special needs, as explained by interviewee SH. He further clarified that the product screening allows academic researchers to develop a contact and networking with the industry. This is equally true since university needs to do some marketing and channelling university's products to the outside world and update the products with the current trend in the industry.

It is admitted that university may lack particular methods to do for the product screening or to identify any commercial value in the products. However, the challenge is to apply the best approach and the right approach to effectively commercialise university's products. Different approaches may be adopted by different universities to pursue for their innovative research products commercialisation. Interviewee to explained that they have adopted three ways to pursue for commercialisation looking from the perspective of the

innovative products. Firstly, internally they conducted a screening process to match between product and the market requirement and identify intellectual property which potentially applicable and can be commercialised. Secondly, they have a request from the industry. For this method, they work together with the industry and later they develop the intellectual property. They found that this method is more effective because the products is readily set from the beginning to the requirement and the needs of the industry. Thirdly, they called as symbiosis program, which basically they work together with MTDC. For this reason, there are different phases they went through for the selection, through interviews to identify young potential entrepreneur graduated from the local university. This young entrepreneur will be sent for entrepreneurship training for 6 months. Under this program they have identified number of possible innovative products with potential entrepreneur. Later, what they did was to match the product and funded them to start for the spin-off company. Thus far, this program was considered as a successful one to encourage for commercialisation in the university.

Thus, to select a very potential product is a must to guarantee the success for the commercialisation. The innovative research products need to undergo certain phase of evaluation, for example as shared by interviewee CH, where he stated that "usually the potential products will be introduced to the industries and public through business networking and we do exhibitions to promote university products. We manage the licensing agreement between researcher and the interested party for collaboration". Similarly interviewee RS also made a similar note by saying that "for every product, it need to go through panel of expertise from various background for a patent screening and evaluation which provides a valuable advice and insights to the researchers. This panels will evaluate whether the product is novel or not and whether it has a commercial value". This platform is very significant for academic researchers to improve the quality and the potential of their research products. In promoting this selection, there must be certain approach which has been adopted by the university. Since the market is changing rapidly, interviewee SH suggested for the university to have the strategy and mechanisms to promote for commercialisation especially different among technologies. These mechanisms or strategies are made even more effective with the help of an assigned person, for example a project manager who can assist academic researchers in many ways. According to interviewee CH, this project manager able to assist academic researchers in

obtaining necessary information to match the product to potential industry collaborators to provide business advice and to monitor the business development progress from time to time.

Another identified challenge is that a mismatch of the relevancy and expectation between university and academics. This was highlighted by interviewee RS where he said that "one of the main challenge is that the fundamental mismatch with regard to relevancy, time horizon and expectation". This challenge occurs because different products require different phase of development, as emphasised by interviewee CH. He said that "the duration of the commercialisation process varies from project to project, but it can be a long process, months to years. It was a challenge when (research management centre) has to meet period required by collaborator especially". This was also agreed by interviewee TO where he stated that "the researcher sort of over expect their product [...]. It is when they think their products are great. But why we cannot commercialise their products? I tell you this, sometimes the researchers are very careful with the industry [...] they keep all the information about the product confidential. Then how the industry will know about their products".

Thus, it is better to prioritise the innovative products, especially when research management centre received a lot of application for products commercialisation. Interviewee TO highlighted that "I think it was about time, speed when we had to deal with hundreds products and with 30 officers. You know and overcome it. We prioritise the most potential product that can be successfully commercialise. Put on priority". In supporting this view, interviewee SH stated that prioritisation is very important and according to him engineering products are more easier as compared to products related to information technology.

Some academics may not have even commercialisation in mind when they start their commercialisation. This was true for interviewee SH which he admitted that "personally to me, when I developed a product, my motivation is not to commercialise the product. I develop the product that I believe can help others. So making money is not in my mind at all. Maybe some others researchers develop product and

they aim to commercialise the product. To me this is not the case. To me I just want to develop product that help people and it can be sold and at the end it can generate some money and we also used that money to help others. And developing more products to help others. So it is not about for generating money for ourselves. As I said, we develop thing that we like. I will never change my motivation [...]. Because my product is all to help people with special needs". Although this intention is considered as a noble one, nonetheless, it is important to have in mind the commercialisation journey the moment academic researchers undertake their project. This is to ensure that they have reached their commercialisation journey successfully. Furthermore, this intention might not too well matched with the intention of the industry which focuses on the money driven.

Lack of business related knowledge is one of the challenges encountered by academic researchers. This was admitted by interviewee SH when he said that "I don't have a background on business related field. So I think I need to get some exposure how to manage the start up for example, send me to the training, industrial attachment and how to manage the start-up company, I need those [...] now I plan to go to industrial attachment in order to equip myself on how to start the business, to maintain the business and that is all my own initiative". Individual initiative is needed for every academic researchers to equip themselves with business related knowledge to enable them aware the marketability and the trend in the current industry. It was not only that entrepreneurial skills were considered a lacking among academic researchers (Decter *et al.*, 2007; Farsi *et al.*, 2011; Amanor-Boadu and Metla, 2008), but communications skills were also found to be critical among academic researchers (Decter *et al.*, 2007; Farsi *et al.*, 2011).

