High-tech Commercialization Challenges From A National Viewpoint: Case Of Nanotechnology

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Abstract

Technology commercialization is one of the major challenges facing high-tech businesses. This article investigates major national challenges facing Iranian Nanotech companies for commercializing results of their research and development activities. Challenges are extracted using Delphi method and referring to experts in the field. They include (1) lack of business expertise in the field of high-tech business, (2) lack of national focus on commercialization of technology, (3) improper infrastructure for development of high-tech firms e.g. obtaining required licenses, standards, and intellectual properties, (4) unstable laws and supportive policies, and (5) inadequate technology support from universities and research centers. Result of the article enhances Nanotech company managers' awareness about challenges and provides policymakers and stakeholders with a proper insight to the environment of high-tech businesses in Iran.

Keywords: Nanotechnology, Commercialization, Policy making in High-Tech

1. Introduction

Nowadays, businesses in Iran are faced with different challenges. Some challenges are due to technological factors outside the firm's boundary. Rapid rate of technology change, innovation and development of new products on one hand and intensity of competition in the areas of conventional technology on the other hand have caused a dramatic decrease in competitive power of Iranian products with foreign products. Therefore, advanced technologies and their applications in production or services are considered to be an important source of competitive advantage for firms and have a great potential to develop and maintain markets of a company. Neglecting this fact would harm the country severely and removes Iranian companies from the competitive arena. Therefore, technology commercialization and creating wealth from advanced technologies is an undeniable necessity for our country.

This study investigates technology commercialization challenges in the field of nanotechnology from a national view point. The article is structured as follows. Next part describes the methodology we used to conduct this research. Then challenges and possible solutions are discussed. Finally, conclusion and managerial implication are pointed out.

2. Methodology

There were twenty nanotech companies in Iran at the time of study that had introduced product to the market. Nanotech companies' viewpoints on environmental challenges of technology commercialization were gathered via conducting interviews with firms' top managers as well as company documents. At least two executives from each company were interviewed. Resulting information was used as a base to conduct a Delphi study. The information were presented to the expert group who were consultants of Iran Nano Business Network and based on Delphi methodology key challenges of nanotechnology commercialization in Iran were extracted.

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3. Key National Challenges of Technology Commercialization

The study shows that there are five major challenges in commercializing Nanotechnology in Iran business environment. These challenges include inadequate business expertise and knowledge in high-tech field, lack of national focus on technology commercialization, improper infrastructure for developing high-tech firms, unstable laws and supporting policies, lack of technical support from universities and research centers. The following parts explain each issue.

3.1. Lack of Business Expertise in High-tech

Human capital is one of the important growth drivers of high-tech startups [1]. Iran faces a dearth of human resources with business expertise in the field of high technology, who can direct commercialization policies of a company. Lack of business expertise is one of the major obstacles of nanotechnology commercialization in Iran. Companies face several problems in planning their commercialization activities and often end up continuing on a trial and error basis which usually leads to company failure. A study on successful Nanotech companies in the world shows that their managers have valuable experience in high-tech business management [2]. Overcoming this challenge necessitates empowerment of high-tech company managers in short-term and training high-tech business managers in long-term. It is vital for our country to invest in training human resources specialist in high-tech business and provide infrastructure for the creation and development of local knowledge in this field.

3.2. Lack of National Focus on Technology Commercialization

National focus on technology commercialization means country's efforts to gain wealth from technology development. This approach has not been seriously considered by many governmental managers. Some only consider oil and gas as resources and do not believe in technology development and think of investment in this field as a show or embellishment. Some other managers are only following the development of science regardless of the results they achieve. Much of the country's resources now are used in these two ways and is not targeted on technology commercialization. Even the phrase "technology commercialization" is not mentioned in the fourth development plan. No centralized structure is in charge of commercialization and no assessment is being conducted in this area. Commercialization is not either considered as a criterion for an organization's success.

