

The Influence of Entrepreneurship Characteristics on Attitude towards Knowledge Commercialization

Mohammed NawzadSabir¹, Bestoon Othman^{2*}, Farhad Al-Kake³ and Wirya Rashid⁴

Abstract--- *Recently, universities are contributing to the economy through the commercialization of research and are also playing important roles in economic development, while simultaneously carrying out traditional teaching and research roles. However, universities must provide teachers with an environment in which they can engage in commercial activities in order to successfully transfer technology. In order to explore the commercial characteristics necessary to improve the marketing activities of research universities, which has received little attention in the literature. Therefore, to fill this gap, this study aims to explore the relationship between the entrepreneurial characteristics of university research academics and the attitude of commercialization of knowledge. A random selection of 94 teachers from the Polytechnic University of Malaysia examined the relationship between the characteristics of the company (i.e. Need for Achievement, Locus of Control, Leadership, Commitment and Determination Risk-Taking Propensity.). The results of the study show that leadership and self-confidence are the most important features of increased marketing. The study also found a positive relationship between all these features and the marketing attitudes among teachers. Therefore, it is recommended that university administrations improve the commercial characteristics of teachers in order to increase the commercialization of research activities.*

Keyword--- *Entrepreneurship, Characteristics, Attitude, Knowledge Commercialization*

I. INTRODUCTION

Global social changes, economic volatility, environmental challenges and solutions for the knowledge economy, innovation and evolving entrepreneurial solutions are needed. To meet the challenges facing the economy, both developed and developing countries must encourage entrepreneurial activities. The overlying area of this research is entrepreneurship, with particular emphasis on academic entrepreneurship. Entrepreneurship is receiving increasing attention due to its impact on a country's economic growth and job creation. In the field of entrepreneurship, academic entrepreneurship has attracted the attention of scholars who refer to the various ways in which the academic world transcends potentially useful knowledge. Entrepreneurs carry out a series of activities in a

¹College of Public Administration and Natural Resource Management, Charo University

^{2*}Department of Business Administration, Koya Technical Institute, Erbil Polytechnic University and Universiti Tun Hussein Onn, Malaysia.
E-mail: Bestoon2011@yahoo.com

³College of administration and financial sciences Knowledge University, Iraq

⁴Marketing Department, College of Administration and Economic university of Sulaimani, Iraq and Faculty of Administrative and Financial sciences, University of Cihan 46001, Sulaimani/Kurdistan, Iraq

commercial manner as they extend revenues and transfer technologies that transcend beyond creativity, invention and the discovery of traditional technology.

In the commercialization of academic research, universities involve numerous mechanisms for the transfer of knowledge to private companies [60]. These mechanisms are emphasized by researchers involved in spin-offs, publications, licenses, conferences and collaborative projects [44]. Commercial, academic research is linked to economic progress and social benefits and is considered the bearer of socio-economic development [6].

Innovation in research universities is seen as an engine of growth by policymakers in many countries [57]. Universities as communicators and knowledge producers play an important role in society. In the last decade, in addition to research and teaching, has received more attention [7].

Merrill and Mazza (2010) [42] argued that the transfer of university knowledge is a potential source. They also pointed out: technological licenses, patents, university business consultancy and spin-off training [42,53]. In fact, the commercialization of knowledge created by universities has become the third mission of universities and teaching research [11], mainly due to commercial development [26].

However, the transfer of university technology requires entrepreneurship-oriented teachers. O'Shea and others. (2008) points out that individual entrepreneurial and entrepreneurial trends are important for shaping teacher marketing. Similarly, Rashid and Ismail (2014) [48] also stressed that technology transfer is successful and that universities must provide an environment for entrepreneurial activities. Similarly, Ping et al. (2019) argue that scholars with extroverted personalities are more likely to engage in technology transfer activities. He also concluded that personal characteristics, such as realization requirements, independent desires and internal control points, have forced scholars to become entrepreneurs. Researchers believe that entrepreneurship involves identifying opportunities, taking risks and organizing resources [31]. It is the ability to focus on individual behaviour based on personality, characteristics and the ability to conduct entrepreneurial activities [9].

The government has proposed a vision for 2020. According to this vision, Malaysia will become a high-income country by 2020; therefore, it is necessary to transform Malaysia into an innovation base through the National Innovation Model (NIM). The National Innovation Model (NIM) is described as a tool to balance the methods between technology-driven innovation and market-driven innovation. In technology-based models, innovation, scientists and researchers fund research and development to improve technology. Therefore, this will help scientists promote their ideas in the international market. At the same time, the market is determined before entrepreneurs use their knowledge acquisition technology. The Ministry of Science, Technology and Innovation considers science, technology and innovation as key elements of today's modern economic success. Take the national scientific and technological policy as an example.

II. LITERATURE REVIEW

A. Commercialization of University Research

Developing countries have begun to pay more attention to the commercialization of technology, although the basic conditions in terms of scientific capacity and innovation are very different from those of developed countries [59]. In developing countries, most marketing activities are carried out through informal mechanisms, such as special, short-term and small-scale consultancy projects based on isolated initiatives, rather than following an institutional commercial approach [3]. The challenge for both developed and developing countries is to generate a systematic marketing process from the research organization to the business sector, maximizing the contribution of public investments to research and innovation for economic growth. From an economic point of view, inventions that do not enter the market are essentially inactive and can be considered as a waste of scarce economic resources.

