

Academic Entrepreneurship and Innovation in Higher Education: An Integrated Framework for Malaysian Universities

¹MOHAR YUSOF, ²ZULKIFLEE ABDUL-SAMAD, ³FADZIL HASSAN,
⁴ZUHAIRUSE MD. DARUS, ⁵MOHAMMAD FADHIL MOHAMMAD AND ⁶AZAMI ZAHARIM

¹Bank Rakyat School of Entrepreneurship
Universiti Tun Abdul Razak,
50100 Kuala Lumpur.
MALAYSIA

²Department of Quantity Surveying, The Faculty of Built Environment,
Universiti Malaya, 50603 Kuala Lumpur
MALAYSIA

^{3, 5}Department of Quantity Surveying, Faculty of Architecture, Planning and Surveying,
Universiti Teknologi MARA, 40450 Shah Alam, Selangor Darul Ehsan
MALAYSIA

⁴Department of Architecture, Faculty of Engineering

⁶Unit of Fundamental Engineering Studies, Faculty of Engineering and Architecture,
Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor Darul Ehsan
MALAYSIA

Correspondence Author: ujang@vlsi.eng.ukm.my <http://www.ukm.mymohar.yusof@gmail.com>
<http://www.unitar.edu.myzulkiflee1969@yahoo.com> <http://www.um.edu.mypadzil037@salam.uitm.edu.my>
fadhilnavy@yahoo.com <http://www.uitm.edu.my>

Abstract

This paper discusses the phenomenon of academic entrepreneurship and its significance to university education, societal development and economic development. It analyzes and presents academic entrepreneurship as a leadership process of creating value through acts of organizational creation, renewal or innovation within or outside the university that results in research and technology commercialization. The study identifies the complexities involved in nurturing the entrepreneurial academic paradigm and the impact it has on the leadership role of the university. Academic entrepreneurship is a new phenomenon in Malaysia and the focus has very much been placed on research and technology commercialization. The evolution of academic entrepreneurship in the Malaysian context is examined. From these discussions, the paper offers an integrated framework of a university's entrepreneurial system which takes into account the role and linkages between the government, university and industry. Last but not least, it discusses issues, challenges, the way forward for Malaysian universities and implication for academic entrepreneurship research.

Key-Words: - Entrepreneurship, Innovation, Technology Commercialization, Framework, Academic

Introduction

The essence of this paper is the phenomenon of academic entrepreneurship. It has become a very interesting, complex and important phenomenon because it is situated at the core of changes in the landscape and context of higher education

transformation in Malaysia. In essence, it is changing how universities are being viewed. No longer are universities viewed only as the liberator and protector of all knowledge and science, of fact and principle, of inquiry and discovery, of experiment and speculation. No longer does it only play the role of producer of human capital and industry-ready workers. In this century, universities pursue academic entrepreneurship to strategically

place and position themselves as important engines of sustainable technological development and economic growth.

The main purpose of this paper is to propose an integrated framework of a university's entrepreneurial system which takes into account the role and linkages between the government, university and industry. In doing so, this paper discusses the phenomenon of academic entrepreneurship and its significance to university education, societal development and economic development. The discussion also draws from trends and progress of academic entrepreneurship in developed societies in the USA, Canada, Europe and Australia. The evolution of academic entrepreneurship in the Malaysian context is examined and discussed within three contextual elements of a university's entrepreneurial system.

Academic Entrepreneurship and Innovation

Academic entrepreneurship can be defined as the leadership process of creating value through acts of organizational creation, renewal or innovation that occurs within or outside the university that results in research and technology commercialization. It occurs at the level of individuals or groups of individuals acting independently or as part of faculty or university systems, who create new organizations, or instigate renewal or innovation within or outside the university. These individuals can be referred to as academic entrepreneurs or entrepreneurial academics (academic intrapreneurs). Value from academic entrepreneurship is achieved through the integration of scientific activities, academic activities and commercialization activities (Chrisman *et al.*, 1995; Clark, 1998; Etzkowitz *et al.*, 2000; Sporn, 2001; Etzkowitz, 2004; Brennan and McGowan, 2006; Kirby, 2006; Phan and Siegel, 2006; Rothaermel *et al.*, 2007).

