

**THE RELATIONSHIP BETWEEN ENTREPRENEURSHIP
CHARACTERISTICS AND ATTITUDE TOWARDS KNOWLEDGE
COMMERCIALIZATION**

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THE RELATIONSHIP BETWEEN ENTREPRENEURSHIP CHARACTERISTICS
AND ATTITUDE TOWARDS KNOWLEDGE COMMERCIALIZATION

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*To my parents, my wife, my beloved kids, my siblings
and friends for their support and sacrifices,
and to our PESHMARGA,
that they protect our lovely land Kurdistan.*

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A multitude thanks to Allah Almighty for bestowing upon me this opportunity to embark on a journey that I ever dreamed. Indeed lessons have widened my horizons of knowledge and opened me to the new perspectives. In the name of Allah, most benevolent, ever-merciful, all praise to be Allah, Lord of all worlds.

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ABSTRACT

Universities contribute to the economy through commercialization of their research output which plays an important role in economic development along with their traditional role of teaching. Universities need to provide an environment for the faculties to engage in entrepreneurial activities for successful technology transfer. There is a need to enrich the literature on entrepreneurial characteristics that are required to enhance the commercialization activities among faculty members of research universities. Thus, this study examined the relationship between entrepreneurship characteristics and attitude towards knowledge commercialization among academic staff of research universities. A random sample of 94 faculty members from Universiti Teknologi Malaysia participated in a survey to investigate those relationships. The results showed that leadership and self-confidence are the most important characteristics to increase commercialization. In addition to that, there is a positive relationship between all entrepreneurial characteristics with attitude towards commercialization among faculty members. The study recommends that the management of universities should promote entrepreneurial characteristics development of faculty members in order to increase commercialization of research activities.

ABSTRAK

Universiti-universiti menyumbang kepada ekonomi melalui pengkomersialan hasil kajian dan memainkan peranan penting di dalam pembangunan ekonomi, di samping peranan tradisional pengajaran. Universiti perlu menyediakan suasana untuk fakulti terlibat dalam aktiviti keusahawanan bagi kejayaan pemindahan teknologi. Terdapat keperluan untuk memperkayakan literatur berkaitan ciri-ciri keusahawanan yang diperlukan untuk meningkatkan aktiviti komersialisasi antara ahli fakulti di universiti-universiti penyelidikan. Oleh itu, kajian ini meneliti hubungan antara ciri-ciri keusahawanan dan sikap terhadap komersialisasi ilmu dalam kalangan staf akademik universiti penyelidikan. Sampel rawak seramai 94 ahli fakulti Universiti Teknologi Malaysia telah diambil untuk menyelidik hubungan tersebut. Dapatan kajian telah menunjukkan kepimpinan dan keyakinan diri adalah ciri-ciri paling penting untuk meningkatkan komersialisasi. Selain itu terdapat hubungan positif kesemua ciri-ciri keusahawanan dengan sikap terhadap komersialisasi dalam kalangan ahli fakulti. Kajian mengesyorkan kepada pihak pengurusan universiti untuk menggalakkan pembangunan ciri-ciri keusahawanan di kalangan ahli fakulti bagi meningkatkan komersialisasi aktiviti penyelidikan.

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LIST OF ABBREVIATIONS

NIM	-	National Innovation Model
MOSTI	-	Ministry of Science, Technology and Innovation
MOHE	-	Ministry of Higher Education
NKEA	-	National Key Economic Areas
NA	-	Need for Achievement
LC	-	Locus of Control
LS	-	Leadership
CD	-	Commitment and Determination
TAU	-	Tolerance of Ambiguity and Uncertainty
SC	-	Self-Confidence
CSAA	-	Creativity, Self-reliance and ability to adapt
IN	-	Innovativeness
ME	-	Motivation to Excel
RTP	-	Risk Taking Propensity
OR	-	Opportunity Recognition
ATKC	-	Attitude towards Knowledge Commercialization
EC	-	Entrepreneurial Characteristic

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter includes research background along with brief introduction of the university. Further, the chapter highlights the problem statement, purpose of the study as well as research objectives and research questions. The significance of the study scope of the study will also be discussed. Finally, conceptual definitions will be highlighted.