Othman et al., (2019)[47] defines the marketing process as a broad transfer of knowledge and technology, including teaching, university research and research contracts with companies. They studied how these mechanisms can drive innovation in the industry. They found that reading and referring to publications, attending conferences and seminars and informal contacts were the most important knowledge transfer and marketing activities in the marketing phase. However, they did not consider models of direct technology transfer, such as licenses. Jensen et al. (2003) [28] found in their research offices, technology transfer and university administrators that the revenues deriving from licenses are an important result of the commercialization of technology, while the faculty preferred the sponsored revenues for research licenses.

Licensing is identified as a major process in technology commercialization as described by [15]. Several studies indicate that the formation of spin-off companies is a more successful route to commercialization than licensing [16]. After a scientific discovery, the faculty or researcher files an invention disclosure with the help of the technology transfer office only if the disclosure has enough value to be transferred [26]. Takahashi and Carraz, (2011) [53] argued that the invention should be a significant breakthrough, fill market needs, and be mature enough to be used by a company, the technology transfer office evaluates its potential for commercialization and decides patenting strategies, including global or domestic patents. Thus, according to the literature discussed above researchers concludes that the process of commercialization is essential in university research and it not only generates profits but also it is helpful to meet global needs.

B. Entrepreneurial Characteristics

The problem of identifying entrepreneurs is confused because there is still no universally accepted standard definition of entrepreneurs. Therefore, it is not surprising that there are many definitions of entrepreneurs and entrepreneurs in the literature [25]. Abreu and Grinevich (2013) [1] state that there is no consensus on the definition of entrepreneurs and that no definition can be used to represent today's entrepreneurial image. However, it is widely believed that there are some personal characteristics and characteristics as entrepreneurs [1].

Zimmerer and Scarborough (2005) [62] define entrepreneurs as the purpose of creating new businesses in the face of risks and uncertainties, using them to identify profits and growth by identifying important opportunities and pooling the necessary resources. Schumpeter (1934) [50] argues that entrepreneurs are innovators who use the

creation of new businesses as a means of using inventions. Zimmerer and Scarborough (2005) [62] argue that entrepreneurs are a usually creative and innovative person who can build some recognized values around perceived opportunities.

The characteristics of successful entrepreneurs have been studied in many studies to develop entrepreneurial personality traits and have been found in many studies [56,17, 20,21]. The characteristics of the entrepreneur, such as the requirements for implementation, the sources of control, risk-taking, commitment and leadership, have been seen as the main characteristics of entrepreneurs [56]. Numerous studies have shown that entrepreneurial characteristics can be obtained through birth, life experiences or through entrepreneurial processes and education [17]. Researchers believe that entrepreneurial characteristics are universal and should be developed in the early stages of education to improve entrepreneurial talent [20]. Table 1 provides a summary of the literature on entrepreneurial characteristics. The literature focuses on the five characteristics of successful entrepreneurs. These characteristics are the need to achieve, control the source, leadership, commitment and determination and risk-taking.

Table 1: Summary of Literature on Entrepreneurial Characteristics

Author/ Characteristics	NA	LC	LS	CD	RTP
Collins, Hanges and Locke, 2004	X				
McClelland, 1961 [41]	X				
Busenitz and Arthurs, 2007 [10]	X				
Darroch and Clover, 2005 [14]	X				
Wickham, 2001 [58]	X				
Koh (1996) [29]	X				
Mullins (2002) [46]	X				
Shane, Locke and Collins (2003) [52]		X			
Henry et al. (2003) [25]		X			
McCarthy (2000) [40]		X			
Timmons and Spinelli (2009) [55]			X	X	
Zhao, Seibert and Hills (2005) [61]			X		
Collura and Applegate, 2000 [12]				X	
Moore and Petty (2006)				X	
Avolio, et al., (2004) [5]				X	
Hatch and Zweig (2000) [24]				X	
Boyer, 2006 [8]					X

Garon and Moore, 2004 [19]					X
Longenecker et al. (2006) [39]					X
Kuratko (2009) [31]					X
Kolakowski (2011) [30]					X

NA=Need for Achievement, LC=Locus of Control, LS= Leadership, CD= Commitment and Determination, RTP= Risk Taking Propensity.

C. Attitude towards Commercialization

Past researches indicate that attitudes of individuals are precursors to their behaviors and external factors influence attitude and intentions of individuals. It has also been ascertained that negative attitude towards entrepreneurial activities result in failure of such activities [32]. Lam (2011) [33] have highlighted that presence of informal networks to support entrepreneurial activity along with social channels of communication would lead to higher entrepreneurial attitude among individuals.

Attitudes play a vital role towards success of entrepreneurial activities as it helps in building disciplined, persistent, committed behaviors among individuals [55]. However, attitudes vary from one individual to another on attractiveness of entrepreneurial activities; understanding of such attitudes can be instrumental in assisting the policy direction and in encouraging entrepreneurship [21]. Goldstein, et al. (2013) also highlight that the most relevant attitudes towards entrepreneurship includes willingness to bear risk and individuals perceptions of their own skills, knowledge and experience. In addition, positive attitude towards entrepreneurship not only create support, but also help in gathering financial resources and networking benefits for those involved in entrepreneurial activities and for those who are willing to engage in entrepreneurial activities.