Gaps between academics and industry collaborators: Lack of common knowledge and understanding between academics and industry are considered as a challenging task to bridge these two strangers. These aspects are depicted in Table 3.

All of them agreed that both industry and university do not understand each other functions. In most cases, their

Table 3: Aspects of gaps between academics and industry collaborators

Aspects	TO	SH	RS	BH	CH
Industry collaborators play less effective role to market their products		✓			
Both academics and industry need to understand each other function		✓			
Lack of common understanding and vision between academics and industry	✓	✓	✓	✓	✓
It is difficult to get a right and potential industry partner		✓	✓		
There should be a criteria how to select industry collaborators	✓	✓	✓	✓	
Mismatch the relevancy, expectation and time horizon between industry and academics	✓		✓	✓	

interactions seem are not compatible towards each other. Thus, both sides must show sincere commitment to effectively reach for commercialisation activities. The gap between both parties need to be bridged as this seems absent at the moment as stated by interviewee SH. Although the commercialisation maybe a successful one, nonetheless, along the process there could be many issues arise in term of expectation and relevancy from the industry, as admitted by interviewee TO that "it can be successful but the process, you can have many issues. The problem we have is because they are the industry, they want everything to be fast and cheap. Besides that, I think it also comes from the researchers. They want to sell faster, but they do not follow the procedure of the university". Thus, researcher and the industry must have the common knowledge to understand each other's functions.

It is identified that both academic researchers and industry collaborators generally do not have a common understanding as they involve of two different worlds. The conflicts occurred due to different motivation, culture and priorities between university and industry (Dexter *et al.*, 2007; Farsi *et al.*, 2011; Fiaz and Naiding, 2012; Howitt, 2013; D'Este and Perkmann, 2011; Aziati *et al.*, 2014; Ramli and Zainol, 2013; Lind *et al.*, 2013). Most academic researchers prefer to disseminate knowledge and publish their study, whereas industry people tend to guard their interest from their competitors (Aziati *et al.*, 2014; Ramli and Zainol, 2013; Fiaz and Naiding, 2012). This conflicting led to difficulty in establishing a trust between them (Othman and Malek, 2012). Hence, a link needs to be drawn to ensure that both parties appreciate and understand each other. However, the challenge faces by academic researchers is that difficulty in finding the right and potential industry collaborator. Interviewee SH said that "it is so difficult to get potential collaborators because normally the industry don't really understand what we are doing. It is not that they do not really understand. I think they concern that they are not experts in that area". This may be true because industry collaborators may not really understand the technical part of the innovative products made by academic researchers. Industry collaborators should be encouraged to have basic technical knowledge in the areas related to the academic researchers for them to appreciate the academics role.

Furthermore, industry collaborators sometimes do not understand the products and the motivation for academic researchers to commercialise their research products. This was emphasised by interviewee SH where he said that "for information technology related product, especially in our case, we are concentrating in developing product for very specific market which are children with dyslexia. The fact that it is

meant for the dyslexia children [...]. It is also suitable for other children with learning difficulties such as down-syndrome, autism etc. [...]. It is much easier to do it through social media network rather than on specific industry. Unless the specific industry or the industry that interested to collaborate with us really understand our motivation of our product. We are not selling system. Because I am interested in producing product in helping people rather than just making money" Furthermore, his noble intention should also be praised and he added that "we want to create job through our product. So rather than making money for ourselves, we want to create job for our product". Thus, industry collaborators should appreciate the motivation of academic researchers by not focusing only for profit making but at the same time to fulfil responsibility to help the society, particularly to develop the nation. In this sense, building a common intention is necessary to maintain a good rapport between two parties. This challenge of different intentions has been further shared by interviewee SH, he said that "researchers and business partner might have different intention. But sometimes there are other issues which our partner collaborators might not have the same intention like us [...] to find even one potential customer is one thing, to have the one that share the same motivation is another thing".

In selecting the most potential and appropriate industry collaborators, university must practice careful consideration to develop and maintain a good rapport. For example, interviewee TO said that in his university, they have certain criteria to select the potential industry collaborators. According to him, they appointed an advisor to advice on matters related to industry. Furthermore, to target the respective industry, panels from the industry offices and marketing manager are appointed. These types of persons will be able to provide a good platform for networking and link with the industry. Similarly, the same experience was also shared by interviewee BH when he said that "when I seek for industrial partner, I give them the criteria that I want. And if they have a contact, they will match the product with that company". Building a good networking and collaborating with industry is a must for academic researchers. Building a good rapport and investigate what are the needs of the industry are important towards a successful research products commercialisation.