1.2 Research Background

The global social change, economic volatility, environmental challenges and for evolving knowledge based economy, creative, innovative, entrepreneurial solutions is required. To meet the challenges faced by economies, both developed and developing countries need to encourage entrepreneurial activity. The broad area of this study is entrepreneurship, with specific emphasis on academic

entrepreneurship. Entrepreneurship is gaining increasing attention because of its impact on a country's economic growth and job creation. Within entrepreneurship, academic entrepreneurship has caught the attention of scholars, which refers to the variety of ways in which academics go beyond the production of potentially useful knowledge. Entrepreneurs undertake a range of activities in the form of commercialization because it expands technology transfer revenues and fills the technology transfer pipeline beyond traditional technology-based ideas, inventions and discoveries.

In academic research commercialization, universities involve in a number of mechanisms to transfer knowledge to private companies for utilization (Young *et al.*, 2007). These mechanisms as highlighted by researchers relate to spin-off, publication, licensing, meeting, and cooperative projects (Mohaghar *et al.*, 2012). Academic research that is commercialized is linked to economic progress and social benefits and is accepted as a vehicle for socioeconomic development (Barajas *et al.*, 2012).

Research universities' innovations are being viewed by policymakers in many countries as engine of growth (Wang, 2010). Universities play an important role in society as transmitters and producers of knowledge. In the last decade, discussion about universities third mission of economic development, has received greater attention, in addition to research and teaching (Etzkowitz, 2002).

Researchers are also of the opinion that knowledge transfer by universities is potential source that can help generate revenues for the universities (Merrill and Mazza, 2010). Researchers have pointed out that universities engage in variety of technology transfer mechanisms such as business incubator activities; technology licensing, patenting, university-based business consulting, spin-off formation (Merrill and Mazza, 2010; Takahashi and Carraz, 2011). In fact, commercialisation of knowledge created in the universities have become the third mission of the universities besides teaching and research (Collier and Gray, 2010), mainly because

researchers in the universities produce innovations as a result of their research activities which in turn can be exploited commercially (Ismail *et al.*, 2011).

However, technology transfer from universities require entrepreneurial oriented faculty. O'Shea *et al.* (2008) have highlighted that the entrepreneurial disposition of the faculty and individual's abilities are important in shaping the faculty's behavior regarding commercialization. Similarly, Rashid and Ismail (2014) are also of the view that entrepreneurial mindset is needed for technology transfer. They further point out that for technology transfer to be successful, universities need to provide environment for the faculty to engage in entrepreneurial activities. Likewise, Roberts (1991) argues that academics having extroverted personalities were more likely to engage in technology transfer 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. Researchers are of the view that entrepreneurship involves identifying opportunities, taking risks, and organizing resources (Kuratko and Audretsch, 2009). It has been further highlighted that entrepreneurship requires individual attributes that focuses on the individual actions based on personalities, characteristics, and ability to conduct entrepreneurial activity (Buenstorf and Geissler, 2012).

The government has given a vision 2020, according to which Malaysia will be high income country by 2020; accordingly, there is a need to transform Malaysia from the resource based to the innovation economy base through the National Innovation Model (NIM). National Innovation Model (NIM) has been described as the tool of balancing approaches between technology driven innovation and market driven innovation. In the technology driven model, innovation, scientists and researchers are being funded for R&D, to improve upon the technology. Thus, this will help scientists and researchers to commercialize their ideas to the international market. Meanwhile in the model of market driven innovation, the market is determined before entrepreneurs use their knowledge to acquire the technology. The Ministry of Science, Technology and Innovation have outlined Science, technology and innovation as the central elements of success in today's modern economy. They

also provide the Second National Science and Technology Policy as the framework for improving performance and Malaysian long-term economic growth (MOSTI, 2010). The aim of this policy is to:

- Raise the national capacity and capability to research and development (R&D), developing technology and acquisition.
- Encourage partnerships among industry and funded organizations.
- Place Malaysia as the technology provider to the strategic key and knowledge industries.
- Enhance knowledge transformation to products, processes, services or solutions.
- Foster the values of the society and approaches that identify S&T as critical to future prosperity, as well as the need of life-long learning.
- Ensure that S&T utilization can accords the emphasis through approaches on the conformity with sustainable developmental goals.
- To progress the new knowledge based industries.

