Academics Entrepreneurial Orientation and Research Commercialization: Role of Technology Transfer Office

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Abstract: - Universities are unique in sense that they hold the key to inventions and innovations in the form of highly capable human resource. This human resource if provided with suitable environment and support exhibits entrepreneurial behavior. The present study is an attempt to investigate the moderating role of technology transfer office on the relationship between academic’s entrepreneurial orientation and commercialization of academic research. The study is conducted in Malaysian five research universities focusing on two faculties of science and technology and engineering. Sample for the study comprised of academic researchers engaged in R&D activities and belonging to the two faculties. The results indicate that TTO significantly influences the relationship. The results of the study are significant for the university management and researchers. The study recommends future course of action for researchers interested in pursuing the subject area.

Key-Words: - Entrepreneurial orientation, commercialization, research universities, technology transfer office, academic researcher, Malaysia.

1 Introduction
Universities are the traditional custodians of learning, knowledge and technology. They are unique as they hold the key to innovations and inventions. The key is the faculty and researchers that are continuously involved in R&D activities. Thus, faculty is the source of all R&D activities that happens within university. The faculty needs to have entrepreneurial orientation if they want to be involved in entrepreneurial activities. These entrepreneurial activities are helped by the support structures in the form of technology transfer offices established in universities around the world to enhance commercialization of academic research.

Researchers are of the view that increasing entrepreneurial activities in the universities have left universities with no choice but to re-invent their operational activities and engage themselves in entrepreneurial activities to remain competitive globally [18]. Though entrepreneurial activities are associated with the profit making but universities engagement in entrepreneurial activities is merely to stay economically healthy. Hence, innovation and commercialization has become an essential agenda for universities to survive in the competitive environment [16].

It has been highlighted that points out that the traditional academic viewpoint dictates universities to have sole focus of teaching, learning and research and not involve in commercial activities [10]. This traditional academic thinking has been the result of continuous government funding [8],[25]. In the public protected environment there was no pressing need for universities to change their previous academic philosophies; hence there was reluctance on their part to enter into the marketplace [32],[7],[17]. However, due to increased competition in the higher education system worldwide, where public and private sector universities strive for funding from both public and private sectors, as well as the government emphasis on universities to engage into research and development for knowledge and technology development has compelled these universities to venture into entrepreneurial activities [13],[31], [38],[5].

Rauch et al. [44] highlights that even though the field of entrepreneurship is relatively new to the university environment; commercialization of academic research depends on the university support to encourage academic staff to commercialize their research [10]. Two things are important if universities want to engage in commercialization

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activities: university support structure such as technology transfer office and entrepreneurial orientation of the academic staff and researchers. O’Shea et al. [41] have highlighted that the entrepreneurial disposition and individual’s abilities are important in shaping the individual’s behavior regarding commercialization. Similarly, Jain et al. [29] have also highlighted the missing link that is the university scientist whose disposition towards entrepreneurial activity is the key to emergence of knowledge intensive fields.

The increased entrepreneurial activities engaged by the universities across the globe has mainly been attributed to the establishment of special support structures in the form of Technology Transfer Offices (TTO) and incubator centres [39],[6],[26]. Technology Transfer Offices have become critical in transferring research results to private companies in the form of licensed technologies [26],[11] through its capable and expert staffing and reward systems [6],[24],[52],[21]. The TTO have become the gatekeepers and boundary spanners in the technology transfer and commercialization activities undertaken by the research universities [55],[6],[50].

The present study is an attempt to investigate the entrepreneurial orientation of the academic researchers towards commercialization with the moderating role of technology transfer office. The context is the Malaysian research universities engaged in R&D activities for commercialization purposes. The sample has been taken from two faculties of five Malaysian research universities. These faculties are engineering and science and technology. These two faculties have been targeted because of their role in R&D activities and subsequently commercialization.

Malaysia is a developing country ranked in the upper middle income group and is looking to join the high income bracket by 2020. The country is striving hard to attain this goal by enacting policies and measures that help in the overall economic development of the country. In this scenario, the role of higher education institutions has been highly emphasized. It has been highlighted that Malaysia is still behind in terms of its research capabilities [4] and in fact has entered the commercialization game very recently, which is reflected through a small percentage of R&D output in the form of commercialized product [28],[2].

Entrepreneurial orientation in universities may be reflected in the way entrepreneurship is viewed within the university, the manner in which risk-taking is considered in performance reviews, or the means by which success is measured [49], [45]. Kenney and Patton [31] suggest that today’s universities need to develop entrepreneurial skills and traits. Hence, there is a need for perception of the importance of the market in forming a new philosophy for the future of higher education with respects to traditional academic principles [35],[31].

