Strategic evaluation NMP FP6

Ex-post evaluation of NMP (FP6)

Strategic level

Strategic impact, no revolution.

Final Report

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Short summary:	This report presents methodological approach, summarized findings and recommendations from Ex-post evaluation of NMP in Framework Programme 6- Strategic Level.

Foreword

In June 2009 the "Strategic Level Ex-post Evaluation of NMP in Framework Programme 6" was assigned to Oxford Research and The Austrian Institute for SME Research by the European Commission, Research Directorate-General – Industrial technologies.

The purpose of the evaluation has been to study the strategic value and impact of NMP in its wider European and international context, with special focus on the ERA dimension, against the general policy objectives of FP6 and against the specific objectives of NMP.

The structure of the report was shaped during the evaluation exercise. Part 1 of the report presents the evaluation background and methodology, also shaping the context for data presented in Part 2 with analysis of the NMP FP6 programme objectives. Part 2 of the report presents analysis of data and findings with regard to evaluation questions. This part groups the most important aspects addressed in this evaluation: design and implementation of the programme, nature and relevance of results and its strategic impacts. Part 2 also contains country case studies that give additional light into study findings.

As a final result of this work Part 2 depicts outcomes of the evaluation with a chapter containing conclusions and lessons learnt. Part 3 of this report lists all relevant Appendices presenting data and tools used in the evaluation process.

We would like to thank all those who contributed to this evaluation – the managers of projects financed under NMP FP6, national and international experts and programme managers and especially to our main contact persons from European Commission: Mr. Michel Poireau, Mr. Jesus-Maria Alquezar-Sabadie and Mrs. Sandra Peeters. We thank them for the smooth co-operation.

Kristiansand, Norway, 08.04.2010

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Chapter 1. Executive summary

The title of this report refers to the general finding that the third thematic priority (NMP) in FP6 strategically affected Europe's competitive position and was an important programme which also influenced Member States' policies and research agendas. However, it cannot be directly linked to a revolution with regard to creating substantial scientific or industrial breakthroughs although these were among the explicitly targeted objectives. The programme strengthened Europe's position as one of the world leaders in the respective scientific and industrial fields, but did not enable Europe to outperform other key actors such as the United States or Japan.

Aim of the study

This study is evaluating the strategic value and impact of thematic priority "Nano-technologies and nano-sciences, knowledge-based multifunctional materials, and new production processes and devices" (NMP) in Framework Programme 6 (FP6) in its wider European and international context. The former includes a special emphasis on the Lisbon Agenda, the European Research Area (ERA) dimension as well as the general policy objectives of FP6 and the specific objectives of NMP itself. The comprehension of the context differentiates this study from the classic evaluation exercises measuring effectiveness and efficiency on the project level such as the simultaneously commissioned project evaluation of NMP FP6, which is conducted by another consortium and supposed to be completed in 2011. Being an ex-post evaluation it primarily refers in all its analyses and respective conclusions to the past. However, we believe that the conclusions drawn and the recommendations developed by all means are for their better part relevant for both the understanding of present developments and future plans.

The study provides recommendations from the overall lessons learnt and, where appropriate, from the comparison made between EU NMP activities and similar activities in Member States. Although this strategic evaluation cannot be a fully developed impact assessment on the level of individual projects or measure the actual outcomes of those, it was necessary to analyse the programme outputs and outcomes but on a higher, more aggregated level. However, this cannot be completed without an understanding of the 'physical' impacts, which are in many cases not created yet due to the fact that part of FP6 projects are still running and eventual scientific impact or commercialization of scientific products coming from those projects in most of the cases will be continued in the years to come.

Nanoscience and Nanotechnologies are an important part of the entire research priority; they also appear as a stand-alone research field in many national programmes. Therefore a special attention to this field was intended, while simultaneously all data were presented and analysed within the context of the N, M and P split as defined in Work Programmes.

Methods

This evaluation was developed with use of both qualitative and quantitative methods. Apart from the desk work covering available documents and databases, the survey instruments were deployed both for the individual project co-ordinators and also to facilitate the collection of data on relevant national measures in Member States.

The research team conducted a series of 48 in-depth, semi-structured interviews with experts from business, research and policy-makers' groups following a pre-defined geographical coverage. Questions from the survey were also addressed in the interviews so as to get more qualitative, reflective answers to such issues as priorities in NMP FP6, the monitoring process and the funding schemes. This was also to assure necessary triangulation of data gathered.

Another important step of the study was the collection and verification of data about country measures financing research similar to NMP priority. Subcontracted members of European Network for Social and Economic Research conducted verification of information in different European countries, contacting relevant country experts and studying publicly available programme information. Data about 89 relevant measures were gathered and analysed, showing a large variety of approaches and dimensions all over Europe. These data allowed the evaluators to distinguish three categories of countries: "the front-runners", "the second-movers" and "the followers", which were later used in the analysis.

The widest quantitative data set that was analysed in this evaluation resulted from a web based survey which covered co-ordinators of projects funded under NMP FP6 with a response rate of 56%. A fully representative coverage with regards to essential project characteristics such as type of instrument and NMP-subarea (nanotechnology, materials, production processes etc.) was reached. It should be noted that not all co-ordinators were familiar with all the different objectives and dimensions or have a sense of their project's contribution to different strategic goals. Nevertheless, they did have insights into the context of their research and they were capable of assessing issues of the European R&D policy context, both linked to their R&D projects and apart from their own activities, on a more abstract level. Another important issue in this context is that 71% of the projects covered by the survey were finished before the survey was launched in September 2009.

In the final stage of the project, case studies have been prepared, covering national policies that were relevant to the evaluation questions. The evaluation team has not been limiting this part of research only to best practices, but tried to identify and describe novel, specific approaches and solutions implemented in different countries.

The whole evaluation process was assisted by comments and recommendations from a Guidance Group of external independent experts in the NMP field and in evaluation methodology, both with regards to the tools used and their implementation, as well as deliverables and their content. Another feedback input has been provided by the European Commission evaluation project officers responsible for the evaluation at hand.

Findings

Full information about the findings can be found in respective chapters of this evaluation report. In this paragraph a short summary of findings is presented within the framework of main evaluations questions:

1) To what extent were the **objectives** assigned to NMP FP6 met or reached?

> A large part of this evaluation report is dedicated to the analysis of the objectives and the extent to what they were met or reached. The reason for that lies in the way these objectives were designed and formulated, as no quantifiable target parameters of success were defined at programme, area, or topic level. In addition, the set of

objectives – directly or indirectly linked to NMP FP6 – covers a substantial range of targets, making it impossible to find easy answers to this question.

The strategic evaluation at hand aimed at understanding the impact NMP had in terms of changing Europe in different desirable directions, including the wider context of the European Union such as its established goal to become the world's most competitive knowledge-based economy (the Lisbon Agenda), an increased international co-operation of researchers including the reduction of barriers for researchers' mobility (the European Research Area, ERA) and general objectives regarding all sorts of developments towards an increased sustainability of production, consumption, transport etc. Apart from these wider objectives, NMP was of course endowed with its own rather specific goals and objectives. Naturally, these do not only have to be seen as having derived from overall European goals but as actual distillations. Therefore, the overlaps are manifold and sometimes blur the boundaries between different agendas, objectives etc.

In sum, the objectives assigned to NMP FP6 have been achieved to different extents in different areas and by different instruments. NMP FP6 was quite successful with regard to the production and strengthening of excellent and new knowledge (but not necessarily 1st class knowledge), critical mass, shifts in research, and education/career chances/mobility of/for researchers. The interviews revealed that the impact on environmental sustainability was positive and substantial. In contrast, project coordinators judged the impact linked to commercialisation issues and especially to sustainability and environment issues (Gothenburg objectives) as not that important. This different result refers to project coordinators considering the immediate, more visible impact of their projects, which they considered were more visible for other areas than environmental sustainability. Most of the project results did not reach the commercialisation phase until the end of NMP FP6, it would have been difficult for them to estimate the impact on environmental sustainability in the long run.

A more general increase in the market-orientation of R&D was achieved, as well as an increasing cooperation between academia and industry. However, the programme showed significant difficulties involving SMEs, which partially were inherent in the complex design of the programme, and lack of knowledge in companies. It also appears that NMP FP6-funded projects contributed more to the creation of new knowledge (i.e. "creation of excellent knowledge", "strengthening of existing scientific and technological excellence") as well as to shifts in research towards exploitation and industrial utilisation than to commercialisation, yet.

One of the main objectives of NMP FP6 was to create '**critical mass**' without any notion of what this might be. Since the term itself is not defined (neither on programme nor project level) and is not connected to any quantitative target measure, the analyses have to remain on a purely qualitative level. However, interviews revealed that experts' and participants' **assessed that NMP FP6 supported** the achievement of critical mass by means of **providing sufficient resources** for individual projects and therefore, the programme as such, especially in the nanotechnology and nanoscience area.

The allocated funds in NMP FP6 seem to have reached a critical mass in the nanotechnology area, due to, among others, the higher promotion and visibility of the 'nanotechnology' area, compared with the new materials, new production processes and devices areas. Although a high relevance of the priorities and the key scientific and technological challenges identified in NMP FP6, safety regulations, toxicity-, health risks and ethical issues related to NMP – were not promoted strongly enough either at the national level or in NMP FP6.

2) What have been the nature, relevance and value of the **results** produced?

In terms of the outcomes of NMP FP6, the promotion of nanotechnologies in Europe is considered to be strategically important. Through the promotion of nanotechnologies, development of an Action Plan and efforts towards a European Strategy for Nanotechnologies, which are major outcomes in their own rights, the NMP FP6 programme has contributed to mainstreaming national programmes and to facilitating the development of a European Research Area as well as triggering the member states to establish own agendas and strategies for nanotechnologies nationally. Key industrial challenges were faced within different research projects, but they were not declared to be finally dealt with. The knowledge was rather considered to be only "high class knowledge" rather than "first class" in many cases.

NMP FP6 not only brought NMP on the political agenda but supported the establishment of certain dynamics in the field, in terms of RTD cooperation and networks between a variety of actors, sectors and disciplines, through both enhancing the existing teams, but also encouraging new teams and approaches. Furthermore, the thematic priority facilitated processes that frequently include research that was initiated by already established research teams under previous FPs, developed in NMP FP6 and continue in FP7 and beyond, which extend into – and influence – other research fields and technologies beyond central NMP-fields.

Affecting research fields and technologies beyond NMP, the NMP FP6 has without a doubt contributed to the scientific advancement and integration of nanotechnology RTD in Europe, in terms of publications in high ranked journals, innovation related outputs, patents and spin-offs. Areas such as nanomedicine, forestry, energy, electronics, textiles, machine tools and robotics have been considered by the experts to have advanced considerably through the NMP FP6 projects. To what extent the knowledge related results constituted first class knowledge it was difficult to estimate, although the nanotechnology area seems to be the area which has come furthest in this respect in NMP FP6. Moreover, difficulties in attracting first class knowledge industry-driven research may have an implication upon the nature of the results in NMP FP6.

Generally, the NMP FP6 set-up allowed participation of new research teams and partnerships and constituted a favourable environment for developing sustainable collaborations in the field of NMP and beyond. Capacities to establish and maintain new cooperative relationships significantly improved for a majority of participants in NMP FP6. However, the tangible effect on sustainable co-operations among researchers appears to be somewhat limited.

In general, the new knowledge and know-how produced is considered as being not sufficiently disseminated and used by final users, especially by industry. Besides the access to (new) knowledge, which can be perceived as a preparatory effort for an actual knowledge transfer, the analyses indicate a well developed access to, or actually joint usage of physical R&D-related infrastructure and furthermore a remarkable exchange of personnel within the projects reflecting actual knowledge and technology transfer. It also appears that the projects within NMP FP6 contributed to a large extent to an improvement of the programme-objective “knowledge and technology transfer”, when assessed in a more general context among different other objectives.

Participating in NMP FP6 clearly had positive effects on research related investments and R&D expenditures, whether they originate in the research consortia’s own budgets or private third-party funding. However, these results have been achieved to a different degree and the main reasons for the weaker mobilisation of private capital lie in the uncertainty of an economic utilisation of the research conducted, the risk of failure and difficulties in handling IPR.

3) How **relevant and effective** was the programme from its design to its implementation?

Among the general findings regarding the relevance and effectiveness of NMP FP6 was the conclusion that the design-related aspects were more effective than the administration-related implementation aspects of the programme. Opportunities to cooperate with international partners, the expected higher level of research and a better thematic adequacy offered by NMP FP6 have been found to be among the most important factors which triggered participation in the programme.

The revision of the Work Programmes in NMP FP6 worked fine in general although transparency could be improved. The reaction and adaption to changes in the scientific and industrial scene affecting NMP technologies took place quite appropriately. Some ETPs’ role in shaping the priorities has been positive and their importance was increasing. Although the priorities and the topics were relevant and actual in NMP FP6, the selection and the focus of priorities, among which the industry focus, improved towards the end of the programme.

In spite of NMP FP6 alignment with the Member States, the USA and Japan in addressing key scientific, technical and industrial challenges in terms of transforming their old industries, a greater market orientation of the research and closer co-operation with the industry stakeholders in Europe is considered to be a key European problem. However, it is important to add that NMP FP6 was the only programme worldwide which was implemented using the split of areas defined as N, M and P. Other national programmes use different layouts (in most of cases wide research programmes covering all disciplines, or industry/sector related programmes, where pure nanotechnology or pure materials-related programmes are listed as a separate discipline, or an enabling technology).

Analyses of existing measures and their results in Member States indicate three groups of countries – both in a technological and in political context: front runners, fast second movers and followers. Still in terms of selection of priorities all Member States tend to concentrate their funding in the topics, where they already have a competitive advantage of some kind (existing knowledge, research resources or industry base). To this point NMP FP6 managed to offer a wide variety of possibilities (relevant research topics) for all interested actors to participate, and was treated as a complementary and attractive source of funding for many research teams simultaneously operating in national programmes. European funding was considered to be very attractive also for new research teams, especially by the representatives from followers’ and second movers’ countries. Simultaneously, long and complicated procedures and low success rate for the newcomers appeared to be discouraging for this group of beneficiaries, especially including SME.

When comparing to Member States, their programmes’ priorities are designed (especially those investing larger amounts into research) to make the best use of the existing country potential and to meet the interests of national research teams, political bodies and industry lobbyists. MS programmes' objectives have similar strategic dimensions, but the measurement of accomplishment of those strategic objectives is not undertaken. The evaluations are concentrated rather on direct results on project level and implementation issues, then on measuring the overall strategic impact.

To some extent, there was a connection between changes in the priorities and focus in national programmes (at least for some MS) and the outcomes of the revision process of the work programme in NMP FP6, through the consultation process which usually involved national delegates and experts active both at the national level and EU level. The choice of priorities and focus in NMP FP6 and those in national NMP-related programmes influenced each other in different ways and to a different extent. The hypothesis that NMP frontrunners, which also are the biggest countries in Europe, influenced the priorities and focus in NMP FP6, while an inverse influence being the case for the second-movers and follower countries, which include smaller countries and new MS, seems to have got some support in this evaluation.

4) What were the **impacts** with regard to the ERA and Lisbon objectives?

The overall contribution of NMP FP6 to the issue of transforming Europe into a more attractive working place for researchers from outside Europe (Lisbon Agenda) was assessed to be rather weak, while the contribution of NMP FP6 projects to an increased mobility *within* Europe and the attraction of skilled employees / researchers from EU countries was considered to be quite substantial.

Through a research agenda driven by industry, involving the ETPs and industry stakeholders, the multidisciplinary character and the efforts made to integrate actors, sectors and disciplines in NMP FP6, effects upon the increased orientation of European RTD towards the market are to be expected, although issues such as SME involvement and IPR exploitation were present and posed difficulties in this respect. By successfully integrating researchers both in academia and in businesses, by ensuring a multidisciplinary environment in the projects and opening for co-operation with countries beyond the EU and by providing increased career opportunities for young researchers, has NMP FP6 moved closer towards ERA objectives. There are aspects which still have to be improved such as reducing legal and practical barriers hampering mobility across institutions, better knowledge of and experience about IPR among the researchers and hesitance from the industry to bring in their cutting edge research into the FP financed RTD. ERA-NETs great potential for producing trans-national research collaborations plays an important role in improving the coherence of implementation of national and EU RTD activities and in the area of co-ordinated funding in NMP.

As requested, the evaluation team established a comprehensive matrix of indicators for possible future use by European Commission, based on analysis of correlations between various strategic documents (see Chapter 8.7).

5) What are the main **lessons learnt** and the possible recommended actions which could be derived from this evaluation?

A comprehensive list of recommendations is presented in the paragraph below, summarizing findings and recommendations described in full in Chapter 10.

Recommendations

An overview of the recommendations is presented below with a split corresponding to their possible application range.

NMP FP6-related recommendations

1. **NMP rationale:** Make the rationale behind NMP subareas integration more explicit, underline M and P subareas role in the programme. Perhaps incorporate M and P into Nanotechnology Action Plan.
2. **Use existing platforms:** Use existing mechanisms for stakeholders' involvement through current platforms within the planning processes. Cross link existing mutually relevant platforms.
3. **European Distinctiveness in a global marketplace:** Include quantitative and qualitative technology mapping and foresight studies in NMP to identify key fields of European expertise in the NMP area, and to adjust funding levels according to identified key development research fields.
4. **Simplification of Procedures:** Simplify application procedures aimed at enhancing participation of new research teams from "second movers" and "followers" countries. This must be associated with support measures for newcomers to receive necessary application support and with further simplification of project reporting and accounting procedure for all programme participants.
5. **Multi Disciplinary Projects:** The focus on encouraging and funding multi-disciplinary research projects should be maintained or intensified.
6. **Fine Tuning with Regard to Targets:** Make the targets of the different instruments applied in NMP FP6 clearer and more distinct. Consequently, the fine-tuning of the instruments with regards to their targets should be considered.
7. **Joint cross-thematic calls to meet user demand side:** Increase the number of joint calls of different thematic priorities in areas that are heavily interlinked and where such joint calls meet a respective demand on the user's side.
8. **Address Societal Challenges with public debate studies and regulatory works:** Intensify and target major societal challenges using NMP in such areas as: healthcare for the ageing population, issues related to energy, protection of the environment, sustainability in all production processes, reduction of waste in materials. Open a debate on the creation of a system of NMP-related regulations, assuring a safe and responsible approach to research in NMP areas in Europe.
9. **First Class Knowledge and Time-to-Contract:** Define "first class knowledge" in detail to be able to measure the degree of achieved first class knowledge. Time-to-contract indicators are to be lowered to assure more industry engagement and therefore generating first class knowledge and focusing on market orientation.
10. **Detailed and Coherent Commercialisation Strategy and Commercialisation Platform:** Create a new type of policy instrument with the primary aim of bringing European technologies to the market, e.g. a European NMP Commercialisation Platform gathering stakeholders committed to commercialisation, should be set up to enable action upon the ECs wish to increase commercialisation.

11. **Communication of EC Pipeline:** Implement a direct action to let venture capitals access the EC project pipeline, and for researchers to hear about the market potential of their work.
12. **Transparency of Negotiations and Information Flow:** Increase the transparency of negotiations and assure information flow during planning and revision processes related to NMP

General recommendations with regard to implementation of Framework Programmes based on the findings from this evaluation:

13. **Support measures for research teams:** Consider additional funding for dedicated project preparation, awareness building and support measures for new research teams in MS. Continue simplification of the reporting and accounting procedures.
14. **Infrastructure:** Include infrastructure as an important planning dimension for shaping future research priorities in Europe. Coordinate with structural funds implementation.
15. **Dissemination of Knowledge:** Intensify dissemination activities towards industry and the broader public. Use PUDK/PUDF to larger extent.
16. **Support for Start-Up Companies:** Support start-up companies, for instance by provision of efficient incubator facilities.
17. **IPR Protection and Innovations to market:** Intensify investigation into the reasons behind the scarcity of inventions being transformed into innovations and eventually protected by means of IPR.
18. **SMART Targets and Long Term Monitoring:** Define future objectives for NMP with use of SMART targets. Develop a monitoring and evaluation indicators system that will allow comparing impact of the programme over a long time period (10 years at least), with estimated targets to be reached

Above recommendations result from the data collected and analysed during the evaluation process. Additional recommendations gathered during the interviews were presented in Chapter 11.9. This additional material reflects single opinions of the interviewed experts and was not triangulated by other means and therefore not presented as a main outcome of the study.

Guidance for reading this report

Due to complexity of the subject matter, different parts of the report should be considered relevant by different readers. The details upon the methodology of the evaluation and the background of the programme are presented in Part I. The full presentation of findings and the detailed analysis are in the main body of the chapters gathered in Part II, while the introductions and conclusions to the respective chapters present shorter summaries of the data and concluded answers to the evaluation questions. Thus, for those readers in need for a quick overview of the evaluation findings and analyses, a focus on introductions and conclusions of the respective chapters (from Chapter 6 to Chapter 9) is recommended. For more detailed information about the issues addressed in this evaluation the focus on the chapters is recommended. For those readers interested in final conclusions and recommendations from this evaluation, considering Chapter 10 on findings and recommendations, is advised. More details with regard to raw data gathered and methodologies used were collected in Appendixes in Part III.

PART I

Chapter 2. Introduction to context of the evaluation study

2.1 Introduction

The European Commission approached the development of industrial technologies in a holistic manner with the implementation of the Nanoscience and Nanotechnology, New Materials & New Production Processes and Devices thematic area under FP6, instead of a more narrow focus on "nanotechnologies" that can be noted in various other research policy initiatives globally. The impact of this comprehensive approach can even be traced to the level of individual projects funded through the programme. Nanoscale technology is only one of several possible solutions to challenges in materials development and engineering, and the solution to a specific problem may instead lie in a new production process or use of new tools and instruments. It is therefore of utmost importance to assess the impact of the major research policy priority represented by NMP, which has the potential of fulfilling a range of European Union policy objectives.

The strong global hype and focus on the term *nanotechnology* has spawned a vast number of studies, analyses, action plans, and reports that unfortunately have largely overlooked the importance of developments within industrial technologies that are driven by new understanding of materials characteristics and knowledge-based novel production modes and tools not directly relating to Nanoscience & Nanotechnology (N&N). This means that the **majority of existing documents in the field concentrate almost solely on nanotechnologies and their related applications, along with their market potential**. This inevitable bias represents a definite challenge for the present study, especially in terms of comparative analyses. Nevertheless, the present study consistently takes into account the whole range of research and development aspects relating to entire NMP area, in order to present an evaluation, as balanced as possible, of the NMP in FP6.

To give an overview on how much the **"N&N" world is cross-cutting in relation to materials and processes** the evaluation team analysed the "project abstract" descriptions of all the projects financed under NMP FP6 in New Materials and New Production Processes areas. The word "nano" was used 317 times in all 120 projects descriptions for "materials" and 94 times in 86 "production" projects. The division between "what is" and "what is not" a "nano" project goes therefore much deeper into project level descriptions, and cannot be strictly defined by the split used in NMP FP6 projects' lists.

The exploitation of nanoscale phenomena is intimately linked with the development of knowledge-based materials and new production processes and devices, and it has therefore been a part of the European Commission's strategy to also explicitly address these interrelated fields with a focused set of policy and financial instruments. N&N has certainly been viewed as an important technological driver of the NMP priority, but, as previously mentioned, it is important to bear in mind that **not all new multifunctional materials and new production processes and devices need to be fuelled by nanoscale materials** phenomena; there is a wealth of new technologies that are not directly based upon the control of materials at the atomic or molecular scale.

2.2 Processes – a new-old dimension of industry

Production processes are implemented in all possible industry sectors, and incorporate a range of relevant available technologies. As a separate research area "New Production Processes" was successfully supported in the programme Competitive and Sustainable Growth as one of the four thematic programmes under the Fifth RTD Framework Programme (1998-2002). This was, however, not the first time that production was focused upon.

Innovative technologies and methodologies for improved competitiveness, leading to enhanced industrial output in product/service combinations, to the development of added value, quality and market response, and reduced time-to-market has been the focus of the mankind development from the very beginning. The first famous new production processes may be aligned with mastering of fire and various related high-temperature processes for the production of metals and ceramics. Inventing new processes continued to intensify and diversify during ancient times and through the Middle Ages. The Industrial Revolution of 18th and 19th century introduced major changes in agriculture, manufacturing, mining, and transport, and had a profound effect on the socioeconomic and cultural conditions in Europe, then subsequently spreading throughout North America, and eventually throughout the whole world. The onset of the Industrial Revolution marked a major turning point in human history; almost every aspect of daily life was influenced in some way. It started with the mechanisation of the textile industries, the development of iron-making techniques and the increased use of refined coal. Trade expansion was enabled by the introduction of canals, improved roads and railways. The introduction of steam power fuelled primarily by coal, wider utilisation of water wheels and powered machinery (mainly in textile manufacturing) underpinned the dramatic increases in production capacity.

Nowadays the micro and nano scale technologies and engineering as well as innovative industrial products and systems with improved lifecycle performances are typical examples to be considered within this area. The world is facing a rapid need to develop and exploit, especially for greater eco-efficiency and reduction of discharges of hazardous substances into the environment, leading-edge technologies for the knowledge-based products, services and manufacturing processes in the years to come.

For this reason, the FP6 Specific Programme adopted by the European Parliament[1] introducing this action in NMP FP6 defines the main research areas for new processes and devices:

- The development of new processes and flexible and intelligent manufacturing systems incorporating advances in virtual manufacturing technologies, including simulations, interactive decision-aid systems, high-precision engineering and innovative robotics;

[1] Web source http://ec.europa.eu/research/fp6/pdf/fp6_en.pdf

- Systems research needed for sustainable waste management and hazard control in production and manufacturing, including bio-processes, leading to a reduction in consumption of primary resources and less pollution;
- Development of new concepts optimising the life cycle of industrial systems, products and services.

New production processes are not, by definition oriented only to N&N. This is the part of NMP programme, which was largely oriented to non-nano research, with fewer projects using nanoscale phenomena as an enabling development platform.

2.3 Materials technology: a historical background

Materials technology and advancements in engineering

The use and processing of materials has always been one of the main driving forces behind the development and prosperity of mankind since the early days of civilization, mainly in the fields of ceramics, metallurgy and glass,[2] and more recently in an increasingly wide and complex range of different advanced materials, production processes, and integrated functional systems.

Materials science and engineering drastically intensified in the 1960s, when applications of materials became increasingly based on scientific principles rather than the empiricism that prevailed prior to World War II.[3] The materials science and engineering, as we know it today, can be described as "**the study of substances from which something else is made or can be made; the synthesis, properties, and applications of these substances**."[4] The definition covers both natural, traditional materials as well as synthetic, advanced materials which are designed by materials scientists.

Since the 1970s there has been an unprecedented expansion in the number of advanced materials, novel production processes, and devices that have entered many aspects of human life.[5] These advanced materials, which form a basis of the modern high technology,[6] include steels and other metallic alloys; super-alloys; polymers; carbon materials; optical, electronic, and magnetic materials; superconductors; technical ceramics; composites; and biomaterials. Many of them have been successfully adapted by the markets and are now utilized in a range of industries and areas, for example: the living environment, health, communication, consumer goods and transport.[7] According to the Max Planck Institute of Materials Research, "Materials science plays a key role as one of the main pillars of economic progress and social well-being in Europe and, indeed, the world as a whole."[8]

The Technical Revolution (also called the Second Industrial Revolution) in late 19th and 20th centuries is a good illustration of severely disruptive developments in manufacturing technologies. Advancements in chemical, electrical, petroleum and steel industries subsequently led to improvements in their respective application areas. As an example, the

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2 Web source: http://www.materialmoments.org/top100.html

3 Web source: http://www.accessscience.com

4 Web source: http://www.mpg.de/pdf/europeanWhiteBook/wb_materials_010_015.pdf

5 Web source: http://www.britannica.com

6 Web source: http://www.mpg.de/pdf/europeanWhiteBook/wb_materials_010_015.pdf

7 Web source: http://www.mpg.de/pdf/europeanWhiteBook/wb_materials_011.pdf

8 Web source: http://www.mpg.de/pdf/europeanWhiteBook/wb_materials_016_017.pdf

invention of the Bessemer converter enabled inexpensive mass production of steel, which itself then influenced the rapid construction of railroad systems, skyscrapers and large ships.[9]

2.4 The impact on science and technology

Historical evidence shows that man has been exploiting nanoscale-induced phenomena in materials and processes long before modern times through trial-and-error approaches. Early material workers are noted to have been using a range of materials that – through specific processing – resulted in nanostructures. As an example, recent characterisation of a 17th century sword blade made of so-called Damascus steel revealed the presence of carbon nanotubes and nanowires of cementite.[10] Medieval artisans unknowingly became nanotechnologists when making red stained glass by mixing gold and silver compounds into molten glass. This produces tiny spheres in the glass that absorbs and reflects sunlight giving red, yellow, blue, and other colours. Recently the Roman so-called Lycurgus Cup has also been identified to have decorative glassy materials with unusual optical properties, resulting from phenomena that relate to the nanoscale.[11]

When looking back, the most apparent step towards today's concept of nanotechnologies would be the famous 1959 lecture by Richard Feynman "**There is plenty of room at the bottom**", in which he described his vision regarding the crucial role of scientific instruments in creating materials and structures with novel functionalities atom by atom. 22 years after Feynman's lecture the window to the nanoworld was finally opened by two IBM researchers who invented **the scanning tunnelling microscope in 1981**, for which they were awarded a Nobel Prize in 1986. In the same year, Eric Drexler – the so-called "godfather of Nanotechnology" – put forth his vision of molecular assemblers in his book "Engines of Creation". Drexler has been regarded as a major driver in the popularisation of nanotechnology.[12]

Nanotechnology-based developments within materials, production processes and devices are now observed to complete a **20-year transition from the laboratory to market**, which is comparable to development patterns previously noted in the polymer and biotechnology industries.[13] This means that developments can increasingly be measured by a number of indicators such as publications, patents, products in the market, new companies and nanotechnology induced growth in existing companies, number of new jobs, and so forth. Further substantial increases are expected in the commercialisation of nanotechnologies; the OECD points out that there are far more publications than patents in the N&N field. When looking at nanotechnology patenting activities, the United States clearly dominates with a few geographic regions accounting for a very large share of these patents. The large European countries and Japan follow, while remaining countries account for less than 5% of all these patents. Patenting started to accelerate some 12-13 years after

[9] Web source: http://www.britannica.com/EBchecked/topic/195896/history-of-Europe/58404/The-Industrial-Revolution#ref643971

[10] Kochmann, W.; Reibold M., Goldberg R., Hauffe W., Levin A. A., Meyer D. C., Stephan T., Müller H., Belger A., Paufler P. "Nanowires in ancient Damascus steel". Journal of Alloys and Compounds 372 (2004), L15–L19

[11] The Lycurgus Cup – A Roman Nanotechnology, I. Freestone, N. Meeks, M. Sax and C. Higgitt, Gold Bulletin 40(4) (2007), 270

[12] He has, however, subsequently been largely ridiculed by the scientific community, for the reason that some of his predictions more than 20 years after the book was released still belong to the realm of science fiction.

[13] Lux Research: The Nanotechnology Report, 5th edition.

key enabling inventions in nanoinstrumentation were made, which bears some resemblance to patenting trends found within the field of biotechnology.[14]

In a book from 2006, Berube, a researcher funded by the National Science Foundation in the US, reached the conclusion that much of what is branded as "nanotechnology" was in fact upfront materials science with a new label, and was worried that this could lead to a "*nanotech industry built solely on selling nanotubes, nanowires, and the like*" which would "*end up with a few suppliers selling low margin products in huge volumes*."[15] Studies of recent patenting activities indicate that **nanomaterials indeed account for the largest part (38%) of the grand total of patents** in the period 1995-2005, but patenting has simultaneously taken place within higher margin product development such as in the fields of nanoelectronics (25%), nanobiotechnology (13%), nanooptics (11%), nanoinstrumentation (9%), and nanomagnetics (4%).[16]

This complexity of research areas, technologies and final industry products is reflected in **many different market size estimations** that differ so much due to methodologies used for prognosis (See Figure 1).

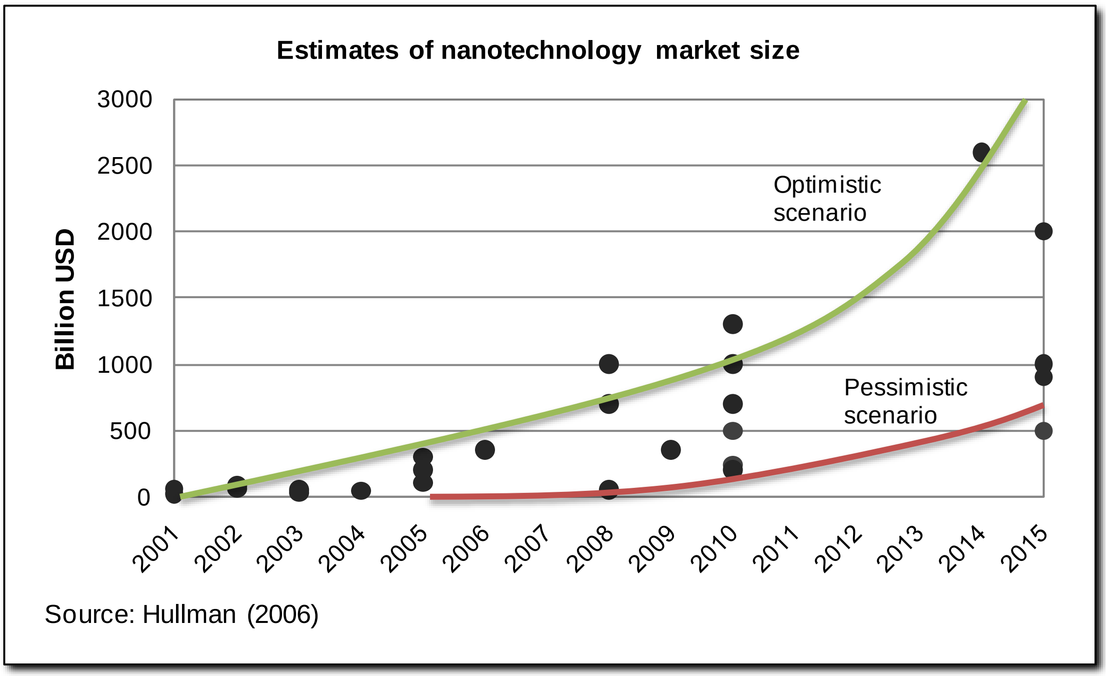


Figure 1. Estimates of nanotechnology market size: Scenarios on the basis of 17 sources (in US$ billion) Source: Hullmann (2006). Black points on the chart indicate market size estimations form different studies.

Market analysts face difficulties in measuring nanotechnology development and its impact. Due to problems in defining what is a nano-based or nano enhanced product, market size estimates differ to large extent. Nanotechnology seems to be rather a platform, or **so-called general purpose (or "enabling") technology**, that is simply used in many different industries (similarly to ICT). *"If nanotechnology could develop into such a general purpose*

[14] Palmberg, C., Dernis, H., and Miguet, C. Nanotechnology: an overview based on indicators and statistics. OECD (2009).

[15] Berube, David. Nano-Hype: The Truth Behind the Nanotechnology Buzz, Amherst, NY: Prometheus Books (2006).

[16] OECD 2009, 56

technology previous experience suggests that the effects on productivity and economic growth could be significant even though these may sometimes come with a more significant time lag" (Helpman, 1998).

A US-based research programme (the Project on Emerging Nanotechnologies – PEN) at the Woodrow Wilson International Center for Scholars keeps track of the nanotechnology-based products currently available in the market place. The number of nanoproducts in the market has increased from 54 in March 2005 – when the measurements started – to 1015[17] in August 2009.[18] This is a great percentage increase in a short time period, but the number of products must still be viewed as low considering the amount of R&D spending that goes into this field of research.

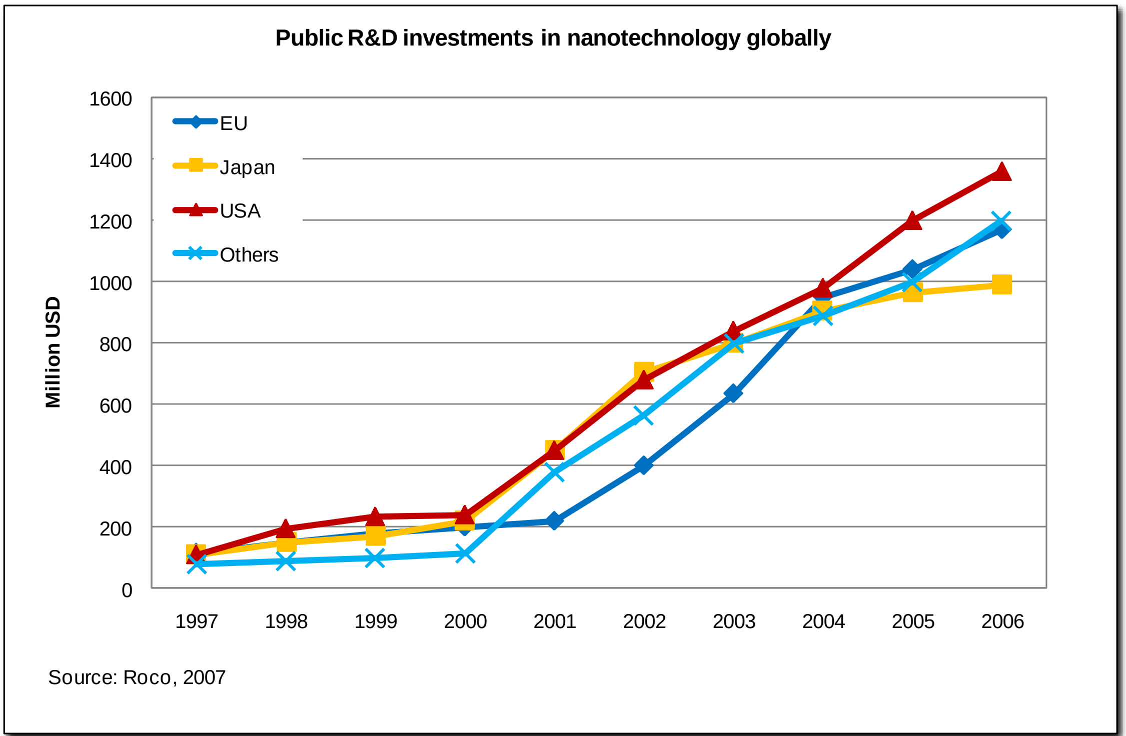


Figure 2. Public R&D investments in nanotechnology globally. Source: (Roco, 2007).

As presented on Figure 2 the important rise in worlds' spending in the area was started in 2001 after introduction of the US Nano initiative. During the period 2001-2003 EU was lagging behind US and Japan in terms of the allocations. From 2004 to 2006 (end of FP6 allocation) key players in the field spent very similar amounts, but still the leading role of USA can be seen. Another significant fact which can be observed from this figure is the fact that during FP6 implementation period EU allocations were multiplied 6 times in value (from around 200 mln to 1,2 bln USD)! Taking this into consideration the issues connected with commercialization of research results are an important part of this evaluation study.

2.4.1 The emergence of nanotechnology clusters

Recent empirical social science research indicates that geographical agglomeration of resources takes place within N&N as with other high-tech fields, such as, e.g., biotechnology. However, there is evidence (see case studies in Chapter 9) that NMP calls

[17] This figure is only demonstrating products identified as nano-based by their manufacturers. This number also does not take into account the many commercial and industrial uses of nanotechnology and nanomaterials that can currently be found on the market.

[18] www.nanotechproject.com

for an even greater degree of co-ordination than has previously been the case, of converging research disciplines in brand new spheres of investigation, and of new connections between start-ups, regional actors and public research institutes. One key issue regarding NMP is **the phenomenon of technological agglomeration**, that is, co-located scientific and technological fields associated to co-ordinated technology platforms to some extent actively shaped by institutional entrepreneurs. Such co-location and co-ordination are interpreted as being crucial for the emergence of vigorous nanotechnology clusters.[19]

2.4.2 Ethical aspects

In 2003 researchers suggested that the existing lag between NMP area and ethics needed to be immediately closed – noting that there was a deficiency of serious publications dealing with the societal impacts – if a halt on the deployment of nanomaterials was to be avoided.[20] More recent research shows that while the identification of these and related issues gave rise to feverish social science research activities that are spawning a wealth of publications, a new gap has been created between real current scientific incremental activities and 'speculative ethics' that are too futuristic. Two approaches are recommended to close this gap: a) the attempt to distinguish and scrutinize predictions that are sufficiently conceivable to deserve reflection and further action, and b) recognize that there are various sub areas of nanotechnology that differ immensely from one another in terms of applications and hence ethical aspects.[21] Doing this would **enable a more efficient governance of nanotechnologies and meaningful public debate**.

The European Commission aims to also take ethics and other social aspects of NMP field into consideration through its Nanotechnology Action Plan.[22]

There is a reasonably wide experience with regard to this process from the regulation of biotechnology public debate in Europe. Interest groups at national and European levels have succeeded in getting ecological, ethical and social considerations on the biotechnology agendas of the various legislative bodies involved. Because of the many concerns which are being taken into account, European regulation was developing slowly, in the meantime leaving an uncertain environment for the biotechnology industry. The outcome, however, is an internationally unprecedented set of new regulations[23]. This approach seems to appear also in NMP field, but the process is only just starting.

[19] Robinson, D. K. R., Rip, A., Mangematin, V. Technological agglomeration and the emergence of clusters and networks in nanotechnology. Research Policy 36 (2007), 871–879.

[20] Mnyusiwalla, A., Daar, A. & Singer, P. TUTORIAL 'Mind the gap': science and ethics in nanotechnology. Nanotechnology 14 (2003), R9–R13.

[21] Nordmann, A., and Rip, A. Mind the Gap revisited. Nature Materials 4(5) (2009), 273-274

[22] *Web source: http://cordis.europa.eu/nanotechnology/actionplan.htm*

[23] Peter Commandeur, Pierre-Benoit Joly, Les Levidow, Beatix Tappeser, Fabio Terragni, Public Debate and Regulation of Biotechnology in Europe, Biotechnology and development monitor, 1996.

Chapter 3. NMP in FP6

This chapter drafts a picture of the thematic priority, starting with contextual background and later presenting facts and figures about NMP in FP6 analysing different dimensions including countries participation, participants' characteristics, instruments and action types as well as application statistics.

3.1 Thematic priority

The NMP constitutes an important research priority; through this the European Commission supports the **transformation of European industry from a resource-based into a knowledge-intensive one that produces high value products**. This in turn is crucial to enable the creation of new industries, and to meet customer requirements as well as growth, environmental, health and other societal expectations.

The disruptive innovations that may arise from NMP could result in **a completely new set of industries as well as transform current technologies in manufacturing**, healthcare, electronics, and communication. For this reason, the EU – with FP6 – has wished to focus strongly on developing these potentially revolutionary industrial technologies, along the lines of worldwide research policy priorities around the industrialised world, particularly in the US and Japan. This was also in tune with objectives embraced by the Lisbon Agenda; to make the EU the most dynamic and most competitive knowledge-based economy within 10 years.

NMP in FP6 constitutes only a part of the world's public engagement in nanotechnologies, new materials, new production processes and devices, although precise measurement of public investment in this area is very difficult. This is due to the fact that many national measures are open to a wide scope of research areas, and presentation of data relevant only to NMP related fields is simply difficult to measure precisely.

The Sixth Framework Programme for Research and Technological Development, which ran between 2002 and 2006[24], represented a previously separately unmatched focus on nanotechnology, new production materials and new production processes and devices in Europe. Of the programme's EUR 17.5 billion budget (a 17 percent increase over the previous framework), EUR 1.4 billion was earmarked specifically for research in NMP. It should also be noted here, that simultaneously nanotechnology was also at the heart of two other priorities of the Sixth Framework Programme; genomics and biotechnologies for health, and information society technologies.

The NMP thematic priority focuses on the following demanding areas:

- Nanotechnology – studying phenomena and manipulation of matter at the nanoscale and developing nanotechnologies leading to the manufacturing of new products and services – a flagship for the next industrial revolution;

[24] *Around ¼ of all projects financed under this programme is still under implementation.*

- Multifunctional knowledge-based materials – developing fundamental knowledge; using the technologies associated with the production and transformation, including processing of knowledge-based multifunctional materials and of biomaterials as well as support for engineering – all those as important innovation drivers;
- New production processes and devices – creating conditions for continuous innovation and for developing generic production technologies, organisation and production facilities as well as human resources, while meeting safety and environmental requirements – the answer to sustainable development.
- Integration of technologies for industrial applications – focusing on new technologies, materials and applications to address the needs identified by the different European Technology Platforms

The underlying objective was **to move towards a knowledge-based and more environmentally friendly industry** through an integrated approach combining materials science, nanotechnology, production technologies, information technologies, biotechnologies, and so forth. It was hoped that the integration of the three areas would enable an efficient **transformation from resource-based to knowledge-based European industries**. The capacity to move towards knowledge-based products and processes also relates to:

- Breakthroughs in new applicable knowledge and long-term RTD;
- Wider scope for industrial research (environment, health, energy, employment, education & training, legal and financial aspects, science and society);
- Ensuring multi-disciplinary, cross-sector and life-cycle approaches;
- Integration of actors, sectors, expertise, disciplines, technologies, activities, funds.

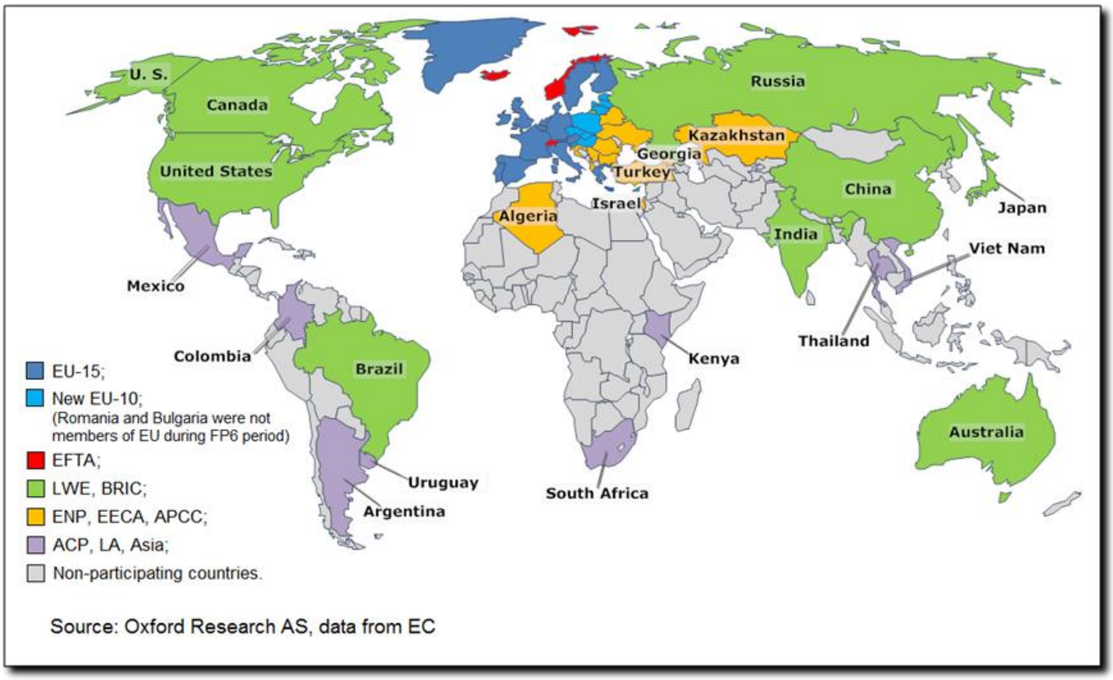
This focus was possible by implementing with a wide selection process of projects for financing under NMP FP6, based on a number of instruments together with extended information systems and partner search facilities.
The range of this intervention is described in following sub-chapters.

3.2 NMP in facts and figures

Data presented in this chapter depicts allocation of the thematic priority with different dimensions.

3.2.1 Countries and participants

Framework programmes were designed to be implemented mostly within EU and the associated countries. Still NMP in FP6 managed to cover a wide variety of countries due to wide project partnerships, engaging scientists from different institutions all over the world. A closer look at the allocations with regard to this international co-operation (see Chapter 11.10) demonstrates that this was rather an inter-European programme, not really concentrating on close co-operation with key international actors in the field. The details of allocation indicate that **most of the resources were spent in EU and EFTA countries.** Co-operation with USA and Asiatic countries was not in the focus at all. Other countries appearing in project consortia do not play an important role in the implementation of the programme. The map below presents the overview of countries represented with at least one institution in project implemented under NMP FP6.



Note: for details about European participants see Figure 6

Figure 3. World map demonstrating countries represented in NMP FP6 projects. Source: Oxford Research AS, data from EC.

Overview of EC contribution per country group

The overall programme budget will be known after the implementation of all projects have been completed (in August 2009, 25 % of all projects were still "running"). We may work here with two important numbers – Total programme costs (including partners own share required) amounted to 2 344 million EUR. The **total EU contribution for all 389 projects financed under NMP FP6 amounts to EUR 1 442 million**.

Countries with the largest total project costs were mainly the EU-15 countries (older Member States) with two exceptions: Switzerland (EFTA) and Poland (New EU-10). Five EU-15 countries – Germany, France, Italy, the United Kingdom and Spain – together amounted to more than half (62%) of all FP6 NMP project costs. Almost identically, countries with the largest total EC contributions were also mainly from the EU-15 countries (older Member States) with the same two exceptions: Switzerland and Poland. The same **five EU-15** countries – Germany, France, Italy, the United Kingdom and Spain – together **amounted to more than half (61%) of all EC contributions**.