A further identified challenge is the complex process of commercialisation which affects the speed and expectation from the industry. It is obvious that the speed between academics and industry is different, as strongly observed by interviewee TO that "the major things I think is the speed. When it comes to the industry, if they want the product, they

need it tomorrow, but the academician mostly cannot make it [...] industry really wants something very fast. Yes we know that because they need to be the leader in the market". Since academics and industry talk in different "languages" it is important to have a mutual understanding and respect to each other. Interviewee RS observed that "it is no secret that university and industry talk in two different languages and are living in two different environment. To industry time is the essence, they always want everything yesterday. On the other hands, university is always seen as relax, they seem to want everything tomorrow".

Thus the speed is the crucial thing expected from the industry, which is quite difficult for academic researchers to fulfil since they have to concentrate and focus on other important tasks such as teaching and learning, writing, researching and community service etc.

This is also emphasised by interviewee RS on the mismatch with regard to the relevancy, time horizons and expectation from industry and researchers. The RS emphasised that "one of the main challenges is the fundamental mismatch with regard to relevancy, time horizons and expectations. It is always the case for small and medium size enterprises, where resources and time are limited and demand is focused on highly applied short term solutions for technical issues. Given their greater emphasis on exploratory and in-depth study, we see a lack of interest from academics. This is an irony that creates barriers to collaboration [...]. Building a common vision for the collaboration is key to overcoming cultural barriers. I think the most fundamental principle in collaboration is avoiding overlapping tasks. University should be able to do things that the industry cannot and will not do and vice versa. Otherwise, time and effort will be wasted. Any collaboration should be a win-win situation". Thus, to avoid the mismatch between both sides, adaptability is needed for the academic researchers to have a common understanding and vision. Although they are seen as stranger, however, this effort should be made possible.

Some academic researchers consider that industry collaborators are less effective and efficient in terms of marketing their innovative products. This was highlighted by interviewee SH where he said that "they rely on us to do the marketing and they also rely on our experts to sell the products. We hope to find another collaborators to continue with our products". Because of this experience, interviewee SH has suggested for the university to hire someone which is assigned to do marketing for the academic researchers. This person according to interviewee SH will manage to help academic researchers in understanding for example the appropriate business model. He further clarified that "may be

if they could help us in terms of understanding the business model. This is because we are a researchers, we don't know how to market the product. We don't have any interest to know how to market the product as most researchers are from technical field. What we want to know, we develop the product so let someone else thinking about the business". A well-defined structure or unit develop by the university is important to strengthen the position of product commercialisation in the university.

In short, academic researchers need to link between their world and industry together so that they can appreciate each other interest. This is because the successful for innovative research products require concerted efforts between industry and academics to play their important roles. Consequently, they will develop a common goals towards achieving their target for successfully commercialising the innovative products. Words of encouragement by interviewee BH is worth to share where he said "to collaborate effectively between researcher and industry, first they need to have the right hardware. Once you have the right hardware, then you have the right software. Hardware means the people. Software means the values. So that you must have both, if you just have a people but the people don't have the value, it cannot go. If you have a value, but you don't have the people, it also cannot go".

CONCLUSION AND FUTURE RECOMMENDATIONS

Commercialisation of an innovative research product has been perceived as a platform to increase the wealth for a country. To achieve this goal, universities and research institutions are therefore play an increasing important role towards commercialising their innovative research products. However, the process is not a straight simple path without obstacles, particularly in a country like Malaysia where commercialisation of universities' research products is still at infancy stage. This study was therefore designed to explore challenges and improving ways of the commercialising of innovative research product in the Malaysian public universities.

The study identified three main categories of challenges in this regard: intellectual property protection and commercialisation policy, producing of innovative research products and gaps between academics and industry collaborators. This study demonstrated that while appropriate policies have already been implemented by the government supporting commercialisation activity, the majority of academics however were yet ready for this process due to lack of understanding of intellectual property concept and the

procedures involved in obtaining intellectual property protection. This result confirmed previous studies that demonstrated difficulty faced by academics mostly with non-law background to cope and deal with intellectual property issues.

In addressing this challenge, the study recommended continuous training on the basic concept of intellectual property and awareness of its importance to generate profit should be available to all academics and officers of university's research centre. This is crucial to ensure any potential innovative research products will be appropriately protected under specific intellectual property branches so that they will be exploited to their fullest prospect within the business environment. This study argued that if research products successfully protected and exploited not only they will generate university's income as aspired by the government, but will also assist the public universities to be more competitive, both academically and commercially.

The second and third challenges were in fact interconnected. The findings confirmed the previous studies in the context that difficulty to produce innovative research products was due to discrepancy understanding and expectation between academics and industries. In bridging this gap, the study recommended that collaboration between universities and industries is essential so that both parties will mutually understand what requirements to be met in developing research products with high potential of commercial value. This study argued that constructive comments from both parties will be beneficial in improving the products and business strategy in the long run. In fact, by using the data of this study, future analysis may be conducted in identifying the major discrepancy between university and industry so that any future collaborative projects undertaken will be well aligned to meet both parties' needs. An effective proven model from other jurisdiction in this aspect may also be worth to consider so that valuable partners can be matched between universities and industries.

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