

CRITICAL SUCCESS FACTORS OF NANOTECHNOLOGY COMMERCIALIZATION IN MALAYSIA

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ABSTRACT

The issues of research, innovations and commercialization have become a hot debate when certain parties dispute the level of research and innovation in Malaysia. In Malaysia, nanotechnology based products have entered the market although at small quantities. The government does realize that a lot of research findings from institutions of higher learning and research agencies could not result in products, that is, to be commercialized. Hence, this research will highlight the barriers that hinder the commercialization of nanotechnology in Malaysia. It tries to explore the critical success factors that affect the growth of nanotechnology base products in Malaysian industry. Based on the issues surrounding nanotechnology growth in Malaysia, this study discusses the four factors that can affect the commercialization of nanotechnology among the manufacturing sector in Malaysia which are dedicated policy, collaboration, customer focused, and technology infrastructure.

Keywords: *Nanotechnology, CSF: dedicated policy, collaboration, customer focused, technology infrastructure*

Introduction

Nanotechnology is still considered as a new thing in Malaysia although it has been introduced early in the 1990's. Nanotechnology's recognition in Malaysia began when it was introduced in the Intensification of Priority Research Area (IRPA) program of the 8th Malaysia Plan. During its early appearance in a national symposium, the nanoscience communities in Malaysia recommended to the government the allocation of bigger funding and coordination of national Research and Development (R&D) activities. So far (by 2006) Malaysia has spent more than RM140 million IRPA grants on a number of nanotechnology-related research projects.

It is unfortunate that many nanotechnology researches were conducted by separate research groups without central coordination and planning but Malaysia is fortunate to be part of the Asia Nanotechnology Forum. Japan started the national nanoscience and technology programs since the mid 1980s and many ASEAN countries like Malaysia, Thailand, Singapore, and Vietnam have already embarked on nanotechnology since the early millennium. In 2003, Asia contributed over USD1.5 billion in nanotechnology program and it is continuously raising its role in the global nanotech arena.

Literature Review

References	Title	Descriptions
Mastora (2007)	Factors Affecting the Commercialization of R&D: An empirical study in manufacturing sector in Malaysia.	In this study, a theoretical framework in terms of a research model was developed to indicate the relationships among the several factors that affect the commercialization of R&D output. Result of regression of the factors on commercialization success indicators showed that reward and recognition, manpower, internal R&D infrastructure, internal teamwork, collaboration, external financial support, customer focus, and project management are strong predictors of successful commercialization of R&D. External R&D infrastructure and internal R&D financial supports are weak predictors.
Ronald (2007)	Barriers to Nanotechnology Commercialization.	The purpose of the study is to identify barriers that constrain or hinder the commercialization of nanotechnology in U.S.A. This qualitative research found that the relevant barriers to nanotechnology commercialization are: time between research and commercialization, lack of proper infrastructure, lack of usage of federal and university laboratories and equipment, lack of coherent policy, lack of trained scientists, engineers and technicians, the reduction of research and development funding, and the so-called "Valley of Death" (Scientists may publish results but may not be interested in commercialization).

(continued)

References	Title	Descriptions
Uda et al. (2009)	Nanotechnology Development Status in Malaysia: Industrialization Strategy and Practices	There are some weaknesses in the analysis of why nanotechnology is not developed in Malaysia: No dedicated policy, need for short and long term human resource planning, lack of private sector participation and investment, lack of facilities, and no world class companies to raise standards.
Philip and Jue (2008)	From Lab to Market? Strategies and Issues in Commercialization of Nanotechnology in China.	This paper probed the interface between nanotechnology research and its commercialization in China. Drawing on bibliometric research and field interviews with Chinese nanotechnology policymakers, researchers, and business representatives, this paper analyzed the nanotechnology research-commercialization gap and explore the policy, institutional, economic, social, and cultural factors contributing to it.
Marina and Isabell (2010)	Antecedents of Cooperative Commercialization Strategies of Nanotechnology Firms.	This study examined the antecedents for cooperative behavior in the commercialization of nanotechnology for both small/medium and large firms. For small and medium firms (SMEs), results confirm the influence of intellectual property rights protection on cooperative behavior. For large firms, the results show a negative relationship for both intellectual property rights protection and ownership of complementary resources with cooperative behavior. Collaboration-based commercialization in nanotechnology for both small/medium as well as large firms seems to follow antecedents previously identified in early studies.
Anthony and Wasiq (2003)	Nanotechnology Commercialization Best Practices	One of the key success factors in commercialization of nanotechnology is a strong IP position at the inception of the company. Another success factor is a clear, concise, well thought-out and compelling business plan. Besides, the success factor is that of a well-balanced team. A final common pitfall that we see in nano start-ups is failing to plan for the progress that an incumbent technology will make during the time it takes to develop the nano-based technology.

