

Nanosciences and nanotechnologies in the 7th Framework Programme

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Nanotechnology has a many-fold potential, in offering solutions to many current problems and expectations of citizens, in opening up more effective opportunities for sustainable development, in boosting wealth creation, or in defending employment and creating new ones. Both brilliant fundamental research and engineering are indispensable at this stage in order to generate new knowledge and turn it into successful and useful industrial innovation. The European Union (EU) has long supported nanosciences and nanotechnologies (N&N)¹ with attention for the various factors for success, the possible risks and measures to take, and its impact on society.

Support for research and technological development (R&D) came both from the European Commission (EC) and from the EU Member States, with a particular effort of coordination at the level of policies, programmes and projects. Under the Sixth Framework Programme (2002-2006) of the European Community for research, technological development and demonstration activities (FP6), the Commission continued and strengthened its support for R&D in this area. In total, almost 1.4 billion Euro has been committed to more than 550 projects dedicated or directly relevant to N&N. As a comparison, the Community contribution has been about 120 million Euro in FP4 (1994-1998) and 220 million Euro in FP5 (1998-2002). Of this amount, some 75% originated from calls of the third and second thematic priorities of FP6, which had calls specifically addressing N&N, whilst almost 25% originated from 'bottom-up' or other programmes of FP6 which did not make explicit provisions for N&N. Most notable amongst the latter is the programme for Human Resources and Mobility, the Marie Curie actions, in which some 160M€ was committed to projects in N&N. Within the third thematic priority (NMP), the participation of industry was somewhat lower in projects related to N&N than in the other projects within this industry-targeted priority. However, in the course of FP6, the industrial participation in N&N projects has doubled, from 18% in 2003-04, to 37% in 2006. The proportion of SMEs within this industrial participation was in the region 35-40%.

A breakdown amongst FP6 thematic priorities and programmes is shown in the table below:

Research funding in FP6 for N&N

<i>FP6 Thematic priority or activity</i>	<i>EC funding M€</i>	<i>% of total</i>
NMP ²	575	41.6
IST ²	466	33.7
Marie Curie ³	161	11.7
Health ⁴	65	4.7
Infrastructures ⁵	40	2.9
NEST ⁶	24	1.8
SME ⁷	17	1.2
Others	33	2.4
Total	1,382	100.0

At the level of public funding, the comparative European positioning in the last few years has remained essentially the same. The funding in Europe increased, but it did so in line with that outside the EU. During its operational duration, FP6 accounted for almost a third of the overall public expenditures in Europe for N&N. On the basis of an approximate figure for the global expenditure in N&N of \$30 billion in the period 2004-06, Europe accounts for more than a quarter of the total, with

Commission funding directly accounting for 5,5%. The relevant figures, for total R&D funding over the years 2004-06, are shown in the table below:

Estimated global spending on R&D in N&N (in M\$⁸)

	2004	2005	2006
EU	2,425	3,050	3,305
US	2,943	3,700	3,706
Japan	2,290	2,230	2,679
Others	870	1,200	1,722
TOTAL	8,528	10,180	11,412

In terms of private funding Europe is at a significant disadvantage with respect to the US and Japan, and far from the relevant target of the '3% objective' (which requires a two-thirds contribution from private funding). This situation, however, is not specific to nanotechnology. On the other hand, it should be noted that the private sector is making progress in this as part of its activities in the different European Technology Platforms (ETPs) dedicated to themes directly relevant to nanotechnology and its applications, such as Nanoelectronics, Nanomedicine, Sustainable Chemistry and Industrial Safety, which have produced vision papers and strategic research agendas. Other ETPs relevant to N&N include Advanced Engineering Materials and Technologies, and Hydrogen and Fuel Cell Technology. The priorities set out by the ETPs are taken into account in the elaboration of the FP7 calls for proposals, e.g. in the NMP, IST, Health and Energy themes.

Under the Seventh Framework Programme (2007-2013) of the European Community for research, technological development and demonstration activities (FP7),⁹ it is expected that the Commission funding will increase significantly, particularly in the specific programme 'Cooperation', and is likely to more than double on a yearly basis. This is thanks to increases in the overall budgets of relevant themes, as well as expected increases in the share of N&N in 'bottom up' programmes, notably the 'Ideas' and 'People' programmes, which are in turn much larger than their FP6 counterparts.

The first calls of FP7 were published on 22 December 2006. The wide coverage of FP6, in terms of subject area and type of funding, is expected to continue. Overall, some 60 calls and topics opened in the first year of FP7, in all specific programmes, are directly relevant to R&D in N&N, with many more being potentially relevant. These cover research and development activities, as well as supporting actions, in nanosciences, technology development, impact assessment, societal issues, nanomaterials, nanoelectronics, nanomedicine, as well as in training and frontier research. Moreover, direct R&D actions in risk assessment of nanomaterials, nanobiotechnology and metrology have been included in the Multi-Annual Work Programme of the Commission Joint Research Centre.