3.3. Improper Infrastructure for the Development of High-tech Firms

Necessary infrastructure for commercialization of nanotechnology in the country is still uncollected. Mechanisms for obtaining licenses and standards, financing infrastructures, intellectual property issues and business infrastructures are not formed yet. Parts of the twenty-year vision document and the fifth four-year development plan (especially articles 37 to 41 of the program) have not been implemented [3]. For instance, the important issue of creating governmental markets has remained unnoticed and companies are deprived of this big market. Calculating commercialization costs in a large range of technologies do not show profit in the absence of these markets. Reference [4] argues that general policies of Iran are very valuable for development of technology commercialization, but these policies have not turned into field operations and administrative regulations therefore they could not create motivation for companies.

Commercialization path of a product goes through the bottleneck of obtaining licenses and standards. License / standard provider agencies are governmental organizations that usually lack information and up to date experts and are incapable of serving high-tech firms. Therefore, firms cannot get the necessary permits to launch their products in the market. Furthermore, there is a relatively negative view in some governmental managers that forms their mindset. For example, they believe that no license should be given to products based on silver nano-particles. In other words, the result of obtaining license is clear in advance. Some nanotech companies have tried for a long time to

get the license of Ministry of Health but did not succeed. In some cases, the license provider organizations announced that they do not have a clarified mechanism to respond nanotech firms.

3.4. Unstable Laws and Supporting Policies

Activity of nanotech startups in competitive business environment is very much dependent on supporting laws and policies that aim the development of these firms. Policy instability has caused managers fail in the long term reliance on government support. Different amount of supports in different time periods sometimes have caused companies to suffer from illusion and sometimes have made them disappointed. Last year, huge amount of financial support was given to the companies but the financing policy was without expenditure plan and supervision and actually caused more problems for firms. From the viewpoint of some successful Iranian high-tech companies, stability of the government's supporting policies is the most important support of the government and even the effects of policy stability are much more than the volume of supports [5].

3.5. Lack of Technical Support from Universities and Research Centers

One of the main tasks of technical and engineering universities is to supply high-tech firms with their necessary technological support. The country should provide the optimal condition for this interaction to take place. In the country's current situation, technology related activities are far from high-tech business related processes and these two had low particular synergy. For example, in the field of nanotechnology, in spite of extensive governmental support policies for technical experts to develop nanotechnology, less stunning results have been achieved. Part of supporting resources such as encouragement grants for nanotech related theses have been allocated to repetitive or unnecessary activities by academics. Investigation and analysis of theses in the field of nanotechnology shows the situation better.

Incentive program for the encouragement of scientific and research activities in the field of nanotechnology started on March 2004 which includes grants for MSc and PhD theses. Since the beginning of this program till March 2010 more than 4000 theses have been supported. One of the major areas of nanotechnology is manufacturing of titanium dioxide (TiO2) and its applications. Investigation of theses related to TiO2 – available in the website of Iran Nanotechnology Initiative Council (www.nano.ir/info) – shows that 222 theses (more than 5% of all theses in the data base) have been conducted in TiO2 field: 40 theses in PhD level and 182 in MSc level. Most of these researches were allocated to synthesis of nano-particles (66%) and thin films (19%). 77.76% of theses in field of nano-particle synthesis have worked on how to synthesize TiO2 through sol-gel method – a method which its details are extractable from the available scientific documentations [6]. This analysis is also true for other areas [7],[8]. These kinds of academic activities can merely satisfy business needs. This model should be improved otherwise it would have low benefits for the country.

4. Conclusion

Challenges facing nanotechnology companies in Iran show that the country still has a long way ahead to succeed in the field of advanced technologies. Despite enormous efforts by businesses and policy makers, they are not satisfied with the results. The study recommends policy makers to highly concentrate on commercialization of technology in order to create advantages for the country. Furthermore, stability of policies and supports are more important than their volumes and therefore any changes must be done tactfully and intelligently or else the costs will outweigh the benefits.

The article has also stressed that traditional managers without knowledge of advanced technologies won't have great success in this field. Specialized business management in this area is required to lead the company toward profitability and growth. Hence the country should carry out proper investment for training high-tech business specialist human resources. Final recommendation of the paper is to empower universities to meet the needs of high-tech enterprises. Universities and

research centers should be encouraged to direct their theses, projects and other scientific activities in a way that the results would be responsive to High-tech business needs.

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