

# Spanish innovation and market on nanotechnology: an analysis within the H2020 framework

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## Abstract

This document provides a broad overview of the state-of-the-art of nanotechnology innovation and market perspective in Spain, looking forward the Europe's Horizon 2020 strategy. *Key Enabling Technologies* (KETs) are the priorities of this framework, and nanotechnology is considered one of the most promising KET since for many is becoming the engine of the next industrial revolution [1],[2]. The authors' aim is to analyze if Spain is prepared to achieve the planned objectives inasmuch as Nanotechnology is a relevant strategy with high potential and scope for economic and social growth. An analysis of this KET is crucial to identify the strengths and improve weaknesses so that Spain can satisfactorily face new scientific and market challenges in the nanotech-related science.

Horizon 2020 is a Framework Program based on R&D, created to redefine the cooperation in funding and scientific research of the EU countries. This 6-year proposal (2014-2020) counts with 80 billion budget, promoting economic growth by turning scientific breakthroughs into innovative products and services [3]. Innovation is considered a key element to achieve H2020 proposal goals, so six strategic KETs are priorities of this framework: nanotechnologies, micro and nano electronics, photonics, advanced materials, biotechnology industry and advanced manufacturing systems, considered as significant accelerators for innovation and competitiveness of industries [4],[5].

Technology innovation, related capital and human investment shapes the National Innovation System of a country [6]. In this regard, the Global Entrepreneurship Monitor (GEM) report (2014) state that Spain belongs to the "Innovation-Driven Economies". However, has been categorized as a "high-capacity/low-performance" country in terms of the Innovation Efficacy Index (IEI) [7], and classified by the OECD as an "innovation follower" instead of an "innovation leader" regarding the European Regional Competitiveness Index (RCI). Spanish surveyed experts also agreed that the scientific and technologic potential in Spain is above the average [2]. This evidence the presence of a gap between high levels of scientific performance on one hand and the minimal contributions to industrial competitiveness and new venture entrepreneurship on the other [7]–[10].

Innovative activities can be measured by patents and publications [11]–[13]. Major contributors in Nanotechnology patent applications during the last decade are USA, Japan, Europe, Korea, and China [14]. Concerning the significance in total patent applications of KETs in Spain, Nanotechnology and Industrial Biotechnology are the lowest in number (**Figure 1**). There is also a worldwide increment of nanotechnology publications. China, USA, South Korea, India, Germany, Japan, France, the Islamic Republic of Iran, England and **Spain** were the top 10 countries in Nanoscience and Nanotechnology publications of 2012 [15].

In Spain, nanomaterials are considered highly attractive and specialized fields, meanwhile technologies that are below the average and demonstrate weakness are nanodevices, hardwares and techniques of analysis, control and measure, as well as nano fabrication, manipulation and integration [2]. At present, the emerging sector of applied nanotechnology is addressed to the biomedicine (nanobiotechnology and nanomedicine) [16], starting to show a promising impact in the health sciences: diagnostics and treatments of diseases, as well as the development of new drugs and novel ways of administration. In this regard, biosensors, biochips, cellular chips, active implants, bioreactors

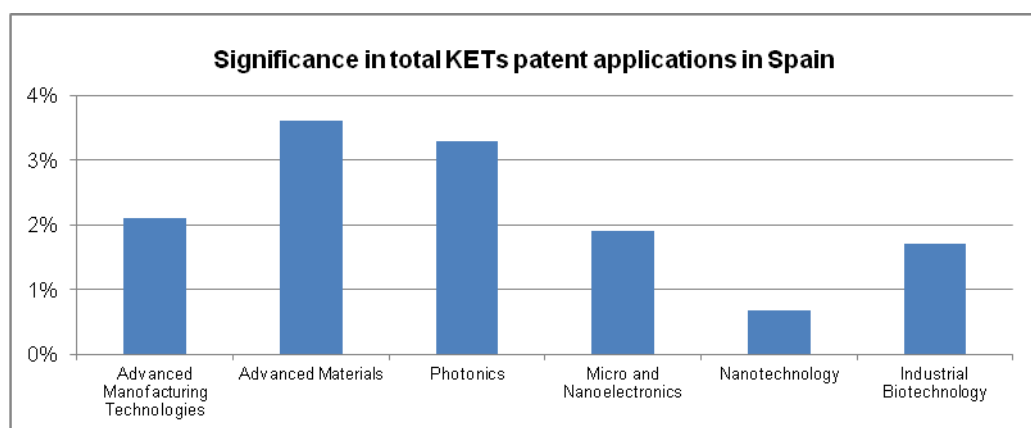
for cellular bi and tridimensional growth, tissue engineering, drugs administration, and genetic sequencing are considered consolidated areas of specialization with the greatest projection in the future and with a prospective of commercialization in 2020 [2].

There are some nanotech products that are already in use [17], in fact, the global nanotechnology market is anticipated to grow around 19% by year during 2013-2017 [18]. According to the Phantoms Foundation (2013), there are 94 Nanoscience and Nanotechnology companies in Spain that are mostly situated in Madrid, Aragon, País Vasco, Comunidad Valenciana, Navarra, Andalucía, and Cataluña. Although the nanotech industry is growing, this document aboard some difficulties implied. Much of the science and technology developed in research labs aren't commercialized [19]. Particularly, nanomedicine firms have focused primarily on the science and less on the commercial applications resulting difficult to bring products to market [9]. Solutions are needed in this aspect through more investigation about this important gap in the development progress of the nanotechnologies industry. Furthermore, performance evaluation of this KET is imperative in order to get better insights on how to obtain an effectively approach and improvement within the H2020 framework.

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## Figure



**Figure 1:** Significance in total KETs patent applications in Spain (source: OECD KETs observatory <https://webgate.ec.europa.eu/ketsobservatory/>)