All these require universities to focus on technology production and dissemination. According to Aziz *et al.*, (2011) Malaysian government has put special emphasis on universities for country's economic development. Malaysian universities are the critical point for achieving vision 2020. However, there are some contextual factors that affect commercialization of research, such as:

- Research capabilities (quality and scale) and research orientation with applied research, engineering and applied sciences being extremely important.
- Institutional incentives and regulatory frameworks enabling and encouraging research institutions and scientists to engage in technology transfer activities.
- An entrepreneurial culture and willingness to collaborate with the productive sector.
- Intermediation support (and technology transfer skills) to conciliate technology supply with demands or vice-versa, implying assistance in

networking, intellectual property management, and contracting services in technology markets.

- Access to finance and financial mechanisms for new firm creation and industry-science collaboration.

In Malaysia, commercialization is a new phenomenon. Universities are still in their infancy in technology oriented commercialization process. According to Aziz *et al.* (2011) out of all public universities, Universiti Teknologi Malaysia (UTM) has a good commercialization policy and guideline for commercialization. They analyzed UTM commercialization infrastructure and procedures that can provide the blueprint for all Malaysian higher educational institutes to follow. They also describe UTM context as an operator for providing overview on commercialization environment in research universities in Malaysia. Table 1.1 shows commercialization activities in Malaysian public universities. Still the amount of the commercialization activities is not at higher level. Thus it is required to study the factors that can influence the attitude of the academic staff towards the commercialization of knowledge.

1.3 Organization Background

Universities primary role is to carry out scientific research. However, this traditional role has been changed to certain extent due to research commercialization (Yaacob, 2011). This commercialization activity involves market like behavior of universities (Slaughter and Rhoades, 2004). Several authors have proposed that research commercialization means intellectual property transfer and development (Australian Research Council, 2000). Zhao (2004) on the other hand broadens it as provision of consulting services which primarily relay on technological innovation. Downie and Herder (2007) emphasized that commercialization is the conversion of

academic research into products, services and processes that can be the object of commercial transitions. Li and Morgan (2010) stated that although the main mission and strengths of universities are still education and research as recognized that in term of commercialization there occurs a huge communication gap between industry and academic.

Few studies have been conducted regarding academic commercialisation in Malaysia (Aziz *et al.*, 2011; Ismail *et al.*, 2012; Rashid and Ismail 2014; Heng *et al.*, 2011). Researchers in the universities produce innovations as a result of their research activities which in turn can be exploited commercially. However, the conversion of research into a commercialized product is a difficult path (Ismail *et al.*, 2012). Commercialisation and innovation has been assigned as niche 1 by the Malaysian Ministry of Higher Education which implies the emphasis and urgency (MOHE, 2010; Aziz *et al.*, 2011) under the Tenth Malaysian Plan. Aziz *et al.* (2011) posited that a developing country like Malaysia is still behind in terms of its research capabilities. They further highlighted that universities in Malaysia have been identified as key factors for the growth and rapid development of the nation, due to vast investment of public funds into research activities among the universities by the government. However, R&D output transference percentage from Malaysian universities to industries via commercialization is very limited (Ismail *et al.*, 2011). In this regard, Rashid and Ismail (2014) pointed out that gap lies between R&D activities engaged by universities and transfer to industry. However, Malaysian universities have only been able to manage 6% of total R&D as commercialized product as shown in Table 1.1.

Table 1.1 indicates that Universiti Teknologi Malaysia (UTM) has approximately 2.5% of commercialized products as 118 R&D projects; while it has 47.45% of potential R&D projects that could be commercialized. Sudullah (2002) points out that the prospective collaborations among the universities and industries in Malaysia are marred with passiveness in Malaysian universities such as insufficiency of the innovative products toward commercialization, lack of researches on commercialization aspect and lack of academic staffs convictions and commitment toward innovation and commercialization.

