

# Chapter 10

## Entry Barriers to the Nanotechnology Industry in Turkey

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### ABSTRACT

*Nanotechnology is the science that focuses on the control of matter at the atomic scale. It has the potential to create many new materials and devices with wide-ranging applications, such as in medicine, electronics and energy production. There are many entry barriers which can affect nanotechnology penetration in developing and emerging nations. This chapter discusses such barriers for Turkey. Despite about 10 universities having nanotechnology programs, the number of nanotechnology firms in the country is still low. Using combinations of interviews, surveys and literature, these issues that continue to stall the commercialization of discoveries in Turkey are examined.*

### INTRODUCTION

Nanotechnology is the study of the control of matter on an atomic scale. Generally nanotechnology deals with structures of the size 100 nanometers or smaller, and involves developing materials or devices within that size. Nanotechnology is very diverse, ranging from extensions of conventional device physics, to completely new approaches based upon molecular self-assembly, to developing new materials with dimensions on the nanoscale, even to speculation on whether we can directly

control matter on the atomic scale. Nanotechnology has the potential to create many new materials and devices with wide-ranging applications, such as in medicine, electronics and energy production.

It is obvious that entry barriers to the nanotechnology industry should be discussed in detail if it is the case that such entry is barred for a variety of reasons and that the public can not benefit from the nanotechnology products. Turkey is a significant example to such occurrence. In particular it appears that there are ten nanotechnology research centers in ten different universities in Turkey. These centers are furnished with strong infrastructure both physically and research wise. Most of the

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researchers have their doctorate degrees from the prominent universities in the U.S. and they are working on cutting edge issues on nanotechnology. However, it appears that there are only thirteen companies in the entire country which can be classified as operating in the nanotechnology sector. Such observation is as alarming as it might be perceived as natural. For example, one could easily claim that in a developing country such as Turkey an industry which requires a long-term R&D investment might not develop as the fruits of such investment would take years to materialize. However such argument can easily be refuted as there are 41 nanotechnology firms in China and 17 in India and 195 for example in Germany. The country size and development levels do not seem to be the main determinants here. So what drives this lack of nanotechnology commercialization?

In Aydođan, Chen(2008) and Aydođan (2009), some insights were provided on the above question. Extending those insights, and in this piece we survey ten academicians from four different nanotechnology Centers in Turkey (interviews were conducted at Marmara University, İstanbul Technical University, Koç University and Sabancı University) to gather their thoughts on this pressing issue of the lack of commercialization in the nanotechnology industry in Turkey. In the below section we conduct the literature review, we summarize the ideas of the interviewees and we conclude by some policy suggestions along with some directional thoughts on research.

## **COMMERCIALIZATION OF NANOTECHNOLOGY: LITERATURE REVIEW**

Although many countries have been developing strategies for the development of the nanotechnology industry since the beginning of the 1990's, Turkey has been lagging behind such efforts. Not until year 2000 that some steps were taken in this direction. Particularly nanotechnology

has been identified as one of the critical sectors for the development of the Turkish economy. In particular a very well-equipped nanotechnology center at Bilkent, one of the most prominent universities in Turkey has been funded by the Prime Ministry State Planning Organization (Devlet Planlama Teşkilatı). Following this a number of centers among the ones we have interviewed in this study have been established. However, the commercialization process of the nanotechnology industry in Turkey has been stalled majorly. As mentioned earlier currently there are only thirteen nanotechnology companies in Turkey.

Although nanotechnology is at its nascent stages, it has become apparent that it will cause in stark changes in every area of our lives. Nanotechnology has its basis in many different sciences, and this makes the basic difference when compared with the impact of other sciences. According to Niosi and Reid (2007), the many different underlying pro-genitor technologies, of which have bases in molecular biology, electronics, materials science, physics (optics and quantum) and others, contribute to the composition of nanotechnology and hence this makes nanotechnology as inherently complex and diverse with diverse applications.

The broad spectrum of nanotechnology has lead to the development of various materials. For example, widespread commercial adoption of nanotechnology is growing rapidly; where early commercial applications are focused on the improvement of cosmetics, coatings, textiles and displays (*Bozeman, Hardin & Link, 2008*).

Since nanotechnology is related to many different fields, it has received considerable attention among researchers from all over the world. Many countries have mobilized their universities and laboratories to conduct research and development activities in nanotechnology. However, as it is in the case of other technological developments, nations differ in their standing related to nanotechnology. Niosi and Reid (2007) suggest that due to the complexity of technologies involved in the development of nanotechnologies, training

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