This is not surprising, taking into consideration economic potential of those countries- their GDP equals to 71% of the entire EU-27.[25]

[25] EUROSTAT 2008, http://epp.eurostat.ec.europa.eu/

This pattern was also confirmed exactly when comparing the above data to European countries total R&D expenditure[26], where first 10 biggest actors in the field are exactly the same, with very small differences in values compared to split presented on Figure 4. Again here Germany, France, Italy, the United Kingdom and Spain amount there to a total of 68 % of EU-27 expenditures (see Figure 126 in Appendixes). In terms of R&D intensity as a percentage of country GDP the ranking is shaped differently. In 2007, R&D intensity was highest in Sweden (3.60% of GDP) and Finland (3.47%), followed by Austria (2.56%), Denmark (2.55%) and Germany (2.54%). The highest increases in R&D intensity between 2001 and 2007 were found in Austria (from 2.07% of GDP to 2.56%), Estonia (from 0.71% to 1.14%) and Portugal (from 0.80% to 1.18%). If such tendencies continue, this last indicator may possibly influence future appearance of the last two listed countries among the more substantial beneficiaries of framework programmes.

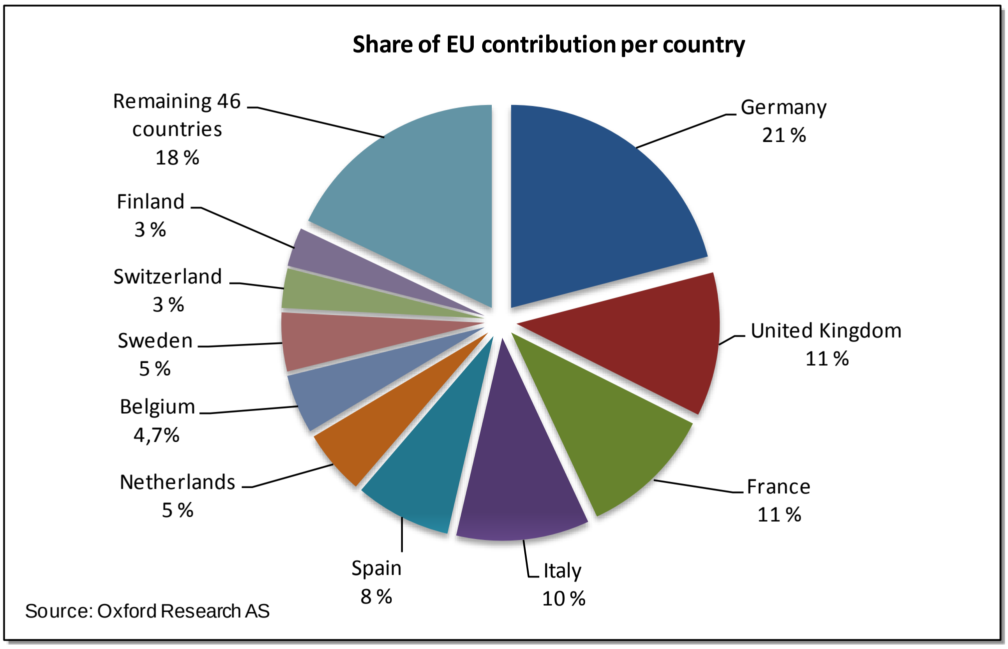


Figure 4. Share of EU contribution per country-overview, Source: Oxford Research AS, data from EC.

In summarising the detailed costs analysis (see: Table 113 and Table 114) it can be said that the **EU-15 countries clearly stand out for having the absolute majority (97%, or EUR 1283 million) of the total EC contribution**. This share is showing again the relative importance of this group for the entire research priority, as it is bigger than their respective GDP share (92 % of the whole EU-27[27]).

The New EU-10 countries were the second largest group however with a much more modest share of total EC contribution (4.14%, or EUR 60 million), ranging from 3% in IP to 8% in NoE. Poland was allocated the largest amount in this group (EUR 25 million).

Not far behind from the New EU-10 were EFTA countries with 3.95% or EUR 57 million of total EC contribution, ranging from 4% in CA, IP and SSA projects to 9% in NoE. Switzerland had its EC contributions peaking to over EUR 45 million.

[26] EUROSTAT news release 127/2009 - 8 September 2009

[27] EUROSTAT 2008, http://epp.eurostat.ec.europa.eu/.

Table: Allocations per countries group			
Groups of countries	Total projects costs per country	Total EU contribution per country	Group share in EU contribution
A	B	C	D=C/total column C
EU-15	2 071 728 971	1 282 513 863	88,9 %
New EU-10	94 148 137	59 759 621	4,1 %
EFTA	115 503 886	57 318 839	4,0 %
LWE	1 653 212	82 500	0,0 %
BRIC	11 597 276	8 666 529	0,6 %
ENP, EECA, APCC	45 662 210	31 729 469	2,2 %
ACP, LA, Asia	4 113 868	2 419 169	0,2 %
Total	2 344 407 560	1 442 489 990	100,0 %
Source: Oxford Research 2009, data from EC.			

Table 5. Allocations per groups of countries. Source: Oxford Research AS, data from EC.

The map below (Figure 6) depicts European actors active in the programme with colours indicating the size of allocation and charts indicating relative importance of the country with regard of number of co-ordinated projects.

Figure 6. Map of NMP FP6 participants in Europe demonstrating budget allocations (colours) and number of co-ordinated projects (with indicative mini-charts per country). Source: Oxford Research AS, data from EC.

All above presented data indicate clearly that NMP FP6 was to a large extent "old members club" programme, with some "newcomers" trying to appear, but not necessarily important in financial terms.

3.2.2 Instruments used

Instruments implemented in FP6 NMP

The list of instruments used in FP6 NMP comprised of: Integrated Projects (IP), Networks of Excellence (NoE), Specific Targeted Research Projects (STREP; abbreviated also as STP), Co-ordination Actions (CA), and Specific Support Actions (SSA). Each instrument has a distinctive set of objectives[28]:

- **Co-ordination Actions (CA)** aim to strengthen the links between national, regional and EC RTD projects. They are intended to promote and support the networking and co-ordination of research and innovation activities. They cover activities such as: conferences, studies, exchange of personnel, exchange and dissemination of good practices, setting up common information systems and expert groups.
- **Integrated Projects (IP)** are instruments designed to support objective-driven research, where the primary product is new knowledge. IPs are multi-partner projects that bring together a critical mass of resources to reach ambitious goals aimed either at increasing Europe's competitiveness or at addressing major needs in society.
- **Networks of Excellence (NoE)** are designed to strengthen scientific and technological excellence on a particular research topic. They are multi-partner projects that integrate at European level the critical mass of resources and expertise needed to provide European leadership and to be a world force in a given domain.
- **Specific Support Actions (SSA)** aim to prepare future research activities, roadmaps and scenarios. These projects aim to contribute actively to the implementation of activities of the work programme, the analysis and dissemination of results or the preparation of future activities, with a view to enabling the Community to achieve or define its RTD strategic objectives.
- **Specific Targeted Research Projects (STREP or STP)** are at "frontiers of research" and aim to support long-term innovation and transformation of industry. They can be implemented in one or both of two forms: 1) a research technology development project designed to gain new knowledge either to improve existing or develop new products, processes or services; 2) a demonstration project designed to prove the viability of new technologies.

NMP FP6 also launched a new class of Integrated Projects dedicated for SMEs (IP SMEs)[29], which provided high-tech SMEs an opportunity to have a leading and decisive role in an IP and aimed to serve the needs of SME-intensive industrial sectors. Some of the specific conditions for IP SMEs were a required minimum threshold of 50% SME partnership and a majority vote in a decision making structure.

NMP FP6 also enhanced cross-functional collaborations with other priorities through dedicated co-ordinated calls.

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[28] Web source: http://www.tacticaltech.org/files/tacticaltech/fp6-guide.pdf

[29] Web source: ftp://ftp.cordis.europa.eu/pub/nmp/docs/eag_position_paper_en.pdf

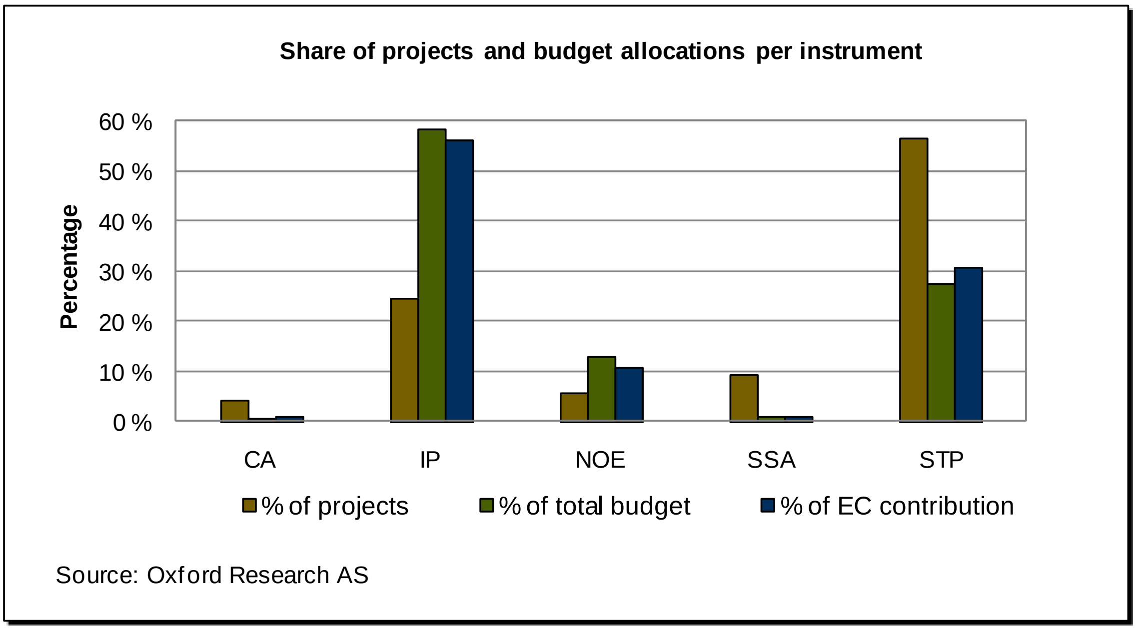

Figure 7. Share of projects and budget allocations per instrument. Source: Oxford Research AS, data from EC.

The majority of the projects 57% (220 projects) of all FP6 NMP projects (389 projects) were financed under STP. A significant share (24%) of projects was under IP. This allocation of resources indicates that research result-oriented instruments **(IP and STP) were largely in focus,** compared to more "networking" instrument types (CA, NoE and SSA). It seems that that the set-up of work programmes (presented in Appendixes in Table 130) influenced to large extent the selection of instruments by project consortia.

Apparently, the selection of available instruments changed over the work programmes in NMP FP6 in different research topics (see Appendixes, Table 131). Networks of Excellence were totally discontinued. CAs were largely reduced and SSAs appeared widely only in second workprogramme. Both IPs and STPs were widely available in all work programmes, across most of calls for proposals. This resulted in the final split of projects implemented (see Figure 8). Projects financed under these two instruments have also substantial budget allocations, which is clearly due to their effect-oriented, high-cost nature.

Therefore the process of planning of work programmes influenced to large extent the final money split and, as a consequence, also possible outcomes and outputs of the entire programme. The expected results coming out from projects financed under diverse instruments vary to large extent, depending simply on differences in instruments' purpose and character, as described above.

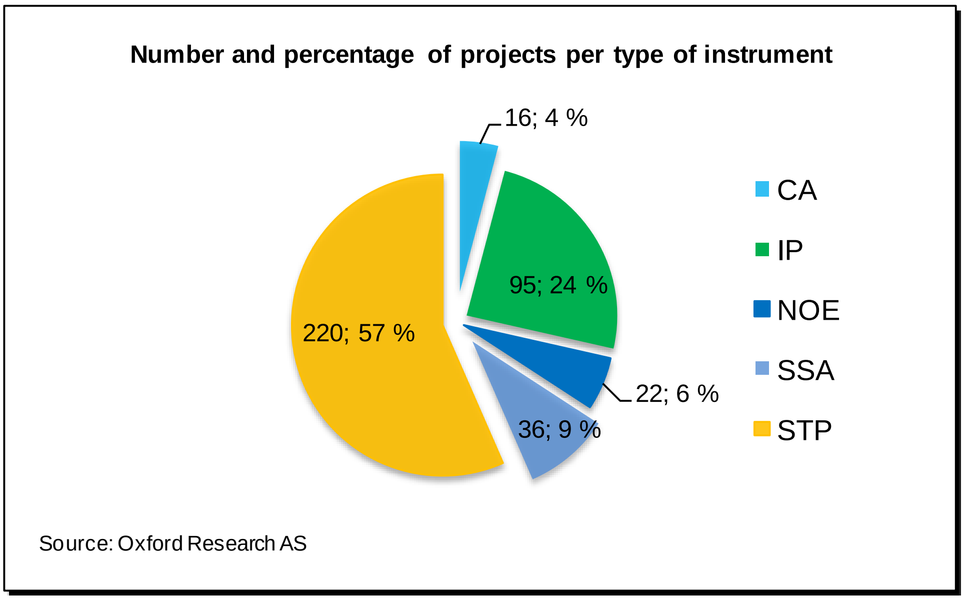

Figure 8. Number and percentage of projects per type of instrument. Source Oxford Research AS, data from EC.

Additional information to the previous paragraph with regard to participation structure is also relevant in this context. An average number of partners per project were the highest under IP (30) and CA (26), and the lowest under SSA (7), whilst an average number of partners per project for all instruments was 15. The majority (48%) of all project partners were under IP. A significant share (34%) of all partners was under STP. This subject of how the issue of a number of project participants in different instruments influenced the implementation of projects is discussed in later parts of this report (see Chapter 7.2).

Integrated Projects (IP) amounted to more than half (58%) of total project costs. Naturally, they also attracted more than half (56%) of all EC contributions. Detailed information is presented in the Table 9.

Table: Allocations of total project costs and EC contribution for different instruments

Instrument	Total costs (euro)	EC contribution per instrument (euro)	Share in NMP total cost per instrument (%)	EC contribution to total costs per instrument (%)	Share in participants contribution per instrument (%)	Share of EC contribution per instrument (%)
A	B	C	D=B/total column B	E=C/total column C	F=100%-G	G=C/B
CA	16 701 913	15 550 545	1 %	1 %	7 %	93 %
IP	1 366 828 583	812 535 742	58 %	56 %	41 %	59 %
NoE	297 944 376	157 221 743	13 %	11 %	47 %	53 %
SSA	18 464 020	14 712 498	1 %	1 %	20 %	80 %
STP	644 468 668	442 469 462	27 %	31 %	31 %	69 %
Total	2 344 407 560	1 442 489 990	100 %	100 %	38 %	62 %

Source: Oxford Research 2009

Table 9. Allocations of total project costs and EC contribution for different instruments. Source: Oxford Research AS, data from EC.

Due to differences in the character of the instruments used and also due to participation structure, the level of financing from EU budget between them was to some extent different.

Networks of Excellence (NoE) had the lowest (53%) and Co-ordination Actions (CA) had the highest (93%) share of their project costs financed by the EC.

Another important view on how the priority was structured is related to action types, demonstrating the thematic activities covered by the projects, as presented in the chapter below.

3.2.3 Actions in thematic priority

During the implementation research foci considered for funding NMP research areas were divided into following action types:

- Nanotechnologies and nanosciences (coded as "action type" NMP-1),
- Knowledge-based Multifunctional Materials (coded as NMP-2),
- New Production Processes and Devices (coded as NMP-3),
- Integrating NMP-1, NMP-2 and NMP-3 (coded as NMP-4),
- Cross-cutting activities (coded as NMP-5),
- Nanotechnologies and nanosciences, knowledge based multifunctional materials and new production processes and devices (coded as NMP),
- Applied IST research addressing major societal and economic challenges (Coded IST-1).

At the stage of application preparation each of the projects was defining its primary and secondary priority action type. The data presented below refer to primary project action type recorded from the applications.

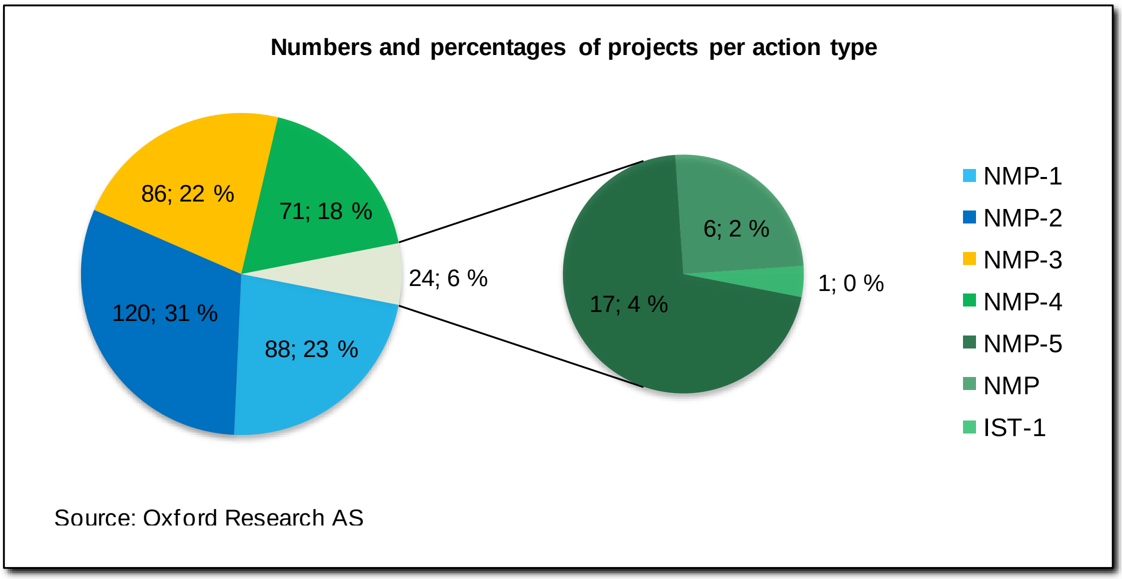

Figure 10. Number and percentage of projects per action type. Source: Oxford Research AS, data from EC.

Due to relatively close character and low representation of sub-areas coded: IST-1, NMP, NMP-5 will also be presented within category "Rest (grouped)" in following analyses.

The significant factor, which might be observed from Figure 11, is the relative importance of action types in the programme. The total share of EC contribution per Action coded NMP-2, NMP-3 and NMP-4 was around 27-28%. NMP-1 had a lower share of 18%.

NMP-1 was not the most important in terms of direct allocations and number of projects financed. Only connected with integrating and cross-cutting actions allocation, and together with some of the projects in NMP-2 and NMP-3 which were using nano-dimension technologies as enabling technology, the whole N&N related allocation can be properly estimated. The same issue was discovered by the evaluation team when analysing MS allocations of relevant research programmes. The precise possibility to distinguish between nano and non-nano allocation do not really exist, since in many cases materials and processes are not even mentioned in MS programmes split, but still they appear on the lists of projects financed.

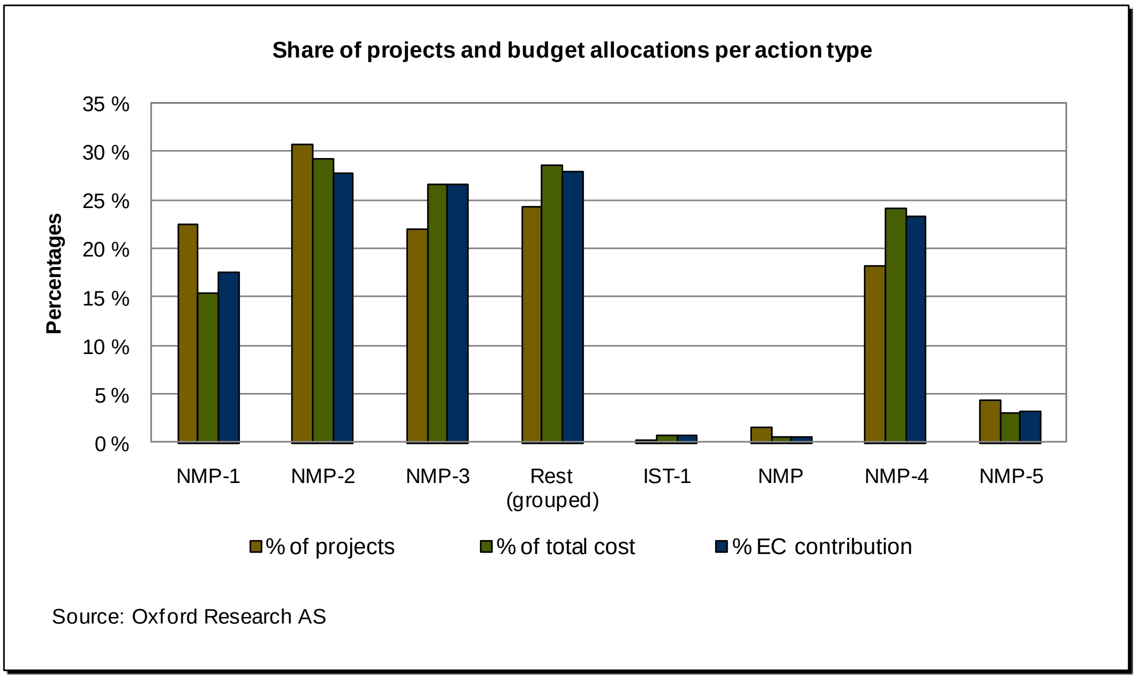

Figure 11. Share of projects and budget allocations per action type. Source: Oxford Research AS, data from EC.

Another finding from this analysis is the relative small importance of actions coded IST-1, NMP, NMP-5; since they had so few projects financed, therefore it would not be not possible to provide statistically sound data with regard to their possible impact on programme objectives. The details of allocations per action type are presented in Table 12.

Table: Allocations of total project costs and EC contribution for different action type						
Subarea	Total costs (euro)	EC contribution per action (euro)	Share in NMP total cost per action type (%)	Share in total EC allocation per action type (%)	Share in participants contribution per action type (%)	Share of EC contribution per action type (%)
A	B	C	D=B/total column B	E=C/total column C	F=100%-G	G=C/B
NMP-1	**362 617 458**	**254 371 924**	15 %	18 %	30 %	70 %
NMP-2	**687 085 152**	**400 887 758**	29 %	28 %	42 %	58 %
NMP-3	**624 191 410**	**383 589 744**	27 %	27 %	39 %	61 %
Rest (grouped):	**672 663 654**	**403 640 565**	29 %	28 %	40 %	60 %
IST-1	*18 029 321*	*10 709 183*	1 %	1 %	41 %	59 %
NMP	*14 432 198*	*7 981 465*	1 %	1 %	45 %	55 %
NMP-4	*569 016 554*	*337 836 925*	24 %	23 %	41 %	59 %
NMP-5	*71 185 581*	*47 112 992*	3 %	3 %	34 %	66 %
Total	**2 346 557 674**	**1 442 489 990**	**100 %**	**100 %**	**39 %**	**61 %**
Source: Oxford Research 2009, data from EC.						

Table 12. Allocations of total project costs and EC contribution for different NMP-sub-areas, Source: Oxford Research AS, data from EC.

In the next sub-chapter a view on participations structure is presented.

3.2.4 Overview of co-ordination and participation

A majority (92%) of the project co-ordinators were from the EU-15 countries (356 co-ordinators), which is more than 20 times more than the number of co-ordinators from the EU-12 (new Member States) (13 co-ordinators), or the number of co-ordinators from the EFTA countries (15 co-ordinators). Countries outside of the EU-27 and EFTA had only 5 project co-ordinators in total (3 from Israel and 2 from Turkey).

This again confirms the finding of NMP FP6 being a rather closed programme addressed for the experienced players as co-ordinators. Almost the same pattern with regard to leading countries and their share in project co-ordination is applied as for the presented financial split (see Figure 13 and Figure 4).

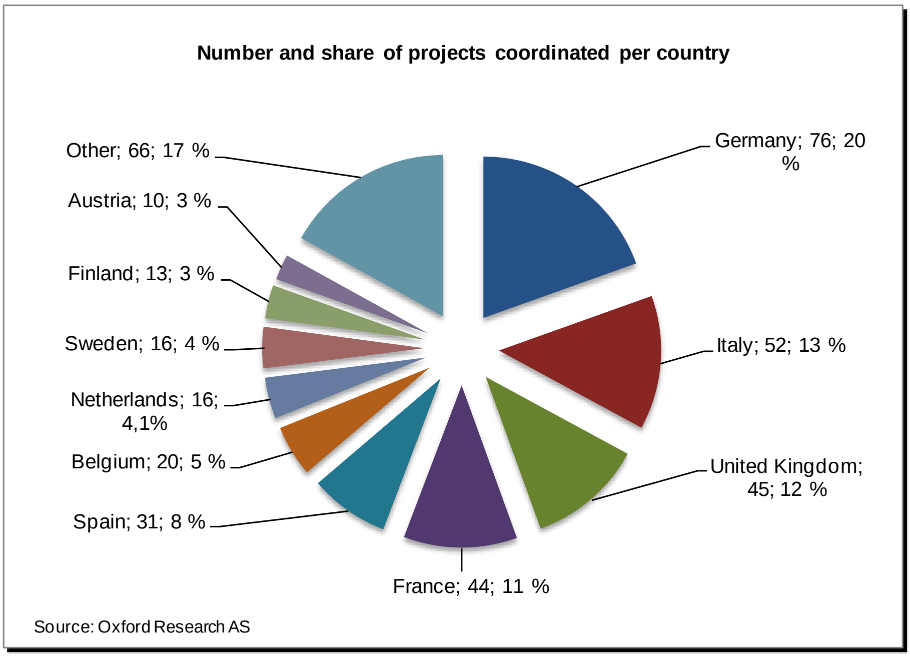

Figure 13. Number and share of project co-ordinated by country, Source: Oxford Research AS, data from EC.

A majority (93%) of all NMP FP6 project participants (5487 participants[30]) were acting as project partners (5108 partners), which gives an average of 13 project partners for each co-ordinator.

Number of participants per project instrument is an important factor influencing consortia ability to reach project expected results, which are different in nature with regard to each of the instruments used. 3 projects financed under NMP priority had more than 50 partners, a large percentage- 31 projects had more than 30 partners in the consortia and 96 projects, 25% of all projects' consortia were built with more than 20 partners.

Table: Average number of participants per instrument	
Subarea	Number of participants
A	B
CA	23
IP	26
NoE	20
SSA	7
STP	9
Average	14
Source: Oxford Research 2010, data from EC.	

Table 14. Average number of participants per instrument, Source: Oxford Research AS, data from EC.

Number of participant in projects was considered to be an issue for the general project management efficiency, but, what is more important, for projects' ability to reach planned results. For more "networking" instruments like SSA, CA and NoE it is less important, but for instruments with the purpose of developing new knowledge (IP and STP) this factor is sensitive.

[30] The number presented here is lower than indicated by full list of participants listed in Commission database (5525) as the data were reviewed and clarified, this resulted in reduction of the full list.

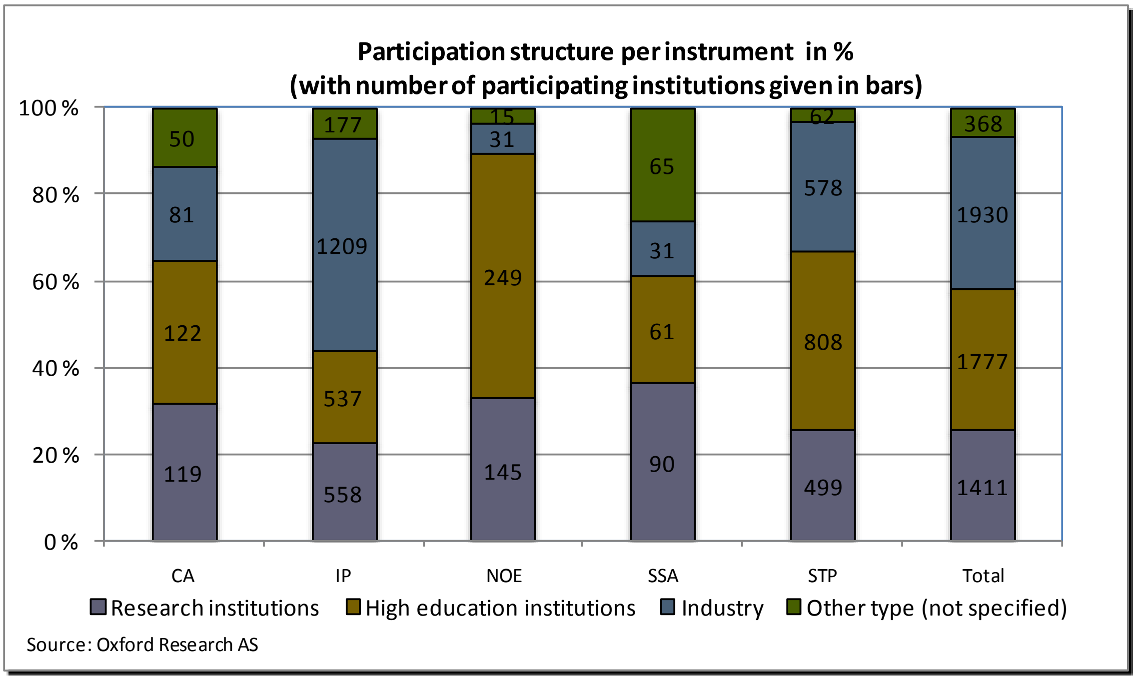

Figure 15. Participation structure per instrument in %, Source: Oxford Research AS, data from EC.

Figure 15 provides an interesting overview of information about the significant differences in structure of participating organizations per instrument. **NoE and to large extent STP were clearly dominated by high education institutions**, while IPs by research institutions. The important factor influencing entire FP6 is the relatively large participation of academic (research& education) institutions in most of the instruments, which is natural in research programmes. On the other hand the high participation factor for industry in the entire NMP FP6, and especially in IP must be underlined here (comparing to other priorities). The average industry participation in FP6 was estimated on a level of 19% of all participations and 18% of EC funding. NMP with its overall 35 % engagement of industry is definitely standing out. Special attention should be given to the fact that **industry has taken most of the EC financial contribution in Integrated Projects**.

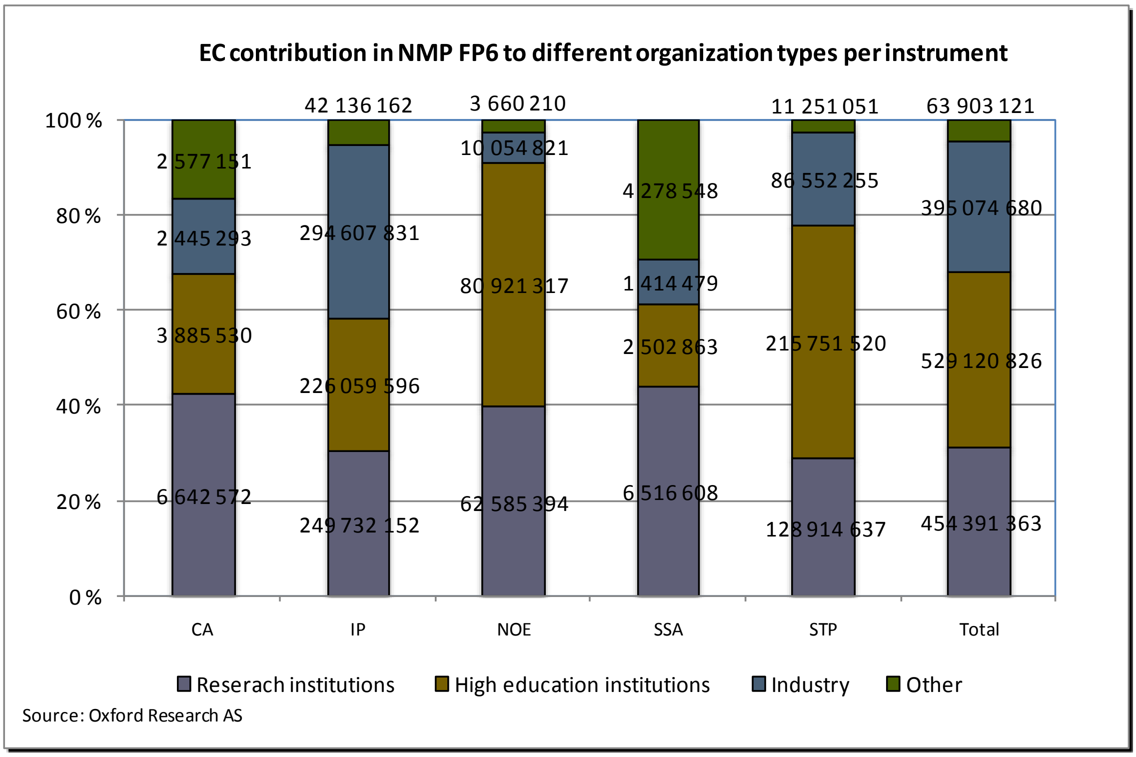

Figure 16. EC contribution in NMP FP6 to different organization types per instrument. Source: Oxford Research AS, data from EC.

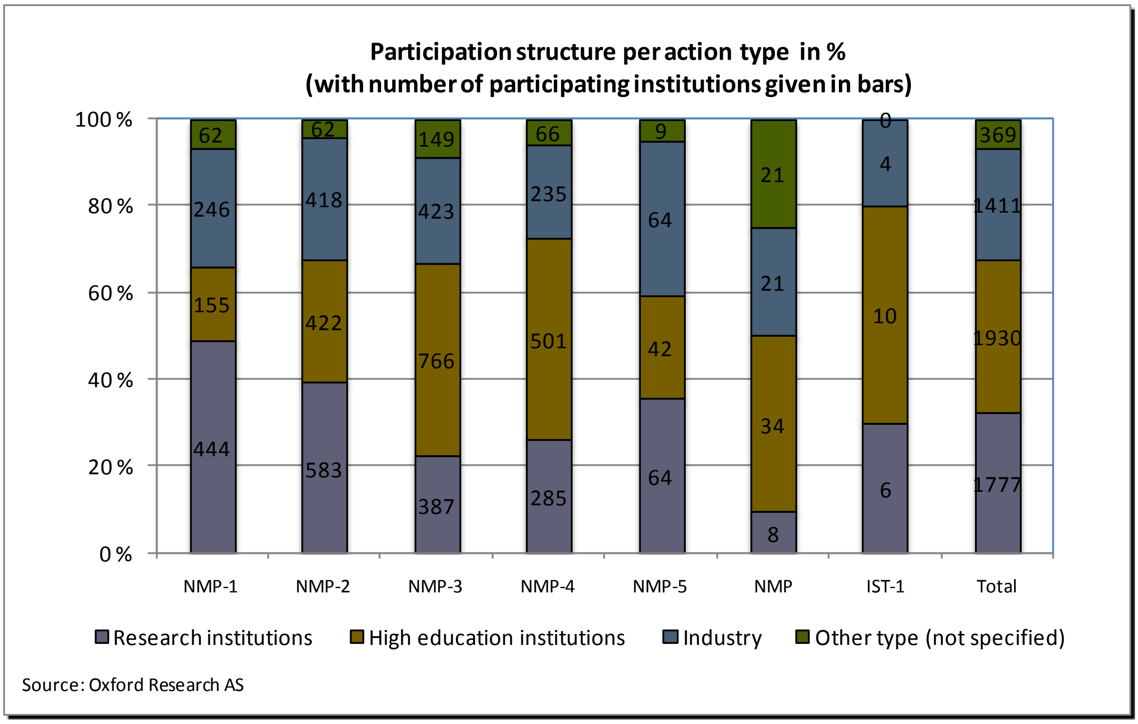

Figure 17. Participation structure per action type, Source: Oxford Research AS, data from EC.

One factor from the structure of participants was very important from the political point of view, when referring to strategic documents. This was the participation of SMEs in the FP6 projects. Comparing ICT priority in FP 6 (reaching over 20 % of the SMEs participating in the research projects[31]), the results of NMP priority was worse (only 13 % of participating institutions were flagged as SMEs).

The **average share of SMEs participating in FP6 NMP projects was only around 11 %** in the EU-27, 13% in EFTA countries, and 10% in the rest of the countries. Out of all 57 countries participating in FP6 NMP projects, only 9 countries (Malta, Greece, Ireland, Israel, Estonia, Switzerland, Turkey, Belgium and Czech Republic) have met the target 15% of SME participation established in FP6[32].

With regard to action type, the desired share of SMEs participation was met under IP instrument probably only due to the introduction of dedicated IP for SMEs. The remaining instruments were below the desired ratio with high underrepresentation in Co-ordinated Actions and Networks of Excellence (3 and 6% respectively), as those types of projects were more "academic" in their dimension.

With regard to action split SMEs were highly active in new production processes and devices (coded NMP-3) as well as in actions designed for integrating the three main areas (coded NMP-4 and NMP). In pure N&N projects and new production materials (coded NMP-1 and NMP-2) the share was much lower than expected, reaching only 9% in both action types.

[31] Information Society Research and Innovation: Delivering results with sustained impact, Evaluation of the effectiveness of Information Society Research in the 6th Framework Programme 2003-2006, May 2008.

[32] COM(2009) 210 final of 29.4.2009, p. 6. Web source: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0210:FIN:EN:PDF

Table: SMEs participation per action type and instrument			
Action type	Number of participating SMEs	Number of all participating institutions	Share
IST-1	3	20	15 %
NMP	32	84	38 %
NMP-1	85	907	9 %
NMP-2	136	1485	9 %
NMP-3	283	1725	16 %
NMP-4	183	1087	17 %
NMP-5	11	179	6 %
Instrument	Number of participating SMEs	Number of all participating institutions	Share
CA	24	372	6 %
IP	484	2481	20 %
NoE	11	440	3 %
SSA	29	247	12 %
STP	185	1947	10 %
Total	**733**	**5487**	**13 %**
Source: Oxford Research 2009, data from EC.			

Table 18. SMEs participation per action type and instrument. Source: Oxford Research AS, data from EC.

3.2.5 Application process

Another important dimension of a programme is the availability of resources and success rate for applicants. NMP FP6 was very popular taking into consideration the high application rate. Each call for proposal announced during the programme implementation resulted in large over submission of project proposals.

On average **almost 8 times more proposals were submitted than projects accepted** (NMP overall success rate was 13 %, compared to 18% for entire FP6). The data available for the entire FP6 show that average time-to-contract (TTC) is 384 calendar days, 50% of FP6 contracts were signed within 365 calendar days from the call deadline, 75% of FP6 contracts were signed within 454 calendar days (approx. 15 months)[33].

As stated in the document "Ex-post Evaluation of the Sixth Framework Programmes for Research and Technological Development 2002-2006"[34] EC "*should engage external help to review its procedures (...) with specific targets including reducing the 'headline' time-to-contract indicator by 50%*".

Under NMP FP6 16 different calls were organized. More details with regard to call context are presented in the Appendices in Chapter 11.9. (from Table 117 to Figure 122).

[33] CEC, DG Research, Management Reporting and Data QualityFP6 Final Review: Subscription, Implementation, Participation, Brussels, June 2008.

[34] CEC Expert Group. (2009). Ex-post Evaluation of the Sixth Framework Programmes for Research and Technological Development 2002-2006. Report. February 2009.

Table: Applications and success rate per call for proposal					
Call Identifier	Total evaluated projects	Number of accepted projects	Number of rejected projects	% of accepted projects	% of rejected projects
FP6-2002-IST-NMP-1	132	8	124	6 %	94 %
FP6-2002-NMP-1	863	118	745	14 %	86 %
FP6-2002-NMP-2	37	7	30	19 %	81 %
FP6-2003-ACC-SSA-NMP	35	9	26	26 %	74 %
FP6-2003-ADHOCSUBV	2	2	0	100 %	0 %
FP6-2003-NMP-NI-3	159	23	136	14 %	86 %
FP6-2003-NMP-SME-3	86	12	74	14 %	86 %
FP6-2003-NMP-STEEL-3	1	1	0	100 %	0 %
FP6-2003-NMP-TI-3-Main	498	68	430	14 %	86 %
FP6-2003-NMP-TI-3-ncp	2	1	1	50 %	50 %
FP6-2004-IST-NMP-2	390	32	358	8 %	92 %
FP6-2004-NMP-NI-4	113	21	92	19 %	81 %
FP6-2004-NMP-NSF-1	36	5	31	14 %	86 %
FP6-2004-NMP-SME-4	87	15	72	17 %	83 %
FP6-2004-NMP-TI-4	427	67	360	16 %	84 %
FP6-2006-TTC-TU-Priority-3	21	0	21	0 %	100 %
Total	2889	389	2500	13 %	87 %
Source: Oxford Research 2009, data from EC.					

Table 19. Applications and success rate per call for proposal. Source: Oxford Research AS, data from EC.

The number of applications as well as success rate differs to a large extent between calls. This indicates large disproportions within the popularity of research topics. The issue of relevance of the research topics proposed in NMP is discussed later in the report (see Chapter 6) with data from interviews and survey. Country case studies reviled that there is a country specialization with regard to selection of research topics which certainly influenced the number of applications per call for proposal (see Chapter 9).

Table: Applications and success rate per instrument					
Instrument	Total evaluated projects	Number of accepted projects	Number of rejected projects	% of accepted projects	% of rejected projects
CA	102	16	86	16 %	84 %
IP	781	95	686	12 %	88 %
NoE	231	22	209	10 %	90 %
SSA	200	36	164	18 %	82 %
STP	1575	220	1355	14 %	86 %
Total	2889	389	2500	13 %	87 %
Source: Oxford Research 2009, data from EC.					

Table 20. Applications and success rate per instrument. Source: Oxford Research AS, data from EC.

The most popular instruments in NMP FP6 were STPs and IP, which was also confirmed by the highest allocations in those two instruments (see also Figure 7). Success rate between all instruments was structured at the same level (from 10 to 18%), which is the opposite of success rate per call as analysed above.

The process of projects' selection, however was not in focus of this study. The question *"Did the programme attract and select the right sort of projects to achieve its objectives?"* is in focus of the second evaluation study for NMP FP6 at project level commissioned by EC and therefore was not analysed here.

Chapter 4. Evaluation methodology

The main purpose of undertaking a strategic evaluation is to develop an understanding of the extent to which the programmes' activities and outputs contributed to the stated (long-term) goals. The outcome of such an evaluation approach provides assistance to decisions about which strategy a programme should adopt in order to accomplish its goals and objectives. In the case of an ex-post evaluation, it aims at the improvement of the programme before a re-launch or the contribution to the development of succession measures.

Although a strategic evaluation cannot be a fully developed impact assessment on the level of individual projects or measure the actual outcomes of those, it is necessary to **analyse the programme outputs and outcomes but on a higher, more aggregated level**. However, this cannot be done without an understanding of the 'physical' impacts, e.g. co-operation patterns, impacts on scientific output, and socio-economic impacts. Here it must be stated that the physical impacts of the programme in many cases are not created yet. This is due to a few factors:

- Projects financed in the programme are still being implemented. In August 2009, **25 % of all projects were still "running".**
- The final outcomes of the activities of NMP FP6 may be only summarized in some years, as all important processes leading to them are still happening and the **indicators are subject to change in the coming years** (e.g. patent offices will receive and proceed with patent applications for many years after the programme finishes, spin-offs and follow-ups are starting to appear currently; articles are sometimes published, sometimes they await their place in relevant journals; it's far too early to measure references to NMP FP6 articles today).
- The **effects of the world's economic crisis** unfolding since October 2008 **might also influence the impact of the programme;** however the Terms of Reference issued at that time did not address this issue. It is possible that the changes in the general economic situation and allocations of national support measures for R&D development will influence the future of NMP priority. This process might change the outcomes and impact of this intervention.

Simultaneously the actual outcomes and outputs of the NMP FP6 intervention will be assessed and evaluated in the context of overall effectiveness of this thematic priority under a second evaluation study commissioned by European Commission. This second (ongoing) evaluation on project level will draw conclusions on the effectiveness of the NMP activity in achieving its stated objectives, and will make recommendations on ways to enhance the effectiveness of current and future similar RTD funding activities. As for a more "classical" evaluation, a different set of important recommendations is to be resulting from this activity, covering such aspects as:

- Selection of the right sort of projects to achieve programme objectives,
- Monitoring, revision and steering practices on programme level,
- Performance, success, and impact of the projects.

The report from the "project level" evaluation is expected to appear in 2011.

4.1 Evaluation questions

In the Terms of Reference for the Strategic evaluation, the European Commission addressed a number of issues that are relevant for the NMP priority in FP6, in a wider context. The study is to provide sound and evidence-based answers to 5 sets of strategic questions:

1) To what extent were the **objectives** assigned to NMP FP6 met or reached?

> Is it possible to assess them at programme, area, or topic level in a qualitative and / or quantitative way and to measure the global progress made towards the designated objectives?
>
> Can the experience of an assessment of NMP related programme objectives in Member States (MS) help?

2) What have been the nature, relevance and value of the **results** produced?

> Can the specific contribution of NMP FP6 to the production of first class knowledge and solution dealing with key industrial challenges be identified and assessed?
>
> Were the results in term of new knowledge and know-how at programme or area level adequately disseminated towards the variety of the potential beneficiaries or users of such knowledge?
>
> How does that compare with the situation in Member States?

3) How **relevant and effective** was the programme from its design to its implementation?

> Were the key scientific and technical (S&T) and industrial challenges identified for shaping EU NMP activities the same as those selected in the main national programmes in Europe, in the USA, and in Japan? To what extent was the choice of priorities and of focus different or similar to those in MS' programmes?
>
> Did the monitoring of the programme (including through the successive revisions of the work programme) allow for appropriate reactivity and adaptation to changes on the scientific or industrial scene affecting NMP technologies?
>
> Did the changes of priorities or focus in MS' programmes influence the process of revision of the work programmes?
>
> Was the level of funding provided to individual topics or areas commensurate with the objectives assigned or the needs to reach critical mass?
>
> Did the programme allow new groups or sectors as well as new and emerging research teams to join, against established or traditional partners?

4) What were the **impacts** with regard to the ERA and Lisbon objectives?

> Did NMP activities during the period of FP6 contribute to programme integration in Europe? To improved priority setting (by reduction of overlaps, increased synergies, joint or shared evaluation and monitoring, etc.? to reshaping of research agendas in Europe and beyond? to the emergence of new teams and new innovative approaches (e.g. through better incorporation of scientific knowledge)?

To what extent did they contribute to the Lisbon objectives (by stimulating increased participation from industry in the programme? by providing advances and solutions towards increased sustainability in industrial production? by supporting pre-normative research that may facilitate the acceptability by the market of new products or processes? by encouraging the development of start-ups?)

Could a set of indicators be provided to this end, including on patent filing, co-operation agreements, and agreements with start-ups?

5) What are the main **lessons learnt** and the possible recommended actions which could be derived from this evaluation, with regard i.e. to:

a. The links between EU activities in NMP, MS, and industry
b. The possible support to key policy issues (e.g. sustainable development, etc.)
c. The complementary measures to ensure effectiveness of research in that field and wider benefits to industry and to companies not participating in the programme

From Chapter 6 to Chapter 9 respective data and findings with regard to questions have been presented. Generalized findings and recommendations were listed in Chapter 10.

4.2 Evaluation process

The evaluation process designed by Oxford Research and KMFA is described in the following chapter.

4.2.1 Methodology overview

Figure 21 below gives an overview of the overall approach and the respective research steps undertaken within this evaluation study, as well as a summary on which methodologies and tools were used in the different stages of the research process. Evaluation questions were grouped according to the split presented in Chapter 4.1.

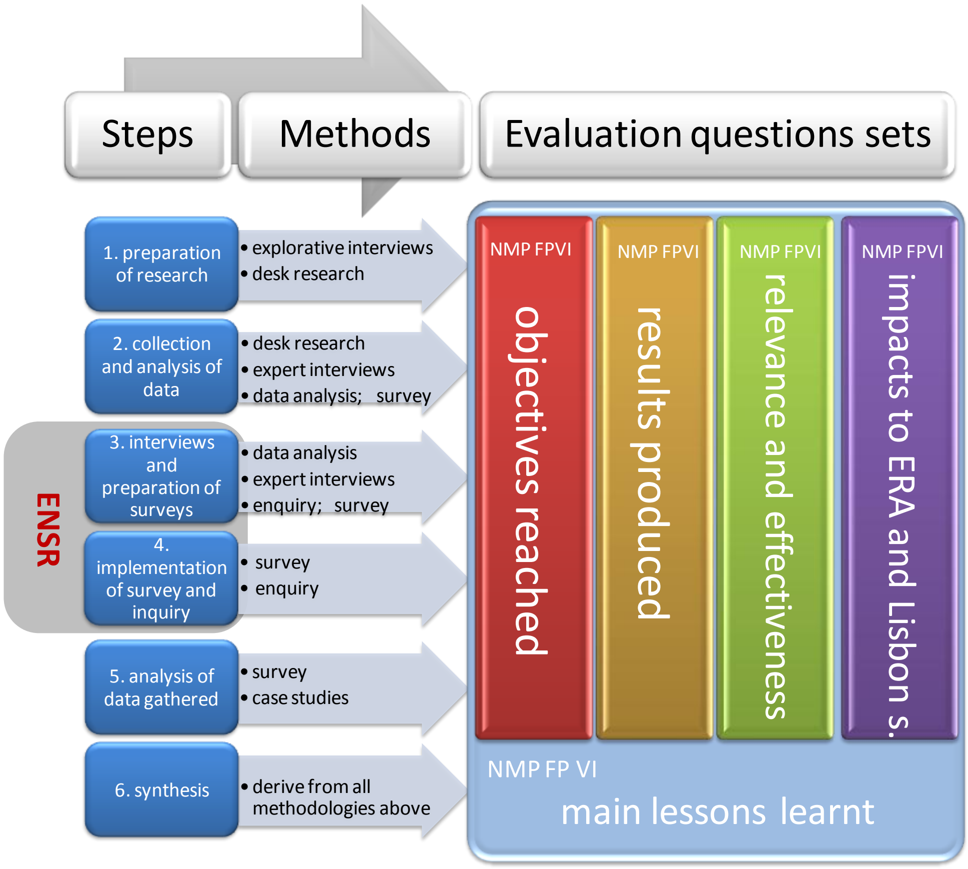

Figure 21. Technical layout of the evaluation with relation to questions sets. Source: Oxford Research AS, 2008.

ENSR – European Network for Social and Economic Research was engaged in the study for gathering data in respective Member States and some of the Associated States.

The general approach indicates that different evaluation tools (desk research, interviews, survey, enquiry and case studies) are used to address simultaneously all groups of evaluation questions. This approach influenced the structure of following chapters of this report, as sometimes for one of the evaluation questions, results from multiple evaluation techniques are presented to elaborate answers to relevant questions.

