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Research, Innovation and Development Strategic Planning for Intellectual Property Management

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Summary

There has been a lot of emphasis on Research and Development, as well as innovation, in Higher Education Institutions (mostly at the universities level) that can lead to commercialization. However, the commercialization of the research and development by Higher Education Institutions remains a challenge. This paper reviews the concepts of research, innovation, and development as well as technology transfer; and then identifies the gaps and proposes the strategic planning for technology transfer. In conclusion, the strategic direction of an organization is determined by its technology, funds available, and its collaboration and commercialization strategy.

Keywords: Technology Transfer, Strategic Planning, Gap Analysis, Research and Development, Innovation, Commercialization

JEL: O3, M1, M2

1. INTRODUCTION

Just like any other investment activity, the expenditure on research and development (R&D) and innovation are cyclical, Business sector funding for R & D is particularly affected by the business cycle and reflects changes in financing constraints and aggregate demand. There has been a lot of emphasis on R&D as well as innovation in the Higher Education Institutions (mostly at the universities level) leading towards commercialization. In fact, one of the indicators of economic growth in many countries is currently being determined by the Research and development activities as well as innovation leading towards commercialization. This paper focuses on the Malaysian scenario. The Malaysian Education Blueprint 2013–2025 and National Higher Education Special Policy (NHESP) beyond 2020 provide the vision and policies are gear towards for Malaysia to become an *education hub* with research and development capability in the region, especially in South East Asia. The current trends in Malaysian higher education are based on Globalization, Teaching, and Learning, Research and Development and Knowledge-based Society (Grapragasem, Krishnan, Mansor, 2014; MOHE 2007a; 2007b; 2012). In order to achieve these, the Ministry of Higher Education has encouraged Higher Education Institutes (HEI) to increase their research and development that can lead to innovation and commercialization.

According to Govindaraju (2010) and Ahmad, Farley, and Ng (2014), the Malaysian government has been for the last 20 years, providing allocations, grants, subsidies, and incentives to intensify research, innovation and commercialization activities. By 2020, the Malaysian Government expects to have at least six (6) public universities

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classified as Research Universities, twenty (20) centers of excellence that receive international recognition and ten (10) percent of the research and development to be commercialized (Ministry of Higher Education, 2007a; 2007b; 2012).

The most common R&D measurement is a country's gross domestic expenditure on research and development (GERD) as a percentage of its gross domestic product (GDP). Even though Malaysia has seen a rise in GERD from 0.5% to 1.13% from 2000-2012 (more than double), the country is still far from achieving its desired GERD of 2.0% by 2020 (Mastic, 2014b). The country policy sets the target of increasing Malaysia's GERD to at least 2.0% of the GDP by 2020. The major challenge of the Higher Education Institutes (HEI) are facing is to bring their inventions to the marketplace. This challenge has created the technology gap and it is vital to narrow this technology transfer gap by transforming Higher Education Institutions' research and development into commercialable products and services. Therefore, there is a need to determine the technology transfer gap. This paper addresses the following research questions:

i) What is the technology transfer gap between inventions and commercialization?

ii) What would be the growth strategy as the strategic planning to bridge this gap?

2. RESEARCH, INNOVATION AND DEVELOPMENT

The Organization for Economic Cooperation and Development (OECD) Frascati Manual defines research and development as "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications." Research and development are usually associated with the organizations' activities to improve the current product, services or process; or to come out with new ones. The wholesome research and development consist of scientific research, laboratory to testing and commercialization activities.

Generally, research and development consist of basic research, applied research, and development. Basic research also known as fundamental research is also scientific research intended to add to the scientific knowledge base. According to Hall (2006), basic research is research undertaken primarily to acquire new knowledge without the application portion. Applied research seeks to solve practical issues, and directed them towards specific goals. Lastly, the development efforts draw on existing research results, or use systematic scientific and technical knowledge, and direct them specifically towards organizational goals. Ultimately, the research and development activities contribute to the development of innovative technologies, thus leading to new products and services that can meet consumers' needs and wants (Lai, 2006, 2014: 2016: 2017: 2018; Lai and Zainal, 2014: 2015). Important inputs have been provided by Drucker (1985) include an empirical study on innovation and entrepreneurship; Trott (2004) innovation management of product development; Von (2003), Bruce, and Bessant (2001) design emphasis; and Jones (2001) the role of practitioners in particular.

Edison, Ali, and Torkar, (2013), as well as Worthley and Lai (2017), described innovation as both a process and an outcome. Frankelius, (2009) viewed innovation as something original or novel, more efficient and effective - that is, commercially viable. Maryville (1992) defined innovation as the new or better processes or solutions whereby unarticulated needs or existing market needs can be met. Tidd, Bessant, and Pavitt (2005) argued that innovation is driven by the ability to see connections, to spot opportunities and to take advantage of them. In this paper, innovation is defined as

the process from the start of the invention to commercialization and beyond. It is therefore essential that the gap between invention and commercialization in technology transfer is identified so that innovation opportunities are taken advantage of.