The research highlights that academic members attitude towards commercialization would increase if their peers in the departments have experienced commercialization themselves or have worked in commercial setting. It has been further highlighted that academic researchers who pursue commercialization do so in believe that it would lead to more freedom in conducting research [7].Bercovitz and Feldman (2006) further are of the opinion that attitude of academic faculty member towards commercialization is shaped by the behavior and attitude of the head of department and peers. If the behavior is acceptable towards entrepreneurial activities, academic members' attitude was positive. Goldstein, et al. (2013) suggest that while the attitudes of faculty and other university researchers involved in commercialization have been studied, there have been relatively few attempts to systematically gauge the attitudes of broad range of university faculty towards university's entrepreneurial activities, whether they are actually engaged in commercialization activities or not.

D. The Relationship between Entrepreneurial Characteristics and Attitude towards Knowledge Commercialization

Bernstorff and Geissler, (2012) emphasize that few studies focus on the cognitive and psychosocial processes associated with scientists that reshape career paths and pursue entrepreneurial paths. Once again, Jain et al. (2009) [27] also highlights the lack of connections, or the attitude of university scientists towards entrepreneurial activities is the key to the emergence of knowledge-intensive areas. Similarly, Thorp and Goldstein, (2010) [54] also shows that it is necessary to study the degree of association between scientific / technical and entrepreneurial orientation and different universities due to the differences between universities and universities.

Meyers and Pruthi, (2011) [43] established a framework based on individual attributes, organization, institutions and external determinants of the derived activities of academic entrepreneurship. Personal attributes focus on individual behavior based on the personality, characteristics and individual ability to conduct entrepreneurial activities [36, 27,28]. The organizational determinants are more concerned with the level of organizational analysis and the impact of resources and structures, such as research and development funds, leading researchers, technology transfer offices and incubators on academic entrepreneurship [43]. Institutional determinants indicate that academic entrepreneurship is more enriched in universities and its environment includes incentives for entrepreneurial activities related to research and marketing and technology transfer policies and procedures [54].

Shane (2004) [52] stated that the process of creating academic entrepreneurs in universities is difficult and time-consuming. Anokhin et al. (2011) [2] reiterated this point, stressing that the process of transforming university researchers into entrepreneurs depends on the experience of researchers and the degree of interaction with the industry. If university researchers maintain close ties to and connect with industry, they are more likely to participate in technology transfer. Lam (2011) [33] stated that academic entrepreneurs lack the skills to convince the industry to invest in product innovation research. This is because the competence in interaction and identification opportunities is different and acquired through experience [4]. Sass (2013) emphasizes that the motivation of academic scientists plays an important role in entrepreneurial activities. Sass further explained the motivation of the academic scientists and considered that the entrepreneurial activities of German academic scientists were mainly due to limited half-yearly contracts, university publications or extinction norms and, above all, to a high degree of self-determination in the academic world. He also explained that academic levels are closely related to entrepreneurial activities.

Researchers like Bercovitz and Feldman, (2006) is of the view that academic researchers 'attitude towards commercialization has evolved from opposition to acceptance of entrepreneurial activities. Jain et al. (2009) [27] are of the opinion that researchers 'participation in broad commercialization activity including patenting, licensing, industry research, consulting of the formation of a start-up is mainly due to their entrepreneurial orientation and attitude towards entrepreneurial activities. Similarly, researchers have highlighted that local context is important for enhancing researchers'and scientists attitude towards commercialization activities [7].

One of the constraints towards successful commercialization is the attitude of the researchers who conduct non-profit oriented research [4] and are only concerned with purely the academic value [13]. Guerrero and Urbano,

(2012) [23] have highlighted that to enhance entrepreneurial attitude among individuals, institutional efforts and support such as creating conducive environment and incentive structures have to be more directed to the individuals to bring them out of mindset of not taking up such activity. Study concludes the discussion in the following hypothesis:

H1: Entrepreneurial characteristics would have a significant relationship with academics attitude towards knowledge commercialization.

Universities are often referred to as sources of technological innovation and play an important role in the commercialization of technology and expertise [23]. The commercialization of intellectual property is seen as an engine of economic growth [22] and is also considered important in creating a sustainable business environment [23]. In addition to their general role in teaching and editorial research, scholars can also be considered as the main contributors to commercialization [18]. Scholars who believe they must achieve success are more likely to actively participate in the creation and marketing of university inventions [34, 35]. Studies have shown that the probability of commercial success depends largely on the need for academic researchers of academic entrepreneurs [33]. The study summarizes the discussion in the hypothesis:

H1a: Need for achievement significantly influence academics attitude towards knowledge commercialization.

Academic researchers are often associated with people with the highest academic level of technical qualifications. The highest academic qualifications, combined with extensive research experience, means that the academic community has been developing scientific expertise and technical skills to make them experts in specific technical fields. This high level of research and reinforcement results in their belief in the ability of researchers to invent, innovate and promote technologically advanced product development [13]. These capabilities are critical to the commercialization of emerging technologies. In fact, many empirical studies in the past have shown how the control of academic researchers can greatly influence the commercialization. Therefore, it can be concluded that:

H1b: Locus of control significantly influence academics attitude towards knowledge commercialization.

Successful marketing of technology begins with leadership. Leadership has established a clear vision and a mission for the commercialization of technology. One characteristic of an effective startup organization or an effective business community is that leaders will make significant efforts to demonstrate their support for entrepreneurial activities. Leaders can simply clarify what it is - what it is not - it should simply serve this process. Anokhin et al. (2011) [2] argue that successful organizations need a clear strategic intent to guide the activities of the organization and its members. The work leadership is a key factor that cannot be easily quantified. Therefore, leaders can play an important role in marketing. Therefore it can be deduced:

H1c: Leadership significantly influence academics attitude towards knowledge commercialization.