Underpinning Theory

Interactive Model

The interactive model develops this idea further and links together the technology-push and market-pull models. It emphasises that innovations occur as the result of the marketplace, science base, and the organization's capabilities (Trott, 2005). The innovation process can be thought of as a complex set of communication paths over which knowledge is transferred.

The innovation process outlined in Figure 1.0 represents the organization's capability and its linkages with both the marketplace and the science base. Organizations that are able to manage this process effectively will be successful at innovation. At the centre of the model are the organizational functions of R&D, engineering and design, manufacturing, and marketing and sales. Linkages with the science base and the marketplace occur between all functions, not just with R&D or marketing.

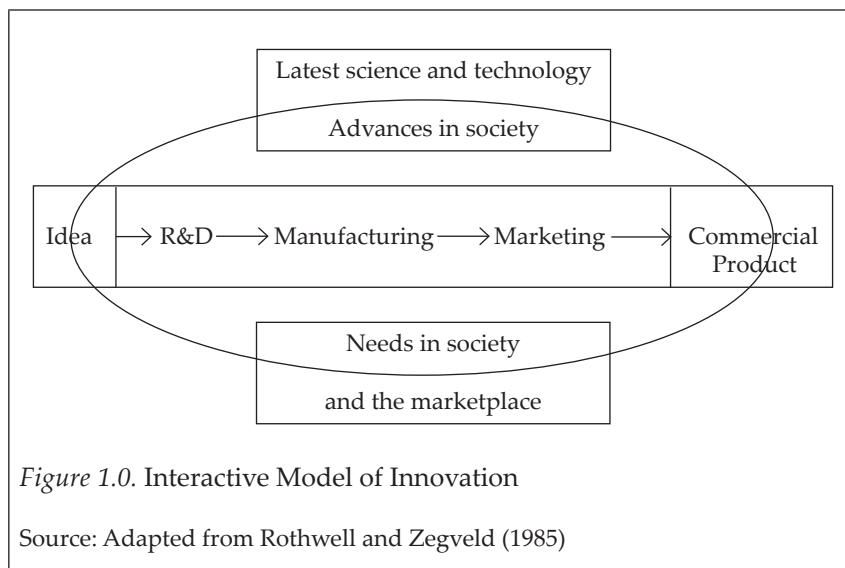


Figure 1.0. Interactive Model of Innovation

Source: Adapted from Rothwell and Zegveld (1985)

Problem Statement

This research tries to explain the issues faced in nanotechnology commercialization in Malaysia. Supported by new policy initiatives and funding, hundreds of researches in Malaysia are engaged in

nanotechnology R&D. Yet, the pathways from laboratory research to successful commercialization remain problematic. Malaysia faces some weaknesses in order to commercialize the nano products. These weaknesses hinder the commercialization of nano products in the Malaysian market, namely: no dedicated policy, lack of collaboration, deficiency of customer focus, and lack of technology infrastructure.

According to National Symposium 2006, Malaysia has no dedicated policy for nanotechnology. Jeff (2006) pointed out that a good model of such regional Intellectual Property (IP) offices is the European Union. There is a regional patent treaty, with one patent office, taking care of the interests of the patent owners vis-a-vis the patent subjects. This protection is, however, non-existent in ASEAN as regional group; hence Malaysia has to resort to national patent office to protect its interest. Unfortunately, we do not have a national intellectual property or patent policy although we have long been a signatory to the Berne Convention that governs copyrights issues in the protection of Literary and Artistic Works (Malaysian Business, 2006).

Nanotechnology is considered new in Malaysia, as such, there is a lack of private sector participation and collaboration in this field. We look forward to more collaboration between researchers in universities, public research institutes and the industry to create strategic partnerships on potential research projects and to bring nanotechnology from lab to market. Malaysia took cognizance that its part in nanotechnology could not be carried out alone and it is advisable to establish a good foundation for undertaking collaborative work with interested organizations worldwide. The close relationship fostered among the collaborative partners working in the area of nanotechnology is important in sharing resources, knowledge, experience and applications (New Straits Times, 2006).