O’Shea et al. [42] highlights that the size and nature of financial resources allocated to universities influence academic entrepreneurship. This means that the greater industrial funding will attract more academicians to commercialize their innovations. Shane [48] is of the view that the nature of funding attracts opportunities for technology commercialization and the propensity of the academics to engage in technology transfer that may vary across fields. O’Shea et al. (2008) have highlighted that the entrepreneurial disposition and individual’s abilities are important in shaping the individual’s behavior regarding commercialization. Similarly, Roberts [46] found that academic entrepreneurs having extroverted personalities were more likely to engage in commercialization activity. He further concludes that personal characteristics like need for achievement, the desire for independence and an internal locus of control compel academics to become entrepreneurs.

Technology transfer is the process whereby inventions or IP from academic research is licensed or conveyed through use rights to industry. Universities, primarily through their knowledge production function, play an important role in the national innovation system [26]. The various stages involved include securing IP rights, prototype product and production process development, and compliance with regulatory standards and marketing activities. In Malaysia, with the government support universities have established TTOs to enhance the commercialization of academic research and to bring the new technologies to the market with emphasis on strong industry-university linkage [43], [26].

In order to improve university-industrial ties, universities operate technology transfer office as a vehicle to support the commercialization activity [23]. According to [53] technology transfer office plays an important role with respect to engendering academic entrepreneurship. This is achieved by engineering synergistic networks between academics and industry, advisors and managers who provide human and financial resources that are

2 Literature Review

Litan and Mitchel [36] point out that the degree of an entrepreneurial orientation in public institutions like universities has not been investigated.
necessary for spin-off formation, and by providing expertise, as many technology transfer office personnel have expertise in evaluating markets, writing business plans, raising capital, assembling teams and obtaining space and equipment.

There are many definitions of commercialization, but in simple words commercialization means; presenting or introducing a new product to market [52],[34],[26],[27]. According to Kenney and Patton [31] commercialization is a process through which developing and selling costs of a new product will be declined because, the extent to which the product is totally matched with its customer needs and wants, the selling of that product easily be carried out. Commercialization has also been termed as set of actions which convey knowledge to a product [30],[51],[22]. Similarly, Siegel, et al [50] is of the opinion that commercialization is the process of turning a creation or invention into a commercially viable service, product or process.

Bathelt et al. [1] recognized that the increased pressure for public research universities to be more accountable as well as to produce commercialized technology has compelled several public universities to pay more attention to the need to be dynamic and operate entrepreneurially. Similarly, Fini et al. [19] also mentions that within modern universities, attention to commercialization of university research has increased mainly due to recognition of the creation and implementation of new technology that drives economic development.

3 Methodology
The present study seeks to investigate the moderating effect of technology transfer office on the relationship between entrepreneurial orientation and academic commercialization. For the purpose the study uses survey method. The study focuses on the academic faculty members of science and technology and engineering faculties of five Malaysian research universities. The unit of analysis is individual researcher involved in R&D activities. The sample size of the study was 249 respondents selected through random sampling technique. The lists of all the faculty members of science and technology and engineering faculties of the five research universities were obtained from two sources: the first source was website and the second source was administrative offices of the targeted faculties. Using random table, respondents were selected.

The survey instrument for the study was designed to capture the perceptions of the respondents regarding entrepreneurial orientation, academic commercialization and technology transfer office. The dependent variable of the study academic commercialization was measured using eleven items, adapted from the study of [54],[33],[40]. Independent variable of entrepreneurial orientation was measured using 23 items adapted from [37]; while technology transfer office as a moderating variable was measured using ten items adapted from the studies of [9],[14]. The items used 5-point Likert scale to show the level of agreement of the respondents. As the instrument was developed for technology transfer office and commercialization, it was subjected to factor analysis for validation purposes. The factor analysis results indicated that the instrument was valid and all the items were retained. Data collected was analyzed through Pearson correlation and regression analysis. Before applying regression, assumptions of regression were satisfied.

4 Results and Discussion
The present study investigated the relationship between entrepreneurial orientation and commercialization with the moderating role of technology transfer office. To establish the relationship between the variables, Pearson correlation was calculated. The results of correlation are shown in Table 1.

<table>
<thead>
<tr>
<th></th>
<th>EO</th>
<th>TTO</th>
<th>Comm.</th>
</tr>
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<tbody>
<tr>
<td>EO</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TTO</td>
<td>0.143*</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Comm.</td>
<td>0.481**</td>
<td>0.216**</td>
<td>1</td>
</tr>
</tbody>
</table>

**Correlation significant at 0.01 level
*Correlation significant at 0.05 level

The correlation analysis shows that there exists significant positive relationship between EO and TTO (r = 0.143, p <0.05) and EO and Comm. (r = 0.481, p < 0.01). The results indicate that the relationship between EO and TTO is of weak nature, while the relationship between EO and Comm. is strong in nature. This further illustrates that the presence of EO would help enhance commercialization. Similarly, the results indicate that there exist a positive significant relationship between TTO and commercialization (r = 0.216, p < 0.01). This shows that presence of TTO in a university would also help in enhancing commercialization process.
To check the moderating influence of TTO on the relationship between EO and commercialization, hierarchical regression was applied. Before regression was applied, assumptions of regression were satisfied. The results are presented in Table 2.