Table 1.1: Commercialization Activities in Malaysian Public Universities (2010)

Universities	Total R&D Projects	Commercialized Products	Commercially potential products	IPR				
				Pending	Granted	Trademark	Copyright	Industrial design
Universiti Malaya	1190	23	98	115	0	0	0	0
Universiti Sains Malaysia	35	53	72	34	8	2	4	1
Universiti Kebangsaan Malaysia	110	27	11	21	2	18	1	2
Universiti Putra Malaysia	218	4	34	30	3	5	0	2
Universiti Teknologi Malaysia	118	3	56	3	7	0	10	0
Universiti Teknologi Mara	190	5	91	23	2	2	9	1
Universiti Islam Antarabangsa Malaysia	43	1	0	1	0	1	1	0
Universiti Utara Malaysia	15	0	7	0	0	2	7	0
Universiti Malaysia Sarawak	11	1	8	4	0	0	0	2
Universiti Malaysia Sabah	18	0	18	9	0	2	3	0
Universiti Pendidikan Sultan Idris	6	0	8	0	0	0	0	0
Universiti Sains Islamic Malaysia	6	0	1	0	0	1	0	0
Universiti Malaysia Terengganu	12	3	12	2	0	1	0	0
Universiti Tun Hussein Onn Malaysia	6	0	7	0	0	0	0	0
Universiti Teknikal Melaka	2	1	2	1	0	2	2	0
Universiti Malaysia Pahang	8	0	0	0	0	0	0	0
Universiti Malaysia Perlis	3	4	15	6	0	0	1	0
Universiti Sultan Zainal Abidin	47	0	0	0	0	0	0	0
Universiti malaysia Kelantan	20	0	0	0	0	0	0	0
Universiti Pertahanan National Malaysia	1	0	2	2	0	0	0	0
Total	2059	125	442	251	22	36	38	8

Universiti Teknologi Malaysia (UTM), an innovation-led and graduate-focused research University, has two campuses; one in Kuala Lumpur (the capital city of Malaysia) and the second in Johor Bahru, (the southern city in Iskandar Malaysia, which is a vibrant economic corridor in the south of Peninsular Malaysia). UTM has academic staff strength of over 3,500 of which more than 250 are foreign graduate faculty members. UTM continuously strives to develop and enhance quality academic and professional programs of international standard and global recognition. The student population consists of more than 15,000 full-time undergraduate students, over 6,000 enrolled on distance learning programs as part-time students and more than 9,000 postgraduate students in various fields of specialization; out of which over 2,000 are foreign students.

UTM has also established a reputation for cutting-edge research undertakings and innovative education, proven by becoming the three-time winner for the National Intellectual Property Award for organization category. A stimulating research culture exists in UTM through 10 Research Alliances (RA) in strategic disciplines namely Sustainability, Infocomm, Water, Cybernetics, Biotech, Construction, Materials & Manufacturing, K-Economy, Energy, Transportation and Nanotechnology. In addition there are 28 Centers of Excellence (CoE) in addition to academic faculties to service technological education and research needs of the university (UTM, 2014).

1.4 Problem Statement

Recently, role of universities is universally accepted in economic development along with their traditional goals of teaching and research. This is due to universities are focusing on the commercialization of knowledge generated in universities. According to Takahashi and Carraz (2011), educational institutions with an entrepreneurial orientation aim towards development of new ideas for revenue generation. Keeping in this view, universities direct and inspire individuals for the development of interpersonal relationships and teams (Yang, 2008). However, universities are facing real challenges in this regard, especially in the case of Malaysia (Ismail *et al.*, 2012). He highlighted that inadequate R&D funding, technological gap between university and industry, lack of expertise, less commitment among academics and limited linkage with industry are the main obstacles of low commercialization rate among Malaysian universities.