Entrepreneurial characteristics as discussed have been found to influence the attitude of the entrepreneurs towards entrepreneurial activity. Academic research for commercialization also pertains to the entrepreneurial activity, academic researchers engage in. Like traditional entrepreneurs, these academic researchers are also

entrepreneurs and are influenced by personality characteristics that have been discussed in the preceding sections. For academic entrepreneur, desire to accomplish something is high and because of it they involve in knowledge commercialization activities and for it they need to demonstrate determination and commitment. Similarly, knowledge commercialization requires academic researchers to recognize opportunities for developing or inventing something that benefits the society and for this they need to take certain risks as well. Thus, recognizing opportunities and taking risk in an uncertain environment is a hallmark of entrepreneurs. Similarly in the context of commercialization commitment and determination of the academic entrepreneurs is important to achieve their goals. Thus study proposed hypothesis:

H1d: Commitment and determination significantly influence academics attitude towards knowledge commercialization.

[45] argued that there are risks involved in the commercialization of knowledge process. An entrepreneurial characteristic from the academic researchers is required to deal with the situation for successful commercialization. Individuals with high tendency to perceive or interpret potentially risky situations are required to participate in the commercialization process [19]. Thus study concluded following hypothesis:

H1e: Risk taking propensity significantly influence academics attitude towards knowledge commercialization

E. Conceptual Framework of the Study

The present study investigates the relationship between entrepreneurial characteristics and entrepreneurial attitude of academic researchers towards commercialization in UTM. Previous literature highlights that entrepreneurial characteristics help individuals to conduct entrepreneurial activities. Entrepreneurial disposition and individual's abilities are important in shaping the individual's behavior regarding technology transfer.



Figure 1: Framework of Study

III. METHODOLOGY

The current study examines the relationship between academics' entrepreneurial characteristics attitude to knowledge commercialization in UTM. To examine this relationship, several research questions were formulated based on the objectives of the study. Furthermore, a sample of 230 respondents participated in the study, hence a

total of 230 questionnaires were distributed to academic staffs of UTM. The number of sample for each faculty was based on the percentage of the faculty. The respondents for the study were selected using simple random sampling technique. The researcher obtained a list of all faculty members from each faculty website. Thus, using a random sampling technique, each participating respondent was selected. Any respondent not willing to participate in the study was replaced accordingly with other faculty members. The present study is descriptive in nature and sought to test some hypothesis. The completed questionnaires were retrieved, and data were entered into SPSS version 21 for data analysis. Several hypotheses were formulated based on the hypothesized relationships proposed in the model of the study. Data was collected by means of a survey using a cross-sectional research design [51]. The use of a survey method is the most convenient method of data collection from a population within a short time, and with a limited budget [51].

IV. RESULTS AND ANALYSIS

A. Demographic Profile

The respondents of the study consisted of 230 faculty members working in different faculties in UTM. Questionnaires that have been returned to the researcher were 94 which have been used for final analysis. The survey instrument consisted of three sections. The third section is based on the collection of the data regarding demographic details of the respondents. Respondents have been asked various items like designation, faculty, department, age, gender, education level, experience etc. The results of the demographic analysis of age, gender and education level is presented in Table 2.

Table 2: Age, Gender and Education

Sr.	Variable		Frequency	Percentage	Frequency
1	Age	31 - 35 years	15	15.9	94
		36-40 years	23	24.4	
		40 and above	56	59.57	
2	Gender	Male	51	54.25	94
		Female	43	45.75	
3	Education Level	Masters	11	11.70	94
		Ph.D	83	88.29	
4	Work Experience	5 years and less	5	5.31	94
		6-10 years	13	13.82	
		11-15 years	16	17.02	
		16-20 years	10	10.6	

		21 years and above	50	53.1	
5	Research Experience Industrial	Yes	50	53.1	94
		No	44	46.80	
	N		94		

B. Reliability

Reliability is the main requirement of any research as it gives confirmation regarding consistency of the results of the survey instrument. It is calculated through Cronbach alpha reliability statistics [51,49]. In the present study the researcher has also calculated item wise reliability of the questionnaire through Cronbach alpha. Table 3 shows that all values are above the acceptable limit of 0.70 [49].

Table 3: Reliability of the Research Instrument

Sr.	Variable	No of items	Alpha
1	NA	4	0.910
2	LC	4	0.929
3	LS	4	0.710
4	CD	3	0.707
5	RTP	3	0.800

NA=Need for Achievement, LC=Locus of Control, LS= Leadership, CD= Commitment and Determination, RTP= Risk taking Propensity

Table 3 shows that the values of Cronbach alpha for all the variables of the study such as Locus of Control, Need for Achievement, and Risk taking Propensity (0.929, 0.910, 0.800) are fall within the acceptable level of 0.70. Hence, the data are reliable and can be used for further analysis.

C. Hypothesis Testing for the Relationship of Each Entrepreneurial Characteristic with Attitude towards Knowledge Commercialization

It was mandatory to test strength of relationship between the constructs prior to apply multi variate regression analysis [51]. Thus, study tested relationships of entrepreneurial characteristics (need for achievement, locus of control, leadership, commitment and determination, and risk taking propensity) and academic attitude towards knowledge commercialisation using correlation analysis. The researcher has checked the relationship of each entrepreneurship characteristic with academic attitude towards knowledge commercialization through Pearson Correlation. The results in Table 4 show that all entrepreneurship characteristics (need for achievement, locus of control, leadership, commitment and determination, and risk taking propensity) are positive and significant relationship with academic attitude towards knowledge commercialization. The results indicate that Risk taking Propensity ($r = 0.379$, $p < .000$) have comparatively stronger relationship with academic attitude towards commercialization. Similarly, Leadership ($r = 0.161$, $p < .022$) and Commitment and Determination ($r = 0.167$, $p <$

.028) have moderate significant relationship with academic attitude towards commercialization, while the relationships of need for achievement ($r = .052, p < .018$), locus of control ($r = .026, p < .010$) have weaker relationship with academic attitude towards knowledge commercialization.

