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## Case Report

# Case Study Approach to Understanding the Process of Successful R and D Commercialization

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## Abstract

Immense body of knowledge on R and D commercialization has accumulated in the past 50 years, however, the success rates of R and D commercialization have remained relatively low, generally less than 20% depending on the industry and level of economic development of a country. These low rates persist despite findings from many empirical studies conducted on the success factors of R and D commercialization. Consequently, the in-depth case study approach of acknowledged successful R and D commercialization was made so that better insights of the complex processes and interactions involved between the firm and the various components of the innovation ecosystem, as well as the larger national innovation system could be gained. The in-depth case study approach will be used on two acknowledged examples of successful R and D commercialization in the context of Malaysia: TyphiDot (a rapid diagnosis kit of typhoid fever) and LTK omega plus (an all natural chicken feed formula that could produce eggs with enriched omega plus).

**Key words:** Research and development, commercialization, case study, innovation ecosystem

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**INTRODUCTION**

There have been concerns among both industry players as well as governments on the need to have better success rates for R and D commercialization for two main reasons:

- For firms, higher R and D commercialization rates would result in the ability to introduce more new products in the market place resulting in increased revenues. Classic studies by Franko<sup>1</sup> and Geroski and Machin<sup>2</sup> have demonstrated a link between R and D expenditures and subsequent sales revenues relative to those competitors who did not spend as much
- At the country level, higher R and D commercialization rates translate into new businesses that directly contribute to jobs creation and increase in economic growth; more importantly, it improves the country's National Innovation System (NIS), NIS is generally considered as comprising of three major components: (1) Government and its agencies, (2) Research institutions and institutions of higher learning and (3) The industry players. The richness and quality of interactions between the components would increase the competitiveness of NIS of a country that will make it more competitive in the global arena<sup>3</sup> for example, argues that a superior NIS has had significant contribution to Singapore's high level of Technical Intellectual Capital (TIC) and this in turn, had enabled her to achieve newly industrialized economy status together with Taiwan and South Korea, a more recent study by Lundvall<sup>4</sup> has detailed out the major components of NIS and their interactions that contribute to national competitiveness of nations, see also Bingwen and Huibo<sup>5</sup> and Zhang<sup>6</sup> for national comparative studies of NIS

Another measure of the likelihood of increased R and D commercialization rates is the Gross Expenditure of R and D/GDP ratio of a country (GERD/GDP ratio). Malaysia's GERD for both the public and private sectors was RM10.6 billion in 2012, resulting in GERD/GDP ratio of 1.13, this ratio puts Malaysia ahead of countries such as Thailand (0.22) and Russia (1.09), but still far behind the Newly Industrialized Economies (NIEs) of Singapore (2.23 at No. 12), Taiwan (3.02 at No. 7) and South Korea (3.74 at No. 3)-please refer to Table 1.

In recent years Institutes of Higher Learning (IHLs) and Government Research Institutes (GRIs) in Malaysia are under pressure to commercialize research outputs so that public funds used for research are accountable. The aim is to commercialize at least 10% of the research output. Apparently most of the research universities have yet to achieve this

Table 1: International GERD/GDP of selected countries (2011/2012)

Country	GERD/GDP	Country	GERD/GDP
Israel	4.38	UK	1.78
Finland	3.78	Canada	1.73
Korea	3.74	Ireland	1.72
Sweden	3.37	Norway	1.65
Japan	3.34	Portugal	1.50
Denmark	3.09	Hungary	1.30
Taiwan	3.02	New Zealand	1.27
Switzerland	2.99	Italy	1.27
Germany	2.91	Brazil	1.16
USA	2.79	Malaysia	1.13
Australia	2.27	Russia	111.09
Netherlands	2.16	Thailand	0.22

OECD<sup>7</sup>. As a benchmark, according to Swamidass<sup>8</sup>, Stanford University has been able to commercialize 24.1% of its inventions as of 2009 (1,782 active licenses out of 7,400 inventions).