Based on the definition above, the phenomenon consists of three components. Firstly, it creates value in the marketplace as well as within the university organizations. A university creates economic value by becoming entrepreneurial. Further, a university that extensively practices academic entrepreneurship is an entrepreneurial university. In the value creation process, leadership at all levels of the academic organization is

important in facilitating, nurturing and supporting entrepreneurial activities. Without strong and effective leadership, the transition or transformation towards an entrepreneurial university may not be realized (Clark, 1998; Jain and Yusof, 2007).

Secondly, the value creation process occurs through acts of organizational creation, renewal or innovation. Table 1 provides the mechanisms that can be undertaken in pursuing these entrepreneurial actions.

Table 1. Dimensions and Mechanisms of Academic Entrepreneurship

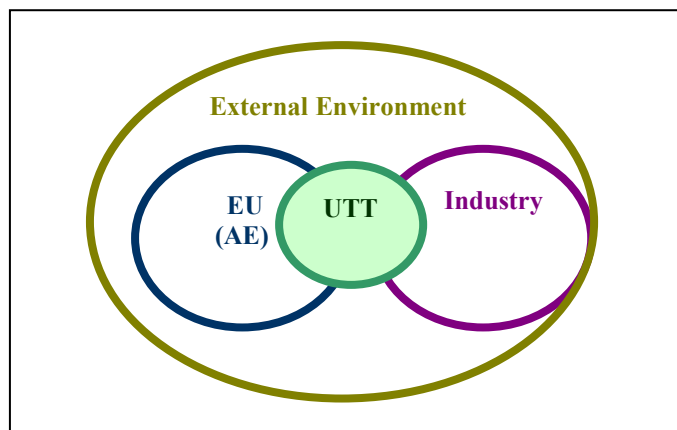
Dimensions	Mechanisms
Organizational creation	Start-up companies University spin-offs Joint venture
Organizational renewal	Research groups Research centers Technology transfer schemes
Organizational innovation	Patenting Licensing Design rights

Source: Adapted from Brennan and McGowan (2006)

And thirdly, academic entrepreneurship results in research and technology commercialization. This is because it facilitates and encourages university technology transfer between the university and the industry. Thus, a higher degree of academic entrepreneurship orientation will result in a greater number of technology transfer and commercialization activities between the university and the industry (Yusof and Jain, 2007).

In an entrepreneurial university, academic entrepreneurship processes and activities are embedded in the university system, encultured in its academic faculties, embodied in its community of practice and embrained in each individual academic. By indulging in academic entrepreneurship, university agents i.e. academic inventors and entrepreneurs, use available organizational resources and state resources and organize their entrepreneurial activities towards exploiting perceived opportunities in the knowledge-based economy. In essence, this means that academic entrepreneurship is a process that occurs within the organizational boundary of the

university. This is shown in Figure 1 where academic entrepreneurship (AE) falls inside the circle which is denoted as entrepreneurial university (EU).



EU – Entrepreneurial University
 AE – Academic Entrepreneurship
 UTT – University Technology Transfer
 Source: Yusof and Jain (2007)

Fig. 1. A Framework Depicting the Relationship between University-Level Entrepreneurship, Industry and External Environment

Previous research into academic entrepreneurship has tended to equate academic entrepreneurship with university technology transfer, more specifically with the creation and development of new organizations, commonly known as the academic or technology based spin-off. However, when academic entrepreneurship is interpreted as encompassing not only organizational creation but also strategic renewal, transformation and innovation within the university systems, then, a boundary exists between academic entrepreneurship and university technology transfer.

This means that not all academic entrepreneurship processes and activities will result in university technology transfer but the process of transferring technology to the industry or the commercialization of the technology or invention through licensing agreements, research joint ventures and university-based start-ups, is an entrepreneurial activity. Figure 1 describes that the entrepreneurial university interacts with the industry and extend its academic entrepreneurship processes and activities beyond the organizational boundary through university technology transfer.

For national and local governments, universities are a source of key assets for technology-driven innovation economy. They provide skilled people and valuable researchable ideas. They attract other key economic development resources such as educated people, firms and venture capitalists. Universities can be relied upon for long-term sustainable relationships. Universities which have been successful in teaching and research have vast untapped resources for nurturing and establishing innovative startups and technology-based ventures (Chrisman *et. al.*, 1995; Etzkowitz *et. al.*, 2000; Cosh *et. al.*, 2004; Phan and Siegel, 2006; Rothaermel *et. al.*, 2007, Jain and Yusof, 2007)

Through academic entrepreneurship, the university becomes the agent of industrial innovation, technological development, economic development and social development especially in the context of growing knowledge-based economies and globalization. Further, the university becomes more economically and societal focused, engages with the task of contributing to the entirety of a cultured and competitive society, honors its intellectual and social purpose of improving the quality of life for the whole community, and, becomes more outward-looking and accountable for public funds and its own internal workings (Cargill, 2006). These are new challenges to the entrepreneurial university.