3. TECHNOLOGY TRANSFER

Technology transfer, also known as transfer of technology (TOT), is the process of transferring technology from one party to another party. Chung, (2011) and Kanyak (1985) described the transfer of the technology from one country to another as the transmission of know-how to suit local conditions. Technology transfer consists of any element or combination of research, development, and engineering transferred across national borders (Jeannet and Liander, 1978). Roessner (1993) defined technology transfer as the movement of know-how, scientific and technical knowledge, or technology from one organization to another. The type of knowledge or understanding that can be used as inputs, such as scientific principles, research and development and intellectual property rights (e.g: patents rights), but at the end, need to be commercialized into product or services (Hayden, 1992). Phillips (2002) articulated technology transfer as the process by which ideas and concepts move from the research and development organization or laboratory lab to the marketplace, whilst Willardsen, McGivern, and Hill (2014) saw technology transfer to involve efforts to transfer both basic and applied technologies towards commercialization. This paper expresses technology transfer in three (3) parts: i) the innovative ideas and concepts that solve identified problems, ii) the discovery of scientific research and development as well as intellectual property rights and iii) the knowledge, research, and development as well as technology from organizations or higher education institutes to the marketplace across national borders.

4. STRATEGIC PLANNING GAP

The concept and practice of strategy have been around for a long time and has been used in military, sports, and businesses; even in politics. Chandler, (1962) defined strategy as the determination of the basic long-term goals and objectives of an enterprise, and the adoption of courses of action and the allocation of resources for achieving these goals. Porter (1986), focused on competition and defined competitive strategy as “a broad formula for how a business is going to compete, what its goals should be, and what policies will be needed to carry out those goals.” According to Lai (2007), if the organization has not developed the distinct competitive advantage strategy, the organization can get stuck in the middle and lose its competitiveness. Mintzberg, (1994) expressed the five Ps strategy in a competitive manner as a plan, a pattern, a position, a perspective and a ploy. Bryson (1995) defines strategy as “a pattern of purposes, policies, programs, actions, decisions, or resource allocations that define what an organization is, what it does, and why it does it.” In strategies, the planning involves the activities to achieve the objectives set. Tregoe, Benjamin, and Zimmerman (1980) defined “the framework which guides those choices that determine the nature and direction of an organization” as organization strategy planning. Tidd, Bessant, and Pavitt (2005) argued that organizations with strategic advantages through innovation e.g., being able to make something no one else can; or to do so in ways which are better than anyone else, a powerful advantage. Therefore organizations should carefully consider their strategic planning to take advantage of this powerful source with strategic advantages through innovation.

Strategic planning for an organization involves the activities of defining the organization’s goals and its strategy and allocating its resources to pursue them. Usually, strategy planning consists of three (3)

parts: strategy analysis, strategy formulation and strategy implementation. The other approach to strategic planning is to identify the strategy-planning gap or carry out a gap analysis study. Parasuraman, Zeithaml, Berry (1985) pioneered the gap study using the conceptual model of service quality and its implications for future research. They observed gaps between executives' perceptions and consumers' perceptions about the same service quality. The difference between the perception of service performance and initial expectations gave rise to what is called *gaps model of service quality* and also can be seen as the *gap analysis*. Service quality used to be studied only by operations and focused on quality. There have been gap analysis studies in areas like corporate image and loyalty (Kuo and Ye, 2009), marketing strategy with online students (Kenney and Khanfar, 2009), managers versus service providers and customers (Luk and Layton, 2002), business process management like enterprise resource planning fit-gap analysis (Pajk and Kovacic, 2013) and other areas. To the best of the author's knowledge, there has not been much research in the technology transfer strategic planning gap; thus this approach is herein proposed.

A gap analysis helps an organization to understand and identify the gaps that exist between its ideal future state and its present state. In the case of the technology transfer scenario, the organization goal is to come out with inventions that can be commercialized. Nevertheless, there are gaps between invention and commercialization that require strategic planning. Performing a gap analysis can be very helpful when an organization tries to improve quality or determine the next steps to undertake strategic planning. In this paper, the strategic planning gap for technology transfer is discussed and shown in Figure 1: Technology Transfer Strategic Planning Gap