Literature exposed many factors related to the commercialization. Rashid and Ismail (2014) stated that successful commercialization requires proactive leadership and entrepreneurially oriented academic staff. Rashid and Ismail (2014) explains that faculty is considered as the major source of all technological

advancements that are attributed to the universities, there is a need to encourage entrepreneurial activities among the faculty so as to engender more commercialization of academic research. However, in this regard few researchers has been done on the factors that influence the attitudes and perception of faculty members regarding commercialization of academic research (Zucker and Darby, 2001; Louis *et al.*, 1989)

Heng *et al.* (2011) argued that universities are the economic development agents and there is a need for faculty to exhibit greater commercialisation behaviour. The authors have further highlighted a need for investigation into precursor cognitive process of commercialisation activity. Moreover, personality characteristics of entrepreneurs have remarkable influence on overall entrepreneurial events (Westhead and Wright, 2000). Characteristics such as sociable, anxious, energetic are considered to be present within individuals as it distinguish them as entrepreneurs. Meyers and Pruthi (2011) suggested that there is a need to investigate the extent at which science, technology and entrepreneurial orientations are associated with various universities as it variation lies among universities and academics. Goldstein *et al.* (2013) have also highlighted that there have been few attempts in measuring the attitudes of faculty members towards university's entrepreneurial activities, whether they are actually involved in commercialization activity or not. This means that an entrepreneurial mind-set is vital for capturing opportunities as it can contribute towards organization's competitive advantage (Rashid and Ismail, 2014). Keeping in view, there is an inadequate research investigating the role of entrepreneurship towards commercialization especially at individual level. Audretsch and Erden (2004) highlighted that few studies focused on the cognitive and social-psychological processes associated with scientists reshaping their career paths and pursuing entrepreneurial paths. Similarly, Jain *et al.* (2009) have also highlighted the missing link of university scientist disposition towards entrepreneurial activity which is considered as a key towards emergence of knowledge in intensive fields.

Factors that influence the attitudes of researchers towards commercialization concerned with the unique characteristics such as need for achievement, locus of control, risk taking propensity, commitment, leadership, opportunity obsession, creativity, ambiguity and uncertainty, self-reliance, motivation to excel, optimistic (Timmons *et al.*, 2010). Regardless of these identified entrepreneurial attitudes, entrepreneurship is relatively new in academic environment of Malaysia, as not many researchers have investigated yet that how entrepreneurship in Malaysian universities affects university commercialization efforts (Aziz, *et al.*, 2011). If universities have to take entrepreneurial approach, it would require to concentrate on the aforementioned entrepreneurial attitudes to excelerate entrepreneurial process (Zhao *et al.*, 2005). Various researchers have highlighted the importance of individual characteristics in research commercialization activity (Clarysse *et al.*, 2005; Powers and McDougall, 2005). Similarly, Bourellos, *et al.* (2012) have suggested that psychological characteristics should be studied in relation to academic entrepreneurship and commercialization.

Thus, by keeping in view the above discussion and gaps identified by researchers in previous studies, this study aims to answer the main question regarding what role entrepreneurial characteristics plays towards academic's attitude for commercialization. Most of literature that is related to university research commercialization in Malaysia investigates the institutional and external factors of commercialization (Khademi *et al.*, 2015; Nagaretham *et al.*, 2012; Aziz *et al.*, 2012), still commercialized product in universities are lacking. Hence, examination of behavioural characteristics of university researchers can be crucial in enhancing the university commercialization as they would reflect the characteristics researchers' exhibit and the attitude towards research commercialization activities.

1.5 Purpose of the Study

The purpose of this research is to investigate the influence of entrepreneurship characteristics (EC) on academic's attitude towards knowledge commercialization. This would help in understanding the main problems and issues which influences the Universiti Teknologi Malaysia (UTM) commercialization performance. The findings could contribute new knowledge in the field of entrepreneurship, and which characteristics influence commercialization process in Universiti Teknologi Malaysia (UTM).

1.6 Research Objectives

The objectives of this research are as follows:

1. To identify the entrepreneurial characteristics of academicians in Universiti Teknologi Malaysia (UTM) that influences commercialization in UTM.
2. To identify the attitude of academicians towards knowledge commercialization in Universiti Teknologi Malaysia UTM.
3. To identify the relationship between entrepreneurship characteristics and academics attitude towards knowledge commercialization in Universiti Teknologi Malaysia (UTM).

1.7 Research Question

The questions of this research are as follows:

- 1- What are the entrepreneurial characteristics of academicians in Universiti Teknologi Malaysia (UTM) that influences commercialization in UTM?

- 2- What is the attitude of academicians towards knowledge commercialization in UTM?
- 3- What is the relationship between entrepreneurship characteristics and academics attitude towards knowledge commercialization in Universiti Teknologi Malaysia (UTM)?