4.2.2 Research steps

The study steps and evaluation tools used during the evaluation has been presented below. Important features of this chapter are the discussion of representativeness of the survey exercise and of the interviews conducted.

4.2.2.1 Preparation of research

Step one (month 1) was dedicated to the preparation of the evaluation and the production of the inception report, which included not only the structure of the final report but also a detailed description of the quality assurance measures, e.g. how the research team will be dealing with respective aspects of the research process and especially with the advice given by its Guidance Group. Information about the research team and subcontracted members of ENSR as well as composition of the Guidance Group is appended in Part 3 of this report (see Chapter 11.2).

4.2.2.2 Collection and the analysis of data

Step two (month 2 & 3) included the identification of relevant information sources and the collection of data as well as structuring the amount of knowledge and information available. Within this phase, it was particularly crucial to develop this structured access to data and information sources. The data available to this point was analysed within step 2 as well. The list of relevant bibliography is presented in Chapter 11.13.

4.2.2.3 Interviews and preparation of survey

In the next **step three (month 3-4)** of the evaluation, the survey instruments were developed both for the individual project co-ordinators of projects funded within NMP and the collection of data on national support programmes and/or approaches to relevant issues, the linkage between EU and national policies etc. At the same time, the research team conducted a range of interviews with experts with regards to programme design and implementation both on the national and the EU level. Step three also included extensive comments on the survey questionnaire, the country enquiry template and the interview guidelines by the Guidance Group. The step was completed with the compilation of the management report at the end of month 4.

Interview Sampling Procedure:

In total 48 interviews have been carried out: 8 exploratory interviews and 40 in-depth, semi-structured interviews. The targeted groups were: researchers, businesses, policy-makers, reviewers, national programme co-ordinators (NPC), national contact points for NMP FP6 (NCP), Commission officials and OECD officials working in the areas relevant to NMP FP6 activities. A comprehensive list of all persons interviewed together with overview of the country and group coverage is presented in Chapter 11.7.

The geographical coverage has been followed, so that representatives from most EU-member countries were included in the sampling. Some representatives from 3rd countries were also interviewed, such as Norway, Russia and Singapore. Old/new countries and small/big countries division has been made with the purpose of covering the diversity of the EU Member States. 6 largest (population) countries in the EU were qualified as 'Big' in this sample. The rest of the member states were qualified as 'Small' in this sample. The 12 Member States that have adhered to the EU after 01.05.2004 are qualified as 'New' in the sample. The rest of the countries were qualified as 'Old' in the sampling. This resulted in interviews being done in 6 big countries and in 7 small countries, the interviews have covered 10 old countries and 3 of the new countries. Other interviews have covered 3 of the non-EU countries.

Interview Guide:

The interview guide (IG) was developed and adjusted during the interview process, as more knowledge accumulated from the interviews. Some of the questions addressed in the survey were to be addressed also in the interviews so as to get more qualitative, reflective answers to the survey questions on priorities in NMP FP6, the monitoring process and the funding issues in NMP FP6.

The IG was composed of both general and more specific questions, which were grouped for the sake of simplification and better focus into 5 parts: ERA objectives, NMP FP6 results, NMP FP6 impacts, NMP FP6 relevance and effectiveness and Lessons and recommendations. In order to ensure the quality of the information to gather, interviewees were sent a simplified version of the IG, called Respondent Sheet, and were invited to get acquainted with it before the interview. For details of the IG please refer to Chapter 11.8.

4.2.2.4 Implementation of survey and enquiry

Step four (month 5-6) primarily dealt with the field work, e.g. surveying project co-ordinators. In the same step, the sub-contracting partners from ENSR filled and checked with relevant country experts templates on national policies related to the EU's NMP programme. Before presenting preliminary results in the interim report, a workshop with members of the Guidance Group was organized to validate the results achieved so far, to allow extensive comments on the quality of the data and information collected and to assure the work-flow for the upcoming steps.

With regard to the organisation of the actual survey, the team analysed the address data as included in the European Commission's data base and completed these data by means of own research and with the support of the Commission, respectively. In total, 389 projects, i.e. 384 project co-ordinators[35], were identified to receive the invitation to participate in the survey. The publication of the survey started October 6th. As agreed in the consortium and stated in the cover letter sent to the project co-ordinators, a first deadline for transmission of the data was set to October 20th and a second (included in the reminder email) and final deadline set to October 30th. Altogether two reminder emails were sent to the project co-ordinators (October 20th and October 28th). The survey was closed at November 12th. Following to this, data cleansing, consistency checks and first analyses were conducted.

In total 217 projects (completed questionnaires) are covered in further analyses, which equates to a response rate of 56%.

The general approach of the survey was to query the co-ordinators of projects funded under NMP FP6. Although the evaluation team is aware of the problem that not all co-ordinators might be familiar with all the different objectives and that not all of the co-ordinators can actually have a sense of their project's contribution to different goals, it was decided to base this part of the process on quantifiable, comprehensible survey analyses. In addition, past experiences with researchers co-ordinating R&D projects on a European

[35] Five persons were coordinating two projects each during NMP FP6

level showed that they do have insights into the context of their research and they are very well capable of assessing issues of the European R&D policy context both linked to their R&D projects and apart from their own activities on a more abstract level.

The dataset of projects that answered the online-questionnaire reflects the "population" of all projects funded under NMP FP6 in every relevant aspect in a representative manner. The distribution of individual project characteristics is almost identical. For details on the dataset representativeness please refer to Chapter 11.4.

The country measures enquiry. Within the evaluation exercise the evaluation team gathered data with regard to national programmes financing research related to NMP in all European countries in the period relevant to FP6 implementation. This activity was undertaken through analysis of CORDIS data and verified by ENSR partners from 23 European countries, through web research, phone conversations and exchange of correspondence with relevant authorities (programme managers) responsible for implementation of different measures.

89 different support measures from 28 countries were identified in Europe supporting R&D in areas relevant to NMP. The data file with identified programmes was used in the later stage of the evaluation project to obtain information with regard to evaluation questions related to MS as well to identify those of the identified measures which might be described in details as case studies.

4.2.2.5 Analysis of data gathered

During **step five** (**month 7-9),** the field work continued with the selection of case studies on particularly interesting national policies that are relevant to the evaluation questions to be answered. The evaluation team did not limit this part of research only to best practices but tried to identify and describe simply interesting approaches and innovative solutions used in different countries. Step five also included the development and delivery of (preliminary) results for the draft final report and the workshop based on the completed analysis of the data collected in step four.

4.2.2.6 Synthesis

Step six was subject to the processing of the outcomes of previous steps.

4.2.3 General methodological challenges

The evaluation team is aware of the challenges that come with every type of collection of primary data, by means of both quantitative and qualitative methodologies. The following paragraphs describe which procedures were implemented in order to ensure a maximum of unbiased information as a basis for the respective analyses. Such biases can refer to the perception of the evaluators themselves, the urge of people surveyed or interviewed to answer in compliance to what they perceive as being societal, desirable, etc.[36]

The main modus operandi with regard to the above-mentioned difficulties was the establishment of a system of checks and balances of results and conclusions by different members of the evaluation team. Every result and every reasoning that was based on such results were not only developed and discussed in teams of at least two researchers but in

[36] Bryd J. S. (2006)

addition cross-checked by the researchers from the respective other research institute. Extended conversations in face-to-face meetings or by means of telecommunication were conducted to ensure a maximum inclusion of different views, expertises, experiences and scientific backgrounds. Furthermore, a second and third cycle of counter-checking and proofreading were established by including external experts in the evaluation team itself and by setting up a Guidance Group of independent experts on both the subject-matter and evaluations. This procedure culminated in the accomplishment of a joint workshop of the evaluation team, its experts and the Guidance Group on preliminary findings and the regular exchange of draft versions of the report at hand. While the former primarily served the purpose of integrating the opinions and perspectives of many into a more or less joint notion of the issues analysed by means of an interactive procedure, the latter emphasised the possibility to get fully independent views on the results and respective conclusions.

The second most important pillar of coping with methodological challenges was the triangulation of results. All results and conclusions demonstrated in the following more analytical chapters meet the claim of having originated from – wherever applicable – at least two different information sources in terms of the methodologies that were used to collect the information. In addition, the evaluation team applied the standard restrictions for the usage of information and data within each of the different methodologies, e.g. statements from one interview had to be supported by at least two other interviewees or, as for the survey, the size of a sub-group of participants to be analysed should not be smaller than 25 questionnaires (depending on the total size of the group or dataset). Apart from that, analyses not fulfilling these criteria can and will be used for illustration purposes or , e.g. in the evaluation at hand analyses by type of instrument included results on Networks of Excellence although there are only 14 in the dataset (which, however, stand for two-thirds of all NoE that were funded under NMP FP6). For the same reason, statements from single interviews were used e.g. when they have been made by very important experts or include very strong propositions.

The interview data were primarily structured and analysed in Atlas.ti software for qualitative data analysis. A triangulation of the answers received from the different interviewees has been employed in the subsequent analysis. Also, the background of the interviewee against their answers has been weighed in the analysis. The basic principle of the triangulation of the interview data was based on the comparison of meaning of the answers from at least three different interviewees, which could be interpreted as equal or similar in relation to a specific issue. This type of data has been reported as findings. Data which had less than three interviewees supporting the same or similar meaning, has sometimes been presented to illustrate an issue or to bring some critical inputs to the addressed issues. In some cases, where an issue was supported by a majority of the interviewees, the finding was generalized and presented as such. Since we have not received a unanimous permission from the interviewees to present their names in the report, the reference to the quotations and the findings from the interviews have been coded. The function of the interviewee in connection to NMP FP6 has always been mentioned together with the coded name of the interviewee, which can be traced with the help of the code/name list in Appendixes – Chapter 11.7, presenting the interview sample.

Chapter 5. Objectives and indicators

While Chapter 2 gave an introduction into the general technology and policy context of NMP FP6, this chapter deals with different objectives relevant for the analysis of the thematic priority itself. Following a short overview of the general political context the analyses focus on the main strategies of the European Union affecting the area R&D (see subchapter 5.1). Apart from such a more general description of the context of NMP FP6, the evaluation team had to develop an understanding of how these strategies and their respective targets and statements could be put into operation in order to eventually answer the question whether or not NMP FP6 achieved the goals it was set to achieve (see Chapter 6 to Chapter 8). The respective documentation is included in subchapter 5.2.

5.1 The political context

In view of globalisation and a growing population, it has become necessary to restructure science, the economy and the social systems in Europe. There is a need for higher investments in research as well as for exploiting Europe's technological output more effectively than in the past.

The **Lisbon Council Meeting** in 2000 took up the challenge of increased investments in research, innovation and competitiveness. It set the ambitious goal that the European Union should become the most competitive and dynamic knowledge– based economy in the world by the year 2010. One of the key steps towards achieving the Lisbon objective is the creation of a **European Research Area (ERA)**. In 2000, the European Commission published the Communication "Towards a European Research Area"[37] and started a broad discussion with the aim of creating a "single European market" for research. The main objectives of this political initiative were to boost Europe's competitiveness, to improve the co-ordination of research activities on national and European level, to develop human resources, and to increase the attractiveness of European research for the best researchers from all over the world. To contribute to this challenge the **Framework Programme** for Research, Technological Development and Demonstration with its **priorities** (one of them **NMP**) was designed and was seen as the most important instrument for the implementation of the ERA.

As ERA is one of the key elements referred to in this evaluation, therefore its understanding is important for further analysis in the NMP context.

The idea of a European Research Area grew out of the realization that research in Europe suffers from three weaknesses: insufficient funding, lack of an environment to stimulate research and exploit results, and the fragmented nature of activities and the dispersal of resources. With FP6, the EU wished to fund long-term research projects and networks with the aim of stimulating the introduction of NMP in existing industrial sectors and generating breakthroughs that could lead to entirely new materials, devices, products, and

[37] European Commission, Towards a European Research Area, COM(2000)6, 18.01.2000

industries. To this end, the EU launched European Research Area (ERA) as an initiative within FP6.
To tackle this problem, the Commission proposed, in January 2000, the creation of a European Research Area. The initiative combines three related and complementary concepts:

- The creation of an "internal market" in research, an area of free movement of knowledge, researchers and technology, with the aim of increasing co-operation, stimulating competition and achieving a better allocation of resources;
- A restructuring of the European research fabric, in particular by improved co-ordination of national research activities and policies, which account for most of the research carried out and financed in Europe;
- And the development of a European research policy which not only addresses the funding of research activities, but also takes account of all relevant aspects of other EU and national policies.

The initiative aims to solve the **"European paradox" – Europe's difficulty to exploit its scientific results** in order to gain technological and economic benefits. ERA, thus, launched in order to develop strengths and address weaknesses of European research, addressing key factors such as scope and scale of projects. A part of this work would take place through improving co-ordinating activities at the European level. The ERA effort furthermore includes mapping of Excellence as an initiative aimed at strengthening excellence in ERA. Mapping of four N&N areas was initiated: micro-nanotechnology for interacting, sensing, actuating, and microsystems; nanobiotechnology; nanotechnology for information processing, storage and transmission; and nanotechnology for materials and surface science.
The **Barcelona Target** has to be seen in close connection with the Lisbon Process: At the Barcelona European Council, which reviewed progress towards the Lisbon goal in 2002, Member States agreed to an increase of research and technological development (R&D) investment in the EU with the aim of approaching 3 % of GDP by 2010, up from 1.9 % in 2000. Next to this it also called for an increase of the level of business funding which should rise from its current level of 56 % to two-thirds of total R&D investment[38].These R&D investment objectives set at Barcelona arose from the recognition that strengthening the R&D and innovation systems is essential in realising the Lisbon strategic goal.

Another relevant strategic agreement was made from the European Council at Gothenburg in 2001. With this strategy for sustainable development (**Gothenburg declaration**) an environmental dimension has been added to the Lisbon strategy[39]. It formed the core of the EU's policies towards sustainable development.

5.2 Operationalising NMP FP6 Objectives

None of the objectives discussed in the following analysis are quantified either in documents or in other sources relevant for the evaluation at hand. The question whether or not the thematic priority NMP in FP6 managed to reach/meet its designated objectives refers to a whole set of different types of objectives on different levels of aggregation.

[38] European Commission (2002): More Research for Europe. Towards 3% of GDP

[39] Göteborg European Council (2001): Presidency Conclusions. June 2001 and: http://ec.europa.eu/environment/eussd/

Furthermore, **these objectives were/are part of different official documents that are only partially linked to NMP**. However, the strategic evaluation at hand was aimed at understanding the impact NMP had in terms of changing Europe in different desirable directions, including the wider context of the European Union such as its established goal to become the world's most competitive knowledge-based economy (the Lisbon Agenda), an increased international co-operation of researchers including the reduction of barriers for researchers' mobility (the European Research Area, ERA) and general objectives regarding all sorts of developments towards an increased sustainability of production, consumption, transport etc. Apart from these wider objectives, NMP was of course endowed with its own rather specific goals and objectives. Naturally, these do not only have to be seen as having derived from overall European goals but as actual distillations. Therefore, the overlaps are manifold and sometimes blur the boundaries between different agendas, objectives etc.

The objectives defined in FP6 Specific Programme[40] and consequently for priorities in their Work Programmes can only be changed by a co-decision of the European Parliament and the Commission; therefore they were not changed over time, during the programme implementation.

To be able to analyse the objectives in the evaluation context, the evaluation team analysed objectives of NMP FP6 as defined in Work Programmes. The description of the objectives in NMP FP6, with the key words highlighted, is presented below.

[40] Web source http://ec.europa.eu/research/fp6/pdf/fp6_en.pdf

"NMP Priority introduction

The twofold transition towards knowledge-based society and sustainable development demands new paradigms of production and consumption. There is a need to move from resource-based approaches towards more knowledge based ones, from quantity to quality, and from mass produced single-use products to new concepts of higher added value, eco-efficient and sustainable products, processes and services.

The primary objective of this thematic area is to promote real breakthroughs, based on scientific and technical excellence. Radical breakthrough can be achieved through two complementary approaches:

- Creation of new knowledge;
- New ways of integrating and exploiting existing and new knowledge[41].

This requires changes in emphasis in Community research activities from short to longer term and in innovation, which must move from incremental to breakthrough strategies.

The **transformation of industry** towards high-added value organisations necessitates real integrated approaches, either "vertical", combining materials sciences, nanotechnologies and production technologies, as well as other technologies based e.g. on information technologies or biotechnologies, or "horizontal", combining multisector interests. An integrated approach should cover consumption patterns so that the complete industrial cycle conforms to the societal requirement for sustainability.

Particular attention will be given to the **strong presence** and **interaction** of innovative enterprises, universities and research organisations in research actions. The integration of **education** and **skills development** with research activities will play an important role in increasing European knowledge, in particular in nanosciences and new technologies and opening opportunities for industrial applications. Europe wide **networks** and **projects** are required that give research organisations access to new technologies, therefore stimulating implementation of new approaches in most industrial sectors, in particular **SME intensive sectors**. A key issue will be to integrate competitiveness, innovation and **sustainability** into consistent RTD activities.

In addition, it is expected that breakthrough research activities should help to foster dialogue with society and generate **enthusiasm** for science."[42]

Box 22. NMP FP6 Objectives

Apart from the given definitions, the objectives listed in Work Programmes have not been accompanied by a predefined measureable system of success (monitoring and evaluation) indicators. Thus, in order to evaluate to what extent the objectives assigned to NMP FP6 have been met, they have been operationalised, focusing on the highlighted key words, which were originally marked by the authors of the work programmes as important (see Box 22).

[41] This particular sentence appeared for the first time in Work Programme for 2004 (edition December 2003).

[42] Source: http://cordis.europa.eu/fp6/sp1_wp.htm#nmp

In the above context we also faced a need for definition of two important terms when analysing one of the evaluations questions: *"Can the specific contribution of NMP FP6 to the production of* ***first class knowledge*** *and solution dealing with* ***key industrial challenges*** *be identified and assessed?"*

The two terms were used in the following chapters:

"First class knowledge"

It is possible to assess the output of frontier/basic science (discovery of new natural phenomena or material characteristics, etc) by analysis of data regarding accepted articles resulting from the FP6 NMP work that were submitted to high-ranking journals (Science, Nature, etc.). Another aspect that one may measure in this context is increased collaboration of European researchers that have led directly to articles. So generally the high-ranking journals will have articles that many researchers read and refer to.

In short: By measuring publications (and increased pan-European collaboration), patents, and the commercialization of research (licensing deals and spin-out companies), and related (entrepreneurial) know-how.

If we move away from the realm of basic science it gets more complex and harder. One must measure also the commercial output of research projects. This means to describe start-up and licensing activities. The point is to identify and analyse research projects that have developed technologies, which have subsequently been commercialized, a long time after the programme is finished.

"Key industrial challenges"

The general notion of traditional industries (manufacturing) is to transform themselves into research and knowledge-based ones, and of course achieve high sustainability. That's the point where the Lisbon Agenda, ERA, Gothenburg and Barcelona declaration meet.

We have defined those challenges by:

- Transformation of traditional industry that faces low-cost competition, by increasing productivity, new business models, and high-value products and services
- Creating an efficient industrial supply chain, by means of the adoption and use of new technologies
- Growing the science-based industry: the integration of advanced technologies resulting in competitive, high-value products and services
- Sustainability: all this industrial evolution should take place while reducing the carbon footprint and generally polluting less.

Thus it can be concluded that the objectives assigned to NMP FP6 focused on:

- Transformation of industry,
- Strong presence and interaction of innovative enterprises, universities and research organisations in research actions,
- Integration of education and skills development with research activities,
- Creation of Europe wide networks and projects providing access to new technologies,
- New approaches implemented in particularly in SME intensive sectors,
- Sustainability assured in RTD activities,

- Enthusiasm for science assured.

It seems relevant in this context that one of the findings of The European Court of Auditors[43] evaluations was, that the lack of specificity of FP objectives tends to complicate the monitoring and evaluation exercises.

As described in the analysis of the political context of NMP FP6, the programme itself and its respective objectives cannot be seen as being isolated from its various linkages with other European strategies and their objectives. Therefore, the evaluation team took to the particularly targeted objectives of strategic documents and processes such as the European Research Area, the so called Lisbon strategy or the Gothenburg objectives with regard to issues of sustainability into consideration as well. Based on a document analysis, the evaluation team developed a list of non-NMP objectives that originate from the above mentioned agendas and strategies.

In order to be able to assess the contribution of NMP FP6 to its various objectives may they be part of the respective working programme (and its revisions) or other documents in the wider European context, all objectives were extracted from their original source, contrasted with each other and classified. The result was an objectives matrix (see objectives' matrix in Chapter 11.3) that allowed the evaluation team to either match different objectives from different contexts under a generic term where appropriate or to identify cases of the same objective being more or less identically mentioned in different documents on different levels of aggregation. This was necessary to reveal the links between different European strategies and to simply reduce the quantity of items and issues to be tested for the sake of both clarity and to minimise burdens for the interviewees and participants of the survey. As a result, objectives can be labelled as for instance only related to NMP, related to Lisbon Agenda and NMP, ERA and Lisbon Agenda etc.

As mentioned before **none of these strategic objectives were defined as quantitative target** parameters and therefore cannot be measured directly. Instead, the approach of the evaluation at hand was to survey the contribution of individual projects to sets of objectives as perceived and assessed by the project co-ordinators and various interview partners. For the questions in the survey about the assessment of the contribution of the projects to all relevant objectives the operationalised objectives have been clustered as follows:

Operationalised objectives of Lisbon, ERA and NMP	
Source of objective	**Operationalised overall objectives** of the EU (i.e. as included in the Lisbon Agenda, ERA-related documents and NMP Work Programme)
… related to an increased orientation of R&D towards market	
N	Increased orientation of R&D towards industrial usage, utilisation and exploitation
L/N	Stimulation of implementation of new technologies in SME intensive sectors
L	Additional investments in any R&D related business area (infrastructure, technology, machinery, human resources, R&D)
L	Increased competitiveness of NMP-related R&D activities
N	Development of industrial breakthroughs (i.e., radical innovations)
L	Increased funding of new enterprises (start-ups, spin-offs)
L/N	Increased participation of industry in NMP related research
N	Increased participation of SME in NMP related research
… with regard to a strengthened knowledge base and pooling of R&D activities in Europe	
N	Creation of critical mass in NMP-related R&D
L/E	Establishment of new centres of excellence

[43] European Court of Auditors, 'Evaluating the EU Research and Technological development (RTD) framework programmes – could the Commission's approach be improved?' together with the Commission's replies, Special Report No 9/2007, (2008/C 26/01), OJ, 30.1.2008

Operationalised objectives of Lisbon, ERA and NMP	
Source of objective	**Operationalised overall objectives** of the EU (i.e. as included in the Lisbon Agenda, ERA-related documents and NMP Work Programme)
L	Establishment of new industrial clusters (innovation poles)
L/E	Improved integration/networking of/between existing centres of excellence and/or industrial clusters (innovation poles)
L/N	Improved interaction of R&D institutions and industry
L/N	Creation of excellent new knowledge
L/N	Strengthening of existing scientific and technological excellence
L	Improved access to (new) knowledge
L/E/N	Improved knowledge and technology transfer
N	Improved knowledge management and protection of intellectual property
L/N	Transformation of industries towards more knowledge and research based ones
N	More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) in industry
N	More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) with other technologies in industry
... related to human resources and labour market	
N	Improved utilisation of research results for education and training measures
L	Improved skills of labour force
L/E	Improved career prospects for young researchers
L/E/N	Increased labour mobility of (young) researchers
L/E	Increased attractiveness of EU for researchers from outside the EU
L/E	Creation of more jobs for highly skilled employees
... with regard to societal and sustainability aspects of European R&D activities:	
N	Increased dialogue with the public
L/E	Improved (conditions for) gender equality
E/N	Increased awareness of ethical issues of NMP related research
L/N	Increased awareness of issues of sustainability in NMP related research
G	Containment of climate change / increased usage of renewable energy sources
G	Increased sustainable production
G	Increased sustainable consumption
G	Increased sustainable transport
G	Improved conservation and management of natural resources
G	Improved handling of threats to public health
... related to European Integration	
L/E/N	Improved co-ordination of research programmes and priorities (national and EU)
L/E/N	Coherence of design and implementation of national and European R&D activities
	Reshaping of research agendas in Europe and beyond
	Increased integration of former EU accession countries in European R&D activities and structures
	Increased catching-up of former EU accession countries with regard to NMP-related research
Source: Austrian Institute for SME Research	

Table 23. Operationalised objectives of Lisbon, ERA and NMP (L= Lisbon, E= ERA, N= NMP, G= Gothenburg)

This operationalisation of objectives was designed to enable the measurement of achieving NMP FP6 objectives in the context of wider EU objectives.

Due to the strategic dimension of this evaluation some final remarks regarding this exercise must be also made.

When assessing whether the objectives of the NMP FP6 in the context of wider European objectives have been achieved, the evaluation team has taken into account the following aspects:

- The **strategic nature of the objectives requires a longer time perspective** and an assessment of strategic achievements in form of strategic co-operation, strategic tools, breakthroughs, strategic partnerships etc.
- The process is still ongoing. Not all the projects (20 % according to the EU database and 29 % of the surveyed projects, respectively) at the time of this evaluation have been finished yet, which means that their **strategic achievements cannot be fully measured yet**.
- The nature of some achievements of NMP FP6, having implications on their measurability, does not allow us to draw any specific conclusions with regards to strategic objective achievements in NMP FP6.
- An **achievement might turn out to be strategic in a future undertaking or in a totally different context** than NMP FP6, EU or MS. An example is a scientific breakthrough, which can turn out to be strategic only after a long process of application development, complementary technology development, its commercialisation and its final use on a possibly non-EU market.
- Strategic **achievements can actually develop from failures** to, because of the exploratory nature and of the high failure probability (i.e. failure to lead to commercially exploitable results) of the NMP RTD projects, an assessment beyond this should be undertaken.

PART II

Chapter 6. Relevance of design and implementation

The following chapter analyses dimensions of both the design and the implementation of NMP FP6 in order to answer questions about the relevance of the programme. Issues such as adaptability and reactivity of the monitoring process, level of funding and openness of the programme towards new groups and sectors, as well as the choice of priorities in NMP FP6 compared to the choice of priorities in national programmes, will be addressed in this chapter. Before dealing with the relevance of the programme in comparison to national NMP-related programmes, the user-focused issues such as motivation for applying, added value of participation and satisfaction with the implementation and administration of NMP FP6 are presented and analysed.

6.1 Design and implementation aspects – users' perspective

Motivation for application in NMP FP6

European Framework Programmes and their respective thematic or other priorities aim at being both the leading support actions in place in Europe and setting trends, rather than becoming substitutes for existing national programmes by allowing for different approaches to be funded, embracing wider scopes of research and new teams to join. Therefore, it is a crucial question to understand what exactly drives research consortia to apply for EU funding.

The opportunity to co-operate with international partners, the expected higher level of research and access to funding resources offered by NMP FP6 have been found to be the most important factors which triggered the motivation for participating in the programme, according to the surveyed project co-ordinators.

The most important trigger is obviously **the possibility to co-operate with international partners** (which, in contrast to most national programmes, receive funding as well). More than 81 % of the project co-ordinators refer to this fact as being their main motivation (for co-ordinators of Integrated Projects a little less than for co-ordinators of other project types within NMP FP6), see Figure 24. Simultaneously, the access to new and more research partners is emphasised by 65 % as a motivation for applying for EU funding, which is of particular importance for co-ordinators of Networks of Excellence (79%) as a dominant motivation. However, this result comes as no surprise; European Framework Programmes do – in contrast to most nationally available support schemes – not only allow for the participation of research partners from other countries but provide all partners involved with funding (national support programmes usually do not fund foreign researcher).

The technological ambition is considered to be higher in EU-funded R&D projects by a majority and therefore, serving as a motivation to seek support from NMP FP6 by 54 % of all projects (mainly for co-ordinators of Integrated Projects and Specific Targeted Research Projects, 69% and 55%), followed by the notion of **a significant chance to create new knowledge** (49 % of all projects). These two motivational factors could be summarised to the appraisal that the (assumed) level of research is the second most important motivation for researchers to apply for funding in NMP FP6 – particularly for Integrated Projects and Specific Targeted Research Projects, following the scope in terms of number of partners and "quality" of partners (in a sense that excellent R&D partners are often scattered among different countries).

The third bloc can be understood as NMP FP6 **compensating for national funding**, e.g. that is either non-existing or insufficient in different ways, although this motivation was true for co-ordinators of Integrated Projects and Specific Targeted Research Projects it was, to a rather lesser extent, true for the other project types (see Figure 24).

The (better) **thematic adequacy of NMP FP6** was a motivation for almost 40 % of all projects, but less important for co-ordinators of Networks of Excellence than for other project types; while 36 % of all projects (and more than 50% of the project types Networks of Excellence and Specific Targeted Research Projects) stated that the fact that there simply was no adequate national funding available triggered a participation in NMP FP6. The comparison between NMP and national funding schemes with regard to their respective endowment and implementation leaves a somewhat inconclusive picture. Although the respective shares stating that their motivation to apply for funding under NMP FP6 was due to their perception of the programme as being equipped with more appropriate funding conditions (27 % all projects), NMP funding projects for a longer period (25 % all projects) or higher funding rates compared to national funding programmes (22 %) only reflect minority opinions, the frequency of such statements has however to be understood as being considerable since they stem from almost 20 % of the co-ordinators on average.

Thereby it is remarkable and outstanding that 47% of co-ordinators of Integrated Projects state a longer project duration as a motivation for application within NMP FP6 compared to other public funding sources at national or regional level (See: Figure 24). However, studies on national funding systems[44] in the past were able to show that especially (high) funding rates are *the* single most important motivation for an application for funding. This indicates that applications for NMP FP6 funding were following a different set of motivations. However, the mere availability of funding surely has to be considered a major motivation for an application for NMP FP6 funding.

A fourth bloc, though based on a single assessment, is the issue of the academic perception of EU-funded projects by means of scientific reputation that can be acquired. More than two-thirds of all project co-ordinators (and 50% of co-ordinators of Networks of Excellence) see this as a motivation as well. However, reputation – as vague as it may be – can be linked to the higher level of knowledge (i.e. excellence) that is being assigned to research on a European level.

[44] E.g., the analysis of the Austrian system of public research funding conducted in 2008/9.

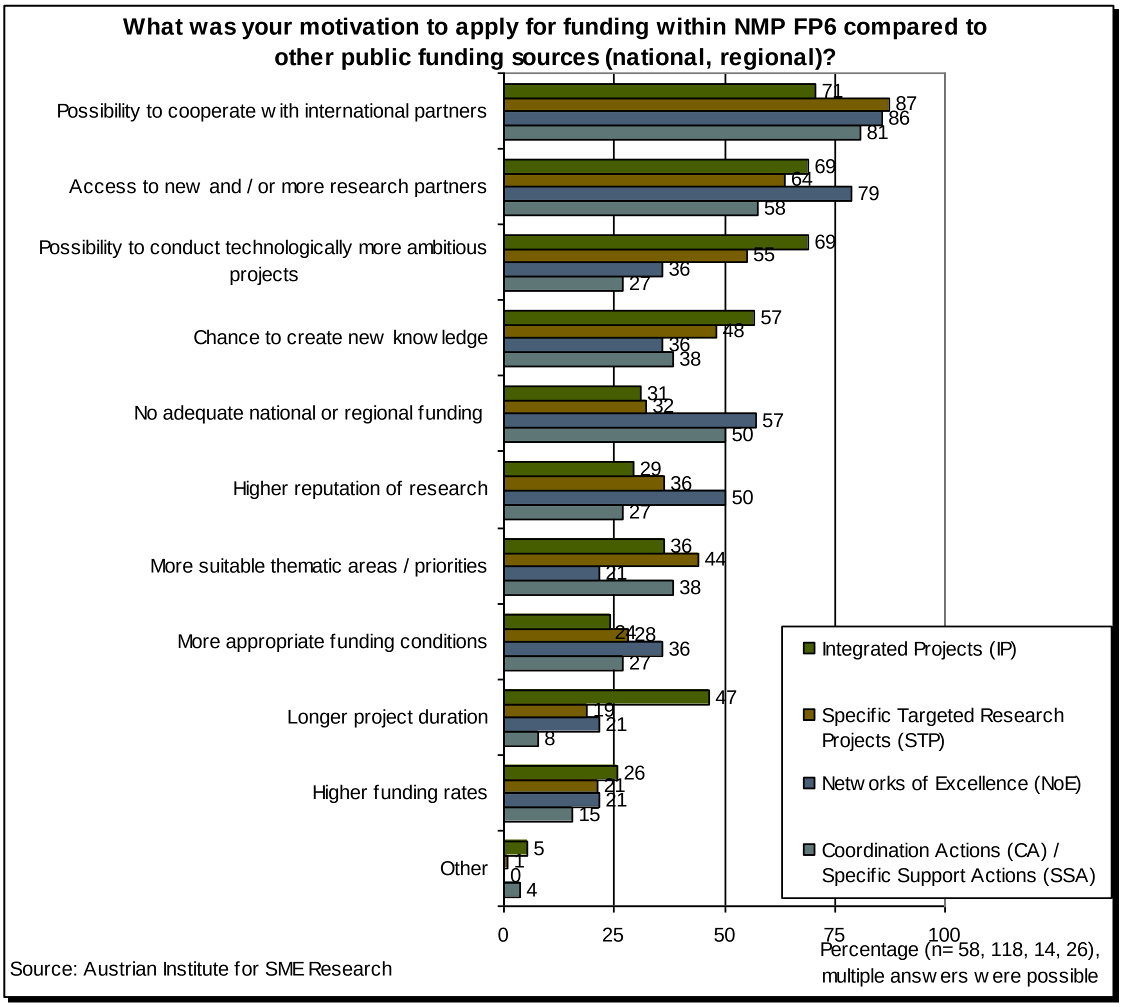

Figure 24. Motivations for the application for funding within NMP FP6 compared to national/regional funding sources (per instrument)

For the results on motivation to participate in NMP FP6, presented per area, consult Table 105 (Appendix: page 225).

Added value of participation in NMP FP6

Important motivational factors such as opportunities for co-operation with actors outside the national boundaries and high expectations on the level of research conducted in the NMP FP6, are supported by the added-value perception of the participation in NMP FP6, which has been found to be the community and network building, access to knowledge and knowhow and stake holder involvement.

The aspects where the co-ordinators see the most added value, compared to national/regional programmes in the field of NMP, are "**community/network building**" aspects. Among these complex following issues can be subsumed: To build up research networks and build up sustainable research-relationships, to get a better access to international knowledge/know-how and to build up or participate in big research consortia.

Figure 25. shows the perception of the co-ordinators of NMP-projects in FP6 regarding the added value of their participation compared to a participation in national and/or regional funding programmes in the field of NMP-related research. The interpretation of this survey result is to be handled carefully, as it shows no equal comparison of the different funding possibilities, but a rating of aspects of NMP FP6-funding with an added value from the EU-funding perspective.

In the case of **access to knowledge/know-how**, more added value of NMP-FP6 funding appears to be seen in an international context ("better access to international knowledge/know-how": 73%), which clearly reflects the added value stated for networking issues, than in an institutional context ("better access to knowledge/know-how in research institutions: 51%) (see Figure 25.). The large difference between these two assessments, however, may be linked to the fact that knowledge is in most cases tacit and not bound to any organisation rather than individuals. Almost 53% of the co-ordinators perceive one of the dedicated objectives of the NMP FP6, "research inclusion of all stakeholders – vertical and horizontal integration", as an aspect with added value of their participation in NMP-FP6, compared to national/regional funding in the field of NMP. Once again, this might be primarily linked to networking issues.

Slightly less added value – compared to the forgone aspects – is stated by the project co-ordinators for the issue of building up sustainable relationships with industry partners and getting access to industry in general, which indicates a difference in the value of EU-funded research projects when it comes to research on the one hand and industry on the other (see Figure 25.). This lower ranking in the added value can be linked to the fact that industry involvement was enhanced towards the end of NMP, which was the picture given in the interviews.

The added value in terms of a better financial endowment of the project is also rather limited in the perspective of the project co-ordinators. However, 41 % state an added value, which is surprisingly high when compared to financial endowment being a motivation to apply for NMP FP6 funding in the first place (see analysis beyond; only 22 % stated the higher funding rates were a motivation). In this case, a rather limited added value might have to be understood as being an actual success.

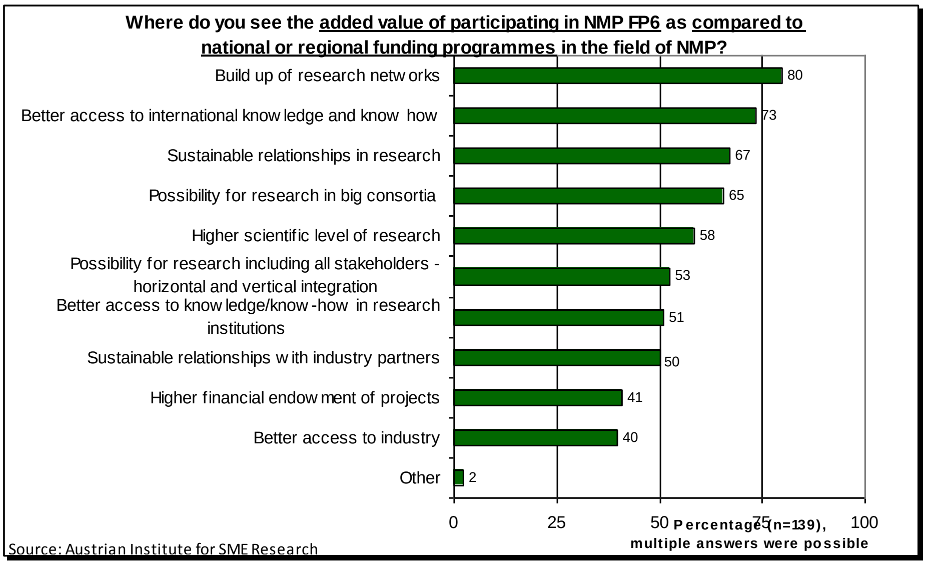

Figure 25. Added value of participation in NMP FP6 compared to national/regional programmes in the field of NMP – perception of the co-ordinators

For the results on the added value of participating in NMP FP6 illustrated per instrument and per area, consult Table 106 and Table 107 (Appendix: pages 226 and 227).

6.2 Design and implementation aspects – strategic perspective

The **revision of the Work Programmes in NMP FP6 generally worked fine** according to the interviewed POs and an expert in the Programme Committee. However the transparency of the revision process was an issue, as it was pointed out by an expert and a PO in the interviews. Since the process involved a limited number of people, sometime the same staff during consecutive revisions, as well its susceptibility to lobbying requires a more transparent system of handling the revision process.

In general, **the selection and the focus of priorities improved towards the end of the programme**, with an increased influence from the ETPs, with the shift from a basic, breakthrough oriented research towards use-orientation and economically exploitable research and technology transfer, focusing on development of solutions for facing key industrial challenges. Also, the high number of proposals received by the Commission in NMP FP6 indicated that **the priorities and the topics were relevant and up-to-date**, according to the interviewed POs. Also the survey results showed that the thematic adequacy of the programme constituted a motivational factor for 40% of the respondents to participate in NMP FP6 (see Table 104, page 225). The surveyed project co-ordinators considered also that the relevance of the thematic priorities improved in NMP FP6 compared with FP5 (Figure 27) and that the topics of different calls within NMP FP6 addressed the most relevant issues at that respective time – for 92% of the co-ordinators (see Figure 28).

The promotion and visibility of the 'nanotechnology' area on the expense of the other areas was the observation of the POs and the national expert in the Programme Committee for NMP FP6. The choice of priorities in 'materials' area was questioned, while being assessed as relevant for the 'production' area according to interviewees from NPC and PO groups and the national expert in NMP FP6 Programme Committee [45]. Some strategic issues which were **not promoted strongly enough both at the national level and in NMP FP6 were the safety regulations, toxicity and ethical issues** related to NMP, '*which are an EU level type of priorities and should be driven by the Commission*', explained a policy maker in the interview[46].

A stronger industry focus was missing in the beginning of NMP, especially in the nanotechnology area, but this improved later, according to the observations from three interviewees from NPC, PO groups and the national expert in NMP FP6 Programme Committee[47]. However, by focusing on enabling technologies and breakthrough research for all types of industries, it was not always recognized by some sectors in the industry, according to the national expert. Several interviewees considered that the focus was dispersed and the national expert in the Programme Committee for NMP FP6 explained: '*… what kind of research we do and what problems we solve. It is called Industrial Technology Program.*

[45] [MS, ZM, JS]

[46] [CI]

[47] [ZM, MS, JS]

But what does it mean 'industrial'? They always talk about the technology, but not about what is going in the industry itself. The message was that we develop different technologies useful for different industries. It was not stating specifically what specific technology was developing for the specific industry'. Also, **the broad focus of NMP FP6 was estimated to have a scattered effect**. The budget system operating in NMP FP6 was not allocating the resources for specific areas but for a specific instrument, letting the different areas compete for resources, thus making allocation and impacts dependent on excellence of individual projects rather than targeting strategic issues in the different areas, it was explained by a PO[48].

ETPs positive role in shaping the priorities for NMP has been mentioned in most of the interviews. They are considered to have a strong potential for analysing the status quo R&D and design road-maps for future developments. They are also considered to be a strong link in co-ordination of information, interests and developments at the EU level and the Member States while developing the work programmes, according to the interviews. A PO explained in the interviews that in the revision process of the Work Programmes there could be noticed a difference between those areas which were working together with ETPs and those which were not, when the former '*knew where they were going from the start*'.

In general the NMP FP6 funding was assessed to be low in comparison with NMP funding in the US and Japan, according to some interviewees. However a recent OECD study showed little difference in NMP funding between the EU, USA, Japan (2009) by the end of 2006 (see Figure 2) as discussed in Chapter 2.4. **'*Concentration*' on strategic issues rather than '*diffusion*' of funding across a wide range of issues** was the approach recommended by several interviewees with the background in science. The issue of funding less projects and allocating more money to the successful projects after a mid-term evaluation was brought up in two interviews. On the other hand, several interviewees experienced difficulties in administrating heavy projects of the IP type in terms of resources and co-ordination, especially in the beginning of NMP FP6.

Reaching a critical mass with the allocated funds in NMP FP6 was assessed in the interviews to **have happened in the nanotechnology area**, while in some sectors of the industry, like manufacturing for example, EU funds alone **could not reach a critical mass without co-operation with national programmes**.

Generally the NMP FP6 setting **allowed participation of new research teams and partnerships** according to the interviews. A PO gave an example: '*in the miniaturisation of the information and communication technologies it means that the functionalities are going to be implemented at very small scales which means that basically they are now at the level of material science and nanoscience. And there, I think this transition from device design in the DG INFSO towards the materials' units is going ok. We are doing a very hard work to attract these people and to present to them what you can actually do with materials science. This has definitely led to a merging between ICT scientists and the nano-material scientists*'.[49] This result is also confirmed by the fact that 68 % of the surveyed project co-ordinators managed to establish new research teams within their NMP FP6 project (see Chapter 7.4). Thereby it has to be pointed out that new research teams are likely perceived as a new composition of research partners including new partners and partners who know each other from the past.

Another PO estimated that in **most of the groups that have been established (ca 75%),**

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[48] [JS]

[49] [AB]

the members know each other from the past. He noticed that the new groups that emerged were coming from the new topics, concluding that new teams emerged either when a new need was addressed or when an existing need was addressed with a new approach. Also **the ETPs** have been mentioned as being a '*big incubation area for establishing research teams*'[50]. Regarding the IPs role in stimulating the emergence of new groups, the opinions were divided in the interviews between those who considered them to favour traditional partners and those who could see a strong potential for the emergence of new groups. However, survey results show that the Project Co-ordinators in NMP FP6 considered that the IPs (73%) and the NoEs managed to establish new research teams (see Figure 44). Interviewees from the new Member States explained that although it was relatively hard to get into partnerships and new research teams, the experience from the NMP FP6 made it easier for them to network and participate in subsequent calls. The Networks of Excellence were mentioned by the interviewees from the new Member States as important arenas for networking and getting into partnerships for future collaboration.

Analysed per subarea, survey results show that projects of the NMP-subarea "Knowledge-based Multifunctional Materials" (NMP-2) lag behind in the establishment of new research teams, while particularly projects within the NMP-subarea "New Production Processes and Devices" (NMP-3) managed to establish new research teams. An exchange of personnel with project partners was generated to a great extent within projects in the subarea "Nanotechnologies and Nanosciences" (NMP-1): followed by projects of "Knowledge-based Multifunctional Materials" (NMP-2) (see Figure 45 in Chapter 7.4).

According to the project co-ordinators NMP FP6 reacted and adapted appropriately to changes in the scientific or industrial scene affecting NMP technologies to a great extent (53% indicate a very appropriate and 36% a rather appropriate reaction and adaption), see Figure 26. Asked for changes (rather) not appropriately reacted/adapted to, many co-ordinators state energy related nano research. From the view of the survey results **the reaction and adaption to changes in the scientific and industrial scene affecting NMP technologies took place quite appropriately**.

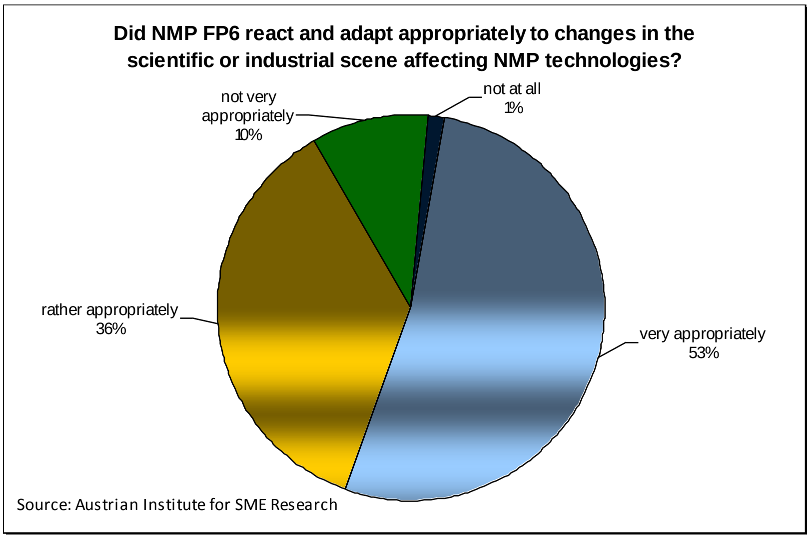

Figure 26. Reaction and adaption of NMP FP6 to changes in the scientific/industrial scene

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50 [GK]

In comparison with previous implementation activities, the survey respondents who had experience from previous FPs (e.g. FP5) considered that the support by EU-project officers and the relevance of the thematic priorities in NMP FP6 mostly improved, when considering the indications "significantly improved" (see Figure 27.)

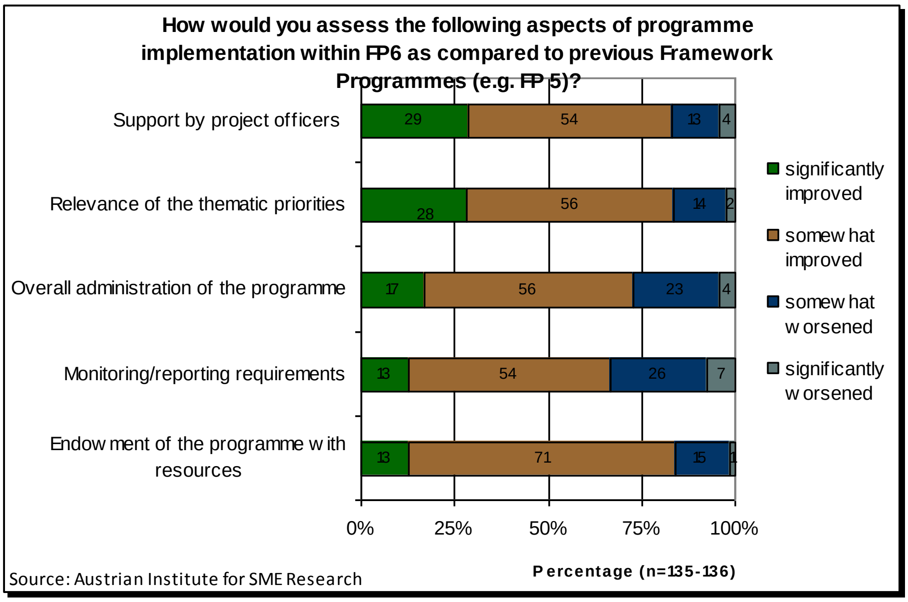

Figure 27. Assessment of programme implementation of FP6 compared to previous FPs

Opportunities of networking, (longer) project duration and the suitability of the thematic calls were implementation aspects, which the surveyed project co-ordinators were mostly satisfied with in NMP FP6 (see Figure 28), while they tend to be (rather) **dissatisfied with more detailed administrative and organisational conditions**, such as the time-frame between project approvals and kick off, administrative requirements, reporting requirements. More than one third of the co-ordinators are not very satisfied or even dissatisfied with the transparency of the project selection procedure, which seems surprisingly high since they got funded. Altogether it appears that the co-ordinators are more satisfied with design-related than administration-related implementation aspects (see Figure 28).