Table 4: Relationships between Entrepreneurship Characteristics and Academic Attitude towards Commercialization

	NA	LC	LS	CD	RTP	ATKC
NA	1					
LC	.139 .182	1				
LS	.036 .732	.114 .275	1			
CD	-.101 .334	.020 .847	.425** .000	1		
RTP	-.144 .166	.116 .264	.384** .000	.584** .000	1	
ATKC	.052* .018	.026* .010	.161* .022	.167* .028	.379** .000	1

NA=Need for Achievement, LC=Locus of Control, LS= Leadership, CD= Commitment and Determination, RTP= Risk taking Propensity

D. Hypotheses Testing between All Entrepreneurial Characteristics and Attitude towards Knowledge Commercialization

Last phase of the data analysis was hypotheses testing using regression analysis. Below table 5 depict the model summary for the regression analysis. R square value was ranging 0.221 to 0.621; this explains the variation in the attitude towards knowledge commercialization could be predicted through the entrepreneurial characteristics (need for achievement, locus of control, leadership, commitment and determination, and risk taking propensity).

The ANOVA results for the regression analysis. F statistics indicated that the value of systematic variation is higher than the value of unsystematic variation. Thus, model is fit enough to depicts the results truly, as f statistics was ranging 4.21 to 11.3 with significance at $p < 0.05$.

Table 5 shows the regression results between the independent variables i.e. entrepreneurial characteristics (need for achievement, locus of control, leadership, commitment and determination, and risk taking propensity) and dependent variable i.e. attitude towards knowledge commercialization. Table 5 indicates that all entrepreneurial

characteristics (need for achievement, locus of control, leadership, commitment and determination, and risk taking propensity) significantly associated with attitude towards commercialization of knowledge.

Table 5: Regression analysis

Model	Unstandardized Coefficients		t value	Sig.	F	R2
	B	Std. Error				
NA	0.508	0.23	2.21	0.001	4.648	0.408
LC	0.348	0.11	3.16	0.000	9.31	0.312
LS	0.22	0.1	2.2	0.001	5.33	0.291
CD	0.1	0.04	2.5	0.000	4.21	0.221
RTP	0.529	0.257	2.06	0.042	11.3	0.512

NA=Need for Achievement, LC=Locus of Control, LS= Leadership, CD= Commitment and Determination, RTP= Risk taking Propensity

Regression coefficient value of NA was 0.508 with standard error of 0.230 and t value 2.21. This value is significant having p value 0.001 ($p < 0.05$). Thus, study established a positive relation between NA and ATKC. So, hypothesis H1a: Need for achievement would significantly influence academics attitude towards knowledge commercialization in UTM had been accepted. Regression coefficient value of LC was 0.348 with standard error of 0.110 and t value 3.16. This value is significant having p value 0.000 ($p < 0.05$). Thus, study established a positive relation between LC and ATKC. So, hypothesis H1b: Locus of control would significantly influence academics attitude towards knowledge commercialization in UTM had been accepted. Hypothesis 3 of the study claims positive relation between the LS and ATKC, regression coefficient value of LS was 0.220 with standard error of 0.100 and t value 2.200. This value is significant having p value 0.001 ($p < 0.05$). So, hypothesis H1c: Leadership would significantly influence academics attitude towards knowledge commercialization in UTM had been accepted. Regression coefficient value of CD was 0.100 with standard error of 0.040 and t value 2.50. This value is significant having p value 0.000 ($p < 0.05$). Thus, study established a positive relation between CD and ATKC. So, hypothesis H1d: Commitment and determination significantly influence academics attitude towards knowledge commercialization in UTM had been accepted.

Regression coefficient value of RTP was 0.529 with standard error of 0.257 and t value 2.06. This value is significant having p value 0.042 ($p < 0.05$). Thus, study established a positive relation between RTP and ATKC. So, hypothesis H1e: Risk taking propensity significantly influence academics attitude towards knowledge commercialization in UTM had been accepted. So, hypothesis H1: Entrepreneurial characteristics have a significant relationship with academics attitude towards knowledge commercialization in UTM had been accepted.

Table 6: Summary of the hypotheses

Sr No	Hypotheses	Results
H1	Entrepreneurial characteristics have a significant relationship with academics attitude towards knowledge commercialization in UTM.	Supported
H1a	Need for achievement would significantly influence academics attitude towards knowledge commercialization in UTM.	Supported
H1b	Locus of control would significantly influence academics attitude towards knowledge commercialization in UTM.	Supported
H1c	Leadership would significantly influence academics attitude towards knowledge commercialization in UTM.	Supported
H1d	Commitment and determination significantly influence academics attitude towards knowledge commercialization in UTM.	Supported
H1j	Risk taking propensity significantly influence academics attitude towards knowledge commercialization in UTM.	Supported

V. DISCUSSION OF THE STUDY

University commercialisation activity is a reflection of institutional behaviour. Universities having entrepreneurial culture support commercialisation activity as against the ones who do not have supporting culture [43]. Academic reluctance to engage in entrepreneurial activity is exacerbated by the attitudes and behaviours of superiors such as head of departments. Bercovitz and Feldman (2016) [7] highlighted that the group norms were important in predicting technology transfer activity and that the individuals are influenced by the behaviours of their immediate peers. The organisational determinants is more concerned with organisational level of analysis and the impact resources and structures like research and development funds, leading researchers, presence of technology transfer offices and incubators have on academic entrepreneurship [43]. The institutional determinants indicates that academic entrepreneurship activity is greater in universities which have an environment that embraces entrepreneurial activity reward systems regarding research vs. commercialisation and technology transfer policies and procedures [54].