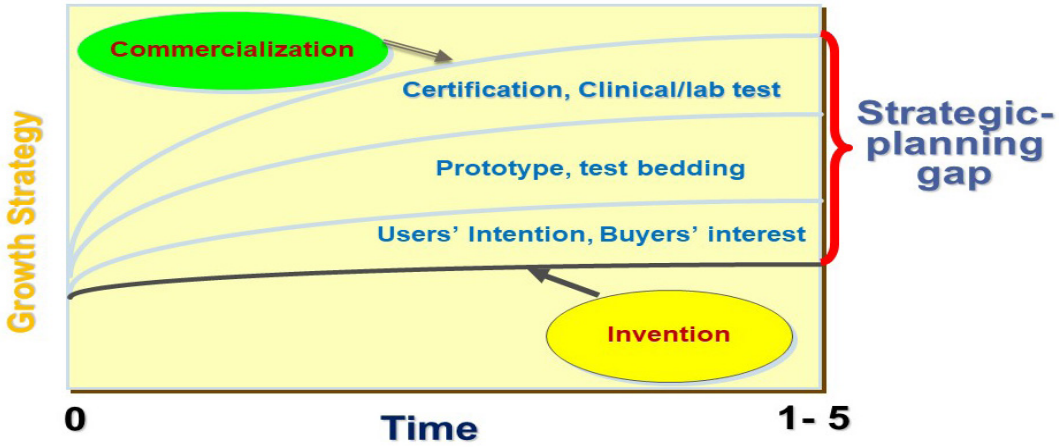

Fig. 1 Technology Transfer Strategic Planning Gap

The Technology Transfer Strategic Planning Gap (figure 1) shows the gap analysis between the invention of products or services and their commercialization. After analyzing 380 inventions from Medical, Engineering, Information Technology, Sciences and Social Science for the last 5 years, the identified gaps are users' intention (Buyers' interest) (78%), prototype (60%), test-bedding (70%), clinical/lab test (25%) and certification (37%); these need addressing before going to market (Commercialization). Technology transfer offices in the higher education institutes should apply growth strategies through these activities of understanding the user's intention as well as buyer's interest; having a prototype

or minimum product viable for test-bedding; and leading to certification of the products or services as well as a pilot (users' acceptance test).

The strategic-planning gap is to narrow the gap between innovation products or services and commercialization. Commercialization is the point where innovation products or services are accepted by the marketplace. Different types of products or services innovation with different target markets will require different time-frames. For information communication technology or software development, with easy access to consumers on a mobile phone for test-bedding with a prototype or minimum product viable (MPV) to study the acceptance, a shorter time frame, within a year or so will suffice. In this type of industry, there are platforms and support from companies like Apple, Google, Microsoft, IBM and others to shorten their development time to develop on their platforms and test-bed with their affiliations. Recently, with the growth in fintech, companies like MasterCard, Visa, Paypal, and others are providing such platforms too. Newer ones, like Bitcoin and Blockchain, are also available and they provide shorter innovation and commercialization time with this type of platform. Whereas, life and medical sciences will take a longer time. Even with collaboration with the industry, like multi-national pharmacy companies and universities, the drug lead can take up to five (5) years. Furthermore, this industry requires certification and clinical test that will take even more time. Therefore, the time-frame for innovation to commercialization will vary according to the industry.

A good point would be to start with understanding consumer needs and wants especially at the starting point of concept and design (Lai, 2014; 2016; Lai and Scheele, 2018). For example, the medical and dentistry faculties that require new electronic tools to support their teaching as "simulation-based learning". In the university environment where a few faculties like IT, Engineering and Medical should collaborate with each other to leverage on each other strengths. By forming, a team with multidiscipline will be able to develop a prototype to be test-bedded in the university environment. An example of the prototype can be something like simulation-based learning and can add gamification to it so it can be interesting. Hence, it is clear that technology transfer with knowledge transfer especially in the "simulated based learning" is vital for project success (Power and Cormican, 2015: Wang and Hou, 2015).

At times, the new processes or technologies (e.g: have been patented) that are owned by the universities can be licensed to the companies to take the next stage towards commercialization. Take the example of the case of patented healthcare products. The licensed company can then take it further to manufacture the products, get the products or services certified by relevant authorities and conduct the users' acceptance test before commercialization. In other words, some of the strategic planning gaps can be transferred and taken up by other parties. For example, the company who licensed the patent instead of the innovators themselves. The strategic growth also depends on the strategic direction of the organizations bringing the innovation to commercialization. This also depends on the type of technology, the funding, the collaboration partners, the micro and macro environment and the commercialization strategy.

CONCLUSIONS

This paper identifies the gap between invention and commercialization, namely, the users' intention as well as buyer's interest, creating prototypes or minimum product viable for test-bedding leading to certification of the products or services as well as the pilot (users' acceptance test) for commercialization. Efforts to enhance innovation can be strengthened via industry-academia collaboration, promoting private

financing of research, development, and commercialization as well as enhancing demand-driven research towards commercialization. The time taken to bring an invention to commercialization differs across industries as well. In conclusion, the strategic direction of an organization is influenced by technology, funding, the collaboration partners, the micro as well as the macro environment and the commercialization strategy; these are areas for further research.

LIST OF ABBREVIATIONS

R & D – Research and development

GERD – Gross domestic expenditure on research and development

GDP – Gross domestic product.

OECD – Organization for Economic Cooperation and Development

TOT - Transfer of technology

UAT – Users acceptance Test

MPV – Minimum Product Viable

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