Innovation Ecosystems and Market Challenges in Nanobiotechnology and Nanomedicine: A multi-KET analysis within Horizon 2020

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Abstract

Horizon 2020 is the new European Commission's initiative: the biggest financial program for Research and Innovation which goes "*From fundamental research to market innovation"* involving the entire innovation chain. With over 74 billion euros budget, H2020 searches turning scientific breakthroughs into innovative products and services [1]. Novelties of the framework include a risk management strategy through a Technology Readiness Level (TRL) seeking a major approximation to the market (**Fig. 1**). The program is composed by three pillars: Scientific Excellence, Society Challenges and Industrial Leadership. This last one aims to support SMEs in the industrial development and application of ***Key Enable Technologies*** **(KETs),** considered crucial accelerators for innovation and competitiveness [2]. Six KETs have been selected as the most strategically relevant: Nanotechnology, Biotechnology Industry, Advanced Materials, Micro & Nano Electronics and Advanced Manufacturing Systems. One of the most promising is Nanotechnology due to its economic and social growth potential [3]–[5].

Individually, each KET has a huge potential, however, their **cross-fertilization** is particularly important since their combination offer even greater possibilities to foster innovation and create new markets. The concept of cross-cutting KETs refers to the integration of different key enabling technologies in a way that creates value beyond the sum of individual technologies. The relevance of this combining process relies on the creation of new unique product properties and technology features, which could not have been possible to obtain with a single technology [6]. In the healthcare domain, nanobiotechnology and nanomedicine application areas of **multi-KETs** in a short (2017) and medium term (2020), are principally based on more efficient and less invasive drugs and therapies, devices and systems for targeted diagnostics and personalized medicine, and smart systems and robots for healthcare services.

In this context, the authors want to focus on the innovative performance and commercialization perspectives for healthcare applications and the challenges to reduce the *gap* between academic research and commercialization through a multi-KET case-study approach. Here is exposed a nano-enabled biomedical device composed with five of the six KETs, designed to be implanted under the human skin (**Fig. 2**). This is an innovative implantable device for in-vivo glucose monitoring of diabetic patients; an initial approach for the development of applications based on nanobiosensors for glucose threshold measurement.

The global market volume in KETs is 646 billion € and substantial growth expected is approximately an 8% of EU GDP by 2015. About one third of the budget assigned to KETs will be address to support innovative projects integrating different KETs. By this year, it was expected that 16% of goods in healthcare and life sciences will incorporate emerging technologies [7]. Nanomedicine is considered a long-term play in the global market [8]; in fact, is anticipated to grow around 25% by year. Three major projecting areas in the healthcare field are nanodiagnostics, nanopharmaceutics and regenerative medicine. The expected market size related to radical innovation-based nanomedicines will be 1.000 M€ in 2020 and 3.000 M€ in 2025 [9]. In this context H2020 will spend 9.7% of the total budget in Health, Demographic Change and Wellbeing; specifically, the program will invest 3.851 M€ in Nanotechnology and 516 M€ in Biotechnology Industry [10]. Finally, an analysis of the state-of-the-art of nanomedicine and their innovation ecosystem within a 5-helix model approach is also analyzed to identify strengths and to improve weaknesses facing new scientific, market and societal challenges.

References

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Figures

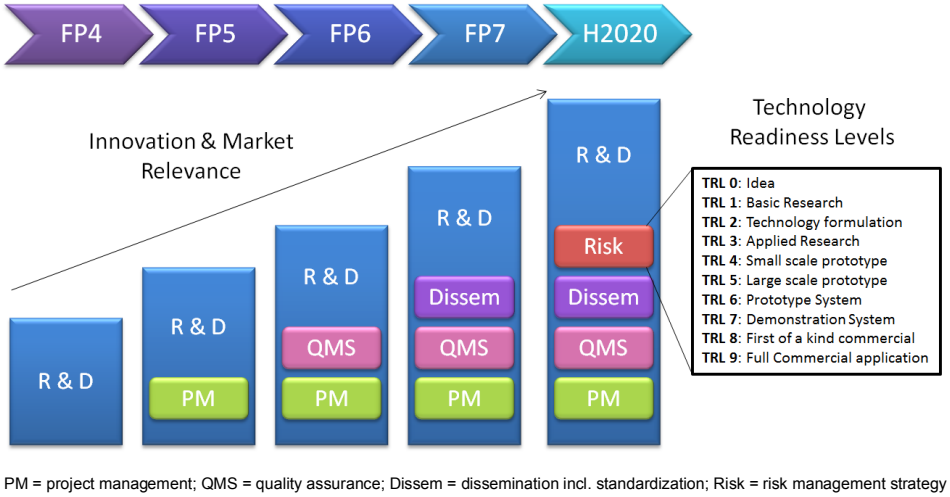

Fig. 1: *Evolution of the European Framework Programs. (Source: European Technology Platform on Industrial Safety)*

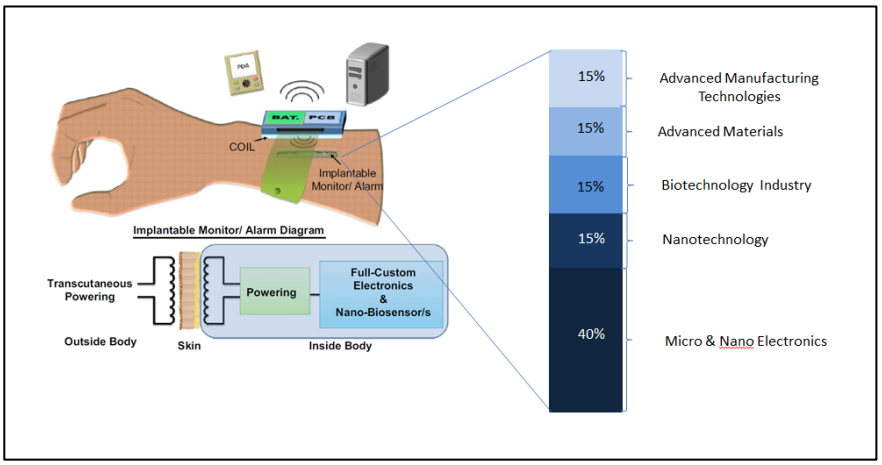

Fig. 2*: Conception of the nano-enabled implantable device for in-vivo glucose monitoring)*