Funding in FP7 has also a strategic relevance. Without neglecting fundamental research, the NMP theme of FP7 aims for research that can lead to useful applications and is relevant to the needs of industry, in accordance to Article 163 of the EU Treaty.¹⁰ This is reflected in the three criteria adopted to evaluate research proposals, quality, impact and usefulness. Moreover, there are many measures in place to increase industrial participation in projects, including that of SMEs, and undertake complementary initiatives, such as the collaboration with the European Patent Office, the introduction of a guarantee fund, and the Competitiveness and Innovation Programme (CIP) which is complementary to FP7.

The FP6 ERA-NET scheme supports the coordination and coherence in the research programmes carried out at national level, such as for NanoSci-ERA, MNT ERA-NET and MATERA. The ERA-NET scheme will be continued and boosted in FP7 with the introduction of the ERA-NET Plus scheme. An additional, valuable contribution to coordination came from COST.

The European Commission's support for these key technologies is not limited to funding of R&D projects. Complementary action to support N&N was already taken in the mid- to late 1990s. As a result Europe is in a leading position in nanotechnology. Now the European industry and society in general should enter the commercialisation phase, to reap the

benefits of this knowledge through innovative products and processes. Safety is steadily addressed, as well as other issues that could represent impediments or delays to the successful use of nanotechnology.

To meet the challenges and to ensure Europe's competitiveness in this sector we need to join forces across disciplines, sectors and national borders. We need to increase investment, boost interdisciplinarity, create the necessary infrastructures, expand human resources and develop international co-operation to support research and foster innovation. At the same time, we need to address societal concerns brought about by the development of new applications. We also need to consider potential regulatory issues. These priorities are central to the European integrated, safe and responsible approach to nanotechnology, as proposed by the European Commission in two Communications, the European Strategy and the Action Plan 2005-09.¹¹

In general, Europe enjoys a strong position in terms of producing knowledge in nanotechnology (e.g. publications), but is weaker in transferring this knowledge into industrial products and services (e.g. patents and start-ups). With regard to funding, the European Commission has steadily increased the level of its funding for research in nanosciences and nanotechnologies, as described above. On the other hand, the level of private R&D funding is lower in Europe in comparison to some other areas e.g. the USA and Japan. The challenge in funding R&D in this diverse and important field, is to focus on the most promising sciences and technologies, leading to higher-performance products and services on the one hand, and sometimes a 'revolutionary', not only 'evolutionary', industrial innovation.

With regard to regulation, a high level of public health, safety, environmental and consumer protection is aimed at. This requires the identification of safety concerns, the collection of appropriate data for an adequate health and environmental impact assessment of the products data, and action at the earliest possible stage through adjustments, where necessary, of risk assessment procedures for issues of nanotechnology. To address these needs, relevant research projects have already been funded; following an informal collection of information, impact assessment is a major component of the first calls of FP7 and the intention is to continue this support in further calls. In the meantime, the Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) has adopted an opinion on 'The appropriateness of existing methodologies to assess the potential risks associated with engineered and adventitious products of nanotechnologies'. Briefly, this has recommended addressing various uncertainties with regard to potential hazards and exposure; addressing gaps in knowledge; and further developing guidelines and methods. Another opinion is being drafted, on the appropriateness of the risk assessment methodology in accordance with the Technical Guidance Documents for new and existing substances for assessing the risks of nanomaterials. Apart from research-centred activities, the European Commission is currently looking into the legislative issues of the increasing use of nanotechnologies, i.e. it is currently exploring the already existing European legislation applicable to nanotechnology and assessing its adequacy and appropriateness. Current analysis shows that the current regulatory framework is, in principle, capable of handling nanomaterials. Ethical issues are also constantly addressed, and in January 2007 the European Group on Ethics delivered its opinion on Nanomedicine.

Note that the views expressed in this paper are those of the author, do not necessarily represent those of the European Commission and do not engage the European Commission in any way.

¹ <http://cordis.europa.eu/nanotechnology/>

² Respectively, 'Nanotechnologies and nano-sciences, knowledge-based multifunctional materials and new production processes and devices' (NMP); and 'Information Society Technologies' (IST)

³ Specific programme 'Structuring the European Research Area', 'Marie Curie Actions - Human resources and mobility'

⁴ Thematic priority 'Life sciences, genomics and biotechnology for health'

⁵ Specific programme 'Structuring the European Research Area', 'Research Infrastructures'

⁶ Specific programme 'Integrating and Strengthening the European Research Area', 'New and Emerging Science and Technology'

⁷ Specific programme 'Integrating and Strengthening the European Research Area', 'Specific SME Activities'

⁸ For the purposes of an approximate global comparison, figures are given in M\$ using 2005 exchange rates. Source: European Commission and Lux Research
⁹ <http://cordis.europa.eu/fp7>

¹⁰ Article 163 of the EU Treaty states that The Community shall have the objective of strengthening the scientific and technological bases of Community industry and encouraging it to become more competitive at international level, while promoting all the research activities deemed necessary by virtue of other Chapters of this Treaty.

¹¹ <http://cordis.europa.eu/nanotechnology/> & <http://cordis.europa.eu/nanotechnology/actionplan.htm>