Given these circumstances, Malaysia, thus faces a double challenge in that:

- Its GERDs, though they have been on the upward trend for the past 8 years are still relatively low compared to the more advanced economies (e.g., the average of the OECD countries stood at 2.40 in 2012) and the NIEs in the East Asia region, i.e., South Korea, Taiwan and Singapore (the average GERD of 3.00 for 2012)
- It was not able to realize the 10% minimum successful R and D commercialization rate for most of the IHLs and GRIs

MOSTI<sup>9</sup> has identified the following challenges to be addressed so that the benefits and effectiveness of research funded by public R and D expenditure will achieve better returns:

- While there were significant technical contributions in science and technology (S and T) activities, the majority of R and D projects were not market-oriented and thus, not readily exploitable for commercial application and that
- The linkages with industry were essentially informal and joint or collaborative R and D was still negligible

These, naturally impede the government's efforts in developing Intellectual Capital Assets (ICA) of the country in order to be more competitive in the global economic arena, which is increasingly becoming knowledge-based.

**R and D commercialization process and the case study approach:** While numerous empirical studies of the factors contributing to successful R and D commercialization are useful for examples, Lewrick *et al.*<sup>10</sup>, Astebro<sup>11</sup>, Wouters<sup>12</sup> and

Van Hemert *et al.*<sup>13</sup>, these tend to overlook the importance of understanding the processes involved that culminate in the end product, i.e., a successful R and D commercialization.

The fact that the success rates of R and D commercialization were relatively low in the Malaysian context (e.g., less than 10% in the case of public funded R and D at IHLs and GRIs) and relatively higher as was the case of Stanford University 24.1% and these vary across different countries and even between different institutions within the same country, e.g., MIT apparently has better R and D commercialization rates than Stanford in the US (Swamidass, 2013), suggests that perhaps: (1) The processes involved and how these interact with other components of the innovation ecosystem (such as access to different types of funding at different phases of commercialization, availability of entrepreneurs, government and institutional policies, customers, suppliers, etc.) is not well understood yet and (2) Country-specific (and industry-specific) factors, such as the different mix and intensity of the various components of the innovation ecosystem, would influence the success rates of R and D commercialization. Thus, a deeper understanding of this “Commercialization journey” would help in providing context for the factors that contribute to successful R and D commercialization as found in many of the empirical research done on this topic to date.

Based on the need to better understand the processes involved and how these interact with various components of the innovation ecosystem that lead to successful R and D commercialization, it is deemed that in-depth single or multiple case studies research strategy would be appropriate. As Yin<sup>14</sup> suggested, the case study approach is suitable when the form of the research question is “how” and “why” and when there is a need to investigate a contemporary phenomenon with-in its real life context, especially when the boundaries between phenomenon and context are not clearly

evident. Mariotta *et al.*<sup>15</sup> made a very convincing argument for the relevance of single-case study approach in management research as did Siggelkow<sup>16</sup>, while Stewart<sup>17</sup> argued for acceptable levels of reliability accorded by multiple-case study method in governance-related research. Gibbert *et al.*<sup>18</sup> provided some suggestions on how to increase the rigor of the case study research by addressing the construct, external and internal validities and reliability.

Substantial body of knowledge can be found in the use of case study approach in R and D commercialization research (see for examples, Bianchi *et al.*<sup>19</sup> where they used multiple case-study analysis involving 16 out-licensing deals executed in 7 Italian pharmaceutical firms, Ukropcova and Sturdik<sup>20</sup> conducted a case study research to describe biotechnology commercialization in Central and Eastern Europe, Pelikka and Malinen<sup>21</sup> employed the case study approach involving 12 small technology firms in Finland to understand operational level of commercialization process). Khairul and Mohd<sup>22</sup> provided an insightful case study of a digital autopsy system commercialization in the context of Malaysia.