The relationship of each entrepreneurship characteristics (ECs) with academic attitude towards knowledge commercialization has been analyzed through regression analysis. Study also used Pearson correlation analysis to test the strength of relationships between the characteristics and attitude towards commercialization. The results in Table 5 demonstrate that all entrepreneurship characteristics (ECs) have a positive and significant relationship with academic attitude towards knowledge commercialization. The results reveal that risk taking propensity ($b=0.522$, $r = 0.379$, $p < .000$) have comparatively stronger relationship with academic attitude towards commercialization. In spite of the fact that other (ECs) need for achievement ($b=0.508$, $r = .052$, $p < .001$), locus of control ($b=0.348$, $r = .026$, $p < .010$) have weaker relationship with academic attitude towards knowledge commercialization. Findings of

the study are consistent with Wu et al. (2015). They found that inventors attitude towards the commercialization is a key factor in success of commercialization process. They conducted a survey on 2006 patents holders. Their results support the results of the current study.

VI. SUMMARY OF THE MAIN FINDINGS

This study significantly focused on assessing the relationship between entrepreneurship characteristics (ECs) and the academics' attitude towards knowledge and technology commercialization. Furthermore, the role of numerous entrepreneurial features in academic attitudes in the area of commercialization was investigated.

The results of this study reveal that the entrepreneurial characteristics, namely need for achievement, locus of control, leadership, commitment and determination and risk taking propensity have a positive and significant impact on academic attitudes towards commercialization. Pearson correlation was used to check the relationship between independent variables (ECs) and dependent variable (attitude towards commercialization). It means commercialization can be guaranteed through these mentioned characteristics (ECs).

The outcomes of this study demonstrate that the risk taking propensity strongly related to academic attitudes towards commercialization. In spite of the fact that need for achievement, locus of control, are least related to the academic attitudes towards commercialization. In addition, all the hypotheses are supported.

VII. RECOMMENDATIONS

The conclusions drawn from this study indicates that there are a few considerations that the university managers and head executive of institutes need to apply into their programs when they have strategies to increase knowledge commercialization. Basic concept of the universities is considered to generate knowledge through teaching and research. However, now the focus of the universities is shifted to the dissemination of the generated knowledge. So recently universities are acknowledged as commercialization centers of the knowledge and hence universities are playing a third role of commercialization beside the teaching and research. Universities are producing economic activities and providing opportunities for the entrepreneurial activities. It is important for the management of the universities to understand what characteristics of entrepreneurs are important in order to build a proactive attitude of the staff towards the commercialization of the knowledge. The most prominent entrepreneurial characteristics components are self-confidence and leadership according to the finding of the study. Thus study suggested to the management to enhance the confidence of the staff and encourage them by providing leader support to initiate for the commercialization of the knowledge.

REFERENCES

- [1] Abreu, M. and Grinevich, V. (2013). The Nature of Academic Entrepreneurship in the UK: Widening the Focus on Entrepreneurial Activities. *Research Policy* 42, 408– 422.
- [2] Anokhin, S., Wincent, J., and Frishammar, J. (2011). A Conceptual Framework for Misfit Technology Commercialization. *Technological Forecasting and Social Change*, 78(6), 1060-1071.
- [3] Arora, A., and Gambardella, A. (2011). Implications for Energy Innovation from the chemical industry. In Rebecca M. Henderson and Richard G. Newell (ed.) *Accelerating Energy Innovation: Insights from Multiple Sectors* (pp. 87-111). University of Chicago Press.

