Bridging Research and Industrial Production towards H2020: Future challenges for Nanomedicine with a multi-KET approach

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Abstract

It is stated that pilot production builds the bridge between research and industrial production since this activity is among technology and commercialization. However, pilot scalability is considered a bottleneck in the way to commercialization, even more in the Health domain where scalability is more complex. In this context, the new European Commission's initiative Horizon 2020, the biggest financial program for Research and Innovation, plans to finance different Risk Management Projects going "from fundamental research to market innovation" involving the entire innovation chain. H2020 is particularly focused on the research and development of Key Enabling Technologies (KETs), which are among the priorities of the framework strategy, that identifies the need for the EU to facilitate the industrial deployment of KETs in order to make its industries more innovative and globally competitive [1]. Six KETs have been selected according to an economic criteria, economic potential, capital intensity, technology intensity, and their value adding enabling role: Nanotechnology, Micro and Nano Electronics, Photonics, Advanced Materials, Biotechnology Industry, and Advanced Manufacturing Systems[2].

While each KET already has huge potential for innovation individually, their cross-fertilization is particularly important to offer even greater possibilities to foster innovation and create new markets. Integration between KETs will be essential for create jobs in industry, improve competitiveness and innovation, and at the same time address today's burning societal challenges in Europe in the coming years. 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 the individual technologies for developing innovative and competitive products, goods and services oriented to solve societal needs. The global market volume in KETS is €646 billion and substantial growth is expected of approximately 8% of EU GDP by 2015. In this context, Horizon 2020 will invest €5.96 billion in the industry sector for the development of the KETs and about 1/3 of this budget will be assigned to projects integrating different KETs [3].

Most high tech pilot production problems are inherently multi-KETs. The scale up of nanomedicines for clinical testing is severely hindered by a lack of knowledge about how and where to manufacture such entities according to Good Manufacturing Practice (GMP) and taking into account the medical regulatory requirements. The Commission states that bridging the so called "Valley of Death" to upscale new KET technology based prototypes to commercial manufacturing, often constitutes a weak link in the successful use of KETs potential[4].

Translation of innovation and time-to-market reduction are important challenges on H2020. After a long R+D incubation period, several industrial segments are already emerging as early adopters of nanotech-enabled products and findings suggest that the Bio&Health market is among the most challenging field for the coming years. As a major application of Nanotechnology, the field of Nanomedicine fits naturally amongst the Key Enabling Technologies defined by the European Commission. It is considered multidisciplinary since it is not restricted to the realm of advanced materials, extending also to manufacturing processes, biotechnology, pharmacy, electronics and IT, as well as other technologies [5]. These characteristics allow the connection to a diversified set of industries [6]. Inherent interactions exist between these sectors and could be mutually beneficial in terms of research innovation (**Fig. 1**). For example, the use of quantum dots and shape-shifting nanomaterials for medical applications could greatly benefit from the latest progress in photonics, and nanomedicine

sensors from biotechnology and biological pores. Additionally, new medical therapies enabled by Nanotechnology and Advanced Materials, can contribute to personalised health care. This strong interdisciplinary character, combined with the possibility of manipulating a material atom by atom, opens up unknown fields and provides an endless source of innovation and creativity in the healthcare domain.

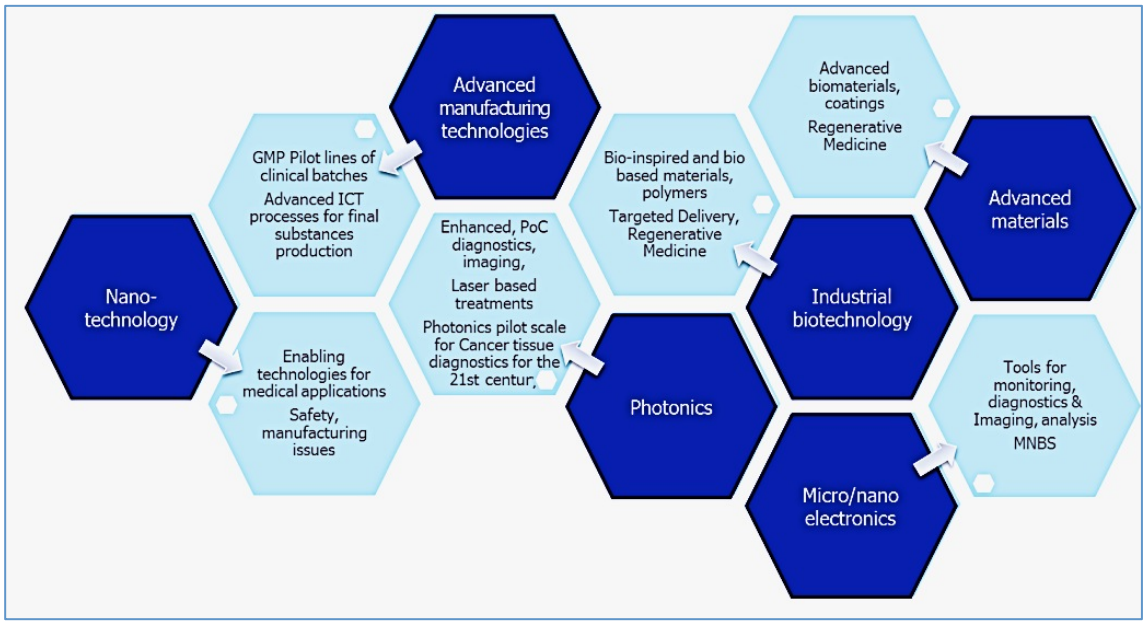

Fig. 1: *A Multi-KET approach of Nanomedicine: common R&D topics with the KETs* [7]

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