The above basically suggests that university's leadership role is becoming multi-faceted. Not only that universities are required to educate people but they need to train skilled undergraduates, graduates and post-doctorates. To contribute towards knowledge-based innovation systems and economies, universities need to increase the stock of 'codified' useful knowledge such as publications, patents and prototypes. They have to participate in problem-solving activities in the industry and community through contract research, cooperative research with industry, technology licensing, faculty consulting, and providing access to specialized instrumentation and equipment, and incubation services. (Cosh *et. al.*, 2004).

Universities need to provide public space in order to facilitate the public in forming and accessing networks, and stimulating social interaction. In addition, they will be able to influence the direction of search processes among users and suppliers of

technology and fundamental researchers. These can be done through meetings and conferences, hosting standard-setting forums, creating entrepreneurship centers, developing alumni networks, facilitating personnel exchanges such as internships and faculty exchanges, and creating visiting committees and curriculum development committees (Cosh *et. al.*, 2004).

Academic Entrepreneurship and Innovation: The Malaysian Context

For Malaysia, academic entrepreneurship is a new phenomenon and the focus has very much been placed on research and technology commercialization. Playing the lead role in instigating entrepreneurial and commercialization activities are the government and local public research universities. The key role played by the government in triggering the development of academic entrepreneurship in Malaysia can be traced from the nation's planned transformation to become a developed society through Vision 2020 in 1991 and the re-focusing of efforts on the development of a knowledge-based economy after the Asian financial crisis. Among the key initiatives were The Third Outline Perspective Plan (2001-2010); Knowledge-Based Economy Master Plan, 2002; and, Malaysian Knowledge Content (MyKe) Survey, 2003. In fact, government research funding under the Ninth Malaysian Plan (2006-2010) which was at 1.5% of Gross Domestic Product increased threefold compared to the Eighth Malaysian Plan (2001-2005) which was at 0.49% of Gross Domestic Product.

Other strategic triggers include initiatives under the Ministry of Science, Technology and Innovation (MOSTI). Among the profound ones was the Intensification of Research in Priority Areas (IRPA) programme. From 1986-2000, RM2 billion have been allocated for Research and Development; Grants/Funds i.e. ScienceFund, InnoFund, TechnoFund and Brain Gain; infrastructure and support agencies such as Multimedia Development Corporation (MDeC), BiotechCorp, MASTIC and NITC etc.; Science and Technology award such as the National Innovation Award; and, policies and action plans such as the National Science and Technology Policy, National Biotechnology Policy and National ICT Roadmap.

Since 1994, the Malaysian Science and Technology Information Centre (MASTIC) had conducted the National Survey of Research and Development every two years and this survey provided information on research and development activities undertaken by the public and private sectors in Malaysia. For instance, the survey in 2006 found that there was a steady increase in research and development expenditure since 1996. Total research and development spending was RM513.3 million in 2004, an increase of 42.4% from 2002. Then again, even though there had been an increase in research and development spending in Malaysian universities, these spending were still very low compared to universities in developed and other Asia Pacific countries.

Among the significant decisions made by the government to stimulate innovation and research commercialization in higher education were the designation of four public universities as research universities namely University Malaya, Science University of Malaysia, National University of Malaysia and University Putra Malaysia (Ninth Malaysian Plan (2006-2010), pp. 258), and, an allocation of RM5.3 billion for science, technology and innovation initiatives to strengthen the national innovation system (Ninth Malaysian Plan (2006-2010), pp. 279-280). In addition, focus and emphasis were given to biotechnology, advanced materials, manufacturing, information and communication technology, and nanotechnology to generate 300 science and technology-based companies through public funded research and development, and 50 companies with global partnerships (Ninth Malaysian Plan (2006-2010), pp. 275).