- [4] Arvanitis, S., and Woerter, M. (2012). Exploration or Exploitation of Knowledge from Universities: Does it Make a Difference? (No. 322). KOF Working Papers, KOF Swiss Economic Institute, ETH Zurich.
- [5] Avolio, B. J., Zhu, W., Koh, W., and Bhatia, P. (2004). Transformational Leadership and Organizational Commitment: Mediating Role of Psychological Empowerment and Moderating Role of Structural Distance. *Journal of Organizational Behavior*, 25(8), 951-968.
- [6] Barajas, A., Huergo, E., and Moreno, L. (2012). Measuring the Economic Impact of Research Joint Ventures Supported by the EU Framework Programme. *The Journal of Technology Transfer*, 37(6), 917-942.
- [7] Bercovitz, J., and Feldman, M. (2006). Entrepreneurial Universities and Technology Transfer: A Conceptual Framework for Understanding Knowledge-Based Economic Development. *The Journal of Technology Transfer*, 31(1), 175-188.
- [8] Boyer, T. W. (2006). The Development of Risk-Taking: A Multi-Perspective Review. *Developmental Review*, 26(3), 291-345.
- [9] Buenstorf, G., and Geissler, M. (2012). Not Invented Here: Technology Licensing, Knowledge Transfer and Innovation Based on Public Research. *Journal of Evolutionary Economics*, 22(3), 481-511.
- [10] Busenitz, L. W., and Arthurs, J. D. (2007). Cognition and Capabilities in Entrepreneurial Ventures. In J. R. Baum, M. Frese, R. Baron (Eds.), *The Psychology of Entrepreneurship Research* (pp. 131-150), Mahwah, NJ: Lawrence Erlbaum.
- [11] Collier, A. and Gray, B. (2010). The Commercialization of University Innovations – A Qualitative Analysis of the New Zealand Situation. Research Report, <http://www.otago.ac.nz/entrepreneurship>.
- [12] Collura, M and Applegate, L.M. 2000. Entrepreneurial Mindset Tool: Building E-Businesses. Retrieved from:
- [13] D'Este, P., and Perkmann, M. (2011). Why do Academics Engage with Industry? The Entrepreneurial University and Individual Motivations. *The Journal of Technology Transfer*, 36(3), 316-339.
- [14] Darroch, M. A., and Clover, T. A. (2005). The Effects of Entrepreneurial Quality on the Success of Small, Medium and Micro Agribusinesses in KwaZulu-Natal, South Africa. *Agrekon*, 44(3), 321-343.
- [15] DayangHaryani Diana Ag. Damita*, AmranHarunb, David Martinb, BabanJabbarOthmanc, B. O. and H. A. (2019). What makes a non-Muslim purchase halal food in a Muslim country? An application of theory of planned behaviour. *Management Science Letters*, 9(12), 2029–2038. <https://doi.org/10.5267/j.msl.2019.7.003>
- [16] Drnevich, P. L. and Kriauciunas, A. P. (2011). Clarifying the Conditions and Limits of the Contributions of Ordinary and Dynamic Capabilities to Relative Firm Performance. *Strategic Management Journal*, 32, 254–279.
- [17] Fathi, R. (2014). The Effect of Entrepreneurship Education on Business Intelligence of Management Students of Islamic Azad University of Elam. *International Letters of Social and Humanistic Sciences*, (19), 24-34.
- [18] Fogelberg, H., and Lundqvist, M. A. (2013). Integration of Academic and Entrepreneurial Roles: The Case of Nanotechnology Research at Chalmers University of Technology. *Science and Public Policy*, 40(1), 127-139.
- [19] Garon, N., and Moore, C. (2004). Complex Decision-Making in Early Childhood. *Brain and Cognition*, 55(1), 158-170.
- [20] Gibson, S. G., Harris, M. L., Walker, P. D., and McDowell, W. C. (2014). Investigating the Entrepreneurial Attitudes of African Americans: A Study of Young Adults. *Journal of Applied Management and Entrepreneurship*, 19(2), 107-125.
- [21] Goldstein, H., Bergman, E. M., and Maier, G. (2013). University Mission Creep? Comparing EU and US Faculty Views of University Involvement in Regional Economic Development and Commercialization. *The Annals of Regional Science*, 50(2), 453-477.
- [22] Golob, E. (2006). Capturing the Regional Economic Benefits of University Technology Transfer: A Case Study. *The Journal of Technology Transfer*, 31(6), 685-695.
- [23] Guerrero, M., and Urbano, D. (2012). The Development of an Entrepreneurial University. *The Journal of Technology Transfer*, 37(1), 43-74.
- [24] Hatch, J., and Zweig, J. (2000). Departments-Entrepreneurs-What is the Stuff of an Entrepreneur?. *Ivey Business Journal*, 65(2), 68-72.
- [25] Henry, C., Hill, F and Leitch, C. (2003). *Entrepreneurship: Education and Training*. England: Ash Gate Publishing Limited. <http://www.rogeliodavila.com/eblsca/docs/m03entrptool.pdf>.
- [26] Ismail, K., Wan Zaidi, W. and Izaidin, A. (2011). The Commercialisation Process of Patents by Universities, *African Journal of Business Management*, Vol. 5(17), 7198-7208.
- [27] Jain, S., George, G., and Maltarich, M. (2009). Academics or Entrepreneurs? Investigating Role Identity Modification of University Scientists Involved in Commercialization Activity. *Research Policy*, 38(6), 922-935.