During globalization, Malaysia, as a developing country, should work harder and compete with other countries to become a viable nation. To reach this goal, Malaysia should create new market with products and services that lead to technology development and always seek for new technology. The success of research and development (R&D) of an organization depends on the ability of the organization to develop and produce new product that meets the customer flavour. However, nanotechnology products are less being customer focused among Malaysians. The commercialization of research and development or science entrepreneurship plays an important role in order to make Malaysia as a country that can economically compete with other Asian countries in terms of nanotechnology research and development.

Another problem for nanotechnology to be commercialized is the weakness in research and development. According to National Symposium on Science and Technology (2006), the current development of nanotechnology in Malaysia still suffers from some shortfalls and one of them is lack of central facility. Moreover, applied research needs to be encouraged more in universities and federal labs. The development of nano tools must increase and be more available to universities and start-up businesses. Lack of usage of federal and university laboratories and equipment hurts small businesses that can't afford this infrastructure.

Inter government agency coordination needs to be established to ensure the awareness of nanotechnology education and impact to the industry. It needs to introduce the state of the art national core facilities and acquiring expertise to conduct more basic and advanced research. Malaysian nanoscience R&D such as nanotechnology needs to be more visible in the world, and international collaborations particularly within the Asia Pacific countries ought to be enhanced to accelerate its progress. Universities should allow academia more time to focus on research and provide necessary infrastructure support to speed up research progress. In terms of nanotechnology industry and commercialization, Malaysia needs to establish a catalytically body to bridge the gap between research and industry as well as providing appropriate policy for attracting international partnership, technology licensing and manufacturing in Malaysia (National Symposium on Science and Technology, 2003).

Research Questions

This paper will tend to answer these questions below:

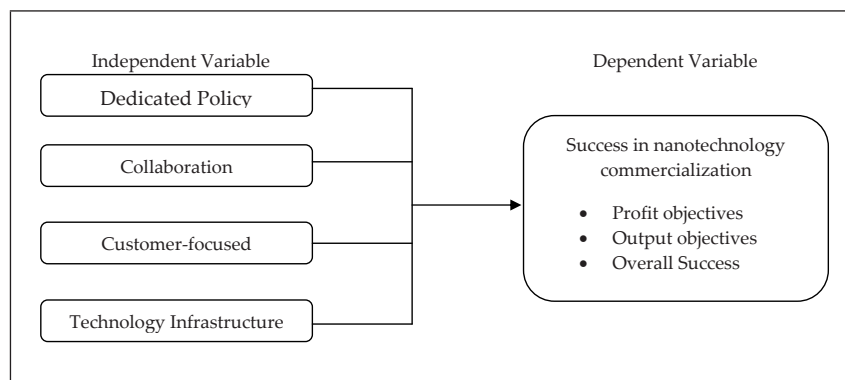
1. What is the policy for nanotechnology in Malaysia?
2. Why are the private sectors not interested to collaborate and participate in nanotechnology?
3. Why do customers focus less on nanotechnology products?
4. How important is technology infrastructure in the development and commercialization of the nanotechnology product?

Research Objectives

The main objective highlighted in this paper is to determine the critical success factors in nanotechnology commercialization in Malaysia. Other objectives in this research are as follows:

1. To identify the policy used for nanotechnology.
2. To identify the reasons why the private sector is not getting involved in the nanotechnology industry.
3. To analyze the acceptance of customers toward nanotechnology products.
4. To determine the importance of technology infrastructure in the development and commercialization of nanotechnology products.

Research Framework



Hypotheses

Based on the theoretical framework, four (4) hypotheses can be written out as follows:

H1a: There is a positive relationship between dedicated policy and success in nanotechnology commercialization.

H1b: There is a negative relationship between dedicated policy and success in nanotechnology commercialization.

H2a: There is a positive relationship between collaboration and success in nanotechnology commercialization.

H2b: There is a negative relationship between collaboration and success in nanotechnology commercialization.

H3a: There is a positive relationship between being customer-focused and success in nanotechnology commercialization.

H3b: There is a negative relationship between being customer-focused and success in nanotechnology commercialization.

H4a: There is a positive relationship between technology infrastructures with the success in nanotechnology commercialization.

H4b: There is a negative relationship between technology infrastructures with the success in nanotechnology commercialization.

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