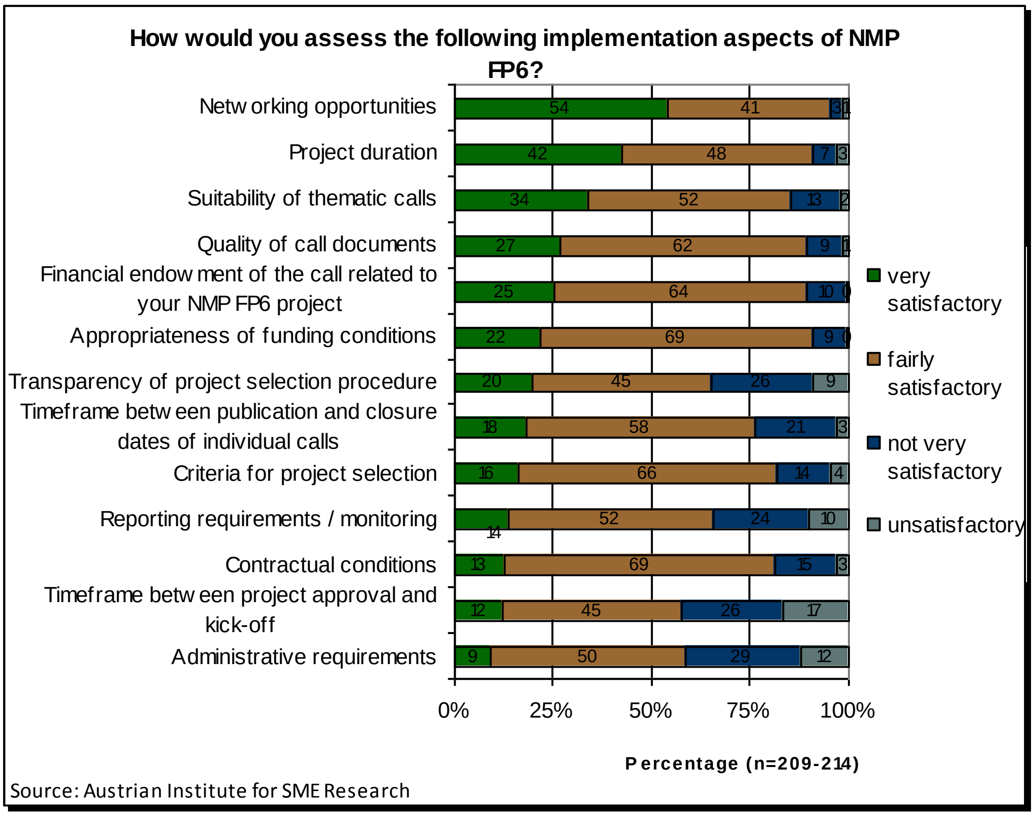

Figure 28. **Assessment of implementation aspects of NMP FP6**

Time and resource demanding administration, as well as delays due to bureaucratic processes in the EU projects, has been brought up in the interviews as characterizing EU projects in NMP FP6. National **systems are less complicated and faster in this sense**, which constitute an important factor in attracting SMEs in these projects, according to the NCPs, the reviewers and the interviewees coming from the industry and SMEs. **The time issue**, being **an important dimension for the industry and the businesses**, especially for the SMEs, created difficulties in their business development for those who were involved in EU projects. Also an increase in the administrative burden and workload has been experienced by the POs. Simplifications and streamlining of procedures connected to contracting which have been intended in the Commission did not work well in practice.

More than half of the co-ordinators are very satisfied (and another 30% are fairly satisfied) with the role of the EU-project officers with regard to the support in NMP FP6 (see Figure 29). The general support of the National Contact Points (NCPs) is assessed more restrained (21% are very satisfied, 41% are fairly satisfied). The support of the NCPs for especially legal and financial aspects is also assessed relatively restrained. This might be an indication of a strong (volitional) involvement of the EU-project officers in the whole programme implementation procedure.

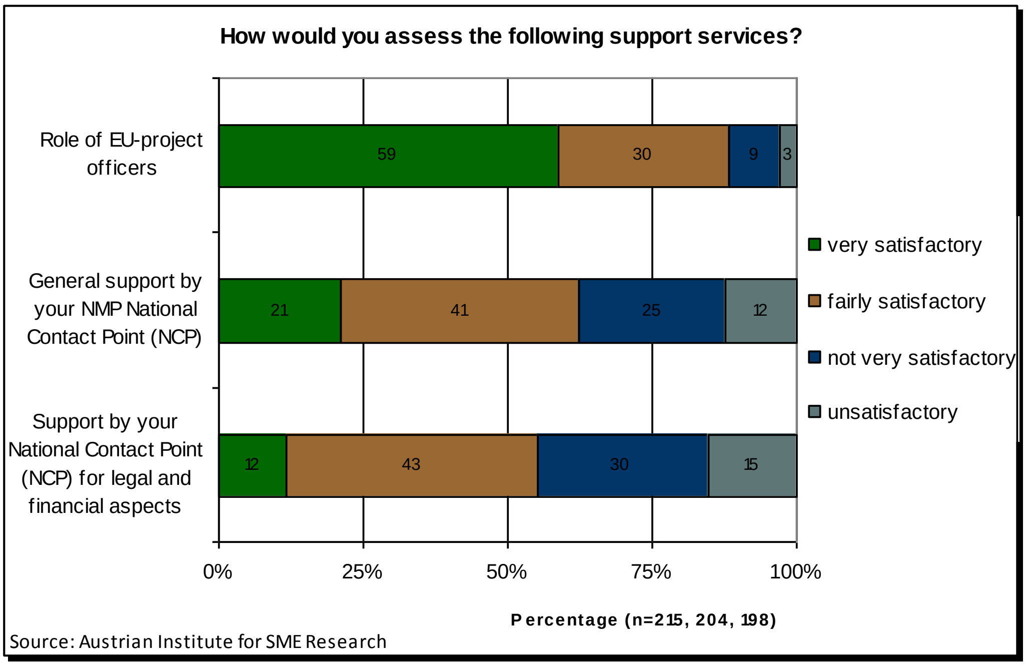

Figure 29. Assessment of support services within NMP FP6

6.3 Comparison with national NMP-related programmes

The survey results show that two-thirds of the project co-ordinators considered that their national priority settings and focus in NMP-related programmes were similar to those set up in NMP FP6, while the rest indicated very different or at least different choices of priorities in their countries (see Figure 30) Findings from the interviews with the national experts, NPCs and NCPs show that **these are similar in general and strategic terms and complementary with regards to the specific areas, the topics and the instruments**. Strategic priorities focusing on development of first class knowledge, industry and market orientation, technology transfer were similar to NMP FP6 in Germany, Netherlands, Finland, Spain, UK and Norway according to the interviewees coming from these countries. However, when it comes to the specific areas and topics, the national programmes are designed to invest into those areas with strongest research and development environments in the country and issues that are faced by their national industries.

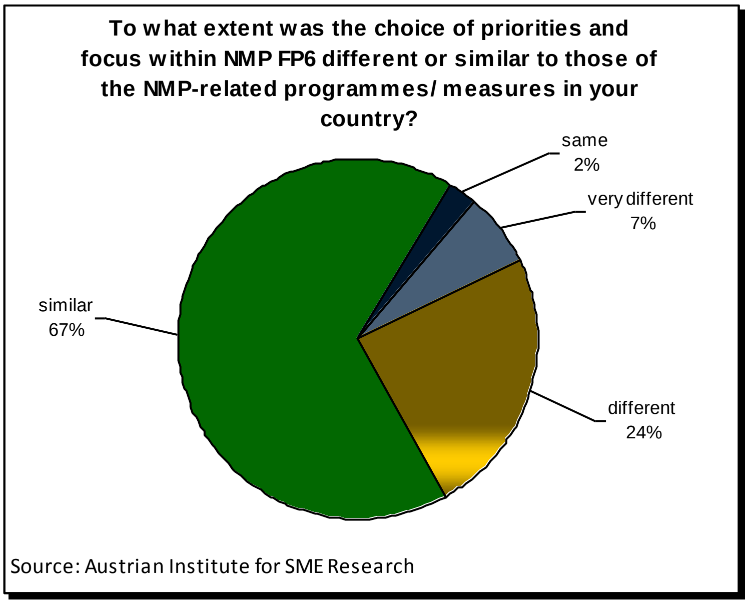

Figure 30. Choice of priorities and focus within NMP FP6 compared to national/regional NMP-programmes

In order to have a better understanding of the focus of NMP FP6 and implications in achieving the assigned objectives, an assessment of the national NMP related programme objectives compared with NMP FP6 objectives, has been employed by the evaluation team. Due to the fact that **most of the implemented programmes are still running** and the fact that **most of the national programmes lack ex-post evaluations**, the assessment meeting programmes' objectives is not possible with use of quantitative indicators. Consequently, the evaluation team conducted an analysis, comparing differences in the setup of the programme objectives and priorities in 13 European countries (+US, Japan). Also, 5 Case Studies on national developments in NMP-related policies and programmes are an outcome of this assessment. For an analysis of the actual national programmes in EU member states and beyond please see Chapter 9 with the case studies. Detailed data upon a selection of MS NMP-related programmes, including programme objectives, is presented in the Appendix in Chapter 11.11, based on a database developed by the evaluation team.

Key scientific, technical and industrial (STI) challenges have been defined in this evaluation as: **transformation of traditional industry, creating an efficient suppliers industry, growing the science-based industry and environmental sustainability.** An analysis of national research strategies in 15 countries, including the US and Japan, complemented by a review of 89 NMP-related national programmes, including the US and Japan, shows **a clear tendency to address key scientific, technical and industrial challenges** in terms of transforming their old industries by adopting new, resource and energy saving technologies for producing high value products and services (for detailed list of programme objectives refer to Appendix – Chapter 11.11).

On a more detailed level, the analysis of research strategies and dedicated NMP programmes shows that they address key scientific, technical (S&T) and industrial challenges by **directing support to either all research fields** (this is the case of largest player – US), **or towards selected themes** which are prioritized according to country's competitive advantage (see Table 129 in the Appendix – Chapter 11.11).

This approach tends to be reflected in most European programmes including the biggest European actors such as Germany, France and UK, but also other actors like Japan, Korea and China. These countries have concentrated on exploitation of selected fields rather than diffuse the funding across a broad range of activities. Governments of the countries that tend to act as **main players in the field invest heavily in addressing the key STI challenges in order to maintain a strong position in the world**. Still not all the countries tend to finance large infrastructure facilities, which support the integration of industry and science. Furthermore **the European countries are planning their research activities in strong correlation with key challenges addressed by framework programmes** and participation in international projects is underlined in almost all national programmes analysed.

Differences and similarities in priorities and focus in NMP

Information gathered from country programme managers in this evaluation indicates that **some national programmes were from the very beginning created with an idea of making use of the European resources**. This in most of cases was related to those countries with limited own resources, but with existing scientific potential including the new MS – Poland, Czech Rep. Bulgaria, Slovakia, Slovenia, Lithuania, but also other countries with a well developed international co-operation and significant own resources like for example Norway and Austria.

An overview of objectives of NMP FP6 demonstrates that the key STI challenges are associated with a list of cross-cutting issues that are important for future developments in the NMP field. The list of main identified cross-cutting issues includes:

- Regulatory issues. Environmental, health and safety implications
- Education and training of qualified workforce
- Communication with the public, “social dimension” of NMP, enthusiasm for science
- Networking activities, exchange of knowledge, international co-operation
- Creation of work places, co-operation with SMEs and industry
- Commercialization of the research results
- Development of large research infrastructure facilities

The analysis shows that the national programmes face the above mentioned cross-cutting issues to different extents. The basic finding is that **those national programmes and strategies which were specifically dedicated to NMP addressed most of the cross cutting issues**. This is particularly the case of the big MS such as France, Germany and UK which also tend to perform as frontrunners with regards NMP R&D in Europe. **More general, industry wide programmes in MS tend to prioritize research in the context of economic growth and innovation**, and the other dimensions are not explicitly addressed (see Table 31).

Table: Facing key scientific, technical and industrial challenges by main challenges and cross-cutting issues

Main challenges

Main challenges appeared in all analysed measures (formulated differently) and might be listed as :

- Transformation of industry
- Adoption of new technologies
- High-value products and services
- Environmental sustainability

Selected country measures[51]	NMP FP6	Austria	Belgium	Denmark	France	Germany	Hungary	Ireland	Netherlands	Norway	Slovakia	Spain	Switzerland	UK	USA	Japan
Cross-cutting issues																
Regulatory issues	•	•			•	•								•	•	•
Education and training	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•
Social dimension	•	•		•	•	•		•						•	•	•
International co-operation,	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Co-operation (SMEs/ industry/ science)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Commercialization	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Research infrastructure					•	•		•		•			•		•	•

Source: Oxford research AS, 2010.

Table 31. Facing key scientific, technical and industrial challenges by main challenges and cross-cutting issues

It must be noted that three of the cross cutting issues tend to be mentioned in all analysed programmes. These include: international co-operation, co-operation between SMEs/industry/science institutions as well as commercialization of research.

A closer look at Japanese intervention may give a confirmation to findings from Table 31. This was also confirmed by data presented in Table 129 of the Appendixes especially with detailed information presented with regard to US National Nanotechnology Initiative, which is definitely the widest programme financing research in N&N field from those analysed.

Japan government classified its policy as "nanotechnology and materials" in Second (2001) and Third (2004) Science and Technology Basic Plan. The government expenditure rose significantly due to this strategic decision, shaping country's policy in the field, and

[51] More detailed information about the analysed country measures can be found in Appendix **11.11 Overview of MS NMP-related** programmes.

positioning Japan in the group of key actors in the field in terms of expenditure (especially per capita) as well as the outcomes measured by number of patents obtained[52].

Many projects have been conducted on the societal implications of nanotechnologies in order to promote their public acceptance. Japan was the first country introducing the subject of societal implications among all Asian countries. Another important dimension in country intervention is the introduction of development of relevant standards for nanotechnological research. First meeting of the Council of Nanotechnology Standards in Japan was held in 2005 and since that year Japan is actively participating in the world's development processes of standards in different subcommittees on terminology, measurement/metrology and health/safety within International Organisation for Standardization (ISO). Simultaneously to those international efforts, a number of projects have been financed to introduce country internal regulations and best management practices in the area of control of chemical substances related to NMP.

Another dimension of Japan's development is the investment in nanotechnology network and infrastructure. In 2002 a Nanotechnology Support Project was launched with a five year duration together with Nanotechnology Researchers Network Center of Japan (Nanonet) to provide coordinated infrastructure facilities for R&D and common information services, as well as to promote the country's research activities internationally. The Facility Use Support focuses on shared use of equipment and comprises of 16 different research institutions in 4 research fields. This project has been prolonged in 2007 under the name of Nanotechnology Support Project. The new prolonged project includes such new interesting solutions as a service fee for facility usage and enhanced support for young researchers (visibility and mobility promotion). Three main objectives of the project are : 1. innovation by integrated and speedy nanotechnology support consisting of "fabricate", "observe" and "measure"; 2. Creation of advance interdisciplinary nanotechnology through integrated research and development of inorganic and organic materials, metals, semiconductor materials and biomaterials; 3. Fostering of scientists in the field of advanced interdisciplinary nanotechnology.

Since the beginning of the 21st century Japan made a great effort to foster commercialization and industry cooperation in the research field. The country's approach to commercialization is emphasized through the Nanotechnology Business Creation Initiative funded by over 60 large corporate executive members, supported by 13 board members from Japanese universities. It gathers over 300 corporate and research institute members. The institution deals with important issues of commercialization through such tools as organization of Nanotech Business Matching Forums; preparation of business strategic roadmaps; working groups on standardization and through establishing strategic alliances with other important international actors in the field, also in Europe. Nanotechnology Business Creation Initiative (NBCI) is an industry-driven organization run on annual-membership-fees. Its main objective is to create and advance business utilizing nanotechnology and to promote collaboration among different industry fields, among big enterprises and SMEs and among industry, academia and government. The initiative also aims into to exchange up-to-date information of nano business

The mains actions include[53]:

- Nanotech-information exchange

[52] Emerging Nanotechnology Power – Nanotechnology R&D and Business Trends in the Asia Pacific Rim, editor Lerwen Liu, World Scientific Publishing, Singapore 2009.

[53] Nanotechnology Business Creation Initiative (NBCI) http://www.nbci.jp/en/index.html

- Standardization & societal Implications (seminars, symposia, forums)
- Nanotech seeds-needs business matching
- Petition for nanotechnology policy among VB, SME, big enterprises making
- Nanotechnology business road-mapping
- Interaction with overseas organizations

Nanotechnology Business Creation Initiative (NBCI) structure is similar to a concept known from innovative business clusters practice (triple helix), where intentional coo-petition of actors in certain area leads to increased market sales and innovativeness, creating many competitive advantages.

Transformation of industry

The two biggest European players – Germany and France consider NMP as a platform with great potential for increased sustainability in industrial production. However, no major breakthrough has happened over the last years in this respect. European countries are struggling with old industrial bases, trying to use new materials and implement new production processes using existing structures. It is a time and resource-demanding process.

Box 32. An example from Germany – assessment of developments from Nanotechnology action plan 2010.

An example from Germany

Assessment of current developments conducted in 2009, when planning the new "Nanotechnology action plan 2010" in Germany demonstrate, that despite having good foundations for the use of nanotechnology, Germany must face up increasingly demanding technological and economical challenges in the future. In comparison with the USA and South East Asia, Germany takes more time to turn the results of R&D into products. The distribution of nanotechnological approaches in various industry branches, the dynamics of start-ups, and the diversity of products has to be more in focus. This means that there are challenges to be faced with regard to the intensification of efforts to utilise the results of research as well as facing the need to realistically estimate benefits and risks, public relations and consumer advice requirements, and any necessary regulatory and standardisation procedures.

The analysis of the country programmes indicates that the need for **greater market orientation of the research** in Europe is considered to be a key European problem. The **industry is not reacting fast enough**, comparing to the USA, China, Singapore and Japan. Therefore most of the European countries are now shifting their programmes from financing research only towards more regulated solutions, oriented towards market use of the produced innovations, as well as towards required participation of SMEs or direct support to SMEs and start-up companies, which are seen as key locomotives for fast market success. In Box 32 example of Tax credit – a mechanism for research financing from France – is presented.

Box 33. Tax Credit – an example of research financing in France

An example of research financing in France

"Tax credit" mechanism (Le crédit d'impôt recherche - CIR) tends to be the biggest measure designed for entrepreneurs to facilitate development of companies, including research expenses. This kind of research financing is the largest in the world, equal to 3 bln euro per year in France. Companies may support research in various areas, not only NMP, but due to the close connection with the market, this measure is shaping directions for other kinds of interventions. There is no data available about the actual spending on NMP–related research, still French companies are among the biggest European research investors, especially in NMP, with well known companies such as Chanel, Lancome and L'Oreal, Renault, Peugeot-Citroen as stakeholders.

Greater integration of actors, sectors and disciplines

The need for greater integration of actors, sectors and disciplines in RTD actions is found to be a key factor in the national NMP-related programmes as well. Also, a shift towards

more market orientation and increased SME engagement has been noticed. An overview of the programmes demonstrating the focus on integration of all actors in the RTD is presented in Table 31.

An important factor which has implications upon the integration objective is the fact that highly innovative enterprises are engaged in doing their cutting-edge research internally, in house. This implies that important industrial actors are rather hesitant to operate within the framework of European research programmes as the research done in their laboratories is designed to enter the market without waiting for the results of application processes and long contracting procedures or time consuming and costly patenting procedures. This means that a part of cutting edge knowledge from the industry-led research stays inside the companies and it is used directly in production lines, without sharing the knowledge in activities like international co-operation with different actors.

Another important finding was that the **key actors on the world stage start to invest large resources in establishment of industry research centres**. The centres that integrate science and industry provide necessary infrastructure with the main objective to facilitate spin-off creation, commercialization and international co-operation. This approach may demonstrate that public intervention in large RTD infrastructure may be important to assure future developments in the field. For an example from France and China, consult Box 34.

Box 34. Examples from France and China

The integration and continued enlargement of research centres foreseen in French Nano-INNOV strategy should be seen as a basis for building future French position on the world market, assuring access to equipment, researchers, and flow of knowledge. It will also allow the scientific bodies (National steering committee) to give directions for shaping future research priorities. This is to assure that France will remain one of the key players on the world scene.

Similar actions are undertaken for example in China, with the purpose to influence country's capacity to create innovation. Between 2000 and 2003, Chinese government decided to finance and coordinate strategic nanotech research and development. Two national nanotech centres, namely the National Center for Nano Science and Technology (NCNST funded with 250 million RMB) located in Beijing and the National Center for Nano Engineering and Technology (NCNET, funded with 200 million RMB) located in Shanghai have been established.

Integration of education and competence development

With regards to integration of education and skills development with research activities it was found that most of **the national programmes include an educational dimension.** The programmes allocated resources to PhD courses and post graduate studies, engaging universities and research centres. The approach in most of the cases was focusing on financing of post-graduate studies, almost without mentioning such areas as up-skilling of employees and training courses.

Box 35. Examples of competence development programmes in MS

Examples of competence development programmes in MS:

The programme "Young Researchers" in Slovenia that has been successfully operating since 1985 presents one of the most successful initiatives to strengthen the research competences for young researchers. The programme has made it possible to employ about 230 new young researchers annually. It has contributed to lowering the average age of researchers for more than 5 years and it minimized the brain drain. Some 20% of the Ministry budget is allocated to the financing of this programme, which contributes significantly to the increase of quality and to infusing fresh blood into the research groups. Since 1991, almost one third of the new researchers with a master's degree, and almost one half of the PhDs have been educated through this programme. Young researchers are employed for a specified period; along with the post-graduate studies, they work on basic and applied projects. Within the period of training and education at home, they can also study abroad (from 1 month to 12 months).

The successful German NanoFutur competition, which was launched internationally in 2003 as part of the "Materials Innovations for Industry and Society" programme, constitutes an important part of the drive to promote the new generation of scientists, and there are plans to extend the scheme. Young scientists from nanotechnology-related fields are given the chance to carry out work relating to nanotechnology in research groups with a large amount of autonomy over a period of five years. Young, natural sciences researchers and engineers on industrial or academic career paths may take part. Since 2003, 17 groups of young researchers have been established during the first funding round. The BMBF has allocated around 20 million euro for further competitions starting from 2006.

In the similar timeframe, French PNANO programme financed 249 temporary working places and 183 post-doctoral studies, doctorates and internships in 2005 (just in 2005, the programme has founded 43 PhDs). It also resulted in 42 patents from the projects financed in this first year.

The study on "Transversal Analysis on the Evolution of Skills Needs in 19 Economic Sectors" done by Oxford Research for DG Employment, Social Affairs and Equal Opportunities in December 2009[54] indicates that skills and knowledge related to development and use of new materials and new production processes will be among key emerging competencies in the technical field in the future. European production moves towards specialisation and excellence meaning significant loss in skilled jobs but increase in high skilled jobs. Box 35 presents examples of competence development programmes in member States.

54 http://www.europarl.europa.eu/meetdocs/2009_2014/documents/empl/dv/transsectanalysis021209_/transsectanalysis021209_en.pdf

Networking for new technologies

The objective of NMP FP6 defined as "Creation of Europe wide networks and projects providing access to new technologies" was to a large extent addressed by country programmes. Many of the national NMP-related programmes, including multi-sector programmes that were much wider in their design, were addressing the issue of national actors' participation in FP projects. National funding was often designed in such a way, that it was supplementary to European financing. In some countries (especially new MS and associated states), participation in EU projects was made a strategic priority, especially in cases of countries that struggle with lack of own resources. This finding is also supported by the interview results. **NMP FP6 is therefore considered a mechanism providing access to knowledge and new technologies for the national research teams from the new MS**. An example on Poland is provided in Box 35 below.

An example from Poland on tools for facilitating participation in FP6

In Poland a constant financial tool was used over the years assuring government funding of participant-required share in project financed from other donors. Research teams being part of consortia financed from EU and other sources could count on reimbursement of maximum 60 % of necessary "own" share.

Other tasks to be implemented include creation of a working system to influence Polish participation in FPs. Detailed task here include such ideas as:

- having more representatives in consultancy bodies to EC; introducing management system for polish representatives in the relevant structures;
- actions to raise the quality of applications to FPs;
- lobbying to address better work programmes' priorities;
- promotion of bilateral agreements with other countries;
- amelioration of research institutes' units responsible for preparation of project proposals;
- system of financial promotion of research teams operating internationally

Box 36. An example from Poland on tools for facilitating participation in FP6

Interrelations between the NMP FP6 and national NMP-related programmes

Findings from the interviews and an inquiry of 22 national programme co-ordinators of NMP – related programmes tend to show that the choice of priorities and focus in NMP FP6 and those in national NMP-related programmes influenced each other in different ways and to a different extent. The hypothesis that NMP frontrunners, which also are the biggest countries in Europe, influenced the priorities and focus in NMP FP6, while an inverse influence being the case for the second-movers and followers, which include smaller countries and new MS, seems to have got some support here.

There may be a connection between changes in the priorities and focus in national programmes and the outcomes of the revision process in NMP FP6, at least for some member states, was the conclusion of the national expert in the Programme Committee in

NMP FP6[55]. He explained that the work upon the content of the Work Programmes usually involved consultations between the national delegates and/or experts with national representatives of research institutes, universities and industries, which were invited to comment upon the topics, based on their knowledge and experience in the field. Usually these people were the same ones which advised upon topics in national programmes, he explained. **The level of influence in the revision process depended also on how active the national delegates and experts were in the Programme Committee in NMP FP6 and how experienced they were in the revision process, according to the observations of the national expert in the Programme Committee**. Delegates and experts from France, UK, Germany, Netherlands, Spain, Italy and Sweden tended to be more active, while among the new MS, it was Poland who was most active in the revision process, was the observation of the expert, member of the NMP FP6 Programme Committee[56].

The complementary and added value approaches of the MS towards NMP F6 could also be observed in the Programme Committees in the revision of the work programmes, through the approaches undertaken by the delegates and the experts. Thus the delegates tried to influence the topics so that duplication of efforts was diminished or they intended to support topics which would provide their national actors with new markets, or influence the existing market in the interest of their national actors was the opinion of the expert, member of the Programme Committee.

An enquiry of 22 national programme co-ordinators of NMP-related programmes upon the influence of the NMP FP6 objectives by the objectives of their national programmes, shows that only some countries – **the biggest actors in Europe, claimed to have the possibility to influence the set up of work programmes in NMP FP6**. These were namely three German programmes, French PNANO and to some extent smaller but important players appear to be – Ireland and Austria. **A majority of national programme co-ordinators noticed no influence on NMP FP6**. **Instead a rather inverse influence**, of EU FPs upon the national programmes, was indicated by the national programme co-ordinators (see Figure 37).

[55] [MS]

[56] [MS]

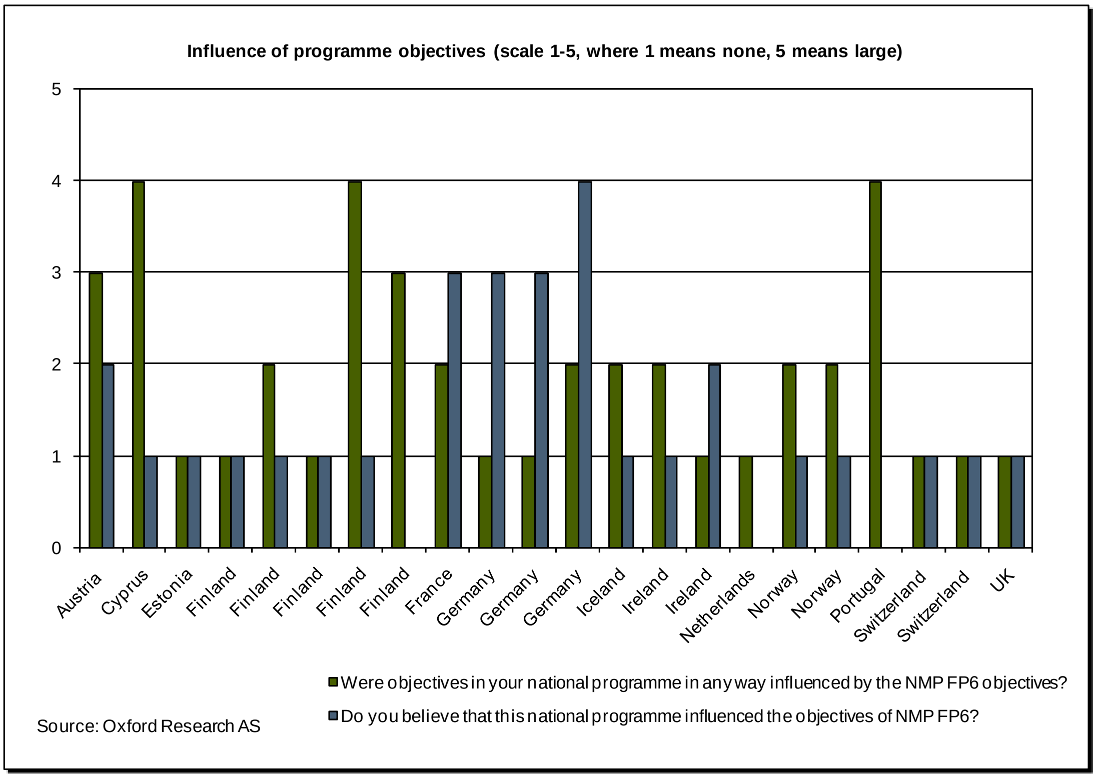

Figure 37. The influences between formulating objectives in NMP FP6 work programmes and country measures.[57]

With regard to NMP FP6 impact on **co-ordination between national and regional research funding and avoiding dispersion of resources and duplication of efforts, the interviewees tended to have a negative answer, having not experienced any development in these issues**. An expert from Germany, which was actively involved in NMP FP6 among others as project co-ordinator and participant in an ETP, explained his scepticism through an example when presenting a national roadmap, derived and adapted from an ETP European implementation action plan to the national level for representatives from 6 ministries in Germany: '*The point is when you address all these ministries, they all have their own agenda and modes of operation and it's almost impossible to get to a co-ordination across those ministerial boundaries, far less to become synchronized and reflect or even anticipate the European activity*'[58].

A clear message coming from the interviews is that **a high level of co-ordination in strategic RTD areas implies interdependency between MS** and the Commission, in national- and EU decision-making powers (of distributing funds) and national- and EU strategic interests (in priority-setting), which would mean a seizure in national governments

[57] Data received from: Austria Austrian NANO Initiative; Cyprus DESMI; Estonia R&D Financing Programme; Finland NewPro – Advanced Metals Technology – New Products 2004-2009; Finland SymBio - Industrial Biotechnology 2006-2011; Finland Research Programme on NanoScience (FinNano) 2006-2010; Finland Functional Materials 2007 -2013; Finland Research Programme on Sustainable Production and Products (KETJU), France "PNANO" RTB; Germany "SME innovative: Nanotechnology – NanoChance"; Germany Framework Programme: Materials Innovations for Industry and Society (WING); Germany Framework Concept for the Production of Tomorrow; Iceland Postgenomic Biomedicine Nanoscience and Nanotechnology; Ireland Centres for Science, Engineering and Technology; Ireland China Ireland Research Collaboration Fund; Netherlands Sustainable Hydrogen Programme; Norway NANOMAT – Nano technology and new materials; Norway BIA - User-driven Research based Innovation; Portugal NEOTEC Initiative; Switzerland Nanotechnology and Microsystems; Switzerland National Research Programme NRP "Supramolecular Functional Materials"; UK Environmental Nanoscience Initiative (ENI).

[58] [RD]

decision-making powers, which MS were not ready to give up. An interviewee which has actively participated in NMP FP6 projects as well as in national NMP programmes, pointed with regards to avoiding duplication of efforts: '*I don't think you'll ever get rid of that. Because we are not living on a federal Europe and each country is looking at its own economy and its capabilities. So there will always be that the country will try and exploit any IP that comes out of that, for its own interest. So there will always be duplication.*'[59]

6.4 Conclusions

Based on the evidence presented in this chapter, the following conclusions upon the relevance of the NMP FP6 programme can be drawn.

From the users' perspective, reflected in this evaluation by the project co-ordinators in NMP FP6, relevance of the programme as defined by their motivation, added value of participation and satisfaction with the implementation of the programme. The **opportunity to co-operate with international partners, the expected higher level of research and a better thematic adequacy** offered by NMP FP6 have been found to be among the most important factors which triggered their motivation for participating in the programme. Opportunities offered by the programme in community and network building, access to knowledge and know-how and stake holder involvement has been perceived as adding value factors for participation in the programme. The **design-related aspects were more effective than the administration-related implementation aspects** in NMP FP6, which nevertheless appear to have improved, compared to FP5. National systems are in comparison perceived as being less complicated and faster in this sense, with the time issue being an especially important dimension for the industry and the SMEs.

The revision of the Work Programmes in NMP FP6 worked fine in general although transparency could be improved. The reaction and adaption to changes in the scientific and industrial scene affecting NMP technologies took place quite appropriately. Some ETPs' role in shaping the priorities has been positive and their importance was increasing. Although the priorities and the topics were relevant and actual in NMP FP6, the selection and the focus of priorities, among which the industry focus, improved towards the end of the programme. The **promotion and visibility of the 'nanotechnology' area on the expense of the other areas has been present** in NMP FP6. **Safety regulations, toxicity and health risks and ethical issues related to NMP – were not promoted strongly enough either at the national level nor in NMP FP6**.

Generally, NMP FP6 set up allowed participation of new research teams and partnerships, although most of the new groups that have been established were based on relations and knowledge of members from the past. **The new groups tend to form around a new need that was addressed or around new approaches that had to address an existing need**. Notably the IPs and the NoEs managed to establish new research teams. The ETPs have played an increasingly positive role for incubating new research teams. Although participants from the new MS encountered difficulties to get into new teams and partnerships, the experience from the NMP FP6 made it easier for them to network and participate in subsequent calls.

Reaching critical mass with the allocated funds in NMP FP6 has happened in the nanotechnology area; in other areas, e.g. manufacturing, co-operation with national

[59] [MM]

programmes is needed. '*Concentration*' of funding on strategic issues rather than '*diffusion*' of funding across a wide range of issues is an issue to be considered in the future.

Priorities and focus in NMP FP6 compared with those in national NMP-related programmes are similar in general and strategic terms and complementary with regard to the specific areas, the topics and the instruments used. Strategic priorities focusing on development of first class knowledge, industry and market orientation, technology transfer in most MS were similar to NMP FP6. However, when it comes to the specific areas and topics, the national programmes are designed to invest into those areas with strongest research and development environments in the country and issues that are faced by their national industries. The complementary and added value of approaches of the MS towards NMP F6 is reflected in the work of the Programme Committees in NMP FP6.

There is a clear tendency in the MS, the USA and Japan to address key scientific, technical and industrial challenges in terms of transforming their old industries by adopting new, resource and energy saving technologies for producing high value products and services. Main players in the field invest heavily in addressing the key STI challenges in order to maintain a strong competitive position in the world. The European countries are planning their research activities in strong correlation with key challenges addressed by the framework programmes. However a **greater market orientation of the research in Europe is considered to be a key European problem**. The industry in Europe is not reacting fast enough, comparing to the USA, China, Singapore and Japan.

To some extent, there was a connection between changes in the priorities and focus in national programmes (at least for some MS) and the outcomes of the revision process of the work programme in NMP FP6, through the consultation process which usually involved national delegates and experts active both at the national level and EU level. The level of influence in the revision process depended on how active the national delegates and experts were in the Programme Committee in NMP FP6 and how experienced they were in the revision process.

The choice of priorities and focus in NMP FP6 and those in national NMP-related programmes influenced each other in different ways and to a different extent. The hypothesis that NMP frontrunners, which also are the **biggest countries in Europe, influenced the priorities and focus in NMP FP6**, while an inverse influence being the case for the second-movers and follower countries, which include smaller countries and new MS, seems to have got some support in this evaluation. However, the similarities also trace back to the fact that research into different aspects of NMP are expected to be more rewarding and influential with regard to the transformation of national economies than others and therefore are more likely to be pursued by national support measures irregardless of actual international influence or coordination.

Finally the issue of NMP FP6 impact on co-ordination between national and regional research funding and **avoiding dispersion of resources and duplication of efforts has not been experienced**. A high level of co-ordination in strategic RTD areas implies interdependency between MS and the Commission, in national and EU decision-making powers (of distributing funds) and national and EU strategic interests (in priority-setting), which would mean a seizure in national governments decision-making powers, which MS were not ready to give up.

Chapter 7. Nature and relevance of results achieved in NMP FP6

The individual sub-areas belonging to the NMP FP6 are designed to support a range of different scientific and industrial research issues, from the financing of basic scientific research into properties of materials to industrial projects aiming at better assessing and meeting the needs of the customers. Other projects are product-oriented and will therefore have different organisation. The nature of the results achieved through NMP, hence, will be of varying character and degree of maturity. A result from a basic science project may or may not directly benefit industry in the short term, while projects supporting the up-scaling and implementation of a novel process or the use of new devices and tools may be directly advantageous to industry.

There has been much discussion and focus on nanoscience and nanotechnologies and there is a global consensus as to the ground-breaking role of N&N and its potential to transform and enable industries. Some parts of this sub-area will still be in an early stage of development in Europe and the individual Member States of the European Union are in different phases of development with respect to industry and science base for the exploitation of the results from the NMP program. At the same time a number of projects initiated as part of the NMP FP6 programme are still not fully completed or just recently completed so that actual results are just yet to be fully displayed. Accordingly it is difficult to provide a simple and yet comprehensive assessment of the nature, relevance and value of the results achieved by the NMP FP6 programme.

This evaluation aimed to assess NMP FP6 results from a strategic level perspective, bringing in the assessments of programme level and policy level participants. This evaluation looked also into how the results varied according to the different measures in the NMP FP6 programme in the light of the objectives of these measures. The results were also assessed in the context of the programme specific objectives, as well as ERA objectives and wider European objectives, stipulated in Lisbon Agenda and Gothenburg objectives. Also a comparison with the situation in the MS has been intended. Finally a number of indications on the nature, relevance and value of the results has been addressed. A more in depth investigation of the results of NMP FP6 projects is being produced in a parallel evaluation (Lot 1) focusing mainly on NMP FP6 projects outcomes and impacts. For a more complete picture on the nature, relevance and value of the results produced in NMP FP6, both evaluations should be consulted.

The nature of the research and development in NMP is such, that it is estimated that more than 50% of the resources invested will not lead to commercially exploitable results, which was explained in an interview with an expert reviewer. That was the case in NMP FP6, too. However, **the failures involved are inherent in this type of research and are part of the learning process**, were the parties have to learn which are the critical issues and which solutions are working or not. Further in the process, **the knowledge from these failures may enable the parties to achieve the goals in shorter time and by selecting the right people**, it was explained by the expert reviewer. Examples have been brought up by the interviewees showing the time perspective and the continuity of their research where the research started in FP 5, advanced in FP6 and continues in FP7, with failures and successes that followed along the process[60]. Thus **a longer time perspective is needed**

[60] [RD, PA]

when analysing the results of NMP FP6, which should be considered in the context of previous and subsequent FPs and over successions of partnerships and interactions [61].

7.1 Overview

In this chapter the aim is to present the results of NMP FP6 and evaluate their nature, relevance and value vis-à-vis the objectives assigned in NMP FP6 and ERA. Major achievements and specific contributions of NMP FP6 to the production of first class knowledge and solutions dealing with key industrial challenges will be dealt with. Also, the dissemination of the results towards potential beneficiaries in NMP FP6 will be assessed. Analysis of the national NMP-related programmes in terms of nature, relevance and value of their results has been attempted; however difficulties in finding comparable data have been encountered and explained. Instead some important issues arising from the study are presented.

A strategic outcome of NMP FP6 is considered the promotion of nanotechnologies in Europe, which has introduced the issue of N&N as an enabling technology on the political agendas throughout Europe. This materialised in the EC Communication "Towards a European Strategy for Nanotechnology" in 2004 that called for shifting the discussion on nanoscience and nanotechnology to an institutional level and proposed an integrated and responsible strategy for Europe. The Strategy was followed by the Nanotechnology Action Plan for 2005-2009 and defined a series of articulated and interconnected actions for the immediate implementation of a safe, integrated and responsible strategy for nanosciences and nanotechnologies. It was a clear message from the interviews with the national experts, expert reviewers, prominent researchers, business people and policy-makers that a major achievement in NMP FP6 was considered the promotion of nanotechnologies in Europe, which has led to the establishment of EC Communication "Towards a European Strategy for Nanotechnology" and the Action Plan and has determined the Member States to establish their own agendas and strategies for nanotechnologies nationally[62].

Also the analysis of the situation in Member States indicates that during the period of NMP FP6 implementation several country strategies and programmes have been developed or revised, addressing the issues not present before in national research policies. The creation of the political agenda with regards to NMP R&D in Europe has been influenced by different actors and international developments, but the European Commission initiative to create a separate priority in FP6 addressing the issue explicitly was undoubtedly one of the most important steps demonstrating the importance and creating channels for discussion on challenges connected to enabling nanoscale technologies.

NMP FP6 affects other research fields and technologies beyond the nanotechnologies, materials, and respective production processes. Apart from the issue of the actual outcome of the projects funded within NMP FP6 presented below, the question concerning which other research fields and/or technologies also benefited from the programme under discussion arises. The findings below can contribute to an assessment not only of the level of outcome but – on a meta-level – also the range of fields affected. Therefore, the project co-ordinators where asked to name the research fields

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[61] [GK, RD]

[62] [GK, JS, RT, HF, AR, FR, PL, MS]

(besides NMP) to which their projects where linked. On the top of the list are the research fields Environment and Sustainability, ICT, Life Sciences and Energy.

When analysed by NMP-sub-areas, one can see that projects in the subarea Nanotechnologies and Nanosciences (NMP-1) **show the most linkages to the research fields Life Sciences and ICT, followed by Environment and Sustainability** (see Figure 38). Linkages of projects in the sub-area Knowledge-based Multifunctional Materials (NMP-2) distribute relatively equally among the fields, while particularly **Environment and Sustainability, followed by ICT and Energy technologies** appear to be the research fields to which projects in the NMP-sub-area New Production Processes and Devices (NMP-3) are dominantly linked. Projects that integrate all of the three NMP-sub-areas (NMP-4) are strongly linked to ICT and Life Sciences.

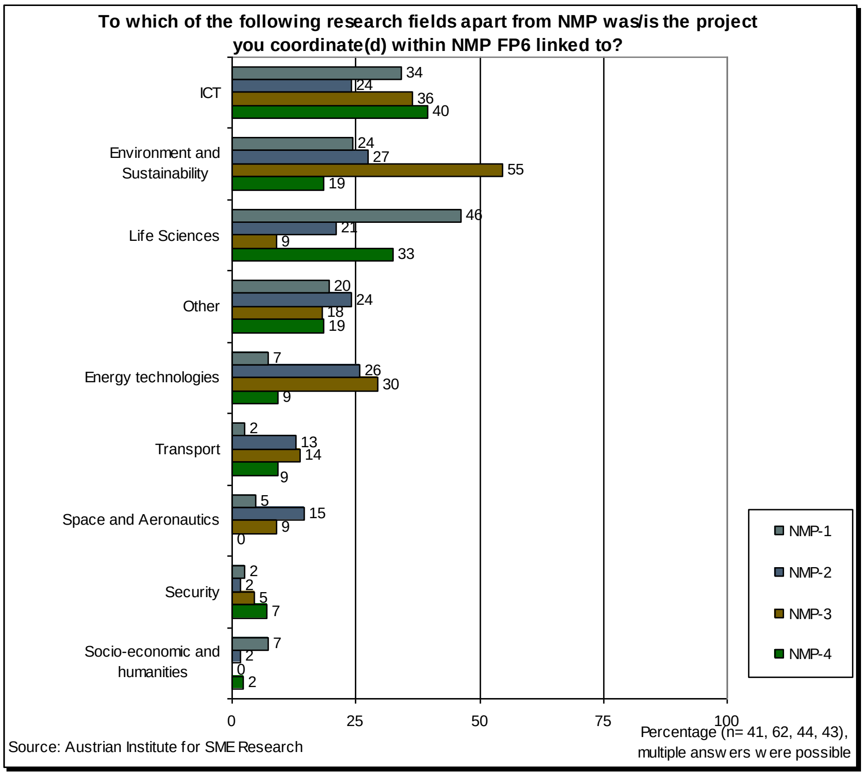

Figure 38. Linkages of the projects to other research fields (assessment of co-ordinators),

NMP-1= Nanotechnologies and Nanosciences
NMP-2= Knowledge-based Multifunctional Materials
NMP-3= New Production Processes and Devices
NMP-4= Integrating NMP-1, NMP-2 and NMP-3

Analysed **by instruments of the FP6**, it appears that the instruments Co-ordinated Actions (CA) and Specific Support Actions (SSA) are highly linked to the research field Environment and Sustainability. Integrated Projects (IP) and Specific Targeted Research Projects (STP) show linkages to all research fields in a well distributed way. Networks of Excellence (NoE) lag behind with linkages to Environment and are more linked to ICT, Life Sciences and Energy technologies (see Table 98, Appendix: page 218).

Beside possible effects of the NMP FP6 projects on different other research areas it is interesting to get an idea of the **main application areas to which the projects were geared to**. According to the co-ordinator's assessments, Integrated Projects in NMP FP6 targeted to a great extent (59%) the industrial application field of industrial engineering which covers for example surfaces, coating, materials processing and others. Also mechanical engineering (45%) is a highly relevant application field of Integrated Projects in NMP FP6. The application field electronics is/was represented to a relatively small extent (19%) within the IPs whereas this field is – together with instruments and chemicals/pharmaceuticals (each 64%) – the dominant one among the Networks of Excellence (NoE). All of these three application fields are also the most relevant fields within the Specific Targeted Research projects (STP). With a view to the Co-ordinated Actions and Specific Support Actions it appears that the orientation of the projects towards (potential) applications fields is evenly distributed (see Table 98, Appendix: page 219).

When it comes to the **NMP-sub-areas** the analysis shows the following picture: Projects of the sub-area Nanotechnologies and Nanosciences (NMP-1) had a clear focus on the application fields instruments, chemicals and electronics (each over 50%) while the (potential) application fields of the projects of the NMP-sub-area Knowledge-based Multifunctional Materials (NMP-2) are evenly distributed.

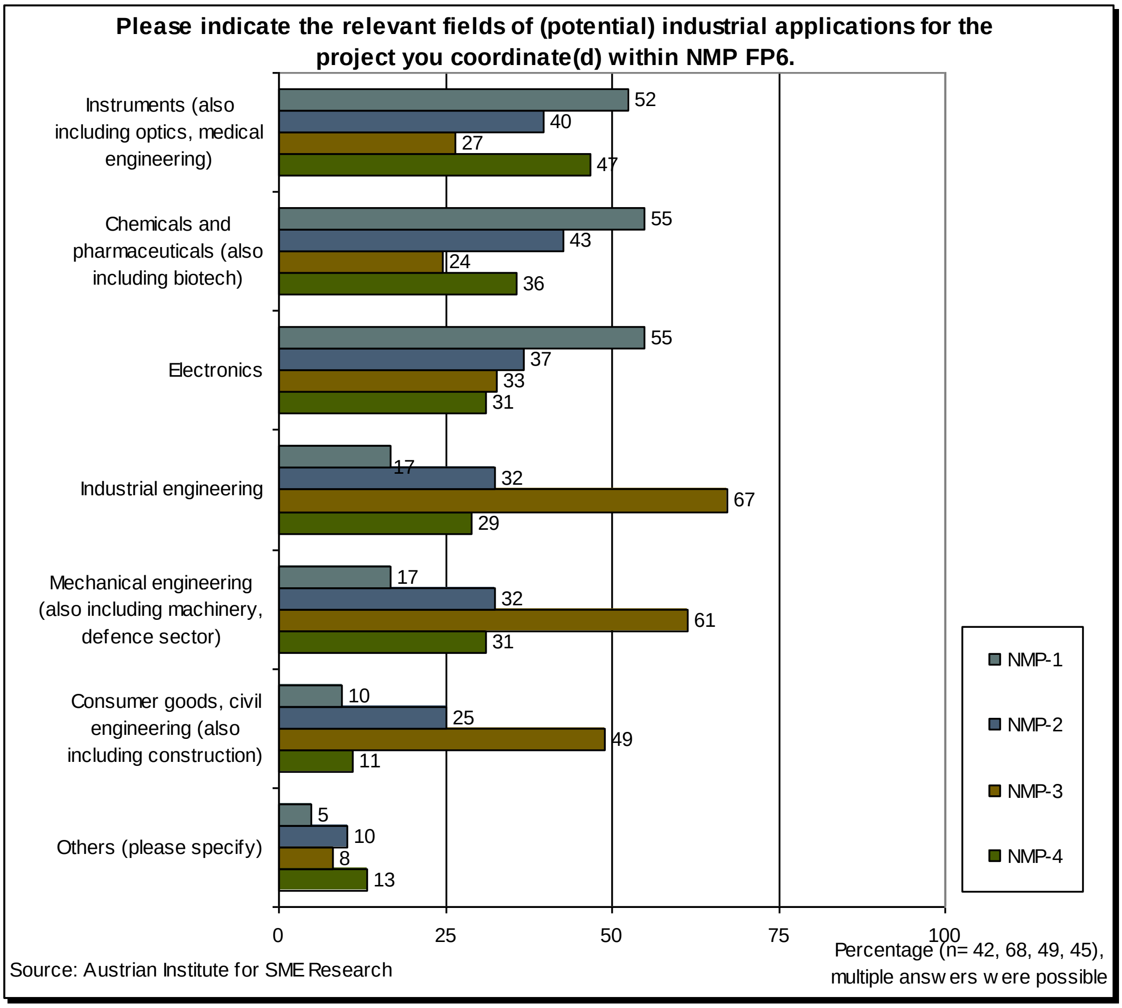

Figure 39. (potential) industrial application fields for the projects (assessment of the co-ordinators

NMP-1= Nanotechnologies and Nanosciences
NMP-2= Knowledge-based Multifunctional Materials
NMP-3= New Production Processes and Devices
NMP-4= Integrating NMP-1, NMP-2 and NMP-3

Projects of the sub-area New Production Processes and Devices (NMP-3) show mainly a focus on industrial and mechanical engineering (67% and 61%) as well as on consumer goods and civil engineering (49%).

7.2 Knowledge related results

First class knowledge as a concept and as a target in NMP FP6 has been addressed in Chapter 5.2 of this evaluation, where the objectives of NMP FP6 have been operationalised and discussed in the context of wider objectives. In the interviews, knowledge related results were associated with advances in science and development of technologies. Interviewees have named areas such as nanomedicine, forestry, energy, electronics, textiles, machine tools and robotics which have advanced considerably through the NMP FP6 projects. Also interviewees, who have worked in the nanotechnology area, considered that **NMP FP6 has definitely contributed to the scientific advancement of nanotechnology R&D in Europe**.[63] Regarding the production of **specifically first class knowledge** in NMP FP6, the opinions were divided in the interviews, depending on the interviewees' definitions of it.