Dmitriev *et al.*<sup>23</sup> in their case study of the commercialization of technology innovations proposed the *ex ante* conceptual model of business model development to start with (Fig. 1). The findings from the 4 case studies were then incorporated into the model to reflect relationships and iterations of the processes among the components of the actual innovation commercialization cycles (Fig. 2: Ex-post model of business model development). This approach can be useful in comparing the processes involved in various types of R and D commercialization (e.g., technology-push versus market-pull innovations).

A useful example of a recent in-depth case study that highlighted the processes and knowledge-sharing activities among the actors of an innovation commercialization system

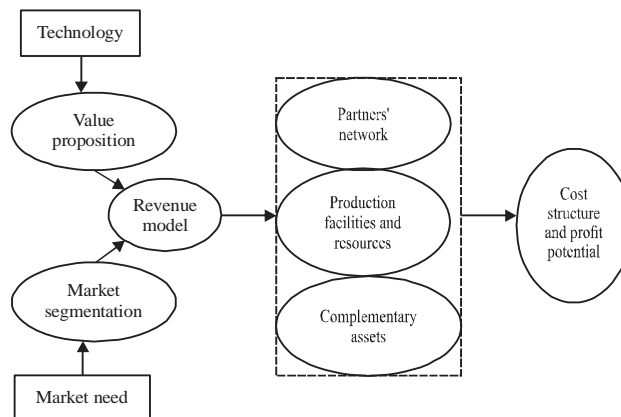


Fig. 1: Ex ante conceptual model of business model development, Source: Dmitriev *et al.*<sup>23</sup>

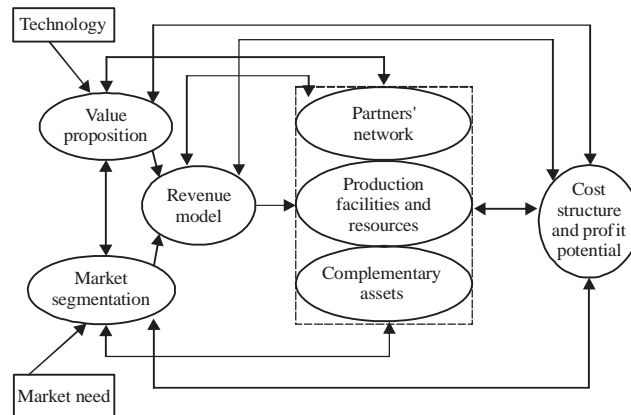


Fig. 2: Ex post model of business model development, Source: Dmitriev *et al.*<sup>23</sup>

can be found in Eklinder-Frick<sup>24</sup>. It described the factors which promote or obstruct policy-initiated innovation process in the context of a regional strategic network. Yet another recent in-depth single case study that used longitudinal and qualitative methodology (based on 18 semi-directive interviews during a 3 years period) providing insights into the innovation-making process of a multimedia firm was put forward by Gandia and Tourancheau<sup>25</sup>.

**Two acknowledged cases of successful R and D commercialization:** The ex ante and post ante models of business development model as proposed by Dmitriev *et al.*<sup>23</sup> will be used in the case study of two acknowledged successful R and D commercialization in the context of Malaysia:

- TyphiDot, a revolutionary method of rapid diagnosis for typhoid fever invented by scientists at Universiti Sains Malaysia (USM), it was successfully commercialized and marketed to 18 countries around the world
- LTK omega-3 eggs-uses all natural chicken feed formula developed by Malaysian Agricultural Research and Development Institute (MARDI) to produce eggs with enriched omega-3 and DHA

To fully capture and understand the relevant processes of the commercialization journeys of the two cases, the ex ante and post ante models of business development model will be constructed in the wider context of the innovation ecosystem of Malaysia.