An Integrated Entrepreneurial Framework for Universities

Research is at the heart of innovation but unless research can be effectively transferred to the marketplace, the benefit to the locality or economy is limited. Research and technology commercialization is the process of finding, creating and leveraging intellectual property that has potential commercial applications. Such applications are the fruits of research conducted within a variety of public and private environments, including universities, research institutions and

established commercial companies. The benefits of technology commercialization include a more rapid technological diffusion to the public enhancing local and regional economic development, a potential source of university revenue, positive effects on the curriculum and as a marketing tool to attract students, faculty and additional industrial research support. The rapid rise and increased emphasis on transferring technology to the private sector for commercialization as an economic development strategy has also led to a rise in entrepreneurial activities in universities. Further, the need to develop more rapid linkages between science, technology and utilization has been caused among others by the rapid rate of technological change, shorter product lifecycles and the more intense global competition which has radically transformed the current competitive position of many regional economies (Monitor Group, 2003; Phan and Siegel, 2006; Yusof and Jain, 2007).

Researchers, scientists and technologists are employed here and they produce a supply of inventions and innovations which may hold commercial potential. A university's entrepreneurial system can be enhanced and strengthened through five basic tenets: (1) recognizing the important role of the university in regional economic development; (2) create and support the technology transfer office; (3) align university curriculum to meet the needs of local clusters; (4) the university actively participates in cluster development efforts; and (5) support start-up company efforts by academicians and students (Porter, 2001).

They are the demand side of the commercialization equation, finding applications for the inventions and innovations produced within universities and institutes.

A network of operational venture capitalists, local entrepreneurs and angel investors who provides capital and test the commercial viability of new ideas and innovations. The venture capital community provides market-based screening of ideas, pairing of business people with inventors, capital and contacts.

Undergraduates, graduates, faculty and researchers employed by companies within the locality either as trainees, consultants, full-time and part-time workers, transfer knowledge to the marketplace by bringing their skills and experience to local companies.

University technology transfer office facilitates the commercialization process between inventors, companies and the venture capitalists. Technology transfer offices should be gateways to facilitate the flow of innovation and not gatekeepers that constrain the flow of inventions and frustrate faculty, entrepreneurs and industry. Therefore, technology transfer managers should be creative and innovative and utilize various types of commercialization models (Litan *et. al.*, 2007)

The university's entrepreneurial ecosystem will generate substantial value for the regional economy and benefits the university. Inventors will enjoy a flexible and innovative research environment; companies gain access to valuable research; and universities receive substantial financial upside from their licensing activities, as well as from the generous financial gifts made by alumni and faculty who have been successful entrepreneurs using technology developed at the university. Thus, the technology transfer office should be best viewed not only as a licensing mechanism but also as a diplomatic entity, which facilitates the transfer of technology for the greater good of the region and which maintains excellent relations with entrepreneurs (Monitor Group, 2003).

Conclusion

The impact of the National Higher Education Action Plan (2007-2010) which is triggering the higher education transformation is that Malaysian universities are expected to contribute more to economic development through research and development, and commercialization activities; universities must seek closer relationships with the government and industry; and, universities need to drive resource efficiency and quality management approaches through all aspects of their business, requiring a high level of both financial and outcome accountability. Several issues and challenges which will be faced by Malaysian universities wanting to nurture their entrepreneurial ecosystems include, among others:-

Would the universities be able to accommodate a third mission of enterprise development on top of primary roles of education and intellectual discovery? Can universities stand up to their local role and gear up to their international role? How will university leadership address the conflict

between role of disciplines and role of inter-disciplines? How will university leadership address the conflict between academic freedom, scientific autonomy, curiosity-driven ‘fundamental’ research versus directed, user-driven, shorter-term development ‘applied’ research? In other words, can academic leadership find a balance between technology-driven innovation and market-driven innovation? Can universities handle the issues relating to conflict of interest and conflict of commitment? How will universities decide between centralized versus decentralized management of the university-industry boundary? How will universities select the appropriate commercialization model for their technology transfer offices? Further, in 2004, research and development expenditure by the private sector accounts for 71.5% of the national gross expenditures on research and development (GERD) (National Survey of Research and Development, 2006). Therefore can universities attract funding from the private sector? Would the private sector be willing to pour their research and development expenditures into research and commercialization activities in universities?

Most studies focused on university entrepreneurship in the USA and selected European countries and a few studies compare and contrast university commercialization activities across countries (Rothaermel *et. al.*, 2007; Yusof and Jain, 2007). This represents an opportunity for researchers especially in other parts of the world, in other cultures or in different economic contexts (developing or transitional economies) to examine whether the same patterns of university entrepreneurial activities or the same dynamics apply to the context of their nations, culture or economic system. In addition, there is a paucity of literature and studies on academic entrepreneurship and research commercialization in Malaysia especially in the higher education system.

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