1.8 Significance of Study

According to the objective the use of this study are well described because it offers input to the university entrepreneurship to provide a clear picture towards commercialization as well as identifying the influencing factors in UTM. However, by providing a better understanding of how academics perceive commercialization process is critical for Universiti Teknologi Malaysia in order to adopt policies that could help the university in enhancing commercialization. Therefore, current study desires to investigate the relationship of entrepreneurial characteristics of academics with their attitudes towards commercialization in UTM. The findings of the study would help increase the body of knowledge on the personal factors that influence commercialization particularly in UTM and generally in Malaysia as there are no specific studies that take into account entrepreneurial characteristics of academic researchers and its influence on researcher's attitude towards commercialization.

Previous studies in Malaysian context focused on aspect of commercialization (Nagaretham *et al.*, 2012; Khademi *et al.*, 2015; Latif *et al.*, 2016 (article in press); Aziz *et al.*, 2012). However, these studies are not focused on the academic staff attitude towards the commercialization. Thus findings of the current study focused on the entrepreneurial attitude towards the commercialization. Furthermore, the empirical finding of the study provides suggestions to the management of the university that would help in motivating the academic researchers towards commercialization activities. The finding and suggestions of this study will

contribute to the existing knowledge which will be useful to university commercialization process and other reader to further development on the factors that affect the commercialization performance of Universiti Teknologi Malaysia (UTM).

1.9 Scope of the Study

The study focused on the entrepreneurship characteristics and attitudes of academic researchers towards commercialization in Universiti Teknologi Malaysia. UTM has been selected as it is one of the research universities in commercialization in Malaysia. For the present study, eleven entrepreneurial characteristics are being focused, which have been extensively highlighted in the literature. Further, attitude towards commercialization pertains to the academic's attitude towards knowledge commercialization. The study will focus on the primary data collection through survey questionnaire. The data was collected from the faculty members involved in research activities in UTM, selected through random sampling technique.

1.10 Conceptual Definitions

Following are the definitions which are being used in the study.

1.10.1 Knowledge Commercialization

In terms of university research commercialization, it is the method of transferring knowledge, skills, methods of manufacturing, technologies, between

universities and institutions to ensure that technological and technical developments are available to a broader range of customers for development of new products, applications, processes, materials, or services (McAdam *et al.*, 2012). Etzkowitz (2000) calls this knowledge commercialization as the third mission of universities besides research and education. Guenther and Wagner (2008) have also defined knowledge commercialization as the ability of higher education institutions to engage in entrepreneurial activities by transferring knowledge and skills to industry.

1.10.2 Entrepreneurship

Entrepreneurship is an activity that involves the innovative combination or ideas in order to introduce new goods or services, ways of organizing, markets, processes or raw materials (Abreu and Grinevich 2013).

1.10.3 Entrepreneurial Characteristics

In entrepreneurship, entrepreneurial characteristics refers to the typical feature or quality that someone or somebody has, such as being innovative, creative and open to change, and having the ability to identify opportunities and achieving stated goals (Neneh and Vanzyl, 2012). Some researchers are of the view that entrepreneurial characteristics can be acquired through life experiences or through entrepreneurial processes (Nieman *et al.*, 2003). Researchers like Walstad and Kourilsky (1998) assume that entrepreneurial characteristics and characteristics are universal in nature and developed at early stages of education process.

1.10.4 Attitude towards Knowledge Commercialization

Attitude is the individual's way of thinking that can effect individuals' behavior. Attitude towards knowledge refers to the way of thinking of individuals towards commercialization of the knowledge (Bamberg, Ajzen and Schmidt, 2003). Van Wyk and Boshoff (2004) are of the view that entrepreneurial attitude is based on three theoretical attitudinal components of beliefs and thoughts, positive or negative affection, and intentions and actions. Huefner *et al.* (1996) suggests that cognition affect and intentions are the fundamental components for orienting attitudes towards achievement, innovation, personal control and self-esteem. Goldstein *et al.* (2013) are of the view that faculty's attitude towards commercialization is the propensity of individual faculty member to approve knowledge commercialization without compromising integrity of scientific research. In other words, scientific research should be available with improved access to information.

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