

NANOTECHNOLOGY: PATHWAYS FOR ECONOMIC CHALLENGES AND SCIENTIFIC POLICIES IN SPAIN

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This paper analyses the state of the art for nanotechnology, focussing on the scientific and economic challenges arising from nanotechnologies and the policies that could be used to meet them in Spain.

Nanotechnology is an endless source of innovation and creativity at the intersection of medicine, biotechnology, engineering, physical sciences and information technology, and it is opening up new directions in R+D, knowledge management and technology transfer. Nanotechnology has already penetrated the market and, consequently, the competitive advantages of the more developed economies are threatened. Given the huge economic investment and cutting-edge research in the field of nanotechnology, scientific policies enhancing the cooperation-based university industry are more in demand than ever before.

Nanotechnology is expected to make a rapid impact on society [1]: creation of future economic scenarios, stimulation of productivity and competitiveness, converging technologies, and new education and human development. Evidence for the rapid impact of nanotechnology can be gleaned from figures for government investment in nanotechnology R+D activities, facilities and workforce training. The 2008 USA National Nanotechnology Initiative budget request for nanotechnology R+D across the Federal Government was over US\$1.44 billion [2]. In Europe, the VIIth Framework Programme (FP) will contribute about €600 million per year to nanotechnology research until 2013, with an additional, similar amount being provided by individual countries. This gives Europe a larger yearly spend on nanotechnology than the United States or Japan [3].

Scientific papers and patents in the nanotechnology sector have grown exponentially over the last two decades. Products based on nanotechnology are already in use and analysts expect markets to grow by hundreds of billions of euros during the present decade. After a long R+D incubation period, several industrial segments are already emerging as early adopters of nanotech-enabled products [4]; in this context, surprisingly rapid market growth is expected and high mass market opportunities are envisaged for targeted research sub-segments (Figure 1).

Nanotechnology activities in Spain are coordinated through the Ministry of Science and Innovation. The Working Program for the 2008-2011 National R&D&I and Innovation Plan has a Strategic Action called Nanoscience and Nanotechnology, New Materials and New Industrial Processes with seven actions (Human Resources, Fundamental Research Projects in R&D and Innovation, Institutional Strengthening, Infrastructures, Using Knowledge, System Articulation and Internationalization, and Networks). Actually, the other four Strategic Actions are close to the N&N activity: Healthcare, Energy and Climate Change, Telecommunications and Information Society, and Biotechnology.

In the context of European policy, N&N is a key area for the European Commission: the VIIth FP (2007-2013) provides a specific programme for Nanosciences, nanotechnologies, materials and new production technologies with a budget of €3,475 million (10.72% of the VIIth FP total budget). Moreover, several specific programmes are involved in nanoscale research, and thus the total budget invested in nanoactivities will be increased by several thousands of

€millions (Meur) coming from the following programmes: Health (6,100 Meur), Food, agriculture and biotechnology (1,935 Meur), ICT (9,050 Meur) and Energy (2,350 Meur).

The “Knowledge Regions” initiative of the VIIth FP, aimed at enhancing regional clusters, and the Spanish R&D Ingenio 2010 Programme (Consolider Program, CENIT Program and Avanza Plan), linked to regional policies that stimulate R&D activities, might achieve the ambitious objective of 2% GERD of GDP by 2010 (3% in Europe).

By the end of 2007, the NanoSpain Network was up to 234 research groups and companies accounting over 1500 researchers [5]. In 2007, there were 211 Spanish projects in the nano field (including 567 subprojects), involving 294 industries as partners or end users, as well as 5,000 researchers (2,400 doctors) [6]. Since 2004 the Spanish NanoTechnology Think Tank has sought to link public research institutions and private companies by exploiting innovative market opportunities from nanotechnologies. Over fifty applications in biomedicine and pharmacology, energy, electronics, ICT, aeronautics, chemistry and advanced materials have been launched onto the market in the search for development agreements [7]

In summary, nanotechnology is critical for the future of economic and regional competitiveness, job creation, and technological superiority. In a context of increasing R+D expenditure, scientific policies might promote the best models and practises from research, industry and financial strategies. As a result, Spain could strengthen its networks of science and technology parks, institutes and research centres, and technology platforms and incubators to meet the new scientific and market challenges.

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Figures:

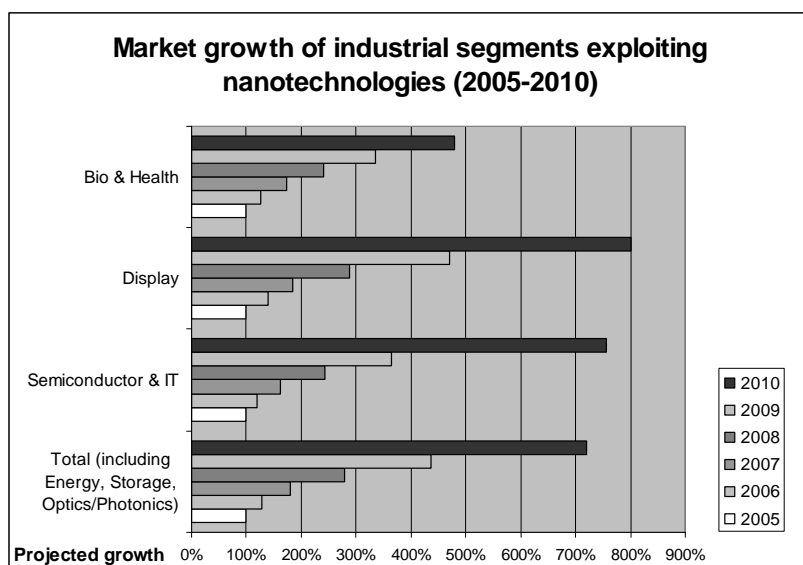


Figure 1: Chart based on Fuji-Keizai USA market research