- [28] Jensen, R. A., Thursby, J. G., and Thursby, M. C. (2003). Disclosure and Licensing of University Inventions: 'The Best We Can Do With The S***t We Get to Work with'. *International Journal of Industrial Organization*, 21(9), 1271-1300.
- [29] Koh, C.H. 1996. Testing Hypotheses of Entrepreneurial Characteristics: A Study of Hong Kong MBA Students. *Journal of Managerial Psychology*, 11(3), 12-25.
- [30] Kolakowski, M. (2011). Risk Aversion. Retrieved from http://financecareers.about.com/od/rz/g/Risk_Aversion.htm.
- [31] Kuratko, D. F. and Audretsch, D. B. (2009). Strategic Entrepreneurship: Exploring Different Perspectives of an Emerging Concept. *Entrepreneurship Theory and Practice*, 33(1), 1-17.
- [32] Lai, W. H., and Tsai, C. T. (2010). Energising R&D Accumulation and Innovation Diffusion: an Intermediary Model of Integrating Industry-University Collaborations. *International Journal of Technology Transfer and Commercialization*, 9(1), 150-165.
- [33] Lam, A. (2011). What Motivates Academic Scientists to Engage in Research Commercialization: 'Gold', 'Ribbon' or 'Puzzle'? *Research Policy*, 40(10), 1354-1368.
- [34] Leydesdorff, L. (2012). The Triple Helix of University-Industry-Government Relations. Available at SSRN 1996760
- [35] Libaers, D., and Wang, T. (2012). Foreign-Born Academic Scientists: Entrepreneurial Academics or Academic Entrepreneurs?. *R&D Management*, 42(3), 254-272.
- [36] Ling, Y. H. and Jaw, B. S. (2011). Entrepreneurial Leadership, Human Capital Management, and Global Competitiveness. An Empirical Study of Taiwanese MNCs. *Journal of Chinese Human Resource Management*, 2(2), 117-135.
- [37] Lo, Y. J., Liu, W. Y., and Wen, C. T. (2010). The Value Added Capability of Innovation Intermediaries in Technology Transaction Markets. Paper Presented at the Technology
- [38] Management for Global Economic Growth (PICMET), 2010 Proceedings of PICMET'10.
- [39] Longenecker, J.G., Moore, C.W. and Petty, J.W. (2006). *Small Business Management: An Entrepreneurial Emphasis*, 13th ed. Mason, Ohio: South Western College Publishing.
- [40] McCarthy, B. (2000). Researching the Dynamics of Risk-taking and Social Learning: An Exploratory Study of Irish Entrepreneurs. *Irish Marketing Review*, 13(1), 46-60.
- [41] McClelland, D. C. (1961). *The Achieving Society*. New York: Van Nostrand.
- [42] Merrill, S. A. and Mazza, A. M. (2010). *Managing University Intellectual Property in the Public Interest*. National Research Council, Washington, DC.
- [43] Meyers, A. D. and Pruthi, S. (2011). Academic Entrepreneurship, Entrepreneurial Universities and Biotechnology. *Journal of Commercial Biotechnology*, 17(4), 349-357.
- [44] Mohaghar, A., Monawarian, A., and Raassed, H. (2012). Evaluation of Technology Transfer Strategy of Petrochemical Process. *The Journal of Technology Transfer*, 37(4), 563-576.
- [45] Muhammad, S. S. (2019). Identification, Assessment and Mitigation of Environment Side Risks for Malaysian Manufacturing. *Engineering, Technology & Applied Science Research*, 9(1), 3851-3857.
- [46] Mullins, L.J. (2002). *Management and Organizational Behaviour*. 6th ed. Financial Times, Prentice Hall, 434-435.
- [47] Othman, B., Harun, A., Rashid, W., & Ali, R. (2019). The impact of Umrah service quality on customer satisfaction towards Umrah travel agents in Malaysia. *Management Science Letters*, 9, 1763-1772. <https://doi.org/10.5267/j.msl.2019.6.014>
- [48] Rashid, W. N., and Ismail, K. (2014). The Role of Entrepreneurial Leaders towards Commercialization of University Research. *Journal of Basic and Applied Sciences*, 4(6), 183-196.
- [49] Saunders, M., Lewis, P., and Thornhill, A. (2009). *Research Methods for Business Students* (5th ed.). Harlow, England: Prentice hall.
- [50] Schumpeter, J. A. (1934). *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*. Translated by Redvers Opie. Oxford University Press.
- [51] Sekaran, U. (2003). *Research Methods for Business: A Skill Building Approach*. (4th Edition). New York: John Wiley and Sons Inc.
- [52] Shane, S., Locke, E.A and Collins, C.J. (2003). Entrepreneurial Motivation. *Human Resource Management Review*, 13 (2), 257-279.
- [53] Takahashi, M. and Carraz, R. (2011). Academic Patenting in Japan: Illustration from a Leading Japanese University. In: Wong, P.K. (Ed.), *Academic Entrepreneurship in Asia*. Edward Elgar Publishing, Cheltenham, U.K., pp. 86-107.

- [54] Thorp, L. and Goldstein, P. (2010). *Engines of Innovation: The Entrepreneurial University in the Twenty-first Century*. Chapel Hill, NC: The University of North Carolina Press.
- [55] Timmons, J.A. and Spinelli, S. (2009). *New Venture Creation Entrepreneurship for the 21st Century* (8th ed.) Boston, MA: McGraw-Hill.
- [56] Timmons, J.A., Spinelli, S and Ensign, P. (2010). *New Venture Creation: Entrepreneurship for the 21st Century*. Canada: McGraw-Hill Ryerson.
- [57] Wang, J. F. (2010). Framework for University-Industry Technology Transfer: View of a Technology Receiver. In *Second International Conference on Communication Systems, Networks and Applications (ICCSNA), 2010* (Vol. 2, pp. 383-386). IEEE.
- [58] Wickham, P.A. (2001). *Strategic Entrepreneurship: A Decision Making Approach to New Venture Creation and Management*. 2nd ed. Financial Times prentice, Harlow
- [59] WIPO (2011). *World Intellectual property Report: The Changing Face of Innovation*. World Intellectual Property Organization, Geneva, Switzerland.
- [60] Young, T. A., Krattiger, A., Mahoney, R. T., Nelsen, L., Thomson, J. A., Bennett, A. B., and Kowalski, S. P. (2007). Establishing a Technology Transfer Office. *Intellectual Property Management in Health and Agricultural Innovation: A Handbook of Best Practices*, Volumes 1 and 2, 545-558.
- [61] Zhao, H., Seibert S.E and Hills, G.E. (2005). The Mediating Role of Self-Efficacy in the Development of Entrepreneurial Intentions. *Journal of Applied Psychology*, 90(6), 1265–1272
- [62] Zimmerer T.W and Scarborough, N.M. (2005). *Essentials of Entrepreneurship and Small Business*