Table 2 Regression Analysis

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R²</th>
<th>Adj. R²</th>
<th>β</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EO</td>
<td>.481*</td>
<td>.232</td>
<td>.229</td>
<td>.773</td>
<td>8.632</td>
<td>.000</td>
</tr>
<tr>
<td>TTO</td>
<td>.216</td>
<td>.047</td>
<td>.043</td>
<td>.225</td>
<td>3.478</td>
<td>.001</td>
</tr>
<tr>
<td>EO* TTO</td>
<td>.420</td>
<td>.177</td>
<td>.173</td>
<td>.094</td>
<td>7.277</td>
<td>.000</td>
</tr>
</tbody>
</table>

R² = 0.01, p < 0.01  

In the first step of the moderation model, relationship of entrepreneurial orientation and commercialization has been evaluated. The result shows that EO has significant positive relationship with commercialization. The EO has a more positive influence on commercialization of research activities. In second step, relationship of technology transfer office and commercialization has been evaluated. The value of F statistics is 12.095 (p < 0.01). The value of beta coefficient is .225. This beta coefficient is significant here as revealed by t-statistics (p < 0.01). The third model indicates the interaction term of EO and TTO. The result indicates that model is significant here as indicated by F-Statistics (52.951, p<0.01). The result further indicates that when TTO plays a moderating role, it brings a variation of 17.7% in the dependent variable. The value of beta coefficient is significant here. The t-statistics is 7.277 (p < 0.01). Significance of beta coefficient of the interaction term confirms that TTO plays a moderating role between the relationship of entrepreneurial orientation and Commercialization. The results do indicate that the influence of the product of EO*TTO is less as compared to when EO alone acts. This shows that EO acts independently of other variables. However, the results are significant for the interaction term of EO*TTO.

The results of the present study indicate that respondents view entrepreneurial orientation as the most significant of the factors in commercialization of academic research, which is influential in commercialization of academic research. Previous researches also point out that higher level of EO within the organization leads to increased performance, new market entry and new product innovation and development [44],[47],[36]. In academic context, EO relates to the greater capacity of identifying opportunities and reacting to internal and external demands of competition [15],[20].

Previous researchers highlight that technology transfer offices are the entrepreneurial centers of the universities helping students and faculty members develop their skills by imparting trainings like technology commercialization, mentoring programs, incubator centers, entrepreneurship education, business plan competitions etc. [6],[21]. Similarly, researchers maintain that TTOs are the driving forces behind commercialization of university research by providing much needed resources in the form of expertise, financial and trainings [12],[53],[50],[43]. In addition, greater the level of entrepreneurial orientation in an organization, greater will be the success of that organization [3].

### 5 Conclusion

The study investigated the EO-Commercialization relationship with TTO as a moderator. The results provide empirical evidence that TTO when acts as a moderator influence the relationship between academics entrepreneurial orientation and their commercialization of research. The results of the study are significant for both policy makers of the higher education institutions and the TTO as well. A strong entrepreneurial climate with the university along with support of technology offices would not only motivate academic researchers to engage in entrepreneurial activities but would also help in enhancing the overall commercialization of R&D activities. The study is significant in the context of Malaysian research universities, as they are struggling to enhance their overall commercialization efforts. Malaysian universities especially research universities need to develop entrepreneurial culture and motivate their researchers to engage in entrepreneurial activities such as commercialization. This can be done by developing and providing enough resources to technology transfer offices so that they can help and motivate the researchers to be entrepreneurial in nature. The study is not without limitations. First the study only focused on two faculties and the sample was limited to academic researchers who were engaged in R&D activities in these two faculties. Inclusion of more faculties and researchers may affect the results of the study. Researchers whether from engineering and science and technology faculty or any other faculty for that matter engage in entrepreneurial activities such as consultancy work etc. Therefore, a sample including researchers from...
other faculties is needed to have an in depth knowledge and information regarding true commercialization output. Furthermore, the study focused only on entrepreneurial orientation of the academic researchers. Entrepreneurial orientation is affected by numerous factors such as leadership style, organizational culture, human resource practices etc. It would be interesting to see the influence of such factors on commercialization activity. Last but not least, the study looked at five Malaysian research universities; it is recommended that a comparative study should be undertaken between public and private Malaysian universities to ascertain the level of commercialization in Malaysia.

References:
[19] Fini, R., Lacetera, N. and Shane, S. Inside or outside the IP system? Business creation in


[41] O’Shea, R. P., Chugh, H. and Allen, T. J. Determinants and consequences of university spin-off activity: a conceptual framework,


Von Proff, S., Buenstorf, G. and Hummel, M. University patenting in Germany before and after 2002: what role did the professors’