There were those who considered that first-class research has been conducted through: '... [*bringing*] *together large consortia with varied expertise in the area. You are not looking at a specific company or institute's objectives and means of production, you are looking at the whole concept, like durable coatings*'[64], or those who argued that in the nanotechnology area NMP FP6 has contributed to strengthening the scientific and technological excellence[65]. On the other hand, an expert reviewer, who also participated in NMP FP6 noted that '*the best knowledge which was coming out of the EU projects was not outstanding, meaning that at best it was as good as the best knowledge coming out of the best national projects*'[66].

While some interviewees considered that large consortia (referring to the IPs) were a positive set up for creation of first class knowledge, others considered it inefficient since '... [*collaboration*] *of course gives rise to knowledge. However, the creation of first class knowledge – and dealing with associated intellectual property issues - is easier the fewer the partners in a project. The more partners in a project, the more everyone guards sensitive knowledge*'[67] and '*putting people into contact via larger projects is helpful in one way to know each other, but it does not mean that their research is better*'[68], it was explained.

The Head of the Nanotechnology Unit during NMP FP6 questioned whether NMP FP6 managed to always **attract first class industry-driven research**, considering that in the nanotechnology area the programme was more successful in this respect.[69] '*This is witnessed by the relatively higher number of patents obtained as a result of FP6-funded research in nanosciences and nanotechnologies*', according to him. However, even though patents are important indicators, '*industries are not always choosing to patent their research results as this is regarded partially as a publication*', fact which determined some industries to only participate in the projects '*when*

63 [POs, RD, NPC, MM]

64 [MM]

65 [GK, JS]

66 [CA]

67 [JH]

68 [AB]

69 [RT]

the basics were already patented', was the observation of a national expert in the NMP FP6 Programme Committee.[70]

The co-ordinators of NMP FP6-projects have been asked to indicate the nature of the results produced within their projects. Above all others, the **creation of new knowledge/new research approaches** appears to be achieved very often (85% for all surveyed co-ordinators). This is valid too for all instruments, except Co-ordination Actions and Specific Support Actions. But also the **integration/exploitation of new knowledge** (68%) is an often achieved result – which is much more often achieved than the integration/exploitation of existing knowledge (47% for all survey co-ordinators). This could be related to the nature of the research undertaken within NMP FP6 in a way that it is more about new than existing knowledge, which is a good sign since NMP FP6 is a research supporting initiative and the re-combination of existing knowledge is closer to the innovation part of the research-application-exploitation chain.

The **integration/exploitation of new knowledge is often quoted as being a result in Integrated Projects** (IP), which is in line with the IPs objective of producing new knowledge. Concerning the 'integration/exploitation of existing knowledge' it appears that the Specific Targeted Research Projects (STP) quoted this type of result to a comparably lesser extent (38%) than the other project instruments, which is again expected considering that the STPs were designed be at the 'frontiers of research' and focus on new knowledge and new technologies.

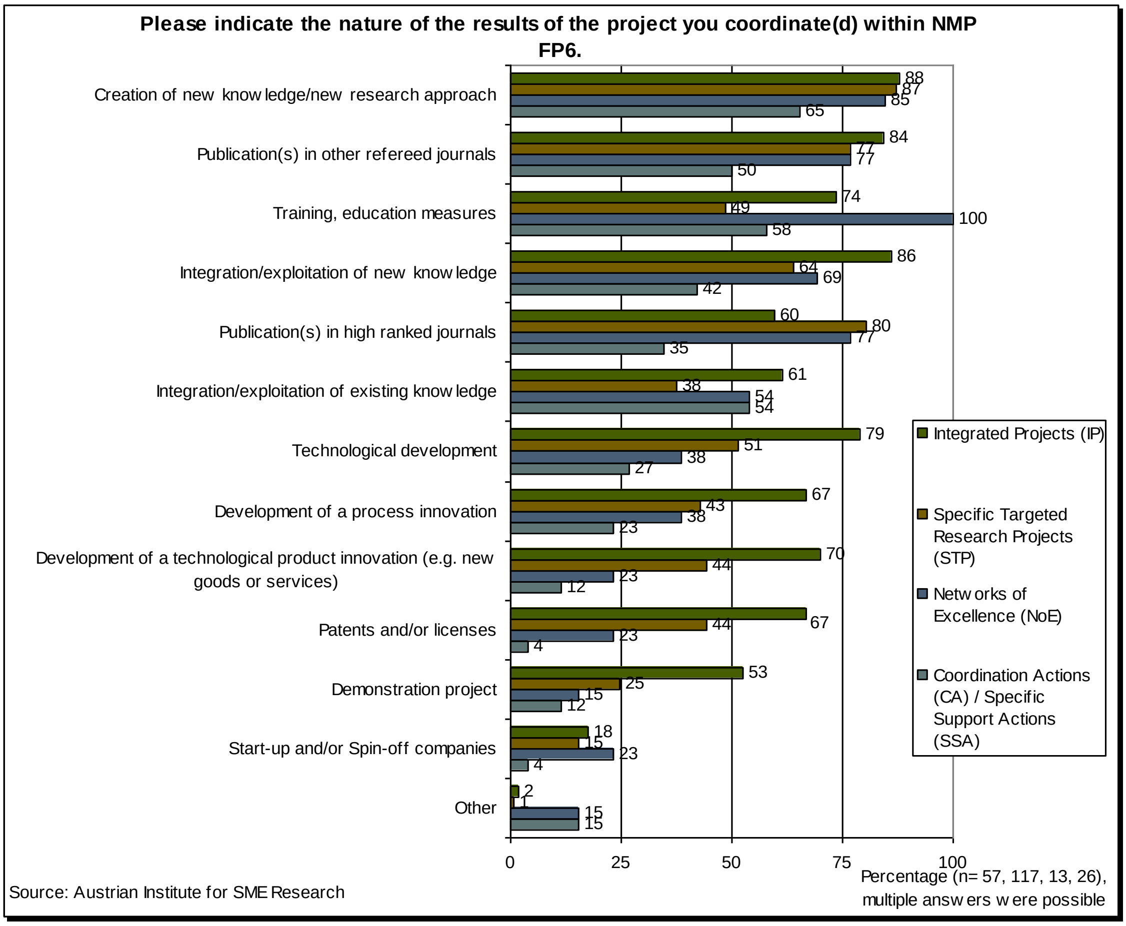

Figure 40. **Nature of results of the projects in NMP FP6 (per instrument)**

[70] [MS]

However, publications in high ranked journals (69% for all surveyed co-ordinators) appear to have been less frequent than publications in other refereed journals (76% for all surveyed co-ordinators) slightly weakening the impression that all the research results produced did reflect the absolute leading-edge at that time. It appears that **NMP FP6 predominantly produced new knowledge, but not necessarily 1st class knowledge** when considering the publications in high ranked journals in contrast to the publications in other refereed journals. However, it must be taken into account that this estimation is based on the individual indications (but no quantified data) of the co-ordinators within the survey.

With regard to the analysis of the nature of results per instrument it stands out that publication(s) in high ranked journals were to a greater extent produced within STREPs (80%) and NoEs (77%) than within IPs (60%). The IPs are, on the other hand, dominating the publication(s) in other refereed journals (84%). This result might be linked to the fact that IPs include a more modular structure including training measures that by nature do not or at least not necessarily lead to publications, especially in high-ranked journals. STREPs, on the contrary, are focussed on mono-disciplinary and single purpose approaches at the "frontier of knowledge"[71]. The same pattern of publications, analysed per instrument, can also be followed in the SSR questionnaire[72], where the STREPs and the NoEs were estimated to produce most of the publications in refereed journals, followed by the IPs and the STPs.

The analysis of the survey results by NMP-sub-areas shows a high frequency in answers regarding publication(s) in high ranked journals within the NMP-sub-areas Nanotechnologies and Nanosciences (NMP-1) and Knowledge-based Multifunctional Materials (NMP-2) – 80% and respectively 76%, compared to the sub-area New Production Processes and Devices (NMP-3) (47%) – which was an anticipated result, considering the product development and industry focus of the latter. On the other hand, the projects within the sub-area New Production Processes and Devices (NMP-3) are equal with the projects of the other NMP-sub-areas when it comes to publication(s) in other refereed journals (see Figure 41).

[71] Web source: ftp://ftp.cordis.europa.eu/pub/nmp/docs/eag_position_paper_en.pdf

[72] SSR questionnaire – Science and Society Reporting questionnaire, designed to help project coordinators respond to contractual reporting requirements and to facilitate the monitoring of the science and society dimension in FP6.

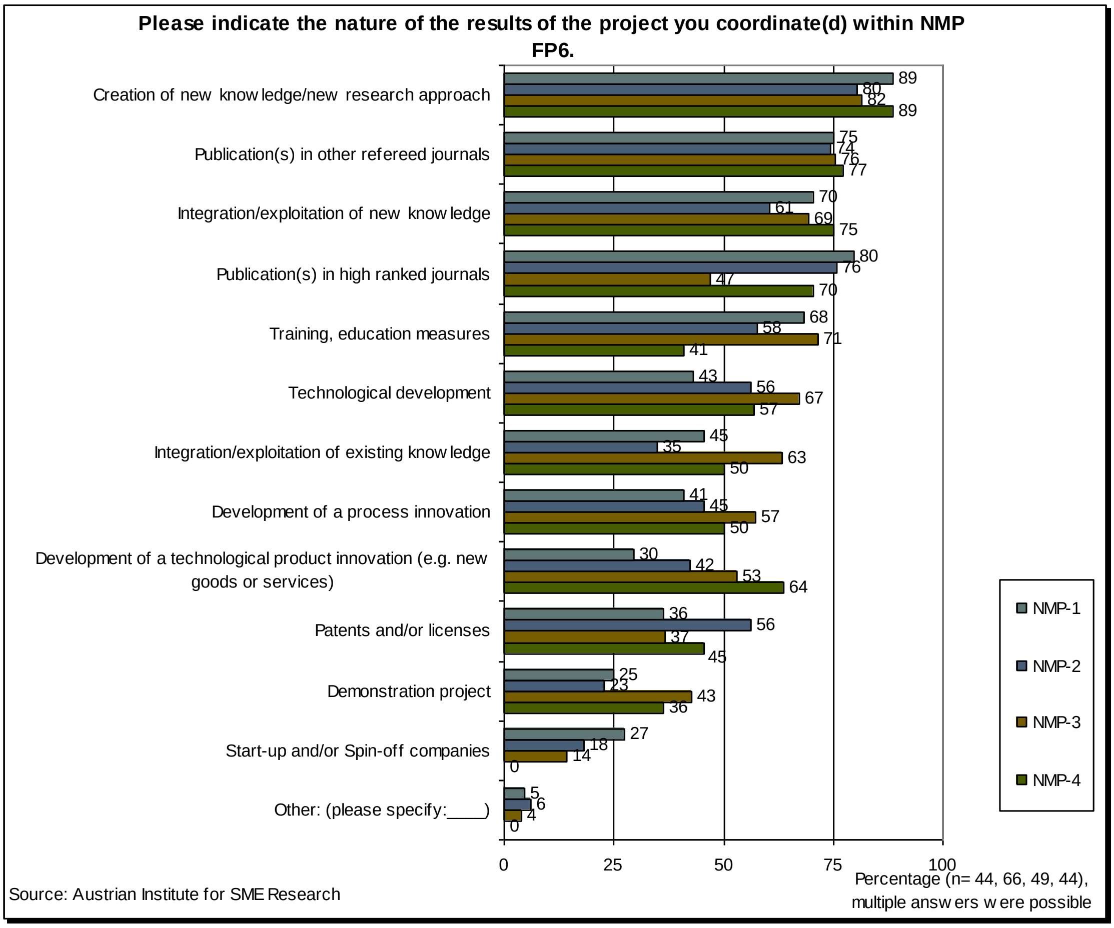

Figure 41. **Nature of results of the projects in NMP FP6**

NMP-1= Nanotechnologies and Nanosciences
NMP-2= Knowledge-based Multifunctional Materials
NMP-3= New Production Processes and Devices
NMP-4= Integrating NMP-1, NMP-2 and NMP-3

Nearly **half of the research projects** (all surveyed projects – assessment of the co-ordinators) in NMP FP6 claimed that they have produced an **innovation related output**: process innovations, product innovations or patents / licenses.

Within all of these three result categories the IPs are clearly dominant. This is also true for the category demonstration projects. These findings differ from the answers given by the project co-ordinators and partners in the SSR questionnaire, designed by the European Commission to facilitate the monitoring of the science and society dimension in FP6 and based on estimations given by the respondents before the projects termination. According to the SSR questionnaire, by NMP-sub-areas the New Production Processes and Devices (NMP-3) and those projects which are/were integrating NMP-1, NMP-2 and NMP-3 (NMP-4) clearly stand out for the achievement of product- and process innovations and demonstration projects.

Patents and /or licences seem to be quoted as an achieved result particularly within the NMP-sub-area **Knowledge-based Multifunctional Materials** (NMP-2), 56% of the co-ordinators of projects within this sub-area state this when specifying the nature of project results. By instruments the **IPs** appear to have patents and/or licences to a greater extent – compared to the other project instruments, finding which confirms the estimations from the SSR questionnaire, where the majority of estimated number of intellectual property rights (38) were attributed to the IPs. According to the SSR questionnaire, the majority of the estimated number of patents were under the STPs (64%), followed by IPs (31%).

Start-up/Spin-off companies as a result seem to be achieved to a comparably larger extent within the NMP-sub-area **Nanotechnologies and Nanosciences** (NMP-1), than within the other subareas, according to the Project Co-ordinators in the survey – 27 for NMP-1, compared with 18 for NMP-2, 14 for NMP-3 and 0 for NMP-4 (see Figure 41). This pattern confirms the estimation pattern from the SSR questionnaire; however the numbers provided in the SSR questionnaire were considerably underestimated NMP-1 and NMP-2, while slightly overestimated in NMP-4, which in principle means that the results were more successful than expected in the respective sub-areas.

Another result of NMP FP6 was, according to the analysis of the interviews, an **increased level of knowledge in the new Member States and in those Member States which did not have a long tradition in NMP RTD**. Interviewees from the new Member States considered that NMP FP6 knowledge creation has contributed to keeping up or raising the level of knowledge on and in NMP RTD in their countries.[73] Also smaller and older Member States which do not have a long tradition in NMP RTD are estimated to have benefited from the research and technology advancements in NMP FP6.[74] These statements were also supported by the interviewees from the MS with more established NMP RTD, acting as frontrunners in the field. This finding was also confirmed by the case studies, which found that national authorities from these countries saw the participation in the framework programmes as an important factor for assuring relevance of research conducted at the national level. **Access to research results and knowledge is therefore seen as crucial for national developments in the field in these countries**.

A specific result of NMP FP6 is **knowledge and experience about new tools designed for organising RTD in NMP at the EU level – knowledge and experience about the functionality and the effectiveness of IPs and NoEs.** The IPs were both praised for their role in integrating actors, sectors and disciplines, for providing networking and partnerships opportunities for the members involved in the projects, but also criticised for the difficulties in management of such big consortia, especially in the beginning of NMP FP6.

[73] [JG, JP, ZM]

[74] [HF]

Case: The Integrated Project "Emerging Nanopatterning Methods" (NaPa)

- FP6 Integrated Project
- NMP Thematic Priority
- Duration 48 months (March 2004 – February 2008)
- Total volume 31 M€ (funded by EU and partners themselves)
- Consortium composed of 35 teams from 14 countries (academia, carmakers, instrumentation manufacturers, etceteras)

The aim of NaPa was to strengthen the potential of nanotechnology within the European Research Area by bringing together the available European skills in the area of methods for nanopatterning. This integration of expertise was seen as a necessary foundation for innovations leading to breakthroughs in the field of nanofabrication, in this manner paving the way to well-organized exploitation of a set of interrelated technologies at the crossroads between applied research and industrial uptake. Exploitable results generated by the project partners include soft lithography, self-assembly, nanoimprint lithography (NIL) and MEMs-based approaches. Key results included the complete development of a new nanomanufacturing tool by the company SET S.A.S. in France, as well as the adaptation of existing semiconductor tools by EVG in Austria, to make them suitable for nanopatterning of range of materials. Development of research instrumentation for self-assembly and scanning probe-based nanofabrication were also presented. Resists for nanopatterning developed in this project are already commercially available from micro resist technology GmbH.

Another substantial result of the NaPa project is the Danish company NIL Technology, which was spun off as a result of the NaPa project at one of the member institutes, the Technical University of Denmark. The company specializes in nanopatterning and nanoimprint lithography, produces specilised NIL stamps, and has resellers in Japan, Korea, and Singapore. NILT meets customers' demands for research and new product development activities, and assists in all stages from pattern design to imprinted pattern.

Box 42. Case: The Integrated Project "Emerging Nanopatterning Methods" (NaPa)

7.3 Addressing key industrial challenges

Almost all interviewees considered that NMP FP6 dealt, **to a great extent, with industrial challenges**. '*All that was going in the industry at that time was addressed by the work programmes*', pointed a PO.[75] At the same time, the **difficult nature** of the industrial challenges themselves and the complex processes involved in developing solutions which are meeting sustainable development demands, ethical issues, toxicity and safety have been emphasized in the interviews. Another difficulty arose in that **NMP FP6 was expected to address the whole spectrum of industrial sectors in Europe, which made it difficult to address each of them in totality,** explained a PO and an active participant in NMP FP6.[76] A **high credit was given to the European Technology Platforms** (ETPs) for their role in addressing industrial challenges by shaping through their strategic road-maps the content of the work programmes in NMP FP6, an activity that continues more visibly in FP7. Manu*future* and SusChem ETPs were specifically mentioned in this respect, albeit their role was more substantial towards the end of the programme.[77]

It is too early to estimate the contribution to industrial breakthroughs

Both survey results and interview results indicate that it is too early to estimate the contribution to industrial breakthroughs of NMP FP6. With regards to breakthrough research in NMP FP6, there were divided opinions in the interviews. Some of the interviewees considered that NMP FP6 has managed to select consortia able to produce breakthrough results, while others considered that that was not the case. **Difficulties in defining breakthroughs** both among the applicants and in the Commission have also had implications upon fulfilling this objective.

Some interviewees consider that a breakthrough proves to be a 'breakthrough' only after its commercialisation and its visible impact upon the society can be observed, which is a process longer than the lifetime of one FP. Efficiency of funds allocation for a wide range of topics in NMP FP6, compared with an alternative, more focused channelling of the resources towards more advanced areas of research (as in the USA and Japan), has been argued upon by several interviewees. Also, the **lack of a first-class metrology and characterisation equipment** necessary for producing breakthrough research has been pointed out by two interviewees with the background in science and policy-making, issue which might make Europe pay a high price in the future, according to them.[78]

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75 [JS]

76 [JS, AL]

77 [MS, GK, RD]

78 [FR, PL]

7.4 Co-operation and networking related results

Producing first class knowledge and solutions dealing with key industrial challenges are possible only when a combination of factors, such as relevant priorities, favourable structures, efficient measures and relevant competencies among others, working within dynamic and synergic processes such as public-private partnerships, co-operation between academia and the industry, mobility of knowledge and technology development across borders and disciplines to name just a few of them. Being also one of the most important motivation factor for participating in NMP FP6 (Chapter 5.1), co-operation and networking dealt with in this chapter, intent to present and analyse those process-related results, which have implications upon the nature and relevance of the results related to first class knowledge and solutions dealing with key industrial challenges.

In terms of an impact of the participation in NMP FP6 on consortia's co-operation capacities, the results of the survey show the following patterns (see Figure 43): The **capacities to establish new co-operative relationships significantly improved for a majority** according to the co-ordinators opinion (58% for all surveyed co-ordinators); 43% state that **the capacities to maintain already established co-operative relationships have significantly improved**. The establishment of new co-operative relationships significantly improved particularly for the consortia of **Networks of Excellence** (93%). For 31% of the consortia the capacity to form new long-term oriented international research networks has significantly improved and for 36% it has rather improved. This impact has been achieved particularly for the Networks of Excellence: 64% of the NoE co-ordinators state the capacity to form new long-term oriented international research networks has been significantly improved).

Capacities to co-operate with external research competences significantly improved for 41% and again it stands out that this is particularly true for **NoEs** (79%), while in contrast for a smaller number (28%) also the capacity to co-operate with external industry partners did so. **Co-operation capacities related to external industry partners have primarily improved for consortia of Integrated Projects** and Networks of Excellence, according to the project co-ordinators. Interestingly, the actual industry participation in Networks of Excellence is low and by definition partners from industry are foreseen to participate only indirectly in the projects, i.e. members of NMP NoE improved their capacity to co-operate with partners from industry although that is not at the centre of the instrument itself by design (see Table 100, page 220).[79]

[79] For the main target groups of the different instruments please see ftp://ftp.cordis.europa.eu/pub/fp6/docs/synoptic.pdf

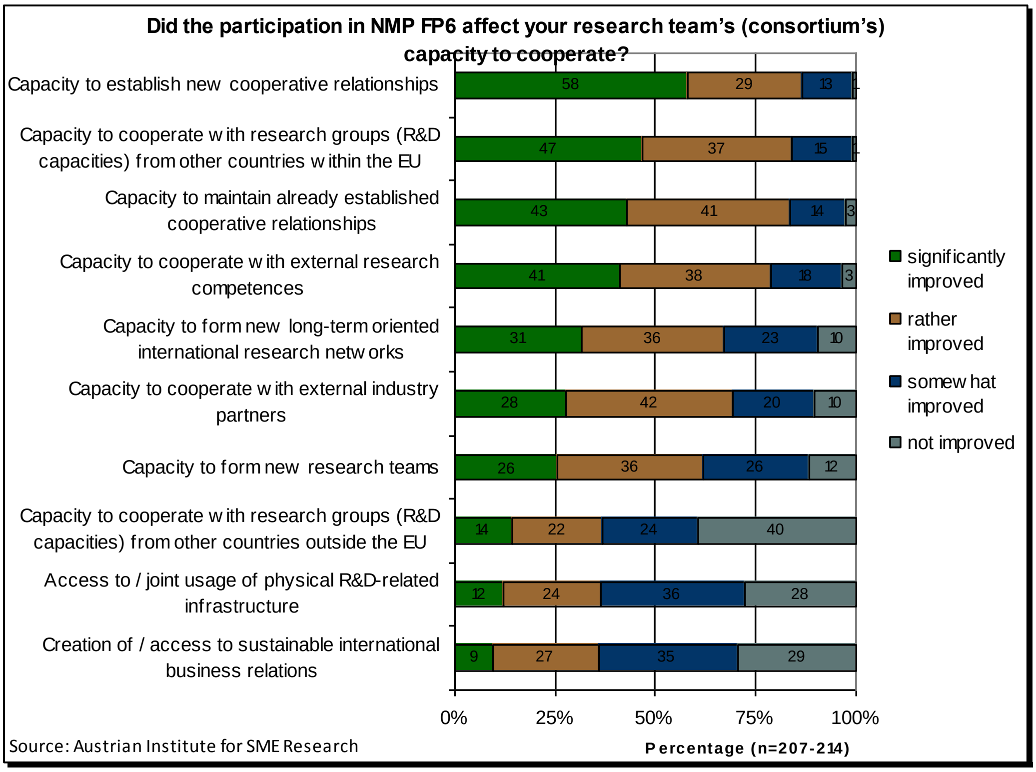

Figure 43. Impact of the participation in NMP FP6 on consortia's co-operation capacities – all co-ordinators included in the survey

As already shown, access to (new) knowledge was crucial for the coordinators of NMP FP6 projects and can be perceived as a preparatory effort for an actual knowledge transfer that can either occur within the project (between individual project partners) or can result from "external" linkages. Indicators for knowledge and technology transfer are e.g. joint R&D activities, joint publications, the exchange of skilled personnel but with regard to knowledge transfer also different dissemination activities. Indications from the survey with regard to an actual knowledge and technology transfer show the following: 36 % of the project coordinators see an improvement (answers "significantly improved" or "rather improved") of the access to or actually joint usage of physical R&D-related infrastructure, another 36 % indicate it has "somewhat" improved.

Furthermore, a remarkable share (63 %) of all coordinators covered by the survey indicated an exchange of personnel with project partners as an output of their project, which indicates – with regard to knowledge being linked to people, knowledge that cannot be codified – knowledge transfer as well. The survey also shows an overwhelming majority (72 % of the coordinators) that claims major or medium contributions of their project to an improved knowledge and technology transfer (see p. 113).

With regard to the NMP-subareas the area **New Production Processes and Devices** (NMP-3) **stands out concerning the improvement of the capacity to co-operate with external industry partners**. This result is rather coherent as the subarea New Production Processes and Devices shows also a relatively high industry participation rate among the NMP-subareas (see Table 101, Appendix: page 222).

Co-operation as an issue in meeting Lisbon and ERA objectives

With regard to the overall objectives of the creation of the ERA, NMP FP6 aimed at several goals in the field of co-operation among researchers both within the EU and beyond (see also the analysis of the contribution to strategic objectives above). When asked what outputs the research projects funded under NMP FP6 were able to realise, 68 % of all surveyed project co-ordinators state that they managed to establish new research teams and consortia. **Referring to the importance of new co-operation patterns as stated in strategic EU documents on the one hand and the often mentioned problem of finding new R&D partners among a limited set of research institutions in a given field, NMP FP6 has to be considered a success.** Notably the Networks of Excellence (93%) and the Integrated Projects (73%) managed to establish new research teams (see Figure 44).

Also the interview results show that the NoEs, provided favourable networking and partnership opportunities, especially for the new EU Member States.[80] One example was the NoE KMM, a network for advanced materials, which is still alive and has the form of a virtual institute. For the researchers and SMEs from the new MS, achieving good results in NMP FP6, has led to new partnerships and new projects in FP7. '*For us FP6 certainly was a base to become partners in FP7. The role of FP6 was very, very important to keep up the role of the scientific level in the country (ed. Hungary) and make these as points of excellence to the young people*'.[81]

However while being praised for their networking and partnerships opportunities, the NoEs were criticised in the interviews for failure to achieve their integration objectives. The national expert in the NMP FP6 Programme Committees explained that the major difficulty with the NoEs was '*that it was not implemented in the right way and the users of this instrument were not fully aware about the impact which full implementation of the NoEs would have on their own organisation. The NoEs would have contributed to the ERA but the research society was still not ready for full integration*'.[82]

[80] [JG, JP]

[81] [JG]

[82] [MS]

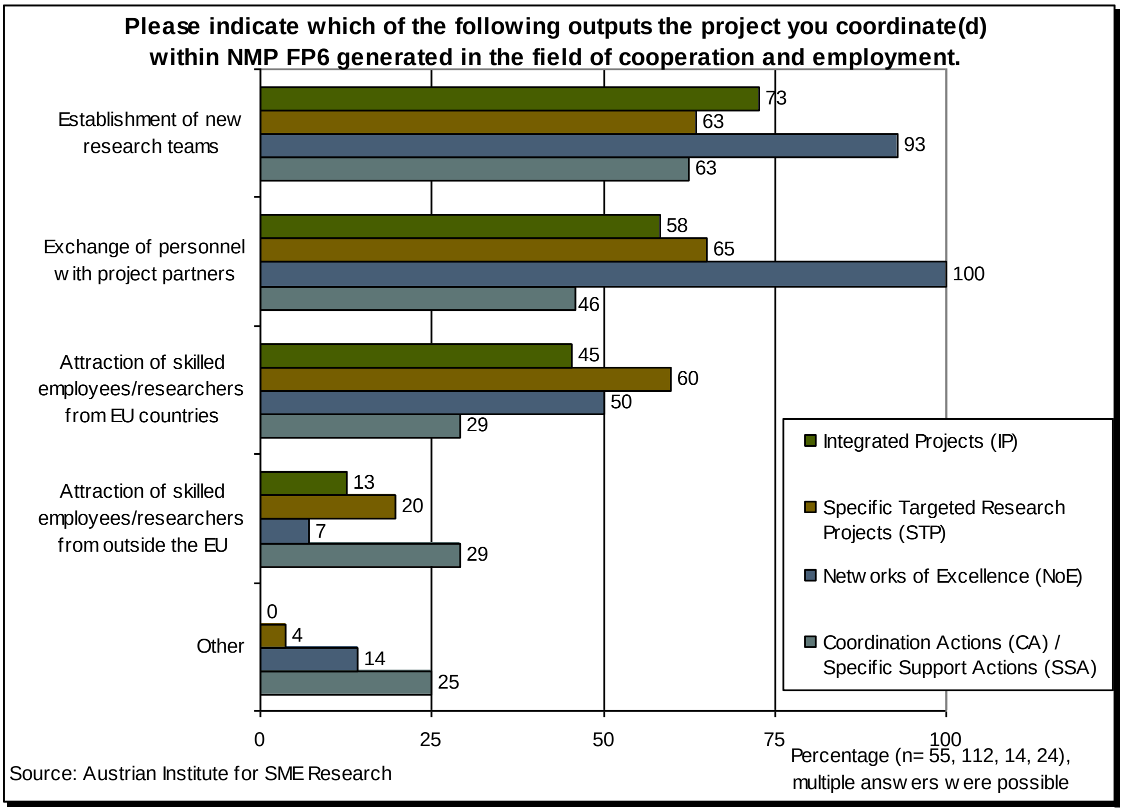

Figure 44. Indication of outputs of the projects generated in the field of co-operation and employment (per instrument)

Regarding the depth of co-operation, it is be interesting to point out that 63% of all co-ordinators included in the survey state that they even went further into co-operation as they exchanged personnel with their partners and therefore deepened the co-operation and raised the chances of it to continue. Thereby it must be assumed, that most of the co-ordinators probably answered to this item against the background of the presumption of part-time personnel exchange, rather than permanent exchanges. The exchange of personnel was generated for all of the Networks of Excellence included in the survey and for remarkably 65% of the Specific Targeted Research Projects (see Figure 44).

The overall contribution of NMP FP6 to the issue of **transforming Europe into a more attractive working place** for researchers from outside Europe (stipulated in Lisbon Agenda) has to be assessed as being **rather weak**. In fact, only 18% of all NMP FP6 projects covered by the survey actually attracted skilled employees / researchers from outside the European Union. (29% of the covered Co-ordinated Actions and Specific Support Actions and anyhow 20% of the Specific Targeted Research Projects (see Figure 45). With regard to an **increased mobility within Europe**, it has to be stated that the overall contribution of NMP FP6 to this goal has to be considered to be **quite substantial**. A very interesting result is that half of the projects have managed to attract skilled employees / researchers from EU countries.

Projects of the NMP-sub-area "Knowledge-based Multifunctional Materials" (NMP-2) lag behind in the establishment of new research teams, while particularly projects within the NMP-sub-area "New Production Processes and Devices" (NMP-3) managed to establish new research teams. An exchange of personnel with project partners was generated to a great extent within projects in the sub-area "Nanotechnologies and Nanosciences" (NMP-1): followed by projects of "Knowledge-based Multifunctional Materials" (NMP-2).

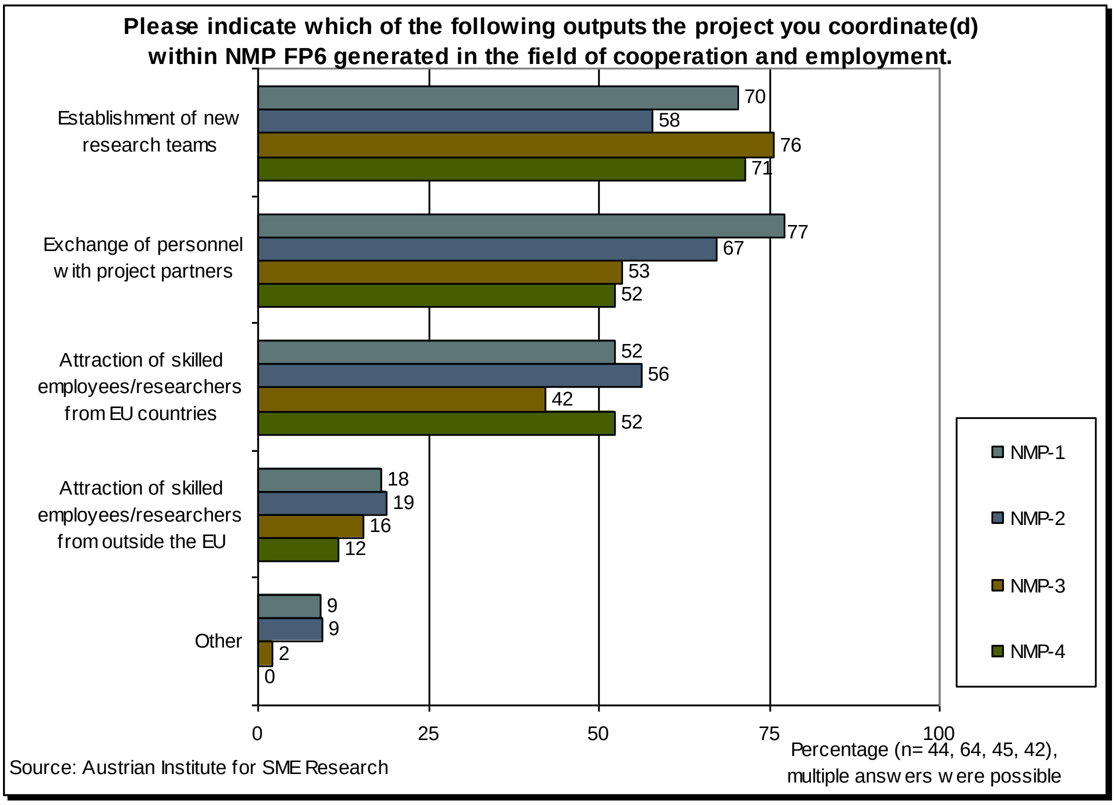

Figure 45. **Indication of outputs of the projects generated in the field of co-operation and employment (per instrument)**

As discussed above, the European Union is not only aiming at creating new co-operation patterns but to support **sustainable co-operation among researchers**. The tangible effect – as compared to the more general contribution (see above) – is somewhat limited. Only a minority of all surveyed co-ordinators (8% with regard to already started projects and 5% with regard to future plans, respectively) of research consortia remained fully intact for follow-up RTD projects after their co-operation in NMP FP6. Networks of Excellence stand out with 14% who already started another project, directly linked to the NMP FP6 project in co-operation with the whole consortium (see Figure 46).

Although forming a very small group within the projects, it seems interesting that 3 % of all surveyed co-ordinators do not intend to do any follow-up research with one of their co-operation partners in NMP FP6. However, **57%** of the project co-ordinators of Networks of Excellence and every second co-ordinator of Co-ordination Actions and Specific Support Actions have already conducted or are conducting research linked to their NMP-funded research with selected partners from their NMP FP6 project. For the instruments Integrated Projects and Specific Targeted Research Projects the corresponding percentage is only 32% and 21% (see Figure 46).

In contrast almost every second co-ordinator of an **Integrated Project** and 56% of those who co-ordinated a **Specific Targeted Research Project in NMP FP6** are **actively planning further R&D projects with selected partners** from their joint project in NMP FP6. While Networks of Excellence and Co-ordinated Actions/Specific Support Actions obviously were more rapid in continuing their co-operation out of NMP FP6, Integrated Projects and Specific Targeted Research Projects tend to be more restrained. Nevertheless they are planning such further co-operation with selected partners in large part.

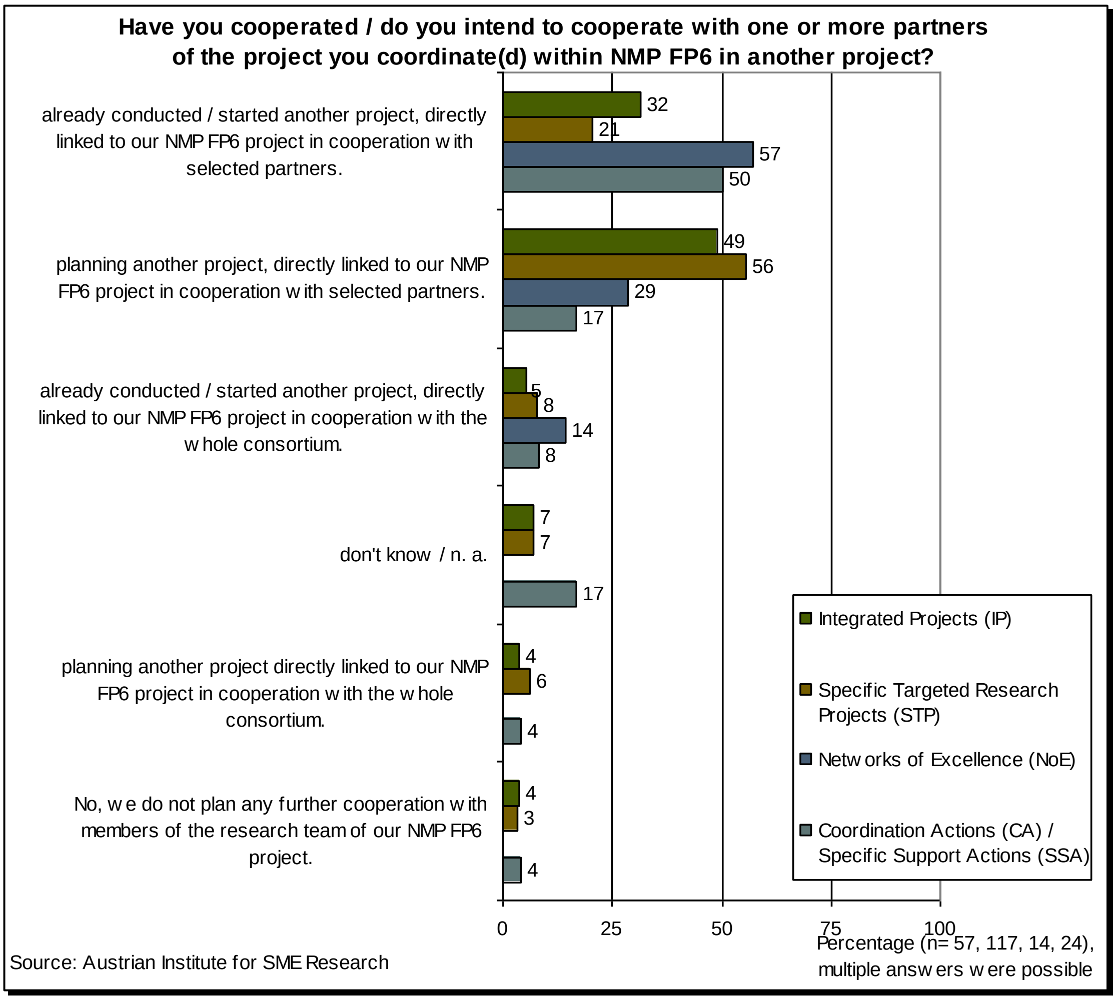

Figure 46. Co-operation patterns as a result of the participations in NMP FP6 (per instrument)

With regard to the NMP-subareas it appears that co-ordinators of projects in the sub-area Nanotechnologies and Nanosciences (NMP-1) are planning further projects directly linked to their NMP FP6 projects with selected partners to a high extent (60%) even though also 52% of co-ordinators of projects in the subarea Integrating NMP-1, NMP-2 and NMP-3 (NMP-4) also state this (see Figure 47). Those who already started further projects directly linked to their NMP FP6 projects with selected partners are prior co-ordinators of projects in the sub-areas Knowledge-based Multifunctional Materials (NMP-2, 41%) and New Production Processes and Devices (NMP-3, 32%). The sub-area Nanotechnologies and Nanosciences (NMP-1) stands out too with 14% who already started another project, directly linked to the NMP FP6 project in co-operation with the whole consortium.

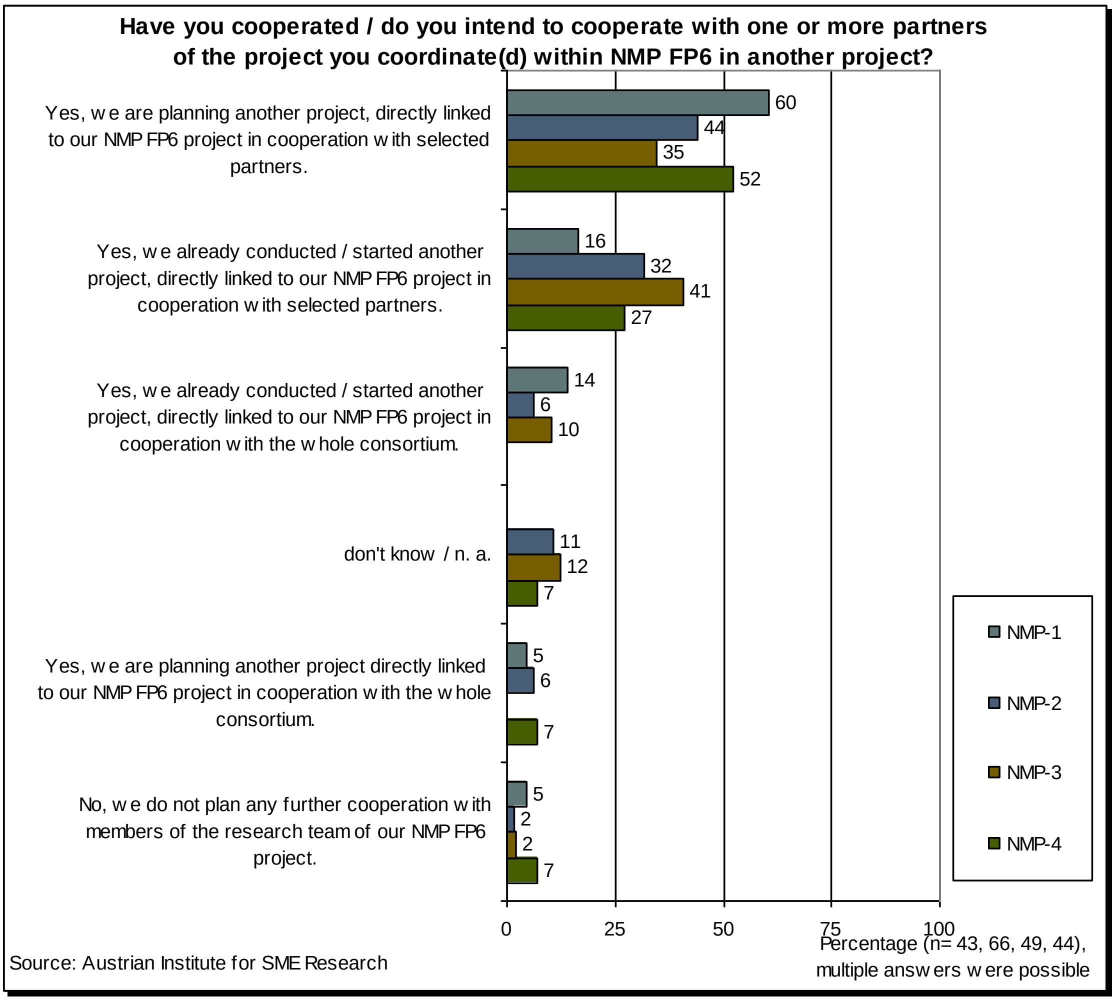

Figure 47. Co-operation patterns as a result of the participations in NMP FP6

According to the survey **participation in NMP FP6 appears to be a notable improvement** (significantly and rather improved: 84%) **of capacities to co-operate with research groups from other countries within the EU**, while **the capacities for co-operation with research groups outside the EU improved for a far smaller number** (significantly and rather improved: 37%). This aspect – among all other aspects of effects on co-operation capacities – shows also the highest percentage of those co-ordinators, who indicate "no improvement" (40%). Analysed by instrument it appears that particularly the Co-ordinated Actions and Specific Support Actions achieved an improvement for this specification of co-operation capacities (significantly and rather improved: 85%), while no co-ordinator of the Networks of Excellence state that this significantly improved (see Table 100, Appendix: page 220).

7.5 Comparison with national programmes

Comparable evaluation data from national research programmes is not available

The European Commission is the first actor in the field trying to assess the intervention in NMP in terms of results in such dimensions as production of first class knowledge, key industrial challenges and the dissemination of result activities. The evaluation team has found that the available country programmes do not assess the public intervention in this way.

A detailed view on a selection of country programmes relevant to NMP indicates that **almost none of the country measures have been evaluated fully towards the results produced**, in terms that might be compared here with results of the survey.

Quantitative information about programme allocations and number of projects is known in most of the programmes, but this does not demonstrate the results obtained, or the impact.

Box 48. PNANO results

In the years 2005-2008 in the area of NMP **French** PNANO allocated a total of 541 mil euro. In this period more than 6000 projects were submitted by research teams and 1169 by business clusters. On average 26 % of applications were financed in the area NMP with average sums of, accordingly 400 000 and 870 000 euro per project. All together ANR financed under all available measures 587 projects in nano-area with 285 mil euro in 18 different dedicated programmes, plus it spent 69 mil euro on "National network of technology centres for basis technological research"

PNANO financed 249 temporary working places and 183 post-doctoral studies, doctorates and internships in 2005 (just in 2005, the programme has founded 43 PhDs). It also resulted in 42 patents from the projects financed in this first year.

An important dimension of PNANO was the creation of National network of technology centres for basic technological research in 2003 (RTB). This infrastructure is essential for the development of NMP related research.

In some national programmes data was collected with regards to such indicators as number of PhDs, patents and publications (most common indicators), conferences and seminars or lab space created (less frequently used). However, final data necessary to produce comparative analysis do not exist, as the programmes are still ongoing and the time perspective for evaluation of results is too short. For example for France, the data from the PNANO evaluation presented in 2009, aggregated only for projects financed in 2005, the rest of projects are still ongoing or were finalized recently (see Box 48). It is too early to measure the result indicators. Programmes financed in Germany are also monitored in terms of such indicators as number of PhDs, scientific publications and patents, but no precise data is available from programme managers contacted and only estimations have been given, which do not allow a comparison.

An important indicator that might be addressed in such a study is the number of financed projects, but the average allocations per project in different countries differ to large extent, and therefore a comparative analysis here will not demonstrate any reliable outcomes.

Some examples of data on the results of selected country measures were presented in the case studies (see Chapter 9).

> Since start-up and up to September 2006, **Norwegian** NANOMAT has made grants and commitments to over 75 projects. They financed 44 doctoral candidates and 57 post-doctoral fellowships.
>
> The financing of innovation-oriented projects has increased since 2004. This has caused a rise in the level of industry interest. In 2004 six new industrial companies took part in knowledge-building projects with user involvement and user-led innovation projects financed by the programme. This figure rose to 11 in 2005 and 21 as of June 2006.
>
> Key figures for NANOMAT for the period June 2002 to June 2006:
>
> - Scientific publications:
>   - articles in refereed scientific journals: 209
>   - articles in other scientific journals, books, published addresses from international meetings, other reports and addresses: 305
> - Results dissemination (dissemination measures vis-à-vis relevant target groups, measures for public dissemination, mass media stories): 60
> - R&D results (new methods, models, prototypes): 10
> - Commercial results (new processes, patents/patent applications): 4
> - Introduction of technology (collaborating companies and companies outside the projects): 3
>
> An evaluation of Norwegian NANOMAT programme has been recently tendered.

Box 49. NANOMAT results.

With regard to patenting activities as one of the most important result indicators, an interesting issue was mentioned by the programme managers. The concept was formulated that **enterprises, including SMEs – by intention – do not apply for patents resulting from the supported research projects**. The main reason is that in order to obtain a patent too much know-how has to be made public. Enterprises and research institutes in other countries might use this knowledge as input for their research (without paying licensing fees). Therefore, SMEs are usually reluctant to apply for patents and prefer to keep the knowledge in-house as their trade secrets.

The observed **shift** in accents of national programmes described in Chapter 9 and discussed in Chapter 6.3 (from financing research infrastructure and pure research project towards product oriented research) will influence over the years also the expected results. The first NMP related programmes in leading Member States before implementation of FP6 were dedicated towards the creation of necessary infrastructure and scientific base and networks. Recent developments in the field demonstrate that the nature of **results produced** will be shifting towards **market oriented products** and the country programmes tend to finance projects oriented towards industry oriented research and commercialization/market use of the scientific outcomes. Greater concentration on **SMEs participation** and creation of **spin-offs** is also noticeable in programme objectives descriptions (see Appendixes, Chapter 11.11). Definitely those factors will in the future shape the evaluation practice in research programmes, but the period necessary for new products entering the market in NMP area is longer than this evaluation perspective.

Another issue arising in terms of expected results in the implemented projects is **the provision of qualified workforce that is competent enough to operate with enabling technologies**. The arising educational needs in the industry are mentioned in analysed programmes in USA, Japan, Germany, France and UK. Those programmes underline the necessity for wider, lower level educational programmes, which will prepare human resources necessary for implementation of new production technologies on industrial level. Other actors in the field tend to finance academic excellence in terms of PhDs and postgraduate studies, investing in academia level excellence rather than in industry vocational trainings. This issue will also influence the evaluation result indicators in the future programmes, but on this stage of implementation of the most advanced country measures it's again impossible to obtain data referring to this factor.

This finding is confirming the discussion from an interview with an expert reviewer and active participant in NMP FP6 and in one of the most influential ETPs. The expert explained that ' [*if*] *you disseminate knowledge and ideas that are based on a completely different level of expertise, than what people have been trained in, then you would have to do a time consuming re-training or you will not get the right effect… the leverage right*'.[83] The expert believed that education and competence development is a success factor for European survival on a scientific and economic basis. This is something that he experienced as taking place to a certain degree in FP6 and is strengthened in FP7. '*But instead of being an activity that takes place in 10-15% of the project activities, it should be wide-spread, it should be executed in more than 50% of the projects*' was his recommendation.