**TyphiDot:** TyphiDot was the commercialized product of Malaysian Biodiagnostic Research Sdn Bhd (MBRSB) which began operations in 1995. The company was initially

established to commercialize research undertaken on diagnosis of typhoid fever, however, it has expanded into producing various other medical diagnostic products utilizing technology platforms such as protein-based immunochromatography tests (ICT tests), polymerase chain reaction method (PCR) and enzyme linked immunosorbent assay method (ELISA). The company is a BioNexus status company under the Malaysian Biotechnology Corporation (2015).

In the case of TyphiDot, the needs and the design and development criteria of the market place are already evident (i.e., rapid diagnostic tests which are specific, sensitive, easy to perform have built-in-controls, cost effective do not require refrigeration, absence of culture facilities, minimal lab infrastructure, lack of electricity, lack of trained personnel and transportation without cold chain<sup>26</sup>).

The R and D activities and commercialization processes were implemented with those market needs and requirement in mind. The purpose of conducting an in-depth case study on TyphiDot is to understand what were the specific activities and commercialization processes involved and how these were linked to and interacted with the appropriate components of the innovation ecosystem that resulted in a successful R and D commercialization.

**LTK omega plus eggs:** The LTKM Berhad is the only poultry farm in Malaysia licensed by MARDITECH that produces the first ever designer egg in the country under the brand name LTK omega plus. In comparison with an ordinary egg, LTK omega plus contains up to 5 times more omega-3 fatty acids, 5 times more docosahexaenoic acids (DHA), 4 times more vitamin E and 2 times more selenium. Alpha-Linolenic Acid (ALA) is the major essential omega-3 fatty acid and is found

abundantly in vegetable oil such as flaxseed. Hens fed with a uniquely formulated diet by MARDI's scientists containing flaxseed are able to lay eggs enriched with omega-3 fatty acids. The LTK omega plus contains approximately 400-600 mg/100 g omega-3 fatty acids and 120-200/100 g DHA. A large and medium size egg weighs around 60-69 and 50-59 g, respectively; consumption of only one LTK omega plus egg daily can contribute substantially to the recommended daily intake of omega-3 fatty acids (<http://www.ltkm.com.my/>).

In the case of LTK omega plus eggs, MARDITECH made a decision to license the technology to an already established egg producer versus a start-up. Apparently this was a major decision on the parts of both parties-the people involved in the negotiations came to a mutual agreement and managed to sell the idea to the management of their respective organizations. On the part of MARDI, they need a potential licensee that could take the risk of having a minimum number of hens to be fed with the innovative formula for piloting and quick scaling up purposes, on the part of LTK Berhad, they need a technology that could assist them with a product that offers meaningful differentiation that meets the healthy eating trend of consumers in the market place. The company went for Initial Public Offering (IPO) after adopting the licensing agreement with MARDI.

An in-depth case study of LTK omega plus eggs would provide useful insights into a successful R and D commercialization of a government research institute (MARDI) with a commercial partner. The processes and interactions involved with the various components of the innovation ecosystem would provide further understanding of the commercialization journey.

## **CONCLUSION**

The R and D commercialization is becoming increasingly important to many companies and governments alike. Successful commercialization results in innovation in the form of a new product or process, which in turn could create business start-up (such as TyphiDot) and expand existing business (such as LTK omega plus). Either way, it creates jobs and contributes directly to economic growth of a country. Thus, getting higher success rates of R and D commercialization holds the key toward a vibrant entrepreneurship ecosystem and wealth creation.

An immense volume of knowledge has been created and accumulated over the past fifty years from studies on R and D commercialization and its related areas of innovation and entrepreneurship. Despite all these knowledge, successful

R and D commercialization has been relatively elusive, especially in developing countries.

Obviously the mechanism and processes involved and their interactions with many of the components of the innovation ecosystem (and the larger national innovation system) are complex and some are yet to be fully understood (otherwise, the success rates could have been drastically improved over the years). The in-depth case study approach could provide further insights into the intricacies of successful R and D commercialization. It would complement empirical studies on the factors and mechanisms that contribute to successful R and D commercialization, especially in the context of a developing country such as Malaysia.

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