[83] [RD]

7.6 Dissemination of results

Considering that the last cohort of NMP FP6 projects was still running at the moment of interviews (September-October, 2009), the opinions about proper dissemination of project results were limited, but divided. Some interviewees were satisfied with the dissemination considering that it is '*ok*', '*good*', '*working fine*' or '*just normal progress*'. Some others did not consider that that was the case. The critical opinions in the interviews referred to the **dissemination in NMP FP6 being addressed towards academia only and not enough towards the industry and the broad public;**[84] and that **the co-ordination of dissemination done by individual projects towards broad industry groups was not efficient in NMP FP6.**[85]

Benefits for different user groups

Survey results indicate that among the user group "researcher", those who work in the area "Nanotechnology and nanosciences (N)" and "new production processes and devices (P)" benefited slightly more from the results (also by means of dissemination activities) than in the area "knowledge-based multifunctional materials (M)", according to the co-ordinator's assessment, who benefited "to a great extent" (see Figure 50.) from their research and respective presentations of research results. **Representatives from industry benefited in much fewer cases "to great extent" from the research results** of projects in NMP FP6. With regard to the NMP-sub-areas, **they benefited most in the area "new production processes and devices (P)".**

The broader public barely benefited, governments and NGOs almost did not benefit at all from the results according to the co-ordinators, but it must be taken into account that they possibly do not know exactly about the benefits of these user groups in the end.

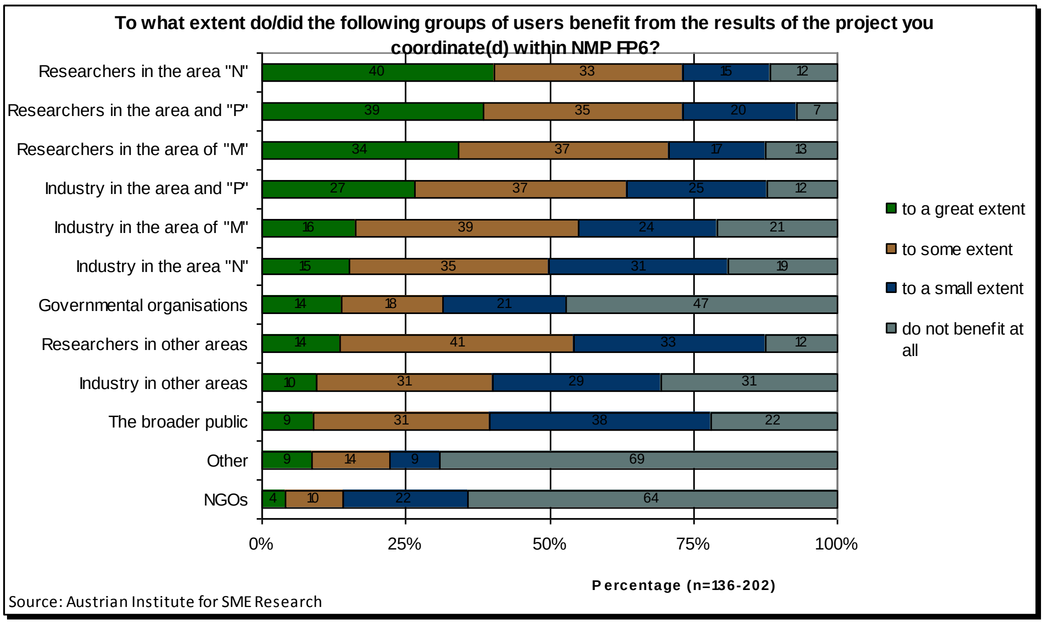

Figure 50. Benefits of results of the projects for different user groups

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[84] [AR, JP]

[85] [ZM, JP]

As for the different sub-areas of NMP, the results reflect this classification in an expected manner, i.e. **the main beneficiaries usually belong to the same sub-area**. However, the assessment that people and organisations outside the actual research team or consortium benefited, to a great extent from the work is by far strongest for researchers in nanotechnology (NMP-1) with 75% of the project co-ordinators stating this fact. Furthermore, it is striking how much potential beneficiaries fall behind in those fields that are not their own, the respective differences in the appraisal that e.g. researchers benefited from the results and dissemination activities to a large extent are vast: as mentioned before, 75 % of project co-ordinators in NMP-1 stated that researchers in the same field benefited to a large extend, while only 27% and 28% stated the same for NMP-2 and -3. This is somewhat surprising since the nature of almost everything eligible/funded within NMP relates to an enabling, multidisciplinary technology.

However, **dissemination seems to be rather limited to the exact same field or sub area**. Another interesting finding concerns the issue of private companies benefiting from research in NMP FP6 by means of disseminating the respective results. The pattern is similar to the one observed for researchers (i.e. dissemination and respective benefits stay within the same sub-area) but on a much lower level. Industry and research in production processes (NMP-3) seem to be rather well connected leaving every other combination of supplier and industrial user of knowledge behind by more than 20% in the project co-ordinators assessment.

With regards to an analysis of dissemination by type of instrument, **NoEs and STREPs lead the way for the research community** especially in nanotechnologies and materials, while **IPs are dominant for both researchers and industry** related to production technologies and CA/SSA are slightly dominating in the other industry segments. The latter are in addition almost exclusive suppliers of information and research results for governmental organisations.

Among the groups "researchers in other areas" and "industry in other areas" (see Figure 51) following areas were indicated most often (top 4): **ICT, Life Sciences, Environment and Sustainability, Energy**. Researchers and industry in the area Life Sciences benefited to a great extent from results of projects within the NMP-sub-area Nanotechnologies and Nanosciences (NMP-1) while researchers and industry in the areas ICT as well as in Environment and Sustainability benefited to almost the same extent from project results of all NMP-sub-areas. On the other hand researchers and industry in the areas Energy technologies, Transport and Space/Aeronautics benefited mostly from project results in the NMP-sub-areas Knowledge-based Multifunctional Materials (NMP-2) and New Production Processes and Devices (NMP-3).

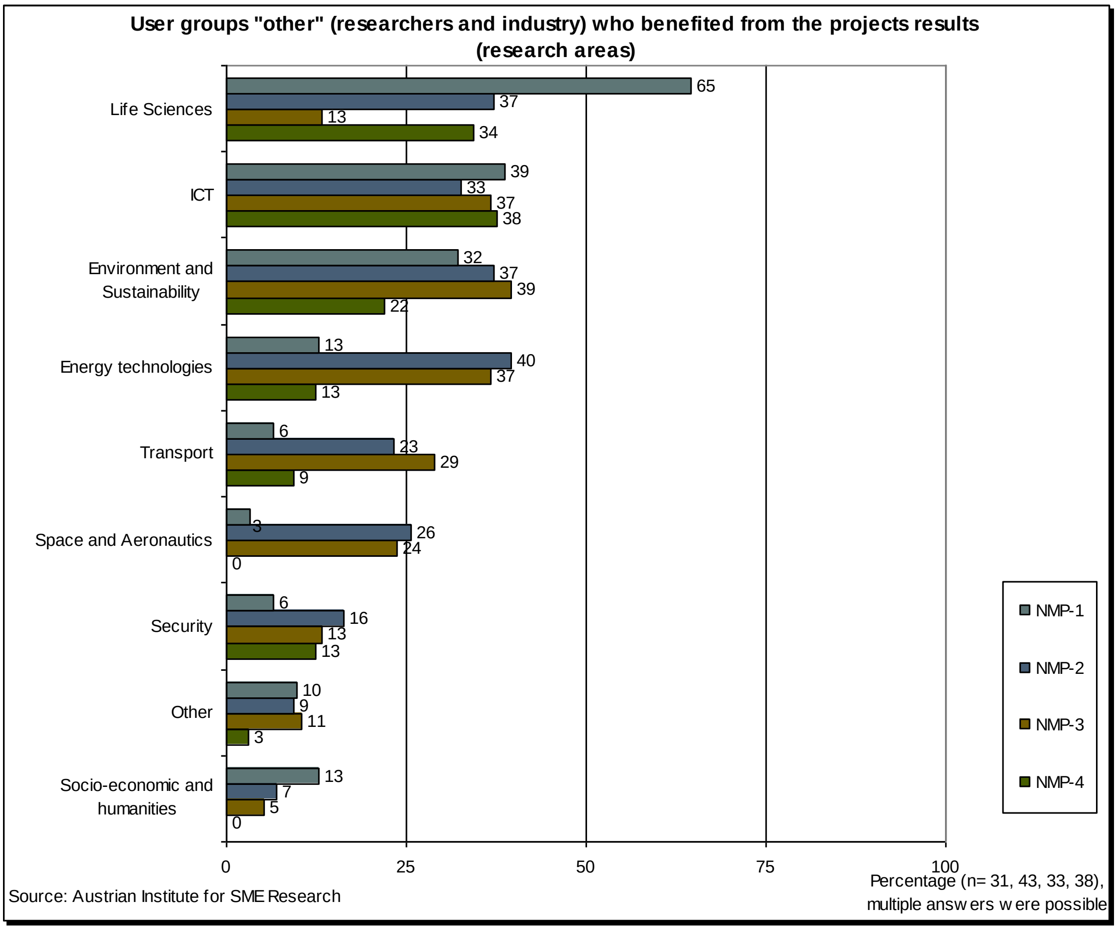

Figure 51. **Research areas of other user groups (researchers and industry), who benefited from the project results**

7.7 Effects on R&D expenditures

Two-thirds of all co-ordinators in NMP FP6, who participated in the survey, state from an overall perspective that the participation in NMP FP6 led to an **increase of the consortium's R&D investments in further NMP-related research** and for 33% of the co-ordinators, the participation in NMP FP6 lead to an increase of private co-financing – apart from the consortium's resources – in the consortium's further NMP-related research[86]. In particular the co-ordinators of Networks of Excellence state an increase of the consortium's R&D investments in further NMP-related research (see Figure 52). Analysed by NMP-sub-area it appears that the area Nanotechnologies and Nanosciences (NMP-1) show slightly more increase than the other instruments (see Figure 53).

[86] 6% of the projects (covered by the survey) were co-financed by private sources – apart from the consortium's resources, 16% were co-financed by national funds, 5% by regional funds. (multiple answers were possible)

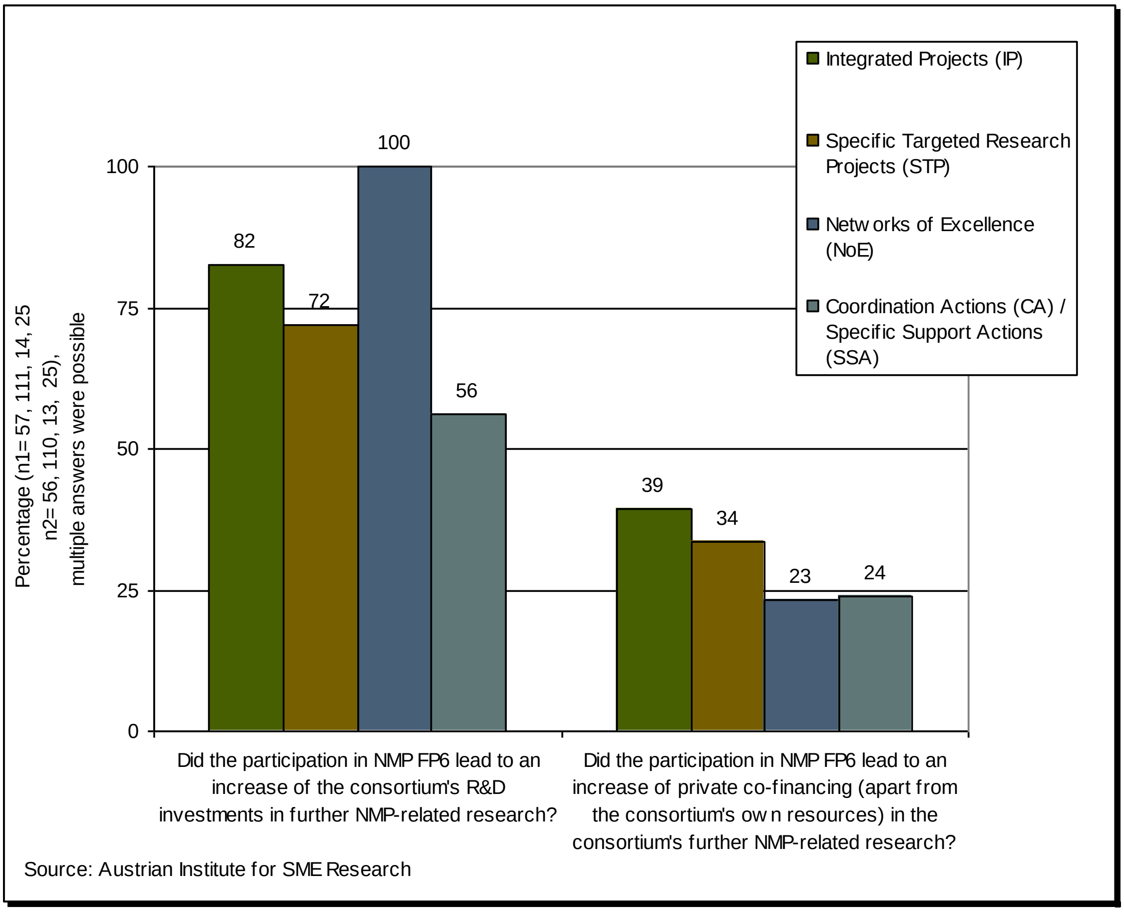

Figure 52. R&D investments as a result of the participation within NMP FP6, increase of private funding following to the participation within NMP FP6 (per instrument)

An increase of private co-financing – apart from the consortium's resources – in the consortium's further NMP-related research as a result from the participation in NMP FP6 has taken place for the Integrated Projects (39%) and the Specific Targeted Research Projects (34%) to a slightly higher extent than for the other instruments (see Figure 52). Among the NMP-sub-areas the area Knowledge-based Multifunctional Materials (NMP-2) appear to gain slightly more increase of private co-financing compared to the other instruments.

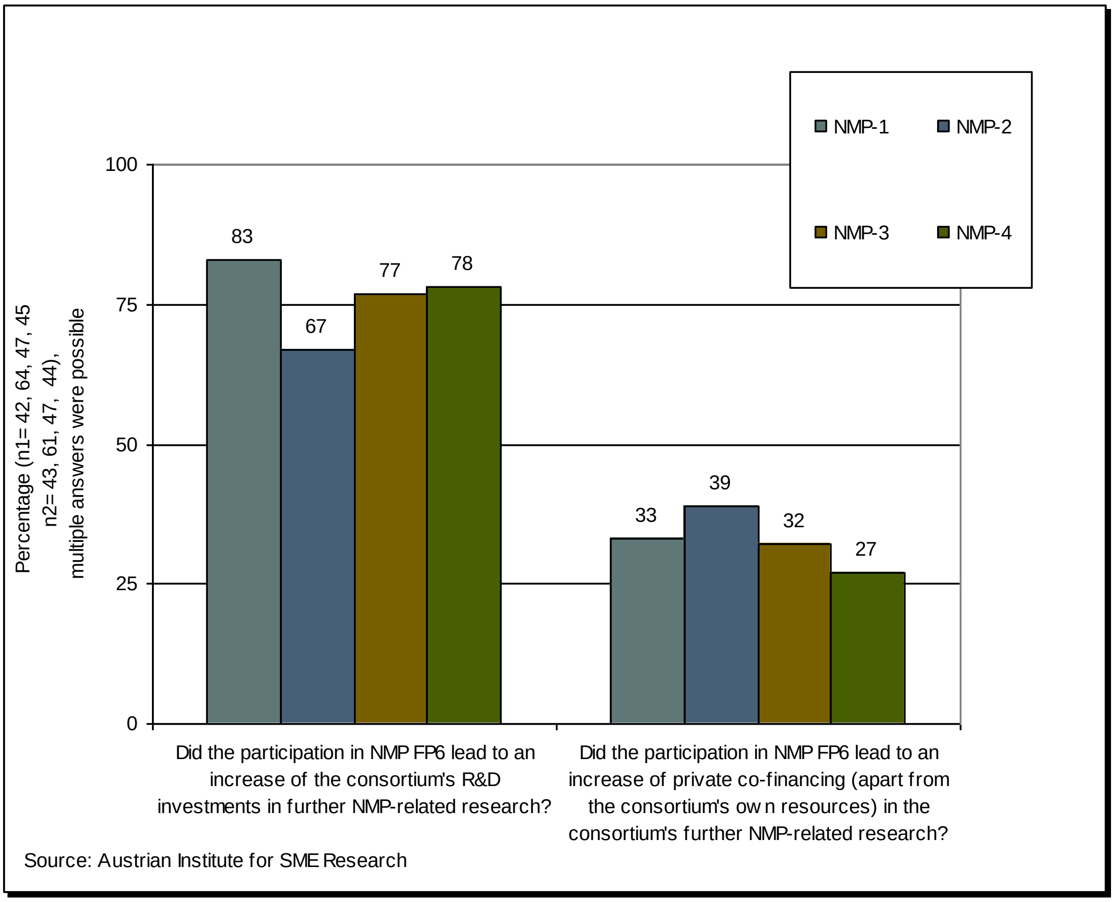

Figure 53. R&D investments as a result of the participation within NMP FP6, increase of private funding following to the participation within NMP FP6 (per instrument)

Difficulties in attracting private investments

An increase of private co-financing – apart from the consortium's resources – in the consortium's further NMP-related research as a result from the participation in NMP FP6 has taken place for the Integrated Projects (39%) and the Specific Targeted Research Projects (34%) to a slightly higher extent than for the other instruments (see Figure 53). Among the NMP-sub-areas the area Knowledge-based Multifunctional Materials (NMP-2) appear to gain slightly more increase of private co-financing compared to the other instruments.

Uncertainty of research results/high risk research, vague prospect of utilisation and IPR-matters are considered to be important in posing difficulties in attracting private investments, by the surveyed project coordinators.

When asked for general problems in attracting private co-financing for NMP-related research projects, the co-ordinators state on top of the list the uncertainty of research results/high risk research (61%), followed by a too vague prospect of utilisation (38%) and IPR-matters (31%).

Box 54. Difficulties in attracting private investments.

7.8 Conclusions

It can be concluded from the evidence presented in this chapter that the results produced in NMP FP6 are:

- Dynamic in nature, being expressed in terms of RTD co-operation and networks between a variety of actors, sectors and disciplines, through both enhancing the existing teams, but also encouraging new teams and approaches.
- Processes that frequently include research that was initiated under previous FPs, developed in NMP FP6 and continue in FP7 and beyond, which extend into - and influence - other research fields and technologies beyond central NMP-fields.
- Of political nature, by bringing NMP on the political agenda in the EU, through the establishment of a EC Communication "Towards a European Strategy for Nanotechnology" and Action Plan and determining the member states to establish own agendas and strategies for nanotechnologies nationally.

Through the promotion of nanotechnologies, development of an Action Plan, in itself being a major outcome, has NMP FP6 programme contributed to **main-streaming national programmes and to facilitating the development of a European Research Area**. The NMP FP6 programme has contributed to the catching up of Europe in the global race for breakthrough technologies and dissemination of science, research and technology in industry and in society, while at the same time focused at integrating academia and industry in different NMP-related research fields.

Learning as a central dimension inherent in the results produced in NMP FP6 has to be emphasized. On the one hand, failures involved in the research were a part of the process, where the participants had to learn about critical issues, find and test solutions, while on the other hand, the participants had to learn to work together in various instruments, actors and stakeholders from the industry, SMEs and different disciplines, by building sustainable public-private partnerships, new teams and sustainable collaborations. In the long-term, the knowledge from NMP FP6 results may enable the achievement of the goals in shorter time, with lower costs and by combining the right competencies.

The enabling nature and interdisciplinary relevance of the results produced in NMP FP6 show their applicability and connection with research fields beyond NMP, with the most linkages to Life Sciences and ICT, followed by Environment and Sustainability, in case of nanotechnologies (NMP-1) and materials (NMP-2) and to Environment and Sustainability, followed by ICT and Energy technologies for the production processes (NMP-3). The application areas of NMP FP6 results had a clear focus on the application fields instruments, chemicals and electronics for the nanotechnologies, evenly distributed focus in the materials and a focus on industrial and mechanical engineering, consumer goods and civil engineering in the production processes area.

Scientific advancement has been produced in NMP FP6, in terms of publications in high ranked journals, innovation related outputs, patents and spin-offs. Areas such as nanomedicine, forestry, energy, electronics, textiles, machine tools and robotics have been considered by the experts to have advanced considerably through the NMP FP6 projects. Creation and integration of new knowledge and research approaches seems to have been resulting from the efforts made primarily by the IPs. To what extent the knowledge related results constituted first class knowledge it is difficult to estimate, although nanotechnology area seems to be the area which has come furthest in this respect in NMP FP6. Moreover, difficulties in attracting first class knowledge industry-driven research may have an implication upon the nature of the results in NMP FP6.

In spite of the **difficult nature of the key industrial challenges and complex processes involved in addressing sustainable development demands, ethical issues, toxicity and safety issues**, NMP FP6 is considered to have **dealt to a considerable extent with key industrial challenges.** However, being expected to address the whole spectrum of industrial sectors in Europe made it difficult to address each of them in totality in NMP FP6. A high credit was given to the European Technology Platforms (ETPs) for their role in addressing key industrial challenges by shaping through their strategic road-maps the content of the work programmes.

Co-operation and networking – a process having implications upon the nature and relevance of the results related to first class knowledge and solutions dealing with key industrial challenges, have resulted from NMP FP6 to a large extent. **Capacities to establish and maintain new co-operative relationships significantly improved for a majority of participants** in NMP FP6. The **tangible effect on sustainable co-operations** among researchers appears to be **somewhat limited**. Only a minority of all surveyed co-ordinators of research consortia remained fully intact for follow-up RTD projects after their co-operation in NMP FP6. However, researchers do or plan to conduct R&D projects with at least some of the cooperation partners from their joint project funded within NMP FP6.

The overall contribution of NMP FP6 to the issue of **transforming Europe into a more attractive working place for researchers from outside Europe** (Lisbon Agenda) has to be assessed as being **rather weak**, while the contribution of NMP FP6 projects to an **increased mobility *within* Europe and the attraction of skilled employees / researchers from EU countries** has to be considered to be quite **substantial**.

Co-operation and networking has contributed to an increased level of knowledge in the new Member States and in those Member States which did not have a long tradition in NMP RTD. Access to research results and knowledge through co-operation and networking is therefore considered as crucial for NMP RTD in these countries. Referring to the importance of new co-operation patterns as stated in ERA on the one hand and the often mentioned problem of finding new R&D partners among a limited set of research institutions in a given field, NMP FP6 has to be considered a success.

Besides the **access to (new) knowledge,** which was crucial for the coordinators of NMP FP6 projects and can be perceived as a preparatory effort for an actual knowledge transfer, indications from the survey with regard to an actual knowledge and technology transfer show quite a good access to or actually joint usage of physical R&D-related infrastructure and furthermore a remarkable exchange of personnel within the projects. It also appears that the projects within NMP FP6 contributed to a large extent to an improvement of the programme-objective knowledge and technology transfer, when assessed in a more general context among different other objectives (see also Chapter 8.2).

Although a comparison with the results produced in national NMP related projects is not feasible due to a lack of national evaluations of this kind, the **shift in accents of national programmes towards financing industry and product oriented research**, allows us to conclude that the nature of results produced in national NMP programmes will be shifting towards market oriented products. In connection with the shift comes the issue of qualified workforce, competent enough to operate with enabling technologies, which has implications upon the results in NMP RTD. It can thus be concluded that academic excellence, education and competence development related to the enabling technologies are key factors for Europe in keeping its competitive position in the world.

The critical points about the dissemination of knowledge in NMP FP6 related to the dissemination being addressed towards academia only and not enough towards the industry and the broad public. Individual project dissemination towards broad industry groups was not efficient in NMP FP6.

Participating in NMP FP6 clearly had **positive effects on research related investments and R&D expenditures**, whether they originate in the research consortia's own budgets or private third-party funding. However, these results have been achieved to a different degree and the main reasons for the weaker mobilisation of private capital lie in the uncertainty of an economic utilisation of the research conducted, the risk of failure and difficulties in handling IPR.

Chapter 8. Impacts on strategic objectives

Based on the results achieved in NMP FP6, the following analysis deals with the strategic impact of the thematic area NMP, rather than focus on its projects' actual tangible outputs. Here, the context of NMP FP6 is taken into account for an assessment of its impacts. NMP FP6 is not an activity independent from other European political agendas in the field of either RTD or other policies. It has been developed under- and implemented accordingly to the overall reorientation of the European Union that is reflected in the formulation of the Lisbon Treaty, the Gothenburg EC, the idea of the European Research Area etc. Therefore, all these different agendas have found their way into the documents describing the actual goals of NMP in FP6.

As discussed in chapter 5.2, this resulted in many interconnections, meaning that goals stipulated in the Lisbon Treaty or from documents related to the ERA have respective counterparts in the work programme of NMP FP6 and its revisions. Therefore, the impact on objectives of the wider European context (i.e. "outside" NMP FP6) cannot be separated from the issue of achievement of the thematic priority's own objectives. In most cases the difference between NMP objectives and those "outside" NMP seems to be a matter of semantics while in fewer cases the context agendas actually provided additional targets for NMP FP6. However, it has to be kept in mind – as described in detail in chapter **5.2** – that none of these strategic objectives, no matter where they originated, were defined as quantitative target parameters and therefore cannot be measured directly.

The following analyses are, however, not as much concerned with the respective origin of an objective as they are aiming at reflecting on the fact that (see above and, again, in Chapter 5.2.) the objectives both in and outside NMP FP6 that are relevant for the thematic priority do overlap in many cases. Therefore, the structure of this chapter follows a more thematic approach; the origin of different objectives is, however, dealt with under the different parts of the analysis.

8.1 Increased orientation of RTD towards the market

Increased networking between business and science as an effect of NMP FP6, has received mostly positive answers from the interviewees from all the groups: research, business and policy, as well as among the project and strategic level participants. ETPs and NTPs have been mentioned as important actors in this issue[87] as well as the IPs which created arenas for networking between the industry and the academia.[88] On the other hand, opinions were divided in the interviews regarding public-private partnerships and involvement of SMEs in NMP FP6. Some interviewees praised NMP FP6 for involving industry in RTD in a greater degree than in previous FPs, resulting in public-private partnerships at the European level.[89] **A research agenda driven by the industry** (ETPs); bringing together organisations, public and private, academia and industry and making them work in projects across national boundaries, has been an important process which started in NMP FP6 and is further developed in FP7, was explained in the interviews, among which the national expert in NMP FP6 Programme Committee and a participant project co-ordinator.[90]

[87] [MS, RD, ZM]

[88] [JS]

[89] [JM]

[90] [MS, MM]

Other opinions, among which a policy maker and a participant researcher in FP6 and FP7, are along the lines that still not **many companies were involved in NMP FP6 so as to establish important partnerships** compared with FP7[91]. Post project collaborations between academia and industry have not been observed to the same extent as in the programmes at the national level (ed. UK), was the observation of an expert reviewer in NMP FP6.[92] **Difficulties involving SMEs** were inherent in the complex design of the programme, bureaucracy and lack of knowledge which made SMEs hesitant in participating in NMP FP6 was the opinion expressed by the interviewees from different groups in the sample.[93] Still NMP FP6 was regarded as more successful in attracting SMEs than previous FPs, but more efforts are necessary in this issue, according to the POs and an active participant in NMP FP6 and FP7.[94]

According to the project co-ordinators, **NMP FP6 has contributed to an increased orientation of RTD towards the market**. The survey results show that more than 80 % of the projects reported as having had a major or at least medium contribution to a change of the utilisation orientation of NMP research towards market and exploitation (See Figure 55). This corresponds with the fact that over two thirds of the projects positively affected the participation of SMEs in NMP-related research and the implementation of NMP-related technologies in SMEs. This contribution is somewhat smaller for industry in general, i.e. including larger companies, which can be expected for the impact of funded R&D projects is very limited for companies above a certain size.

At the same time, 30% of the project co-ordinators reported only minor contribution to funding of start-ups and spin-offs, while 50% of the projects reported no contribution what so ever. Two more objectives that have only partially benefited (i.e. measured by the R&D projects' contribution) are, although very different from each other, similar in that both of them are slightly more ambitious than the others: the development of radical innovations/industrial breakthroughs and the increased investments in R&D related business areas. Although a large share of the projects were able to contribute to these issues, the share of projects with only minor contribution or no contribution at all is almost as large or even slightly larger, respectively. This rather minor contribution to industrial breakthroughs certainly derives from the matter that it is far too early to expect a high amount of such contribution at this stage of NMP-research (only 71 % of the projects included in the dataset are finished).

[91] [CI, AJ]

[92] [CA]

[93] [JM, RV, BH]

[94] [GK, HF, MM]

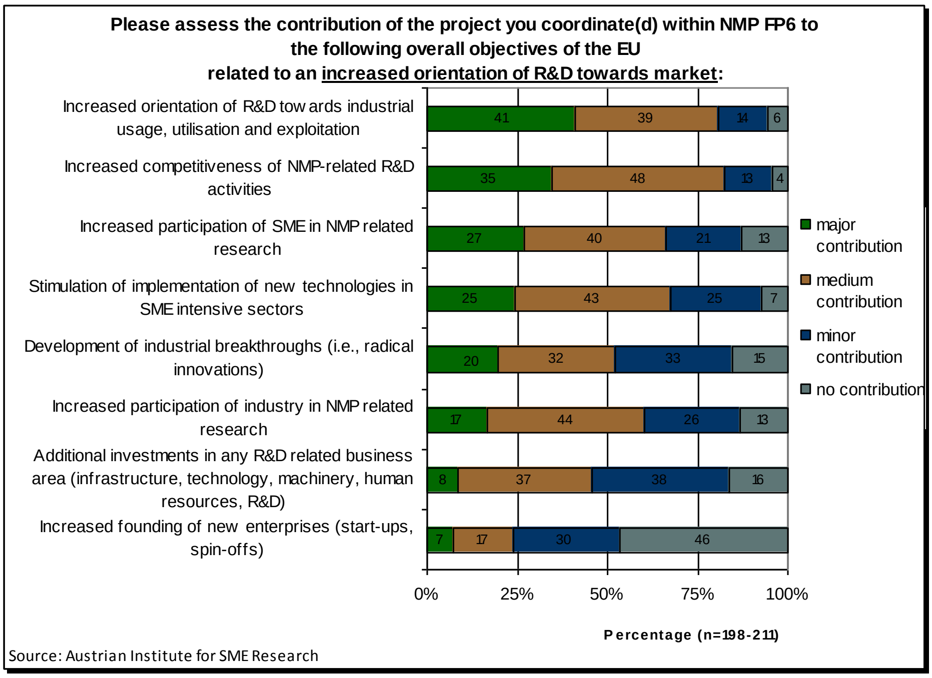

Figure 55. **Contribution of the projects to objectives (related to an increased orientation of R&D towards market) of the EU (i.e. as included in the Lisbon Agenda, ERA-related documents and NMP work programme)**

Contribution per instrument and NMP sub-area

The picture becomes more differentiated when the survey results are analysed by instrument in NMP FP6. In general, the average contribution to increased market orientation is highest for Integrated Projects, followed by STREP, and Co-ordinated Actions/Specific Support Actions and lowest for Networks of Excellence. However, the average percentage of projects with no contribution at all is highest for CA/SSA and STREP, according to the survey results. SME participation seems to have benefited the most from IP and to a smaller extent from STREP projects, while increased industry participation in general benefited from IP and NoE. What has been referred to as the more ambitious objectives in terms of range and scope (development of radical innovations/industrial breakthroughs, the increased investments in R&D related business areas and increased founding of companies), derived comparably less advantages but from all types of projects with the exception of breakthroughs that received a much more positive assessment from IP than from any other type of instrument. In sum, these results indicate that the instruments more or less contribute to the objectives in their specific intended way.

Analysed per area, projects in the NMP sub-area 'nanotechnology' (NMP-1) did contribute significantly less to the objective of more market-oriented R&D than projects in new materials, productions processes and projects integrating all three sub-areas, but had a much stronger impact on more competitive NMP related R&D than the other sub-areas. This reflects the different phases the technologies in their respective life cycle, i.e. while the development of production processes is *per se* often closer to the market, research on "pure" nanotechnology is closer to basic research.

8.2 Strengthening the knowledge base in Europe and creating critical mass

One of the main objectives of NMP FP6 was to create '**critical mass**' without any notion of what this might be. Since the term itself is not defined (neither on programme nor project level) and is not connected to any quantitative target measure, the analyses have to remain on a purely qualitative level. However, interviews revealed that experts' and participants' **qualitative assessments indicate that NMP FP6 supported** the achievement of critical mass by means of **providing sufficient resources** for individual projects and therefore, the programme as such.

With regards to the objectives concerning strengthening the knowledge base in Europe and creating critical mass, the survey results are very diverse. In the survey, an overwhelming majority claims **major or medium contributions to the more general objectives of** creating critical mass in NMP-related research, the strengthening of excellence, creation of new knowledge, access to (new) knowledge, an improved interaction between science and industry and consequently, an improved knowledge transfer. All of these objectives show a strong or medium contribution (72% – 93%) of single projects to shift the issues into the desired direction. Only a half of the surveyed project co-ordinators considered that their projects contributed to the integration of knowledge and technology, while knowledge management and an improved handling of IPR could not really benefit from the research projects funded under NMP FP6; a majority of almost two-thirds of the projects state only minor or no contribution at all (see Figure 56), a point which was also supported in the interviews.

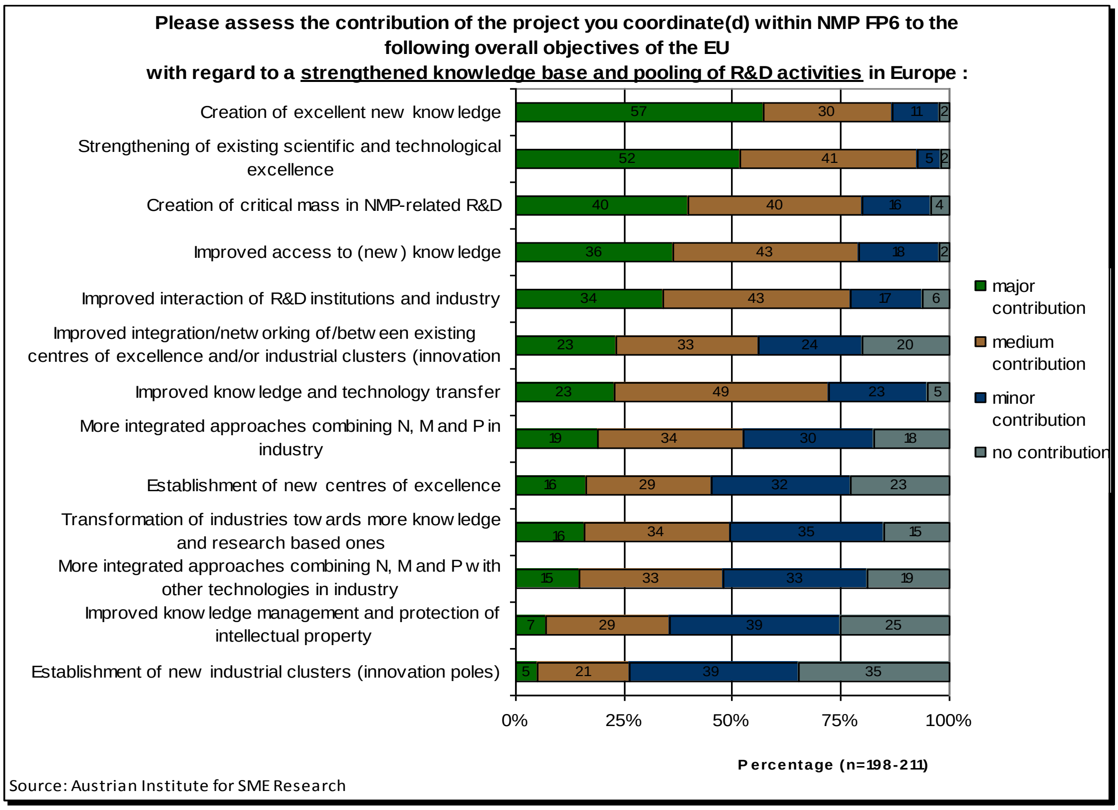

Figure 56. **Contribution of the projects to objectives (related to a strengthened knowledge base and pooling of R&D activities in Europe) of the EU (i.e. as included in the Lisbon Agenda, ERA-related documents and NMP work programme).**

One of the main objectives in NMP-related strategic documents (subsumed as "key industrial challenges", see also Chapter 5.2) and the Lisbon Agenda is the **transformation of resource-focused industries to more knowledge intensive** ones. Here the contribution of RTD projects is somewhat undecided; while 50% claim a major or medium contribution, 50% do not. Centres of Excellence and respective industrial clusters are of importance for both the Lisbon Agenda and the ERA. However, the impact of NMP FP6 on the two main issues under this headline varies to a significant degree. The networking of already existing centres seems to have benefited from research projects funded in NMP FP6 while the establishment of new centres of excellence noticeably falls behind in terms of approval to contribution made by R&D projects. Establishing new industrial clusters ranks even lower in possible contribution of NMP FP6 (with a stated no contribution / minor contribution from more than 70% of the projects).

The **multidisciplinary** character of the NMP FP6 has been praised by the interviewees in most of the sample groups, both at the strategic level (POs, experts) and project level (researchers and business, NCPs). An interviewee, who has been actively involved in the dissemination issues of NMP FP6 projects, expressed that: '*multidisciplinarity is excellent. NMP FP6 has really tackled that. That has been an eye-opener to me… I think a wonderful effect that it made was that it brought a fantastic mix of disciplines… NMP FP6 brought the involvement of other [ed. disciplines] which normally did not have a voice. That was a great success*'.[95] A PO pointed out that **interdisciplinarity was practically present all over NMP FP6**, but more in particular in the integration area of the programme.[96] The IPs have been credited for the multidisciplinary dynamics they have created in NMP FP6 by integrating various actors from different disciplines around a topic.

NMP FP6 has considerably contributed to integration of actors, sectors and disciplines.
The integration of actors, sectors, expertise and disciplines has been an objective which according to the interviewees has definitely been achieved in NMP FP6. According to the national expert to the Programme Committee in NMP FP6, one of the most important things about the FPs is that: '*you bring organizations from all over Europe together. Most of the organisations work within their own national programmes, but to work with organizations abroad is not so easy and this is stimulated by the FPs. So the strong thing about the FP is that many organizations and companies from different countries can work together in one project*'.[97] The IPs have been mentioned as having made the biggest difference in achieving this objective. Only a few NoEs, were perceived as fulfilling this objective. Some POs doubted whether there are any permanent integrative effects of the NoEs when the financing from the Commission is finished. This observation can be supported by the survey results: IPs (followed by the STREPs) contributed to a greater extent to the "integrated approaches combining N, M and P in industry" as well as to "integrated approaches combining N, M and P with other technologies in industry than the other instruments" (for details please consult Table 79 et seq).

Another interviewee, who has been participating in NMP FP6 in the role of an expert reviewer and evaluator, but also as a lobbyist and participant (at different points in time and different stages of the FP), brought up the issue of **sustainable integration resulting in**

95 [OS]

96 [GK]

97 [MS]

long-term collaborations, active after the EU project termination. He has seen collaborations of this kind in his country (UK), but not so many at the EU level. In his opinion, long term collaborations might be outweighing the first-class knowledge objective, by the relationships the FP creates and the habits of working together. According to him this is **a key thing for the future RTD collaboration** in the EU, but it takes time and resources.[98] When asked to compare with successful collaborations in the UK, the interviewee concluded that collaboration should focus on mutual interest of the academy and the industry and it should build on strong personal relationships, which are strong enough to make collaboration survive changes of people in the both industry and academy. '*EU is a long game, it will take a long time for the member states to learn to work together*', according to the expert reviewer.

Some progress towards producing first-class knowledge in NMP FP6, however IPR was an issue

The creation of first-class knowledge in the NMP FP6 received divided opinions in the interviews as well. Some interviewees considered that large consortia which managed to build on varied expertise in one area and focus their R&D on entire concepts (ex. durable coatings) did have a potential to produce first class knowledge.[99] Another interviewee, with a background in materials science, expressed that to some extent collaborations of the IP type may give rise to knowledge. However, the creation of first class knowledge – and dealing with associated intellectual property issues - is easier the fewer the partners in a project. Thus, the more partners in a project, the more everyone guards sensitive knowledge according to his experience.[100] Two other interviewees, also POs, pointed the nanotechnology area as having achieved scientific and technological excellence in NMP FP6.[101] Before NMP FP6 nanotechnology R&D was developing fragmentally in Europe, with Germany, UK and France as major players and through NMP FP6, progress has been made towards EU becoming a world-class player in terms of scientific excellence was the opinion of the PO.[102]

The PO who didn't consider that first-class knowledge was achieved in NMP FP6, argued that putting people into contact via larger projects was helpful, but it did not necessarily lead to first-class knowledge.[103] Another interviewee, an expert reviewer with experience from chemical technology area, concluded that the FP projects did not stand out, their best output was as good as leading national programmes (referring to UK and other member states which are advanced in research and possess the best resources in the national programmes).[104]

Difficulties in dealing with **IPR issues**, as a general problem in the EU projects during FP6, hindered sometimes the creation of first class knowledge in the first place, was an underlying opinion from the interviews. Due to, on the one hand, little knowledge and experience, especially among the researchers, to understand the implications and exploit the IPR and on the other hand, hesitance from the industry to patent and thus bring in

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98 [CA]

99 [MM]

100 [JH]

101 [JS, GK]

102 [GK],

103 [AB]

104 [CA]

their cutting edge research, as well as a costly patenting process, especially for the SMEs, made it a difficult set-up for the creation of first-class knowledge in NMP FP6. However, an improvement in this respect may occur in the long-run due to an emphasis put on the IPR issues at the political level through the EC Communication "Towards a European Strategy for Nanotechnology" and Action Plan "Nanosciences and nanotechnologies: An action plan for Europe 2005-2009".

Little knowledge and experience in exploiting IPR in NMP RTD, especially in the academic environment, was seen as an important deficiency, which had effects upon the IPR exploitation objective in NMP FP6. It was explained by an expert reviewer and participant in NMP FP6 and FP7 that '... [*the*] *IPR generated inside the project is maybe less relevant than the IPR generated outside the project. If you are a little bit experienced in how to do this, you bring only those things into the framework, or into the scenarios the EU project boundary conditions that have directly resulted from activities that were covered by the project plan and by the work packages*'. [105] However an impact is expected to occur in the long-term, argued the head of the Nanotechnology Unit during NMP FP6, since through the Nanotechnology Action Plan, elaborated during NMP FP6 and the efforts undertaken regarding a European Strategy for Nanotechnology, which included the IPR issue in NMP-related RTD.[106]

Progress towards ERA has been achieved in NMP FP6

According to the interviewees NMP FP6 has contributed to ERA in several aspects. That people demonstrated willingness and interest in co-operating, especially by the end of the programme, has been the observation of several interviewees, which were referring to ERA-NETS and ETPs.[107] Even some successful examples of NoEs in the materials area have been mentioned in this respect.[108] By successfully integrating researchers both in academia and in businesses, by ensuring a truly multidisciplinary environment in the projects and opening for co-operation with countries beyond the EU (ex. India, China, Canada and Iceland, Norway, Switzerland) and by providing increased career opportunities for young researchers, has NMP FP6 moved closer towards ERA objectives.

There are aspects which still have to be improved in order to achieve ERA objectives. Little or no progress has been noticed in **reducing legal and practical barri**ers hampering mobility across institutions, sectors and countries, during- and after the immediate closure of NMP FP6 projects was the opinion of a national expert with background in science, a PO and a participant in NMP FP6 from the business.[109] Although efforts had been made, especially in the IPs,[110] IPR-related issues were still in the way of fruitful collaborations in NMP FP6, according to several interviewees.[111] The same reasons named above, namely little knowledge and experience about IPR among the researchers and hesitance from the industry to bring in their cutting edge research due to hesitance in patenting it, made it difficult also for developing fruitful collaborations in NMP FP6. However, this might improve in the long-run due to an increasing emphasis on the IPR issues related to NMP

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105 [RD]

106 [RT]

107 [ML, CA, RD]

108 [AB]

109 [AR, TC, GK]

110 [JS, GK, HF]

111 [CS, HK, JM]

posed also by the EC Communication "Towards a European Strategy for Nanotechnology".

ERA-NETs have been mentioned as an important tool with great potential for producing trans-national research collaborations,[112] being referred to in the interviews as a strong channel connecting NMP FP6 with the national programmes and actors[113] and as an important contribution to ERA.[114] ERA-Nets have been playing an important role in improving the coherence in implementation of national and EU RTD activities and in the area of co-ordinated funding. They have been praised for catalysing processes which otherwise would not have happened.[115] However, as the ERA-NETs were managed by a different Directorate, the POs in NMP FP6 were not able to make the most out of them, which is not the case in FP7, explained a PO, meaning that they have a better grasp and are involved more actively in ERA-NETs activities in FP7.[116]

Contribution per instrument and NMP-sub-area

In general, knowledge-oriented strategic goals have on average benefited most from the instrument NoE, less from STREP and IP and considerably less from CA/SSA except for issues or objectives that are more closely linked to respective industries, IPR, industrial clusters etc. here, the strongest contribution stems from IP. In that sense, each of the instruments shows its more or less predictable and intended effects, that NoE that are designed to bring larger groups of scientist all over Europe together not only to create new knowledge, but also critical mass simply by the number of scientists co-operating. For details please consult Table 79 at page 202 et seq.

An analysis differentiating the four sub-areas of projects funded under NMP FP6 showed almost identical contribution patterns. However, a tendency can be observed that projects within nanotechnology and new materials (NMP-1 and -2) have a slightly higher impact on the objectives regarding the creation of new knowledge and strengthening existing excellence while projects in NMP-3 (production processes) seem to contribute to science-industry relations more frequently. In the end, this is – once again – due to their different life cycle phases, their closeness either to application (NMP-3) or to basic research (NMP-1 and NMP-2).

8.3 Effects on human resources and labour market

Substantial contribution to the development of human resources and labour market in NMP FP6

Project co-ordinators perceived the effects on human resources and labour market on average as having received high affirmation in RTD projects during NMP FP6. As research is always affecting the participants' knowledge and, in international co-operation, their mobility, the career prospects of (young) researchers, improved skills of labour force and increased mobility can be stated as having received supporting impact from the research

[112] [CA, ML]

[113] [JS]

[114] [CA]

[115] [MM, ML]

[116] [JS]

done in NMP FP6 in particular (see Box 54). Beyond that, a somewhat surprisingly high share of project co-ordinators claims an utilisation of their research for training and educational measures indicating that this particular NMP-related objective has benefited from the research conducted. At the same time, a majority of the projects have had an impact on the creation of more jobs for skilled labour and the general attractiveness of Europe for researchers from outside Europe, with the latter being considered to have received major contributions from NMP projects to a relatively large extent.

Opinions from the interviews however tended to be negative or having difficulties to answer regarding impacts on lowering regulation and administrative barriers to professional recognition. Among interviewees there were those who considered that administrative barriers to professional recognition have been diminished, taking place as a function of increased collaboration over national borders or that the barriers have been decreased, but this could not be connected to NMP FP6.[117] The POs made it clear in the interviews that it was difficult for them to make an assessment on the barriers issue and that they have not seen any improvements in this area.[118] It might be interesting to note that those interviewees who answered positively to the barriers issue are coming from the research group, while those who were more negative were coming from the business group (industry, SME).

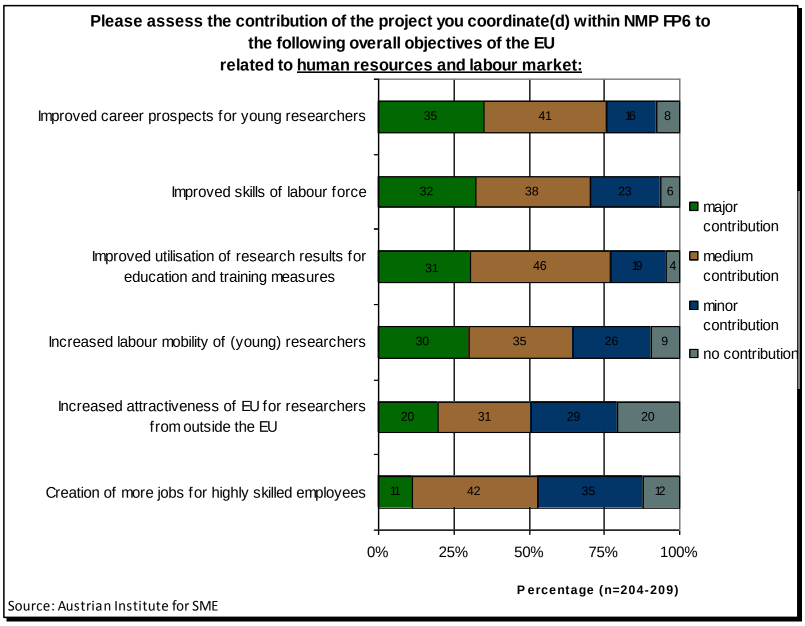

Figure 57. Contribution of the projects to objectives (related to human resources and labour market) of the EU (i.e. as included in the Lisbon Agenda, ERA-related documents and NMP work programme).

Contribution per instrument and NMP-sub-area

With regard to the different types of instruments there is a clear result to be observed: all the above mentioned positive effects rest much more heavily upon NoE and STREP than on IP or CA/SSA. However, this clearly comes as no surprise since the former are

[117] [OS, JH, CS]

[118] [JS, HF, SB, GK, AB]

"classic" R&D projects whose very nature include positive effects on individuals' careers as well as the exchange of personnel, creation of new jobs (however, often project-bound and hence temporary) etc. The analysis for the different sub-areas within NMP also shows a clear result insofar as the projects in nanotechnology and (to a lesser extent) in materials have a much stronger impact on the objectives regarding human resources. However, this might be linked to the nature of the respective scientific fields and the issue of being closer to basic research.

8.4 Societal and sustainability aspects of European RTD activities

NMP FP6 is affected by objectives related to societal and sustainability aspects of European RTD activities in two different ways: first of all, the programme itself is funding projects that are aiming to address directly some of the problems included (especially in terms of reduction of usage of raw materials, environmentally cleaner production process etc.) and second, the respective research itself is object of some of the issues (e.g. related to public health, safety, ethics, reduced energy consumption etc.). However, the questions of a contribution of individual NMP projects to the so called Gothenburg Objectives, i.e. resource sustainability and environment were not seen as being important dimensions by project co-ordinators responding to the survey. The only exception is the issue of production processes increasingly orienting towards sustainability but even here the objective did only moderately benefit from the projects funded.

A different picture is given by the interviewees. **A positive impact of NMP FP6 on increased environmental sustainability of NMP-related RTD was perceived by most of the interviewees**. Although CO_2-neutrality in materials and processes was not considered in the beginning of the programme, it has been put on the agenda and it was 'a red line' in the whole process, according to several interviewees from different groups.[119] Lighter materials and increased energy efficiency of the industrial production were also estimated to be positively affected by NMP FP6 in the long-run, by most of the interviewees. '*The research is helping to make the production processes more efficient. We can do much more with less materials, and the production processes themselves are becoming more efficient. So it's certainly happening an increase in sustainability*', was explained by a PO.[120]

[119] [RD, SB, MS, RV]

[120] [HF]

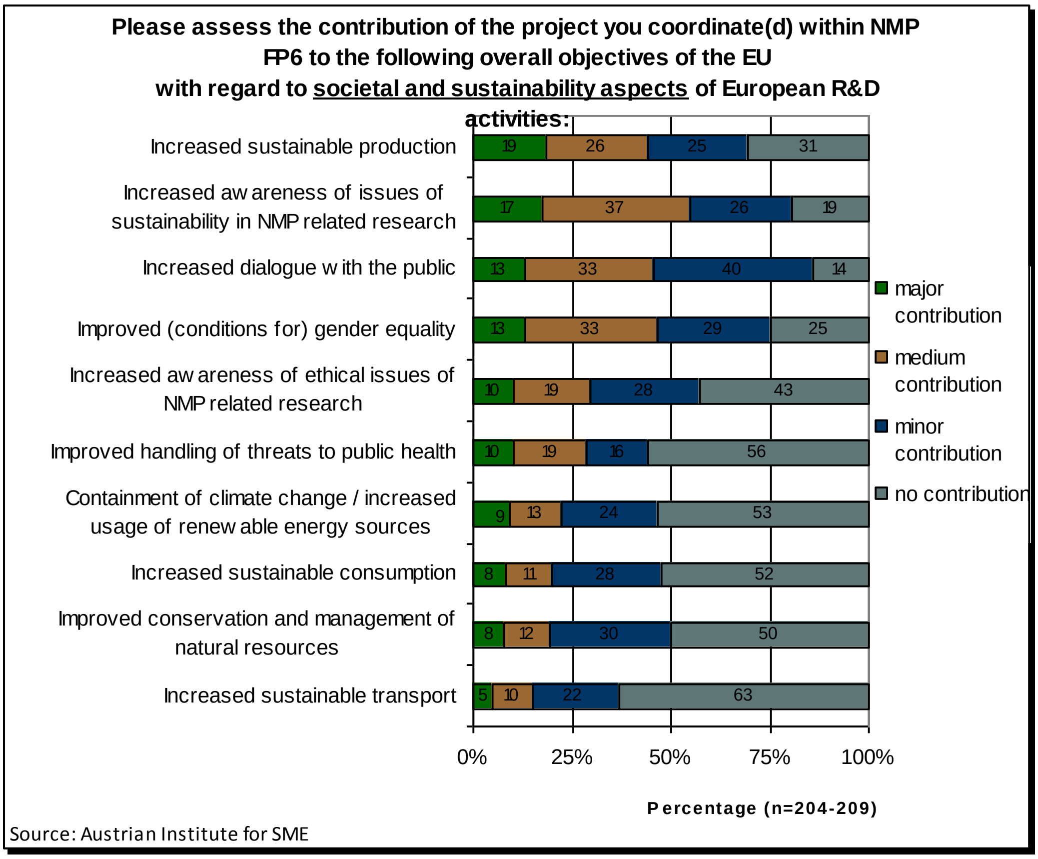

Figure 58. Contribution of the projects to objectives (with regard to societal and sustainability aspects of European R&D activities) of the EU (i.e. as included in the Lisbon Agenda, ERA-related documents and NMP work programme).

Little progress towards dialogue with the public and minimal progress towards addressing ethical issues connected to NMP research in NMP FP6

NMP FP6 intended to also foster the dialogue with the public (especially about nanotechnology for there is a substantial requirement for education about potential threats to public health etc.) but the project co-ordinators are somewhat reluctant linking their projects to this issue; the objective seems to be supported by NMP FP6 only to some extent. A contribution to the question of ethical issues regarding research is denied by the majority, which can be related either to a situation of lack of awareness among researchers in NMP or self-perception as being not affected.

Contribution per instrument and NMP-sub-area

In contrast to the analysis above, the issue of R&D projects contributing to strategic societal objective does not reflect the instruments' very own tasks. Apart from the generally low contribution, neither IP nor STREP seems to have a major effect although by definition[121] these two instruments should address major needs in society. While gender equality and the dialogue with the public to some extent benefited from NoE (this certainly is related to the issue of human resources where NoE were especially strong in terms of contributing to the respective objectives), CA/SSA show the strongest contribution to all

[121] See overview on instruments in FP6: http.//cordis.europa.eu/fp6/instruments.htm

objectives under the headline society and sustainability (nevertheless, the share of projects that stated that they had no contribution whatsoever is comparable). As for the different sub-areas within NMP FP6, the analyses show a consistently low contribution over almost all issues under the headline societal needs and sustainability apart from a few exceptions: projects in the sub-area of production processes (NMP-3) do have a clearly stated impact on the question of increasingly sustainable production and increased awareness for sustainability in NMP-related research. Projects within the sub-area nanotechnology (NMP-1) show a comparably larger contribution to an increased awareness of ethical issues and the general dialogue with the public (see tables: Table 80, Table 82, Table 84, and Table 95 starting from page 202).

With regard to the answers of the project co-ordinators to which, in their perception, objectives the projects contributed to a major extent it sticks out that the contributions to those objectives that are related to the programme (NMP) are stronger than to the objectives without direct relation to the programme. This holds true for all four instruments (CA and SSA combined), although different patterns emerge: the difference between contributions to strategic objectives directly linked to NMP FP6 and those that are not is largest for IP and barely identifiable for CA/SSA. This indicates that on average over all issues IP tend to be much more focussed – with regards to their positive effects – on the agenda (NMP FP6) they are a part of than other instruments that very well affect objectives outside their agenda, especially CA/SSA that have an almost equal contribution to NMP FP6 objectives on the one hand and non-NMP FP6 objectives and therefore, are much less focussed on strategic objectives of NMP itself.

Networks of Excellence show the strongest contribution to NMP FP6 objectives and strategies only indirectly linked to it but to a limited number; respective projects have a much more concentrated, limited but stronger positive effect on strategic objectives than any other type of project funded within NMP FP6. In contrast to that, the other instruments do affect all issues and objectives in terms of a contribution of individual projects though to a diminishing degree.

8.5 Contribution to European Integration of NMP RTD

European integration and the issue of more co-ordination, reduction of duplication and whether or not the EU is or will become a trend-setter in research policy shows indications of being pushed into the desired direction with a significant contribution of NMP FP6. A large majority of project co-ordinators involved in NMP FP6 (69 %) identified a major or medium contribution of the thematic priority NMP as a whole to more co-ordination between NMP-related national and EU initiatives (consult Figure 59). Although less strongly (58 %), a majority also credits NMP FP6 with having promoted more coherent designs and implementation processes of national and EU funding schemes.

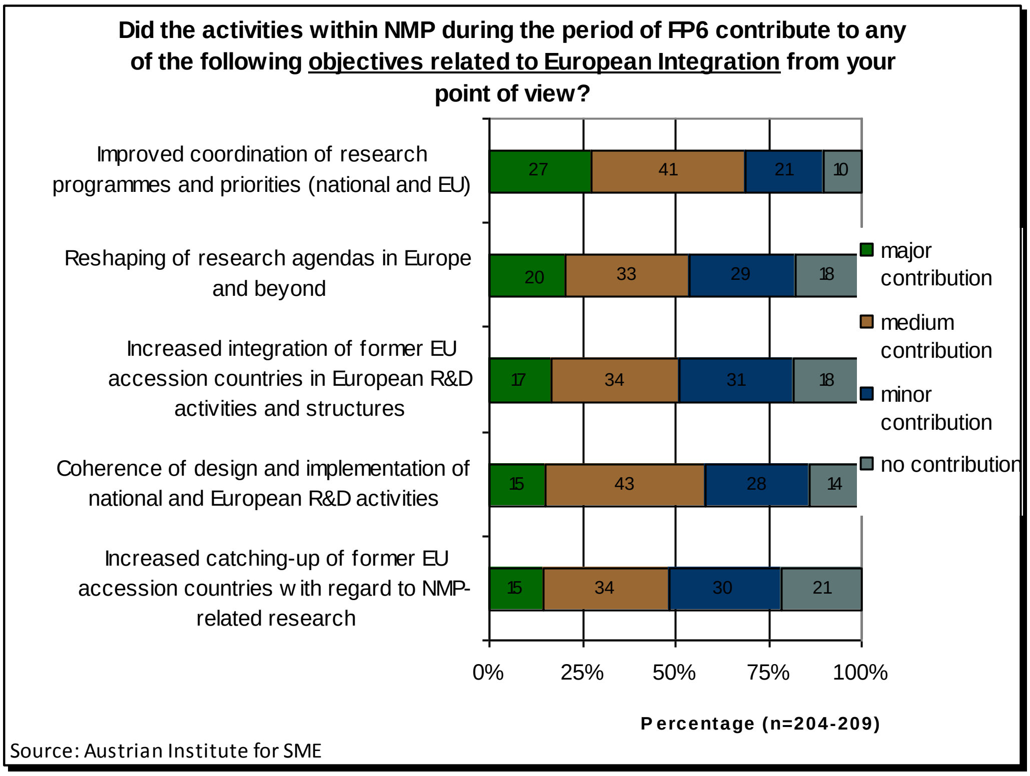

Figure 59. Contribution of the programme to objectives (related to European Integration) of the EU (i.e. as included in the Lisbon Agenda, ERA-related documents and NMP work programme).

Consequently, the role of the EU as a trend-setter, as displayed in the general EU objective influencing the research agenda in Europe and beyond, is also backed by a majority of the project co-ordinators as an outcome of NMP FP6. This finding, however, is ambiguous for the share of those not claiming such an impact or at least assessing it as a minor one is almost as big (46% vs. 54%). The effect of NMP FP6 on the favoured benefits of former EU accession countries in terms of both increased integration (in the ERA) and accelerated catching-up processes are limited for the same reason: the ratio of proponents and opponents of a significant impact of NMP FP6 is almost even. However, only a minority fully declines any impact of NMP FP6.

Priority setting influenced on strategic level, research agendas adjusted.

When analysing the impact of NMP FP6 we have to bear in mind that not all the projects finished their activities by the time the interviews and the survey of the present evaluation were carried out (fall, 2009). The impact of the results and processes which have been produced in the finished projects are either in further development (in FP7) or in non-EU, alternatively in non-FP projects. Nevertheless several interviewees believed that priorities set up at the EU level highly influence the scientific environment in Europe. By setting N, M, P and I as distinct areas in FP 6 and investing considerable resources, these have been put on the research agendas throughout Europe.

On a more detailed level countries were shaping their programme structures and choosing their research priorities independently concentrating on their national competitive advantages and existing resources and knowledge (see Chapters 6.3 as well as case studies in Chapter 9) The participation in a European project was considered as important under many national research programmes. In this context we may also assume that the priorities of research done by national teams participating in FP6 were influenced by European priority setting. In those terms increased synergies might have appeared, since the national financing was in many cases complementary to European.

Interviews leave little doubt that the NMP FP6 has made an impact in Europe. Particularly visible effects are noted in the Nanotechnologies area and to some extent in the Production Processes area (see Chapter 7.1), a point which is also supported by the interviewees' opinions that priority setting in these areas have been more successful than in the materials area. The most **referred example with regards to the impacts was the development and establishment of a nanotechnology policy at the EU level,** through the Action Plan, which triggered similar activities in the Member States. NMP FP6 has played a special role for the smaller states and the new Member States with regards to the level of RTD in NMP, which is particularly important considering their lack of critical mass (see Chapter 9 case studies) and resources on their own, as compared to Germany, UK or France. Interviewees, among which experts and two project officers, emphasized that the current level of development would not have been achieved or it would have been delayed, had it not been for the NMP FP6 efforts.

More specifically, with regards to impacts in terms of reforms at national level to incorporate a European perspective, the interviewees' considered that **on the political level the European perspective tended to be employed by MS engagement** in following Lisbon and ERA objectives. Thus the strategic priorities of the NMP programmes were similar to the NMP FP6, in line with engagements of MS to follow Lisbon and ERA objectives, while choosing to focus on specific, nationally strategic areas and issues and employ a complementary, added-value strategy in particular. Strategic priorities focusing on development of first class knowledge, industry and market orientation, technology transfer were similar to NMP FP6 in Germany, Netherlands, Finland, Spain, UK and Norway according to the interviewees coming from these countries. The similar findings have also been presented with regard to analysed country programmes (see Chapter 11.11 in the Appendixes).

However, when it comes to the specific areas and topics, the **national programmes are designed to invest in those areas with the strongest research and development environments** in the country and issues that are faced by their national industries. An interviewee, who participated in UK national NMP programmes and has been co-ordinating 5 projects in NMP FP6 and FP7 explained: '... [*Maybe*] *some of the wider aspects, not directly related to the programmes themselves. You will notice the same priorities as in the FPs, such as energy, materials, medicine. But they have also special areas which they [ed. Member States]choose to focus more on, like measurement characterisations in the UK, France has maybe more activity in nano-bio*'.[122]

Interviewees, which were researchers working with N, M, and P areas respectively considered that NMP FP6 has had an impact on the energy- and health sectors in Europe, but not strong enough to influence the choice of priorities in these sectors. Nano- and production were better at influencing priority-setting in Europe, probably because of the ETPs was the opinion prevailing in the interviews.

Sustainable collaboration patterns and new collaborative approaches

NMP FP6 impact upon sustainable collaborations in RTD has been considered important. The willingness to work together and build partnerships is assessed by the interviewees to have increased. An observation regarding collaborations from an interviewee, who was an

122 [MM]

expert reviewer, participant and an ETP member during NMP FP6 was: '*I observed in a meeting a couple of weeks ago the readiness of companies and people to sit together and talk on a level of intensity and on a degree of specificity that I have not observed before. Projects that have started suddenly get a new value and generate a new potential. I believe that if we had not had the FP6, NMPs and the scenario, we probably would have more problems to deal with*'.[123]

The setting up of the ETPs, like for example the SusChem in chemistry, has made a considerable effort to bring the European framework and the national activities closer together with regards to priority-setting. SusChem, among other ETPs, has made significant contributions to generating the call structures, content and instruments. In the next stage a number of national SusChem organisations were set up. Both the ETPs and the NTPs **transfer the road-maps that have been developed at the European level down to the national level**, was the experience of the interviewee participant in SusChem. And by doing this, he explained that already a significant contribution to unification of direction of the EU and the direction of the MS has been made possible, according to his experience. The next step in this process is aiming to set up national programmes that are synchronized with the European programmes.

Immediate impact assessments of NMP FP6 on national programmes and policies is difficult if not impossible to find in the Member States. Also the joint or shared evaluation and monitoring of relevant country programmes on bilateral or international level was not identified. In 2007 France, Czech Republic, Sweden and Spain initiated regular multilateral meetings to discuss a common approach of impact assessment of FPs on national level in order to raise awareness of and stress the importance for national FP impacts assessment studies and to bring this as an issue on the national political agendas. Increased knowledge base, enhanced interdisciplinarity, additionality of the FP6 funds, positive influence on competitiveness, sustainability and development for the participating industries and international (EU) collaboration are among the benefits which were gained as an effect of participation in FP6 in Sweden, Spain and Czech Republic. Some main findings of the national impact assessment studies are presented below.

8.6 Conclusions

It is important to stress again that only an assessment of contributions of the individual projects could be surveyed directly, but not the actual achievement of objectives, which had to be deduced from the analysis of the former and of course interviews with key experts and experienced participants and observers. It must also be taken into account that 29% of the projects covered by the survey are still running and that the general notion of especially economic impacts refers to a time horizon that spans 5-10 or even more years after a research project is finished.

The analysis of the different agendas containing objectives relevant to NMP FP6 indicated that **contributions to those objectives directly derived from and mentioned in the thematic priority NMP FP6 itself (e.g. in the Work Programme) and therefore, the achievement of such objectives is much more prominent and frequent than for any other set of objectives**. Results also indicate that there is a **negative correlation between the level of ambition of an objective and the degree of achievement/contribution of NMP FP6 to its achievement**.

[123] [RD]

In general, in the project co-ordinators' perspective it appears that **NMP FP6-funded projects contributed more to the creation of new knowledge** (i.e. "creation of excellent knowledge", "strengthening of existing scientific and technological excellence") **as well as to shifts in research towards economic exploitation and industrial utilisation than to commercialisation, yet**. This assessment holds true for both the different instruments and the sub-areas within NMP with only a few exceptions. One explanation for the success in strengthening the links between science and industry as well as the increased orientation of research towards potential economic utilisations lies in the strong involvement of industry not only in the actual research projects funded but also at an early stage. The contributions of the individual projects are quite strong related to the production and strengthening of excellent and new knowledge (but not necessarily 1st class knowledge), critical mass, shifts in research, and interaction with industry and education/career chances/mobility of/for researchers. In contrast the contributions linked to commercialisation issues and especially to environment issues (see Gothenburg objectives) are rather low. **A positive impact of NMP FP6 on increased environmental sustainability of NMP-related RTD was perceived by most of the interviewees on programme level**. Consult Appendix 11.6 Additional survey results for a comparative illustration of NMP FP6 objectives and Lisbon, ERA and Gothenburg objectives.

The **participation of industry and especially SMEs has met the targeted shares but the obstacles (administrative burdens, complexity of application and implementation) have not been overcome** and prevented NMP FP6 from attracting more small and medium-sized companies. However, NMP FP6 can be considered as having improved compared to FP5 in this regard.

A **considerable impact** of NMP FP6 was indicated by both surveyed project coordinators and interviewees **with regard to the integration of knowledge, actors and sectors** in the sub-areas of NMP. The **creation of first class knowledge** – as undefined and blurry the term might be – **has been observed by some experts and participants**. Still, the **impact on this particular objective has to be understood as being rather limited** for several reasons among which the most important ones are the fact that cooperation in (large) networks often opposes top research due to the nondisclosure of the partners' top research results (for reasons of keeping potential advantages) or the fact that too much times passes between the publication of a call and the disbursement of funding. However, this does not mean that NMP FP6 did not fund excellent research. There is also evidence that **IPR (as a marker for excellent, first class knowledge) are often applied for outside the research project (and team) funded** although the technology was developed supported by the funding.

The **European Research Area has benefited from NMP FP6 to a comparably large extent**; networking and an increased mobility have been achieved throughout the projects funded. IPR and the lack of respective knowledge proved to be partially obstructive though. **ERA-Nets are** to be considered one of the **main positive factors for the achievement of ERA-related objectives** by NMP FP6. The impacts of NMP FP6 on ("improved") human resources and Europe as an (increasingly) attractive labour market are prominent as well. While skills, career prospects (for young researchers) and the mobility within Europe were strongly supported by NMP FP6, the increased attraction of researchers from outside Europe did not benefit to the same extent.

Although especially nanotechnology increasingly becomes a topic of both public and academic discussions on ethical and health issues, only a small percentage of project co-ordinators think that their project actually contributed to such arguments by raising awareness etc. **Researchers themselves generally seem to be less concerned with**

questions of ethics and respective public debates linked to the potential dangers or even threads to public health etc. that might be unintended effects of research especially in nanotechnologies. However, the commercial utilisation of NMP-funded research has to be considered as being at a rather early stage. Discussion on ethical and health issues might become much livelier once applications enter the everyday lives of people. Furthermore, the share of Specific Support Actions that are in contrast to other instruments not focussing on R&D alone but additionally on activities such as studies, benchmarks, foresight, elaboration of technology road-maps and promotion and dissemination of knowledge and good practices in the respondents' database is rather limited. However, if analysed for themselves, CA and SSA do clearly affect these issues much stronger than NMP FP6 as a whole and the other instruments in comparison. Contributions to the so called "Gothenburg objectives", concerning environment issues, are dragging behind all other.

With regard to the European integration and coordination of NMP-related policies the impacts of NMP FP6 remains limited; the respective results are ambiguous. However, the analysis of country programmes showed that there certainly was an alignment of different policies within the duration of NMP FP6 to be observed that started around the year 2000 when NMP put especially nanotechnology on the European agenda. The degree to which national programmes and policies anticipated or reacted to NMP FP6 primarily depended on their experience with similar funding schemes and the existence of national policies before the launch of FP6. A 'real' coordination is however, not something achieved by NMP FP6.

The aforementioned analyses were dealing with the achievement of different objectives from different sources (agendas and strategic documents). In addition, it is important to understand the contribution of the different instruments used in NMP FP6 to the achievement of different objectives. The different instruments apparently have their own respective sphere of contribution to strategic objectives (see Figure 60). The bubbles shown in the respective Figure below indicate the focus of contribution of each of the instruments' projects (assessment of the co-ordinators) in terms of both the **objectives' origin: "scope of objectives"** (parts of NMP, all NMP objectives, NMP plus some of the objectives "outside" NMP, all objectives including NMP) and the **strength of the contribution**, i.e. where the main contributions can be found according to the project co-ordinators' assessment and how strong they were perceived. E.g., NoEs were perceived as having a very strong – and actually their strongest – contribution to only *some* distinctive NMP objectives while CA/SSAs were perceived as having their contribution almost equally distributed among all types of objectives yet less strong compared to NoEs. The apexes of the areas highlighted in the respective colours span the group of objectives that also benefited from the projects under each of the instruments but – compared to their focus (bubbles) – to a lesser extent, therefore defining a sphere or area of contribution. E.g., NoEs are ascribed with having, in addition to their focus, also very weak contributions to *some* NMP objectives, and very strong *and* very weak contributions with regard to some objectives *beyond* NMP). In other words, NoEs contribute to the broadest range of the most different objectives with the largest variety in terms of the strength of contribution. In contrast to that, projects under CA/SSAs contributed quite strongly (even stronger than what is their focus) to all NMP objectives (but less compared to *all* objectives, therefore not their focus) with a lower variety in terms of strength of contribution over all objectives affected.

It can be concluded that the set of instruments contributed very well to the different objectives, and that the mixture of instruments allowed NMP FP6 to have an impact on the achievement of the different goals but it becomes evident that there are blank spots that have not benefited from NMP FP6 so well.

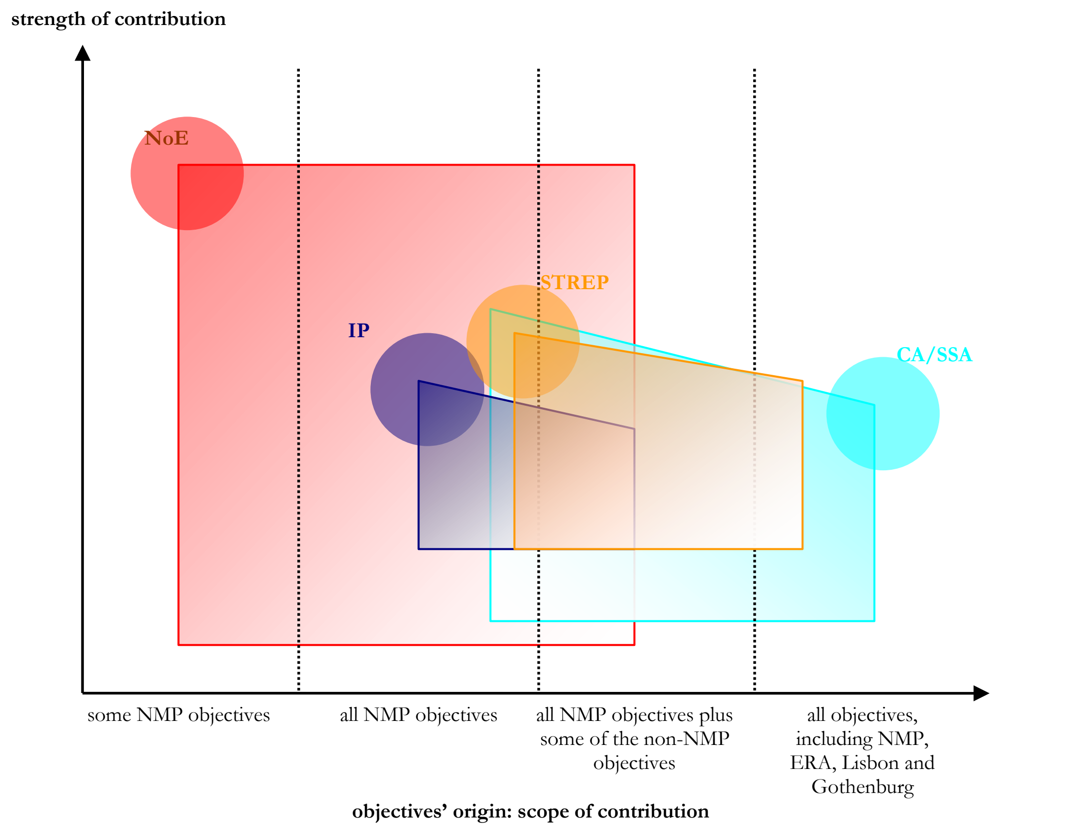

Figure 60. Instruments within NMP and their respective sphere of contribution to strategic objectives

Annotation: The bubbles indicate the main area of contribution of each of the instruments' projects (assessment of the co-ordinators) in terms of both the objectives' origin (parts of NMP, all NMP objectives, NMP plus some of the objectives "outside" NMP, all objectives including NMP) and the strength of the contribution, i.e. where the main contributions can be found according to the project co-ordinators' assessment and how strong they were perceived. The apexes of the areas highlighted in the respective colours span the group of objectives than also benefited from the projects under each of the instruments but – compared to their focus (bubbles) – to a lesser extent, therefore defining a sphere or area of contribution.

The general picture from the interviews with regards to the extent to which NMP FP6 objectives have been reached is positive. The strongest positive response have been provided with regard to the multidisciplinary character of the programme, dealing with industrial challenges, the integration of actors, sectors and expertise and international co-operation beyond EU. With regards to the breakthrough focus of the NMP FP6, development of public-private partnerships, development of 1st class knowledge, integration and exploitation of new and existing knowledge and involvement of SMEs, the responses were divided depending on the experience and level of activity of the interviewee in connection to NMP FP6. Also, it has been argued in the interviews that the objectives assigned to NMP FP6 have been achieved to different extents in different areas and by different instruments, NoE, IPs and ERA-NETs have been most often mentioned in this respect.

8.7 Set of potential indicators

The research conducted within the evaluation at hand aimed, among other tasks, at the development of a set of indicators that could be used in the future to monitor the achievement of objectives at the strategic level.

The analyses of the strategic documents and agendas that include and describe the objectives that are relevant for NMP FP6 have shown that such an undertaking is difficult and has to be seen against the background of the existing strategic documents, their structure and their respective approach to objectives, how they are formulated and designed.

It has been discussed above (Chapter 5) and therefore will not be repeated here: in general, the overwhelming majority of objectives is neither quantified nor directly linked to quantitative target parameters. The task, the evaluation team had to perform was therefore extracting indicators that are in use in comparable contexts and check their appropriateness for NMP FP6. In a second step, the set of indicators has been discussed with experts to validate the result.

As an introduction to the following matrix that displays the allocation of potential quantitative indicators to the objectives relevant for NMP FP6 it has to be mentioned that generally the added value of such indicators cannot be assessed overall, i.e. every indicator – though it aims at a quantifiable and therefore easy comprehensible measurement of achieving given objectives – has its limitations and peculiarities in terms of scope and coverage of different aspects of the respective set of targets, may they result from structural characteristics (depending on e.g. the scientific discipline focussed on) or the simple fact that they are not easily available or even require to obtain respective information first. Below the matrix, such limitations (and advantages, where they can unambiguously identified) will be discussed.

Table. Analysis of objectives and possible evaluation indicators									
Objectives operationalised and summarised				Potential indicators					
Increased orientation towards industrial usage, utilisation and exploitation of R&D	stimulation of implementation of new technologies in SME intensive sectors			Number of follow-up projects dealing with the development of products/services	Number of licence agreements (separate: with SME)	Number of applied/granted patents	Number of follow-up research projects on behalf of / with / of SME	Number of start-ups from academia/spin-outs from industry in areas relevant to and supported by NMP calls	
Additional investments in any R&D related business matter (infrastructure, technology, machinery, human resources, R&D)				Number of new, additional R&D related jobs created	Changes in dedicated R&D budgets (including infrastructure, equipment, HR etc.)	attraction of additional investments (private & public) co-invested with EC funding (and perhaps as a result thereof)	Number of specific facilities (clean rooms) instruments and their concentration (e.g., centres for nanoscopy)	number of technicians' jobs	
Creation of critical mass in NMP-related R&D	Establishment of new centres of excellence	Establishment of new industrial clusters (innovation poles)	Improved integration/networking of/between existing centres of excellence and/or industrial clusters (innovation poles)	Number of clusters/innovation poles related to NMP	Number of centres of excellence (to be defined) related to NMP	Number of co-operation agreements between centres of excellence / industrial clusters	Joint activities of centres of excellence / industrial clusters (conferences, R&D projects etc.)		
Increased competitiveness of NMP-related R&D activities				Number of products in the market	Market share of technological products in specific sectors	In both academia and industry: the management, opening up new/closing down of research programmes	Number of publications (not necessarily quality of), Degree of media focus. Amount of market analyses and reports on related subjects		

Table. Analysis of objectives and possible evaluation indicators									
Objectives operationalised and summarised				Potential indicators					
Improved co-ordination of research programmes and priorities (national and EU)	Coherence of design and implementation of national and European R&D activities			Nature of the design of national programmes and structure of their calls	Common actions by NMP national contact points (NCPs)				
Creation of excellent new knowledge	Strengthening of existing scientific and technological excellence	Improved access to (new) knowledge		Number of publications in high-ranked journals	Number of patents granted	Number of citations of publications, patents, and forward citation of patents	The market share of specific products		
Improved knowledge and technology transfer	Improved knowledge management and protection of intellectual property	Increased dialogue with the public		Joint usage of infrastructure	Number of university courses directly linked to current R&D projects	Number of visiting professors or lecturers from industry or research organisations	Number of agreements on exchange of personnel (mid- to long-term perspective)	Number of agreements on PhD or Master theses done in or in co-operation with industry	Number of licensing and collaboration agreements, start-ups, spin-offs
Improved utilisation of research results for education and training measures	Improved skills of labour force	Improved career prospects for young researchers		Number of university courses directly linked to current R&D projects	Number of R&D related training measures	Number of visiting professors or lecturers from industry or research organisations	Number of student/PhD projects on NMP-related issues		
Improved (conditions for) gender equality				Women/men ratios in different workplaces and in publications	Existence of internal processes to deal with these issues				

Table. Analysis of objectives and possible evaluation indicators									
Objectives operationalised and summarised				Potential indicators					
Industrial breakthrough (i.e., radical innovations) (a breakthrough could also be based on the successful upscaling of a manufacturing process to be applied in industry)	Transformation of industries towards more knowledge and research based ones	More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) in industry	More integrated approaches combining NMP with other technologies in industry	Number of patents granted	R&D intensity (in companies, sectors etc.) based on R&D expenditures, number of researchers, technical staff etc.	Number of products/services (or quantity of the same product sold) new to the market	Changes in market share related to products / services developed in R&D projects		
Increased labour mobility of (young) researchers (and technical staff)				Number of research assignments abroad / in other organisations (mid- to long-term perspective)					
Improved interaction of R&D institutions and industry				Number of co-operation agreements	Joint usage of infrastructure	Number of joint R&D projects	Number of new vs. established partners in joint R&D projects	Number of types of different organisations in R&D consortia	
Increased attractiveness of EU for researchers from outside the EU	Increased attractiveness for non-EU institutes			Number of researchers attracted from outside EU (mid-to long-term perspective)	Number of collaboration agreements with partners in non-EU states	Number of co-publications with researchers based at institutes and in industry outside the EU			
Creation of more jobs for highly skilled employees				Number of new, additional R&D related jobs created	Number of technicians' positions	Number of jobs relating to the production, scaling up, and marketing of NMP technologies (can be R&D people, but	Number of legal jobs, relating to intellectual property rights and technology transfer		

Table. Analysis of objectives and possible evaluation indicators									
Objectives operationalised and summarised				Potential indicators					
						more often not)			
Increased participation of industry in NMP related EC research projects				Number of industry partners in (follow-up) R&D projects	Number of products resulting from such joint projects				
Increased participation of SME in NMP EC related research projects				Number of SME partners in (follow-up) R&D projects					
Increased founding of new enterprises (start-ups, spin-offs)				Number of start-ups, spin-offs etc. resulting from R&D projects					
Increased awareness of ethical issues of NMP related research	Increased awareness of issues of sustainability in NMP related research			Occurrence and number of people working with these issues in companies/academia.	EC funded projects focusing on this	Withdrawal of products from the market place because of the detection of such issues	The formation and activities of interest groups and related projects		
Increased awareness of issues of sustainability in NMP related research				EC funded projects focusing on this	EC funded projects focusing on this	CO_2 reduction	Number of projects related to renewable energy	Number of projects focusing on environmental issues	

Table. Analysis of objectives and possible evaluation indicators									
Objectives operationalised and summarised				Potential indicators					
Increased integration of former EU accession countries in European R&D activities and structures	Increased catching-up of former EU accession countries with regard to NMP-related research			Joint projects including actors from FEUAC	Co-publications with researchers from FEUAC	Number of people from FEUAC in organisations in Europe/the other way around	Number of collaboration agreements between older EU MS/FEUAC	Nature and design of such countries' public NMP funding	
Increased interdisciplinary approaches	Break down of barriers between scientific disciplines			Occurrence of new, innovative constellations of researchers from different disciplines	Patents, products, and publications resulting from such interdisciplinary work				
Increased focus on start-ups from academia				Number and nature of systems put in place to support this					
Improved research priority setting				This is difficult, but would have to do with how the EC dealt with EU academia's/industry's research interests, and how calls are constructed					
Pre-normative research facilitating acceptability of new products or processes by the market					Existence of industrial end-user in projects (binary yes/no)				

Table 61. **Matrix on objectives and indicators, KMFA and Mattias Carlsson Dinnetz, 2010.**

Most of the indicators listed above were – as a rule of thumb – chosen for the fact that there is experience with analysing and eventually understanding the actual scope and coverage, and therefore, also their limitations. Some of the indicators are useful with regard to more than one objective, which is due to manifold links between the objectives (for a respective discussion please refer to Chapter 5) and the multiple meaning of the indicators themselves. Although the research team developed an understanding of the objectives of and in the context of NMP FP6 that formed the basis for the analyses at hand, the European Commission services will have to develop their own definitions and concepts adapted to their own needs and specific objectives of current or future funding programmes or thematic priorities. Without these, the development and application of indicators remain a purely academic exercise.

Apart from publications and patents, most of the indicators will, however, have to be collected for NMP-related research and industry branches and cannot be accessed by means of existing databases (e.g. patent databases provided by the European Patent Office).

Generally, every indicator has the advantage that it can be measured, compared and followed over time. However, and this has to be seen as the most important disadvantage, indicators alone do not tell the whole story, e.g. a successfully filed patent does not contain any information of the role that public funding may have had in its becoming and development. At the same time, patents as such contain much information than their quantity and fields of application. They can also be used to detect cooperation patterns or, by means of patent citations, their relevance and value. The example of patents filed or granted (a differentiation that needs to be made for the obvious reason that not every patent filed becomes a patent granted but both categories are of value for measuring the success of transforming R&D into marketable products/services) gives an impression of the complexity of the discussions that will be needed before settling for any kind of final list of indicators that will actually be used to grasp the achievement of both strategic and operational objectives in the context of European Framework Programmes.

As for individual indicators, it has to be mentioned that the report at hand cannot replace a fully-fledged debate on each of the above listed suggestions. The report at hand will therefore rather concentrate on examples.

Patents and publications both have two major strengths; they are accessible by means of existing databases and their validity and limitations are well-analysed in many reports, books, journals etc. Furthermore, the handling of the two is more or less common. However, taking and simply counting them deprives one of the qualitative information they are holding (see above). Nevertheless, both indicators have proven to work as approximations to concepts such as the performance of academia, the success of R&D in terms of its technological impact and the issue of alignment of R&D to technological and eventually economic applications. Altogether, they are a safe choice even for the discussion of the quality of research conducted since both patenting and publishing (in reviewed journals) include a testing mechanism that – in theory – work in favour of excellent, first class knowledge. However, filing a patent for example means revealing the respective technology; a reason that could very well lead to avoiding patenting for a substantial period of time.

The creation of new jobs is a well-known and often used indicator as well, which in general can also be easily accessed. However, NMP is not a single distinct technology and if a technology at all it is an enabling technology with almost unlimited areas of application. The effects of such technologies on the labour market are very hard to trace, not mentioning that their characteristics make it hard to know where to look for these effects.

In any case, labour market effects in terms of additional, new jobs should consider non-research jobs as well (such as technicians, lab staff etc.) since depending on the technology the pure number of researchers might cover the actual numbers.

With regard to critical mass, several indicators provide knowledge of the effects and consequences of funding research in NMP. The difficulty to be resolved first is the absence of a definition of a threshold for critical mass. However, such mass can be measured in number of jobs (R&D and associated), size of R&D projects, size of research consortia, number of respective R&D or industrial clusters, long-term cooperation agreements (which can be seen as "virtual" clusters) etc. The main problem here will most likely be the selection of which activities or organisations are exclusively linked to NMP or NMP-related research activities.

Knowledge and technology transfer/management can be measured (again, as an approximation) by collecting information on cooperation within and between science and industry in its many shapes such as the number of joint R&D projects, of university courses directly linked to R&D projects (therefore "standard" courses that are used to teach basic knowledge should not be included), of R&D projects with a significant participation of students or PhD students or the number of researchers from industry who teach seminars at universities. However, these indicators are based upon the assumption that knowledge is very often tacit and therefore, linked to people. Cooperation as a means of knowledge transfer can also be analysed by number of co-patents and co-publications.

Apart from the above discussed rather operational objectives, a few remarks on the links between rather strategic goals and indicators should be made. In general, such an undertaking proves to be comparatively difficult for two main reasons, one being the very nature of such objectives in that they are much more process-oriented with no clear defined status to be reached. Furthermore, the concepts behind such objectives simply cannot be broken down into ascertainable pieces. The objective of a more coordinated R&D policy in the EU can be "measured" by comparing national approaches to NMP-related R&D and its funding. However, such a comparison is hardly based on indicators or producing comprehensible indicators. In fact, strategies need to be developed that allow defining dimensions of e.g. funding programmes as ideal types against which the programmes could be compared and ranked and –over time – policy convergence can be observed.

Chapter 9. Country case studies

The evaluation process gave information about existing country measures which finance activities similar to those covered by NMP FP6. Interesting information from MS was also obtained during interviews with different country level officials and desk studies conducted earlier in the project. The cases studies collected here present a great variety of approaches from very different MS. The criteria used for selecting the case studies are presented in Table 62.

Table: Selection of case studies					
	Case studies				
Criteria	Austria	France	Germany	Norway	Poland
"selection criteria"					
Must provide good insight into Member States situation,	•	•	•		•
Illustrates different approaches,	•	•	•	•	•
shows existing links between NMP and national measures.	•	•	•	•	•
"balancing criteria"					
Distribution among different types of Member States (former accession countries, large countries, small countries etc.)	small member	large member	largest member	small non member	large new member
Distribution among different types of activities (e.g. research activities, co-operation activities etc.)	too detailed criterion to demonstrate in a table, in general all selected case studies are demonstrating different approaches on the level of research and co-operation patterns				
Grouping of countries	Austria	France	Germany	Norway	Poland
Frontrunners		•	•		
Second movers	•			•	
Followers					•
Source: Oxford Research 2010					

Table 62. Case studies selection criteria. Source Oxford Research AS, 2010.

The evaluation team focused on demonstration of different approaches and solutions that address directly the evaluations questions related to MS experience. In general the case studies will not answer directly all questions listed, but give a good basis for findings and recommendations, as countries with their different approaches address the issues important for this evaluation.

The case studies concentrate to a large extent on nanotechnologies and nanomaterials, and also give examples of wider cross-thematic programmes including all three areas of NMP. Separate measures supporting purely research in new production processes and devices have not been identified in MS, and therefore cannot be presented, without referring more to the N and M dimension.

9.1 Austria

Introduction to the case

In its 2008 report on nanotechnology policies the OECD ranks Austria among those countries that have an explicit definition of the term "nanotechnology" in their respective RTDI policies, which reflects the public awareness of future potential as well to the potential need for both public support and regulation.

In 2004, Austria launched its national initiative to support research in the area of nanotechnology, the so-called NANO Initiative. The Austrian NANO Initiative is a multi-annual funding programme for nanosciences and nanotechnologies. It funds collaborative R&D in large-scale projects and co-ordinates NANO-related policy measures on the national and regional levels. It is supported by several federal ministries, the federal states and funding institutions, under the overall control of and mainly financed by the Federal Ministry of Transport, Innovation and Technology (BMVIT). The programme is managed by the Austrian Research Promotion Agency (FFG) on behalf of the BMVIT. The strategy and objectives of the Austrian NANO Initiative have been developed jointly with scientists, entrepreneurs and intermediaries.

This support measure was developed during a phase of intense reorganisation of the whole Austrian RTDI political and funding system. For the first time, the (at that time) newly founded Council for Research and Technology Development was not only involved in the development of a new support measure but actually had an important role in its establishment and implementation. In addition, the funding agency FFG that assumed the role of the managing authority of the NANO Initiative was established in 2004 as well.

With regard to the Austrian NANO Initiative's connection to European and international developments, it can be said that nanotechnology as such and being labelled a future technology with the potential for fast economic growth has been on the agenda of the Austrian policy debate since 2000, although particularly the Austrian Federal Ministry of Science and Research funded nanotechnology-research already in the 1990s. This funding was carried out without specific programmes and the main target group was Austrian universities. In that sense, Austria – though it managed to make up for most the time it lost compared to other developed countries – can be characterised as being an early adopter or fast second mover with regard to the development of dedicated national nanotechnology policies. The motivation to establish a national research programme was very much driven by external factors such as the fact that most "peer countries" (Germany, Switzerland, UK, Finland) as well as the EU-framework programmes used the label Nanotechnology for framing focused research programmes and some of the countries (Germany and UK) at some point already had nanotechnology policies in the 1990s. Although there were some efforts to harmonize the national deadlines with the FP6/7 deadlines, the general connections between European Framework Programmes and the NANO Initiative were limited once the initiative was launched.

Facts and figures about the measures taken

In general, the NANO Initiative features an integrative approach combining different elements and instruments of support for R&D in the field of "Nanotechnologies and -

sciences" (N) rather than in the fields "Knowledge-based Multifunctional Materials" (M) and "New Production Processes and Devices" (P), which are covered within the NMP-priority of the European Framework Programme, affecting different agendas in several federal ministries. Its basic structure rests on three pillars: research funding, networking and education/qualification. Furthermore, the programme was designed to function as a platform for co-ordinating existing and future activities in the field of nanotechnology.

Within the programme, five different strategic objectives are targeted:

- Using nanoscale sciences and nanotechnologies for business and society by exploiting RTD results;
- Strengthening competitiveness by co-operation and networking between science and enterprises by creating and expanding critical mass;
- Position Austrian interests trough increased integration and cross disciplinary networking in Europe and international co-operation in research and technology development, in particular in the EU programmes;
- Contributing to the expansion and maintenance of research competence through education and training measures for the qualification of specialists in research and technology development;
- Contributing to the building and expansion of the corresponding infrastructure as well as building centres in basic research and application-oriented special fields.

The strategic objectives within the integrative concept were approached based on four programme lines (funding of clusters and integrated multiannual research projects jointly conducted by research institutions and private companies, networking, education/training, and accompanying measures such as roundtable discussions on nanotechnology and health risks etc.). These instruments have been reduced to two current major action lines:

- National Co-operative RTD Projects Research and Technology Development in Project Clusters (RPC), and
- Transnational Co-operative RTD Projects.

In summary, the Austrian NANO Initiative funds collaborative research. The collaborative setting is similar to EU Framework Programmes for it includes networks of research institutes, universities and firms working on problem driven basic research and applied research questions with a medium term perspective (5-7 years) in large scale so-called cluster projects. This is based on past assessments of the Austrian funding system lacking funding instruments for midterm research activities of collaborative RTD between science and industry with the aim to build up critical masses.

Looking at the potential beneficiaries as well as the organisations eligible for funding, the impression of very broad and almost all-embracing approach becomes even clearer. All types of companies, higher education institutions, research units/centres, non-profit research organisations (outside HEI), and networks are targeted as beneficiaries and are eligible for funding. Although there is no general eligibility of foreign organisations for funding (yet, they can participate in a funded research project), the NANO Initiative is engaged in an ERA-NET called "From Micro and Nanoscale Science to New Technologies for Europe" that covers transnational research.

The overall budget development of the NANO Initiative can be seen in the following chart.

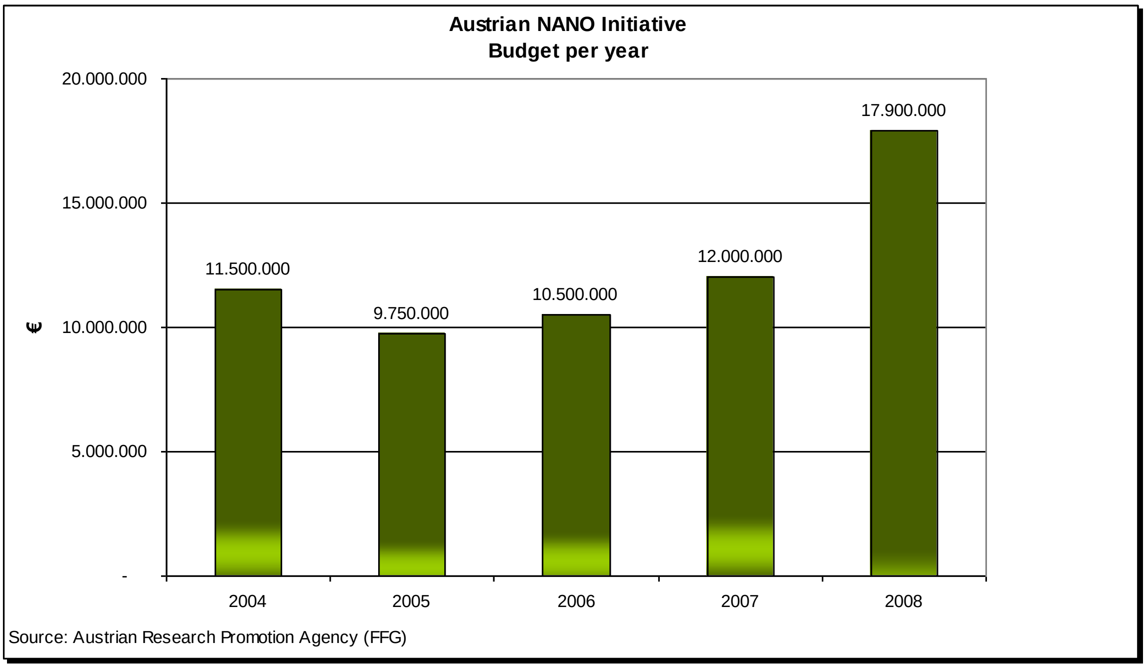

Figure 63. Austrian NANO Initiative budget per year, source FFG.

Between 2004 and 2008, the programme funded research in the amount of € 61.7 million with a more or less stable budget between 2004 and 2007 and a significant increase in 2008 when the previous budget was upgraded by almost 50 % up to € 17.9 million. The importance of nanotechnology and the respective political awareness in Austria is reflected by that fact. After the interim evaluation of the programme was published in 2006 , it has been decided to aim at a progressive increase in the years 2007-2010 leading to a total programme budget for these four years of approx. € 45.0 million. In 2010, the NANO initiative will have spent around € 80.0 million.

Apart from the dedicated budget in the NANO Initiative it should be mentioned that in principle the projects can be funded under two more funding schemes managed by the FFG that are thematically open (not limited to specific research topics) but very relevant for research and industry in NMP fields (measured by the proposed and promoted projects in the fields of NMP):

- The BRIDGE Programme aims to close the "funding gap" between basic and applied research, and
- The general funding ("Basisförderung") to support commercially relevant (application-oriented) research projects.

Some stakeholders criticised the fact that NMP was used as a kind of role model for the Austrian national programme in terms of a certain focus on networking and argued that excellent scientists and researchers should not be "forced" to conduct research in a pre-defined direction or field. However, the interim evaluation of the programme reported that the Austrian NANO Initiative indeed managed to support the formation and networking of a in the mean-time very visible Austrian research community in the field of nanotechnology. The envisaged mobilisation of private companies however, was not fully achieved.

In addition to the NANO Initiative, the Austrian Science Funds (FWF), the equivalent of the FFG for basic research, is also funding nanotechnology as part of its task to "support the ongoing development of Austrian science and basic research at a high international level". Furthermore, the FWF was responsible for parts of NANO Initiative budget in 2004-2006. At the moment, the FWF is funding a special research programme on infrared optical nanostructures (established in 2005), two so-called national research networks on nanosciences on surfaces (established in 2003), high-performance bulk nanocrystalline materials (established in 2008) as well as transnational research projects in ERA-NET. Between 1999 and 2007, the FWF dedicated approx. € 50 million to nanotechnology.

A more recent development concerns the development of an Austrian action plan on nanotechnology that is still under revision but is expected to be published in 2010. It also refers to the ongoing discussion on how to assure and implement a continuation of the NANO Initiative beyond 2009.

Main identified solutions

Although Austria already had funding schemes such as the thematically open general funding ("Basisförderung") and the funding of stand-alone projects in basic research provided by the FWF before the establishment of the NANO Initiative, which very well can/could be approached by individuals and/or organisations seeking public support for research in nanotechnology, the programme with its dedicated budget and the respective backing of the political system clearly had a signalling effect that Austria is aware not only of the importance of nanotechnology as a future technology but also that it potentially prepares the ground for breakthroughs in science and technology as it is an enabling and cross-sectional technology.

Although the NANO Initiative was the single most important individual programme in the field of nanotechnology, it was always accompanied by other funding and support actions such as the European Framework Programmes or national funding for basic research in universities managed by the FWF. According to the experiences and perception of some relevant Austrian stakeholders the design of the Austrian NANO initiative was indeed guided by the design of the NMP-priority in FP6.

The following chart shows that the overall approach of Austria to nanotechnology funding by means of the NANO Initiative and other actions can be seen as not only very broad but based on intertwined instruments.

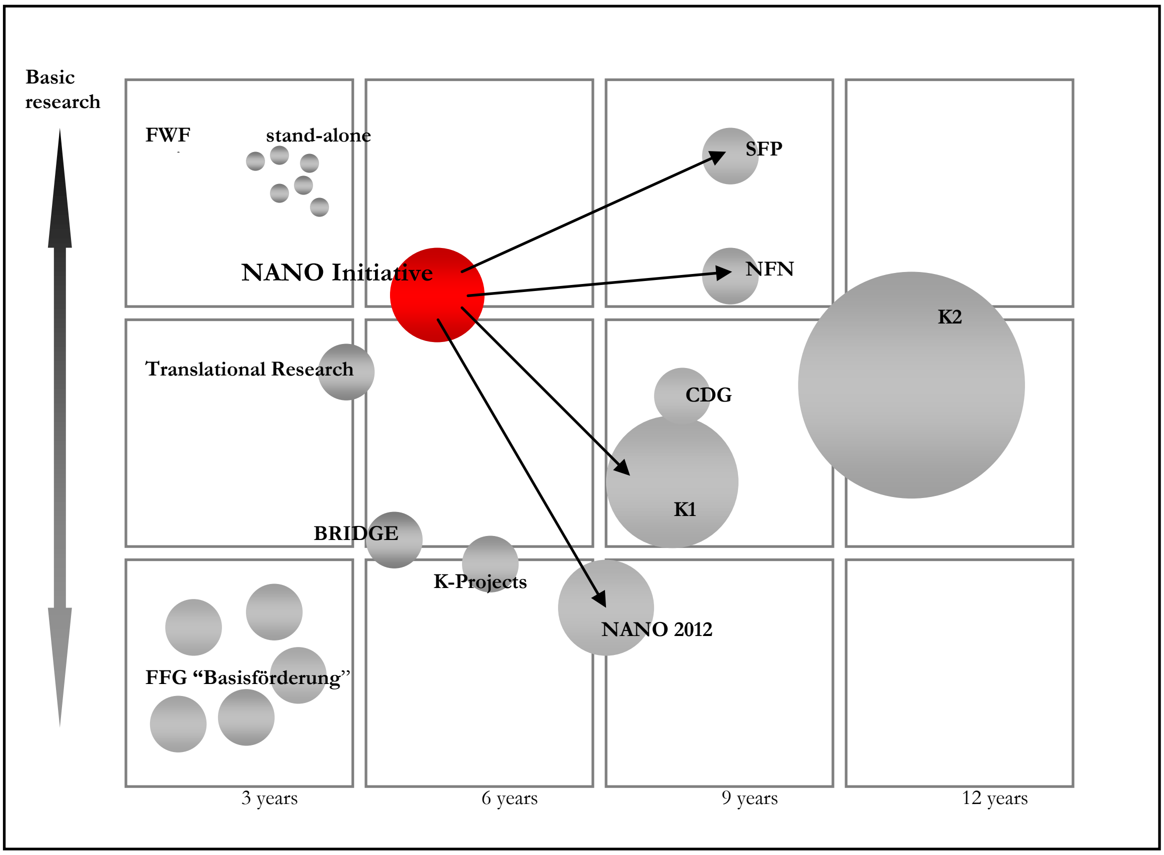

Figure 64. Context of the NANO Initiative and its relation to other programmes (size of bubbles indicates amount of funding) Source: Lebensministerium (Ed.) (2009): Österreichischer Aktionsplan Nanotechnologie (Austrian action plan nanotechnology), Vienna. Modified by the Austrian Institute for SME Research.

The Christian Doppler Research Association (CDG) supports application-oriented fundamental research and enables member companies to have a direct access to new knowledge.

The competence centre programme COMET supports the building up of competence centres that are based on a top-level research programme jointly formulated by science and industry. The programme consists of the three strands "K1-Centres", K2-Centres" and "K-Projects". The programme strands differ according to their international visibility, volume of projects and duration.

The General funding ("Basisförderung") supports commercially relevant research projects which are run by companies, research institutes, individual researchers and inventors. The funding is application-oriented and not limited to specific research topics or deadlines.

The Austrian Science Fund (FWF) supports the ongoing development of Austrian science and basic research at a high international level.

Instruments of the FWF are (among others):

- "Stand alone" projects (funding of individual research in the area of non-profit oriented scientific research),
- "SFB": "Special Research Programmes"
- "NFN": "National Research Networks"

As mentioned above, until now, there is no Austrian nanotechnology strategy that could work as "superstructure" for the different instruments and initiatives. Therefore, the complex and all-embracing approach to funding nanotechnology as presented in the figure above is evolved in the past rather than being designed with an underlying coherent idea, concept or strategy. However, for the Austrian NANO initiative the existing instruments and needs of the Nanotechnology community were analysed in order to provide a sound base for the establishment of the programme, i.e. the NANO initiative was very well strategically implemented into the above described policy context. The policy context itself, it not, however, designed in a strategic manner.

Lessons learned for the European context

Austria by means of its general RTDI and nanotechnology policy and its dedicated NANO Initiative can be understood as being a fast second mover. It followed other countries such as Germany and UK, as well as the European Union in the development of support mechanisms for nanotechnology around the year 2000. The Austrian approach described and discussed above includes the absence of an Austrian national nanotechnology strategy, so far. However, there is a rather complex and all-embracing portfolio of instruments and support measures aiming at research and its support in the field of nanotechnology, which historically evolved rather than being designed with an underlying coherent concept. The forthcoming national action plan can be expected to lead to a change in the overall approach towards a coherent national strategy. In addition, this could very well lead to a change in the co-existence of instruments to instruments that are, in comparison to the current situation, more strategically co-ordinated, adjusted and attuned to each other by means of filling possibly existing gaps and fine-tuning of instruments.

Sources:

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9.2 France

Introduction to the case

France is one of the front runners of the European NMP scene, both from the point of government funding as well as private engagement and commercialization of research results.

The most important for the strategic evaluation of NMP FP6 and possible recommendations is a view on how the government support was organized in a multi-dimensional manner.

Public intervention in NMP area in France is organized in complementary layers and has four elements:

- Research and development, in good integration with the European tools, networks and road-maps
- Infrastructures of the future (centres of integration, competitivity and excellence)
- Economic and Societal aspects (innovation policy, public engagement and national debate)
- Ongoing review of legal framework

From an institutional point of view most of the research policy is endorsed by Agence Nationale de la Recherché (ANR). The ANR is a fairly new institution, it became operational in 2005 to cover Ministry funds and this is the largest operating unit for all French priorities. Other institutions engaged directly in the research are The Centre National de la Recherche Scientifique (National Center for Scientific Research-CNRS) – largest fundamental research organization in Europe, and to smaller extent le Commissariat à l'énergie atomique et aux énergies alternatives (CEA) (Atomic and Alternative Energy Commission).

From 2009 the policy will be organized around NANO INNOV – the French Innovation Strategy for Nanotechnology. The strategy will give directions to all dimensions, with a main task to integrate the three biggest centres for NMP related research (Grenoble, Toulouse and Saclay/Paris South).

Facts and figures about the measures taken and main identified solutions

The public funding of research in France is multidimensional.
The biggest dedicated programme that might be related to NMP is called PNANO. It's the follower of the previous programme at that time called "Technological Networks". However it would be a mistake to say that PNANO is the only and most important part of French policy. French direct intervention in NMP is composed of PNANO with average 49 % of the sources of the entire intervention in nanoscience and technology administrated by ANR. In the years 2005-2008 in the area of NMP PNANO allocated a total of 541 mil euro. Additional money schemes cross cutting the NMP research area are implemented through other 17 other thematic programmes (in such areas as Bio, ICT, medical, materials,

etc). In this period more than 6000 projects were submitted by research teams and 1169 by business clusters. On average 26 % of applications were financed in the area of NMP with average sums of, accordingly 400 000 and 870 000 euro per project. All together ANR financed, under all available measures, 587 projects in nano-area with 285 mil euro in 18 different dedicated programmes, plus it spent 69 mil euro on "National network of technology centres for basis technological research" (Réseau national des centrales de technologie pour la Recherche Technologique de Base -RTB).

The assessment of programme objectives is reflected in plans for organization of research and development in the future. Nanotechnologies' development characteristics are reflected in the ANR programme, underlying 3 aspects: need for multidisciplinary actions, convergence between knowledge and technologies, bridging the gap between fundamental research to applications.

The programme PNANO aims to explore new approaches to structuring the matter and to discovering new properties at the molecular level, by combining top-down and bottom-up approaches. It furthermore aims to implement these new properties and effects and innovative functions through technological development, architecture integration and specific instrumentation and simulation methodologies and techniques.

PNANO continues and expands; ideas initially proposed under the "Blanc programme" (a bottom-up research initiative) were implemented into an engineering science programme concerning information and communication technologies. For instance, the nanoelectronic road-map requires new theoretical and technological concepts to continue to be at a state-of-the-art level on:

- Miniaturisation beyond 45 nanometres, that includes all the research concerning materials, processes and devices and circuits architectures;
- Integration of new functions, that will introduce intelligence within the architecture through the concept of smart miniaturized system for information processing, energy manipulation and interaction with living matter;
- Convergence between nanotechnologies and information technologies (quantum computing, bio-mimetic or bio-inspired systems, molecular electronics).

The scientific portfolio of all PNANO research projects consists of:

- 20 % - Effects and phenomena on nano-metric dimensions
- 20 % - New materials and production technologies
- 20 % - Micro and nano- systems
- 17% - Instruments and simulation
- 18% - Convergence with nano-health and nano–environment
- 5 % - Projects dedicates to impact and regulations

In terms of results of the programme, PNANO seems to be very efficient and effective. Most of the data is provided only for projects financed in 2005 edition. Subsequent projects are still running and full data is not available yet.

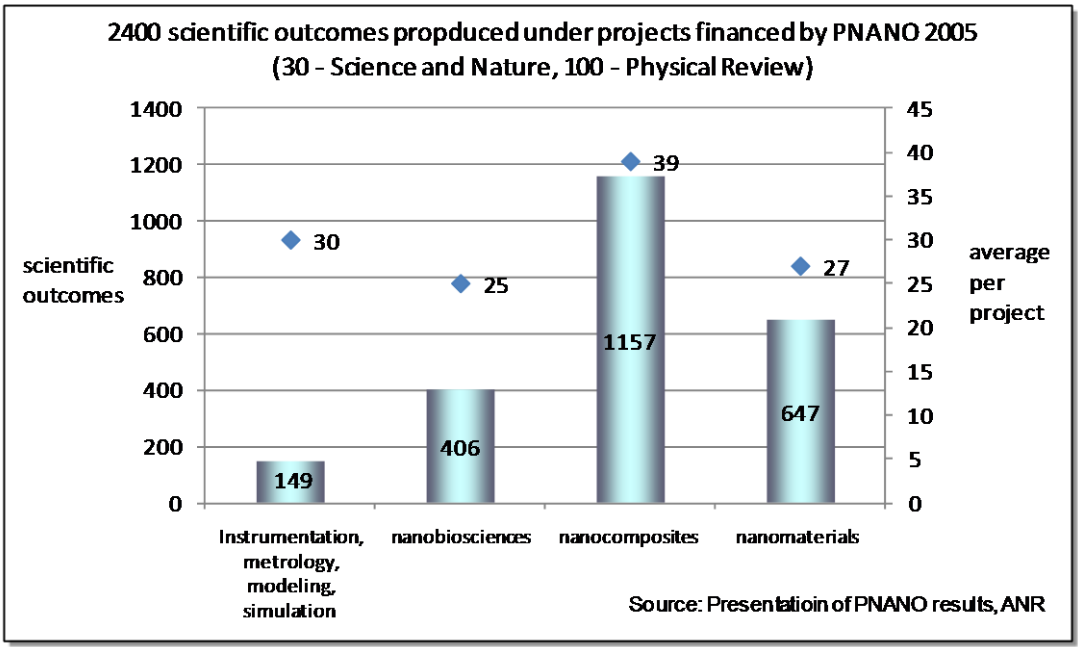
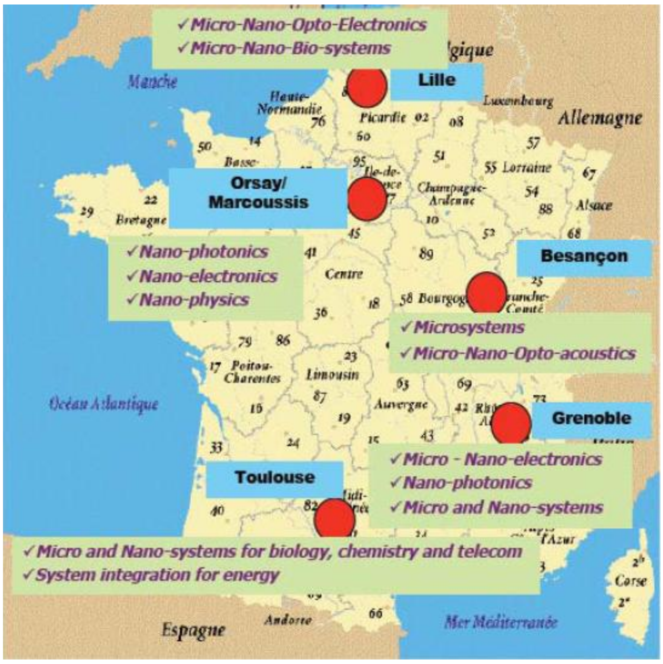


Figure 65. **Scientific outcomes in total and average per thematic project financed by PNANO**

PNANO financed 249 temporary working places and 183 post-doctoral studies, doctorates and internships in 2005 (just in 2005, the programme has founded 43 PhDs). It also resulted in 42 patents from the projects financed in this first year.

An important dimension of PNANO was the creation of National network of technology centres for basic technological research in 2003 (RTB). This infrastructure is essential for the development of NMP related research.



The facilities created in 2003 today compose a total of 14000 m^2 clean room, with 2500 researchers, 1200 conferences, 120 defended theses, implementing a total of 183 projects financed from ANR and 130 projects financed by EU. The purpose for creation of this network was to consolidate the scientific base, and to assure the co-ordination between centres. They compose a basis for implementation of projects financed by ANR, with the most important target for the future to assure openness of research to enterprises.

Figure 66. **National Network of Technology Centres in France**

Apart from central government direct funding of NMP related research, there are other forms of public intervention supported by strong policy instruments.

"Tax credit" mechanism (Le crédit d'impôt recherche – CIR) tends to be the biggest measure designed for entrepreneurs to facilitate development of companies, including research expenses. This kind of research financing is the largest in the world, equal to 3 bln euro per year in France. Companies may support research in various areas, not only NMP of course, but due to the fact of close connection with the market, this measure is shaping directions for other kinds of interventions. There is no data available about the actual spending on NMP–related research, still French companies are among the biggest European research investors, especially in NMP, with well known companies such as Chanel, Lancome, L'Oreal, Alcatel, Renault and Peugeot Citroen as stakeholders.

The other instrument is "Les pôles de compétitivité" (competitiveness clusters), where we may identify major clusters that have NMP-related activity. This is the second largest (after the tax credit) way of research support, as clusters acquire simultaneously national, regional and local financing. Due to the decentralized character of these two measures, it is not possible to assess the real results of research activities done in the industry.

Tax credit was introduced in 2008, Poles were created in 2004 as a policy measure and the first were introduced in 2005 and subsequently appeared the "PNANO"– a pure large government programme, which was first intended for 3 years and then renewed for the next 3 years (first since 2005). The Ministry in charge of industry announced in 2009 that France will expand the research in "tax credit", into a new tool which will be an "innovation tax credit" focused on expectations for the future, to influence the creation of employment in the future economy. This will not be dedicated to NMP-oriented research only and is planned to become a more cross-cutting tool.

Another wide measure, indirectly supporting development in the field is OSEO. It provides assistance and financial support to French SMEs. OSEO was born in 2005, by bringing together ANVAR (French Innovation Agency) and BDPME (SME development bank), around a mission of general interest supporting the regional and national policies. Its mission is to provide assistance and financial support to SMEs in the most decisive phases of their life cycle by sharing the risks, and facilitating access to financing by banking partners and equity capital investors. In 2005 OSEO launched Innovation Development Contract (CDI) with an overall budget of 165 mil euro in order to finance intangible research with a loan (from 40 000 to 400 000 Euro) of 6 years duration, with reimbursement facilities in the first year. 800 SMEs have already benefited from CDI to the overall amount of 153 mil euro. The idea is to offer services at all stages of SMEs development, either creation or maturation of innovation projects. After OSEO registered its 1000th CDI, OSEO decided to review the measure to evaluate its relevance to SMEs needs. It appeared that the CDI was relevant and made an impact on SMEs activity. 8 out of ten reviewed SMEs planned to hire at least 5 persons. Half of SMEs indicated that CDI allowed them to develop export activities. 6 SMEs out of ten foresee a 15% increase in their turnover in 2005.

To summarize this overall picture, the public funding of R&D investments in NMP during the last years placed France on the 4th place in the world just after US, Japan and Germany.

The transformation of the French system was done in a top-down manner with large programmes aimed at creating a friendly environment for innovation and thus targeted actions become far less important.

International and European co-operation

French authorities participate actively in European NMP related activities. There was and is a general co-ordination between the European Framework Programmes and the national

PNANO priorities, as the persons engaged in planning of French programmes participate in various committees in NMP on European and OECD level. On one hand they define research priorities for France, on the other hand they have the possibility to present and to some extent influence shaping of the priorities in work programmes at European level.

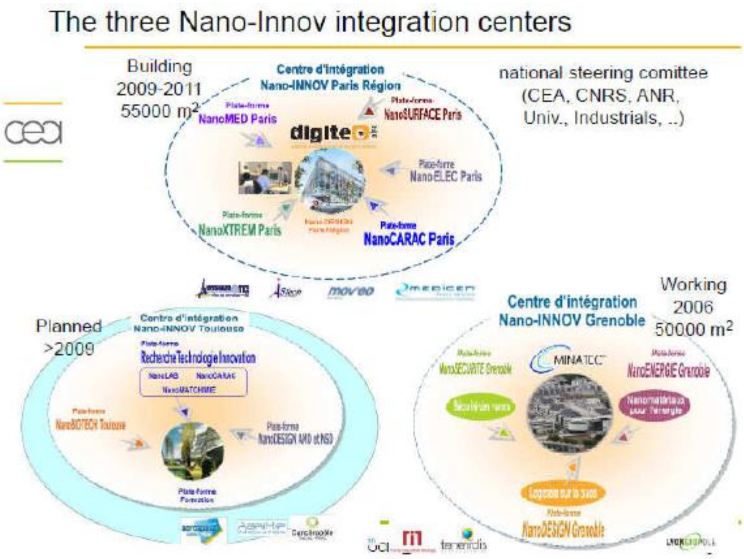
The European perspective and transnational coherence in PNANO was assured by participation in transnational initiatives like Eranet Nanomedicine and Eranet Nanotechnology and toxico. Multilateral initiatives are developed especially with countries outside the EU, like for example in the NanoSciera. Contacts are also developed on non thematic basis with Korea, Japan, Taiwan, China and Canada. Initial discussions are conducted with Russia.

French research priorities in 2010 tend to address more the issues of spontaneous research (Non thematic projects will account for 50% of the ANR budget). Stimulated research will focus on:

- Properties on nano-metric dimensions
- Micro and nano-production
- Micro and nano-systems
- Instrumentation, metrology, simulation
- Convergence with nano-health and nano-environment
- Social dimensions of nanotechnologies

Also the creation of a scientific committee "Nanosciences" is foreseen in the ANR to prepare a document shaping the policy in the Agency and define the programmes for 2011-2013.

Central learning perspective in a European context



There are two main issues that are to be underlined when summarizing the situation in France. One of them is the governmental support for building the research infrastructure, as a point that is missing in the large scale European Framework Programmes oriented entirely towards different research projects, without any large scale infrastructure development.

Figure 67. Integration of research centres in Nano-INNOV

The integration and continued enlargement of research centres foreseen in Nano-INNOV strategy should be seen as a basis for building future French position on the world market, ensuring access to equipment, researchers, and flow of knowledge. It will also allow the scientific bodies (National steering committee) to give directions for shaping future research priorities. This is to ensure that France will remain one of the key players on the world scene. Similar actions are undertaken for example in China, with the purpose of influencing the country's capacity to create innovation. Between 2000 and 2003, Chinese government decided to finance and co-ordinate strategic nanotech research and development. Two national nanotech centres, namely the National Center for Nano Science and Technology (NCNST funded with 250 million RMB) located in Beijing and the National Center for Nano Engineering and Technology (NCNET, funded with 200 million RMB) located in Shanghai have been established. The centres are facilitating spin-offs creation and facilitate commercialization and international co-operation. This approach may demonstrate that public intervention in large infrastructure may be important to ensure future developments in the field.

Other important issues, worth underlying in the French approach are the regulatory efforts and the public dimension of the debate with regard to developments in nanotechnologies.

"Le débat public" was declared by law and obliged 7 ministers to provide answers to questions from the public, on a set of regulatory aspects, including international ones. An important budget was allocated to 17 open public meetings, document production and a project website. The National Commission for Public Debate (CNDP) was responsible for the entire process and summarizes the answers but it does not take any official position.

Ongoing regulatory review is following the public debate. The French authorities are obliged by law to produce no later than in 2011 a mandatory declaration for production, import and commercialization of nano-substances and materials. A parallel discussion on expanding the declaration to already regulated products like pharmaceuticals, food additives etc. is going on.

The French approach described above has a strong focus on trust building and ensuring nanotech continuum, and is organized on four levels:

- Building the policy,
- Receiving feedback,
- Defining observation criteria (including stakeholders opinion) and common and understandable assessment methodology,
- Implementing changes in policy taking into consideration the findings, and may serve as a model for other countries when discussing and assuring sustainable future of NMP.

Comparable approach is also implemented in German as described in "Nano-Initiative – Action Plan 2010" demonstrating that development of research in a responsible manner and informing the public become key issues for major European actors.

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- Interview with Dr. Françoise ROURE (see above) and Mr. Philippe Laredo- Vice Chair of UNESCO the Regional Scientific Committee for Europe and North America; Director of Research, Technical Laboratories, Territories and Societies, Ecole National des Ponts et Chausses (ENPC)
- Presentation from conference Les Journées Nationales en Nanosciences et Nanotechnologies J3N 2009 - Toulouse http://www.pnano.org/com/J3N2009/J3N2009.htm and direct information from Mr. Robert Plana, ANR - Agence Nationale de la Recherche
- www.nanoworld.jp/apnw/articles/library3/pdf/3-12.pdf

9.3 Germany

Introduction to the case, facts and figures about the measures taken

In 1998, a supporting infrastructure plan was put in place with the establishment of six regional and nation-wide networks of competence for nanotechnology. Since then, the participating centres of competence have established active, cross-topic networks throughout Germany. That was in addition to increasing the German Federal Ministry of Education and Research (BMBF) collaborative project funding for this area. Although these measures did not receive the international recognition they warranted, they were implemented two years before the USA began its national initiative and four years before the European Union's comparable measures in the Sixth Framework Programme. On the basis of the white paper presented at the nanoDe congress in 2002 and intensive discussions with representatives from business and science, the German new approach to nanotechnology funding – starting from Germany's highly-developed and globally competitive basic research in sciences and technology – primarily aimed to open up the application potential of nanotechnology through research collaborations (leading-edge innovations) that strategically target the value-added chain.

Germany's public R&D expenditure shortly after amounted to 310 mil euro in 2005 – the third largest amount worldwide, behind only the USA and Japan. Germany is also amongst the top countries in patent applications for nanotechnology, and definitely the biggest actor in NMP FP6.

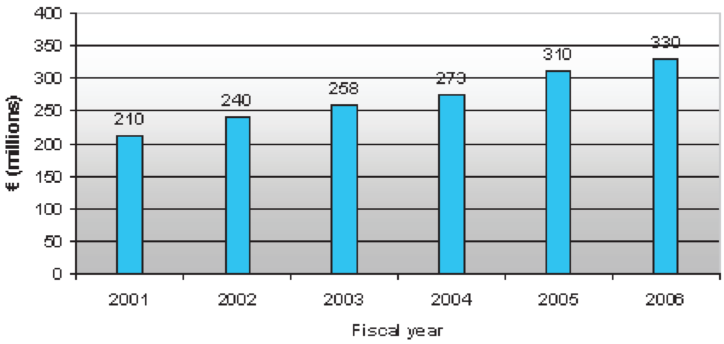

Figure 68. Public funding for Nanotechnology in Germany. Source: Nano-Initiative – Action Plan 2010, Federal Ministry of Education and Research (BMBF).

Identified strengths include a well structured R&D infrastructure and a high level of research in the various sub-fields of nanotechnology. The industrial base for utilising the results of this research is also in place. Around 750 companies are currently involved in the development, application, and sales and marketing of nanotechnological products. 143 of these are large companies, and 600 are SMEs. Also 60 financial service providers operate in investment matters related to nanotechnology. Approximately 63,000 industry jobs can be directly or indirectly attributed to this field. An increase in jobs can be anticipated in relation to start-ups and SMEs in particular.

Since the late 1980s, the BMBF has been funding nanotechnology research activities in the contexts of its Materials Research and Physical Technologies programmes. Initial core topic areas included the production of nanopowders, the creation of lateral structures on silicon and the development of nanoanalytical methods. BMBF support was later expanded to also include other programmes with relevance to nanotechnology, for instance in the Laser Research and Optoelectronics programmes. Today, many projects related to NMP are supported through a considerable number of specialized programmes. Examples include Materials Innovations for Industry and Society (WING), IT Research 2006, the Optical Technologies Sponsorship Programme and the Biotechnology Framework Programme.

In 1998, the BMBF established six competence centres with an annual funding of approx. 2 mil euro. In Phase 3, starting in the autumn of 2003, nine competence centres began or continued their work as nationwide, subject-specific networks with regional clusters in the most important areas of nanotechnology.

The assessment of current developments in Germany in the NMP area demonstrates that despite having good foundations for the use of nanotechnology, Germany must confront increasingly demanding technological and economical challenges in the future. In comparison with the USA and South East Asia, Germany takes more time to turn the results of R&D into products. The distribution of nanotechnological approaches in various industry branches, the dynamics of start-ups, and the diversity of products has to be more in focus. This means that there are challenges to be faced with regard to the intensification of efforts to utilise the results of research as well as facing the need to realistically estimate benefits and risks, public relations and consumer advice requirements, and any necessary regulatory and standardisation procedures.

This assessment resulted in the creation of a number of dedicated measures in the period 2006-2010 and beyond. In this case study we will focus on a description of measures taken to enhance SME Participation and efforts made for larger commercialization of the research results.

Main identified solutions – supporting small and medium-sized enterprises

BMBF has organized its support in a number of dedicated sector framework programmes described in the "Nanotechnology action plan 2010" that directly address the commercialization issue in selected sectors.

One of the main objectives of the Government is to facilitate the access of SMEs to the results of R&D and to encourage an increase in SME's participation in national and European research programmes. This involves introducing SMEs to nanotechnology in a more intensified manner as well as supporting the establishment of a nanotechnology start-up scene in Germany. Centralised contact points and optimised consultation procedures are provided to assist in applications preparation. Funding programmes that specifically target SMEs and support for start-ups encourage nanotechnological innovations in industry. In Germany there is a number of both long running and newly invented programmes that might be listed here:

> Framework Concept for the Production of Tomorrow
>
> Within and across thematic areas, BMBF "supports research on new production technologies with the objective of developing model solutions for future-oriented production in Germany and providing research results for broad use in particular in SMEs".
>
> The research programme has been designed as a "learning programme" in which expert forums identify research needs to be addressed consequently in collaborative research projects. In the period 2002-2007 approx. 120 joint research projects ("Verbundprojekte") have been financed every year (each project has duration of

three years). Approx. 700 single research projects ("Einzelvorhaben") have been supported.

Framework Programme: Materials Innovations for Industry and Society (WING) is a component of the German "High-Tech-Strategy" and is implemented in close proximity with "NanoChance" (described below).
The WING framework programme is exploiting innovation potential of materials and their technologies with a view to developing new products and processes with great social benefit.
Important also is the acceleration of the innovation process in the industry by creating efficient co-operation structures between industry and science with increasing participation of SMEs (e.g. by building up suitable infrastructures and collaborative projects).
The supported projects lead to strengthening long-term effective partnerships between large companies and SMEs for the development of new materials and processes. Favourable conditions for participating in the respective support measure are created for SMEs in order to increasingly incorporate this group in the innovation process.

Innovation Alliance.
Innovation Alliances are a new instrument (2009-2012) of public support to industrial innovation that provide funding for strategic co-operation between industry and public research in key technology areas that demand a large amount of resources and a long time horizon, but promise considerable innovation and economic impacts. IA are part of the German High-tech-Initiative. They started before 2009 and will continue. Through a public-private partnership, the Federal government provides funding for R&D and other innovation-related activities for specific, long-term co-operative R&D projects. Public funds are complemented by private money from industry, typically at a proportion of 1:5 (public/private). Each innovation alliance is set up through an industry initiative, is organised as a long-term co-operative research project and involves several industry partners as well as public research organisations. Innovation alliances are focusing on the development of new path-breaking technologies in specific sectors or for cross-cutting areas.

"Nanotechnology enters into production" was launched in April 2006. This research initiative is targeted at promoting the quick conversion of basic research results pertaining to nanotechnology from lab data into industrial practice. Above all, it aims to make procedures and equipment available which are appropriate for industry and which can be used to produce high-performing products safely and economically. The BMBF has allocated 15 million euro for projects related to this topic.

More detailed measures aimed specifically at SMEs

NanoChance has been started in 2006, funded within the framework of the WING programme, there is no separate funding through this measure as it is provided by the thematic R&D-programmes. NanoChance is a call within the WING programme and at the same time this call is part of the federal governments initiative for SME called "KMU Innovativ".

The development of the "NanoChance" activity intends to support SME's that strive for extending their business area and their use of nanotechnology in order to strengthen their market position. In addition to fostering nanotechnology start-ups, support is given to stabilise and encourage the growth of innovative SME's in order to make room for nanotechnological developments and realise the potential for networking activities and new applications. Initial funding of 20 mil euro has been allocated here. Approx. 20 joint research projects ("Verbundprojekte") are financed every year (each project has a duration of three years). Within the 10 joint research projects approx. 60 single research projects ("Einzelvorhaben") are financially supported. Every project partner within a joint research project (approx. two thirds SMEs, one third research institutes; large enterprises can also participate but do not receive funding) works on one specific (single) research project.

PRO INNO II

The "Programme for promoting an increase in the innovation skills of SMEs (PRO INNO II)" supports those that collaborate with other companies and research institutes in R&D activities. Nanotechnology is an important field of technology for this programme, and has been allocated around 15 million euro.

INNO-WATT

The "Innovative Growth Leaders programme (INNOWATT)" supports industrial research activities by growth leaders (SMEs and external industry research institutes) in the newly formed German states and in Berlin. The main objective is to successfully convert the results of R&D into market products. Since 2004, funding to the amount of 1.8 million euro has been granted for nanotechnology research projects. This triggered an R&D volume of around 3.5 million euro in the new German states and Berlin.

IGF/ZUTECH programme

Since 1995, projects relating to nanotechnology have been promoted within the framework of the IGF (Industrielle Gemeinschaftsforschung) programme and its sub-programme on future technologies (ZUTECH- Zukunftstechnologien für kleine und mittlere Unternehmen). The number of projects that can be clearly identified from their titles as having a relation to nanotechnology has grown continuously to a level of around 3% (3 million euro) of the total annual funding (100 million euro in 2005).

Advice from the BAuA (Federal Institute for Occupational Safety and Health)

The BAuA offers advice on issues relating to health protection and the measurement of nanoparticles in the air. This information and advice is particularly useful for SMEs, since they often lack the required technical infrastructure and personnel. The BAuA also highlights nanoparticle exposure in start-up companies, contributing to a description of the risks for SMEs.

Support for new technology companies – EXIST-SEED

The "Business Start-Up from Science (EXIST)" programme promotes ambitious projects that aim at a permanent improvement of the culture of entrepreneurship at universities and research institutes throughout Germany. Technologically innovative start-up projects with the potential to succeed economically are supported by the EXIST programme from the early phase of the start-up to the maturation of the business idea in the form of a business plan. Around 10% of the some 400 funded projects since the year 2000 have related to nanotechnology.

High-Tech Gründerfonds (including ERP start-up funds/ERP/EIF umbrella funds)
High-Tech Gründerfonds gives newly founded technology companies private equity of up to 500,000 euro in first round financing. The fund, which was established by the BMWi (Ministry of Economics and Technology) , partners from commerce, and the KfW Bank Group, amounts to a total of 262 million euro and hopes to give new impetus to company start-ups in Germany. From August 2005 to June 2006, 48 requests for funding were granted to newly founded technology companies, including high-tech nanotechnology start-ups in fields such as medicine technology and chemistry. High-Tech Gründerfonds has been supplemented by ERP start-up funds (volume of 250 million euro) and ERP/EIF (European Recovery Programme/European Investment Fund) umbrella funds (volume of 500 million euro). These funds contribute significantly to the mobilisation of venture capital investment.

Central learning perspective in a European context

This summary of measures existing in German public intervention in the area of NMP presents a significant shift that happened during FP6 implementation period and at the beginning of FP7. The new strategy underlines the shift in the German policy. From financing large research programmes at research institutes and universities as well as centralized research infrastructure facilities, German policy shifted towards a large number of dedicated programmes that are supposed to reduce gaps between research institutes and private companies and reduce time to turn the results of R&D into market products. The engagement in support to SMEs seems to be crucial in this process and is supported with targeted measures and programmes' requirements.

Another interesting issue is the evaluation of the results of country measures. The evaluations conducted in the past in general terms influenced planning of the measures implemented in the years 2002-2010, but no new evaluations exist so far, that might be related to NMP FP6 implementation period. With regard to indicators that might be potentially used for future evaluations, it was noted that enterprises, including SMEs - by intention – do not apply for patents resulting from the supported research projects. The main reason is that in order to obtain a patent too much know-how has to be made public. Enterprises and research institutes in other countries might use this knowledge as input for their research (without paying licensing fees). Therefore, SMEs are usually reluctant to apply for patents and prefer to keep the knowledge in-house (trade secrets).

Also other measurable results like the number of PhDs or scientific publications are not considered as main indicators for measurement of programmes' successes. The programmes are planned, implemented and monitored, but separate evaluations are not commissioned yet, so it's not possible to define the impact of those interventions on a larger scale.

With regard to the interconnections between main German initiatives and European Framework Programme it was interesting to observe that people responsible for implementation of German measures (similarly only to French PNANO co-ordinator), were the only ones among contacted programme co-ordinators in MS, claiming that the objectives of their programmes to a larger extent influenced the objectives of NMP in FP6, and that respectively NMP FP6 to a smaller extent influenced the objectives of their programmes. In all other countries, contacted programme co-ordinators were claiming that rather the European objectives shaping to a larger extent, their county's priorities, the reverse is true.

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9.4 Norway

Introduction to the case

This case study intention was not to present an overview of programmes existing in Norway in the NMP area, but rather to demonstrate the development processes of one of the programmes, with a look at the design history and stakeholders relations. Additionally this case study also brings a confirmation of Europe-wide tendency and a need to strongly address market oriented, applied industrial research and innovation.

In this context it is important to bear in mind that Norwegian research priorities are shaped by one overwhelming factor – existence of the oil industry and its related branches. Since the discovery of oil resources in 1969 the off-shore industries and heavy constructions industry together with drilling, pipelines and ships were shaping the country's profile, accompanied by the huge aluminium manufacturing sector. Those factors inducted impulse towards research in the area of structural materials. Additionally the green industries in the energy production sector (hydrogen and solar) added an important dimension to the research priorities defined by Norwegian authorities. With only seven universities, one technical university and few research institutes, and only a small number of business clusters active in research, Norwegian research scene seems not to be large in numbers. Norwegian institutions participated only in 25 projects financed under NMP FP6 (co-ordinated 6 of those), with a total budget of almost 20 mil euro, which demonstrates a relatively less important position compared to other European actors. The interesting aspect of this case study is the process of shaping programme objectives over the years, influenced by in house actors and the European perspective.

Facts and figures about the measures taken

Apart from a wide BIA programme (industry-oriented research, with no thematic restrictions, largely financing the NMP field)[124], one of Norway's most important programmes shaping research in the area of NMP is NANOMAT (approx. 51 mil Euro allocation so far), associated to some extent with developments financed by other sector-oriented programmes[125]. NANOMAT work programme indicates plans for a reasonable growth in the coming years (2010-2016) amounting to almost 200 mil euro, with average annual spending of around 24 mil euro. In this context a shift in research priority areas between first and second edition of the programme is very interesting. NANOMAT is implemented by Research Council of Norway (NFR) on the basis of "Nanotechnology and new materials nanoscience and integration, Work programme 2007 – 2016"[126]. It contains a drastic revision of the original work programme, implemented between 2002 and 2006. It was approved by NFR in December 2006. The work programme is based on the foresight study "Advanced Materials Norway 2020", "The National Strategy for Nanoscience and Nanotechnology (nanoST)" and "Nanotechnologies and New Materials: health,

[124] BIA - User-driven Research-based Innovation,

http://www.forskningsradet.no/servlet/Satellite?c=Page&cid=1226993636038&p=1226993636038&pagename=bia%2FHovedsidemal

[125] Approximately 50 % of the funding within nanotechnology and new materials from RCN has been given through NANOMAT in the actual period. The others are mainly: "RENERGI – Clean energy for the future", "PETROMAKS – Optimal management of petroleum resources", "GASSMAKS – Maximising value creation in the natural gas chain", "PROSBIO - Process and biomedical industry", "FUGE - Functional Genomics" and "CLIMIT - Programme for natural gas power with improved environmental performance".

[126] The present programme period is 2007-2011. A plan for 2012-2020 is under preparation, covering finances, thematic areas and programme structure

environment, ethics and society – national research and expertise requirements". The vision of the plan is to make Norway a leading research nation in selected fields of nanoscience, nanotechnology and new materials. NANOMAT lays the foundations for a new, knowledge-based and research-intensive industrial sector and facilitates a sustainable renewal of established Norwegian industry.

The Norwegian government welcomed the National Strategy for Nanoscience and Nanotechnology as advice from NFR, but has not adopted it. One reason for not adopting it was that it is rather broad and stretches outside the domain of NFR into societal areas. One such domain is environment, for which Norway has a Ministry of the Environment and related institutions. Another reason for not adopting the national strategy as a Government strategy was that adopting it would have important effects on budget matters. The Ministry of Education and Research also had to balance this nanotechnology proposal with proposals for different fields, such as humanities and health research, that's why NANOMAT budget allocations in the future are still indicative.

To the Ministry, the plan shows a prioritization made by researchers. This had at least two uses to the Ministry. One is that plans like this provided a basis to argue for additional budget when the Ministry participates in government wide budget negotiations. Secondly, if additional money becomes available, because of the scientific basis or for other reasons, then the scheme for spending these resources is already on place.

Main identified solutions[127]

R&D on structural materials has been important during the last decades due to their importance for the Norwegian industry sector; still the research in other areas related to materials was not neglected. As indicated before the process of programme development was in focus for this case rather than the presentation of country's research portfolio.

At the very beginning, before the creation of the national programme, a series of high level meetings of research institutes was organized including major stakeholders to develop a materials research programme. During the autumn of 2000, a group of researchers wrote the FUNMAT document. FUNMAT was a bottom-up programme of University of Oslo aimed at functional materials, but its agenda also addressed nanotechnology. FUNMAT had six areas of research, one of which was 'Materials for nanotechnology'. Due to lack of resources NFR did not finance this materials research initiative. Simultaneously in the course of 2001/2002 the Ministry also dealt with the EU's 6th Framework Programme. This focused heavily on materials research and nanotechnology and this convinced the Ministry that basic materials research and nanotechnology were important for Norway. In the course of 2003 the Ministry secured 3,6 mil euro of NFR's budget essentially for functional materials research to be spent within NANOMAT (not directly FUNMAT). Thus, the shaping of the first Norwegian programme in Nanotechnology area was to some extent inspired by the developments in Europe at that time, with the outcome of creation of a unified, large programme, based on a complex process of priorities discussion between all engaged actors.

NANOMAT's launch was a result of a merging of three developments. One comes from the field of materials research, which included research toward functional materials around 2000. The second development was the 2003 reorganization at NFR which influenced the

[127] This chapter is developed on the basis of PhD thesis of Frank van der Most "Research councils facing new science and technology. The case of nanotechnology in Finland, the Netherlands, Norway and Switzerland" ISBN: 978-90-365-2897-9, PDF available via http://www.frankvandermost.nl

choice of funding instrument, viz. a Large Scale Programme.[128] Thirdly, the reorganization coincided with plans to develop a nanotechnology funding programme. NFR merged this programme with the labelled budget. Each of the three had its influence on the shape of nanotechnology. The programme was a Large Scale Programme, which determined its aims to achieve specific objectives and identify concrete challenges and opportunities of strategic national importance, having a long term perspective and generate synergy and interaction between strategic basic research, applied research and innovation. It became a materials research oriented programme for nanotechnology. During the relevant period of NMP FP6 implementation, NANOMAT total budget was around 41 mil euro. A detailed description of the programme shows that for a programme for nanotechnology, it was heavily oriented towards functional materials research.

By the end of 2006, about two thirds of the budget was spent on "Nanotechnology and functional materials", "Nanomaterials" and "Other functional materials".
List of "thematic priorities", stress on materials research, consisting of: "Nanotechnology and functional materials in:

- Energy and the environment
- Electronics, optics and communications
- Nanomaterials
- Other functional materials
- Bionanotechnology
- Design, theory and modelling
- Infrastructure and nanotools
- Ethics, the environment and society."

Key figures for NANOMAT for the period January 2005 to December 2006:

- Scientific publications:
    - articles in refereed scientific journals: 363
    - articles in other scientific journals, books, published addresses from international meetings, other reports and addresses: 526
- Results of dissemination (dissemination measures vis-à-vis relevant target groups, measures for public dissemination, mass media stories): 126
- R&D results (new methods, models, prototypes): 19
- Commercial results (new processes, patents/patent applications): 10
- Introduction of technology (collaborating companies and companies outside the projects): 3

Since start-up and up to September 2006, NANOMAT has made grants and commitments to over 75 projects. As for 2006 they finance 43 doctoral candidates and 54 post-doctoral fellowships.
The financing of innovation-oriented projects has increased since 2004. This has caused a rise in the level of industry interest. In 2004 six new industrial companies took part in knowledge-building projects with user involvement and user-led innovation projects financed by the programme. This figure rose to 11 in 2005 and 21 as of June 2006.

In 2005 the Norwegian Government introduced their White Paper on Research "Commitment to Research", where nanotechnology and new/functional materials is one of the priority technology areas. To follow up this White Paper and have a good footing for further work, NFR launched a working party to develop a National Strategy for

[128] Desription of Large Scale Programmes http://www.forskningsradet.no/en/Largescale_programmes/1186122420145

Nanoscience and Nanotechnology. This work was a basis for NFR to reshape NANOMAT according to the rules for the midterm revision of the Large Scale Programmes and in line with the working party's subdivision of nanotechnology and its suggestions for funding of equipment and facilities. Other changes introduced in the end of 2006 were an aim for a 50-50 division of budget over projects for basic and applied research respectively and an increased focus on nanotechnology research, especially ethical, legal, societal aspects, including environment, health, safety and risk. The shaping of the program to a large extent was influenced by expectations of researchers and the Ministry of NFR's performance as a research funding organization with a strategic role. Such processes of continuous change are not only visible at NFR. It occurs in research and government as well. The change in direction of material research is also resulting from plans and frameworks of nanotechnology at other universities, which collectively put pressure on the Ministry and NFR to address the field.

The preferred research areas in NANOMAT Work Programme in 2006 were given mainly from the National Strategy for Nanoscience and Nanotechnology. As can be seen, there is a good overlap with the main nanotechnology areas within the biggest stakeholders, presented in the table below.

Table: Prioritised activities in nanotechnology, nanoscience and new materials at main research institutes				
NTNU[129]	UiO	UiB	SINTEF	IFE
Nanoelectronics nanophotonics, nanomagnetism, nanostructured materials, Bionanotechnology, Nanotechnology for energy and the environment, Functional materials, Polymers and composites	NanoST for energy technology, NanoST for oil, gas and environmental technology, NanoST for ICT, NanoST for medicine and health, NanoST in relation to law and ethics, Functional materials, Materials for energy technology, Materials for oil, gas and the environment, Materials	Nanoprocess, Nanobio, Basic NanoST, Functional materials incl. Biomaterials, Catalysts, Energy conversion and materials	Nanoparticles, special focus: controlled liberation of components and coating, New, smart materials, special focus catalysis, Sensors based on micro/nanosystem technology incl. Biosensors, Development of bionano-related expertise, HSE and ethics, Functional materials; increased functionality in all areas Carbon materials; carbon nanotubes, catalysis and separation	Structured materials, Complex and soft materials, fluids, Selforganising of nanoparticles Targetseeking nanomaterials as tracers, and in corrosion inhibition and surface modification Functional materials, Materials for energy
Source: Frank van der Most, Research councils facing new science and technology. The case of nanotechnology in Finland, the Netherlands, Norway and Switzerland"				

Table 69. Prioritised activities in nanotechnology, nanoscience and new materials at main research institutes[130]

The NANOMAT Programme from 2007 broadly and explicitly followed the structure and categories of the "National strategy" (prepared in November 2006) but also made a more explicit choice to reorient from funding basic research towards applied research and

[129] The University of Oslo (UiO), the Norwegian University of Science and Technology (NTNU), the University of Bergen (UiB), SINTEF and the Institute for Energy Technology (IFE).

[130] All together the IFE, NTNU, SINTEF and UiO received around 80% of the total project grants from NANOMAT of NOK 337 million in the first programme period 2002-2006. Almost 49% of this amount is spent on projects in the FUNMAT field

integration in final products. In the first years of the NANOMAT program about 80 % of the funding was allocated to building new competencies and hence researcher driven projects. 20% of the total budget was allocated according to plan to innovation driven projects. This also reflects the funding of the NANOMAT programme in that period. NANOMAT from 2007 has an aim to shift the balance between researcher driven and innovation driven allocations to fifty-fifty. In addition, the program aimed to increase contributions from industry in innovation driven projects from 1.4 to 2 per each NFR invested euro. This bias on application and innovation was also one of the differences between the first and the second period of the NANOMAT programme.

Another difference with the first programme concerns the selection of fields. Whereas the first period of the NANOMAT programme aimed to develop Norwegian research to an internationally high level and selected broad nanotechnology fields, such as nanomaterials, bionanotechnology, and nanoelectronics, the second period aimed to prioritize those areas that in 2006/2007 still needed to be developed. Its work programme prioritized the thematic areas from the strategy as follows:

1. Energy and the environment: gas conversion, CO_2 capture, petroleum production, solar panels, hydrogen technology, batteries and energy harvesters, energy efficiency, biofuels
2. ICT inclusive microsystems: Nanomaterials and nanocomponents for electronics, data storage, optics, sensors, actuators and radio frequency components; integration of nanomaterials into sensors and actuators; nanostructuring; nanofluidics.
3. Health and biotechnology: Biocompatible materials, sensors and diagnostics, medication.
4. Ocean and food: Tracing of food, smart packaging, food monitoring, surface treatment to prevent algal and bacterial growth.

The strategy also defined expertise areas (in Norwegian in alphabetic order):

- Bio-nanoscience and bio-nanotechnology
- Ethical, legal and societal aspects including health, environment, safety, risks
- Fundamental physical and chemical phenomena and processes at the nanometre scale
- Interface and surface science and catalysis
- Components, systems and complex processes exploiting nanoST
- New, functional and nanostructured materials
- Synthesis, manipulation and fabrication
- Characterisation
- Theory and modelling.

This order was based on "national advantages in resources, industry or expertise". NANOMAT had transformed in line with the Norwegian Government's and the Ministry of Education and Research's prioritization of nanotechnology, and in line with the aims of the Large Scale Programme instrument.

Central learning perspective in a European context

Prioritization of a new field is not a one-time activity but an ongoing process in which NFR develops its priorities in interaction with actors both in research and in the government. NFRs funding of projects reflects the funding and the focus from the Norwegian Ministries. The Ministry of Education and Research were together with the Fund for Research and Innovation, the largest contributors to the NANOMAT programme at the beginning. After a couple of years the Ministry for Trade and Industry influenced the process as a second important actor, giving a shift towards innovation driven research. National programmes and their priorities are therefore developed in a complex way, which takes into consideration many factors and agendas, not only following direct expectations of research groups.

In this case the nature of the NANOMAT programme in the second period changed, in line with the aims of the LSP instrument, which meant a phasing out of attention on basic materials research towards innovation driven research.

The process is not only driven by major or sudden changes in NFR's environment, such as FUNMAT's lobby and the evaluation of NFR in 2001. Some, such as annual budget negotiations and the publication of the Ministry's White Paper are normally repeated procedures.

Thus, not only the organizational shape of NFR, but also ongoing interactions with government and researchers, shape and reshape the way funding programmes outline the field of NMP and fill it with resources. NFR's subsequent steps were not radically different from previous steps and from other actors' attempts to shape the priority of nanotechnology. This can be explained by strong interdependencies between NFR, the Ministries and researchers. Actors who have an abundance of one type of resource cannot dominate priority setting, because they lack others. The Ministry of Education and Research may have an abundance of financial means, but it lacks the capacity to develop detailed plans for potential research priorities. It needs researchers who have an abundance of ideas and who provide scientific quality evaluation. It needs NFR to aggregate ideas, develop priorities and manage the priority programmes. Since the beginning of 2002 this joint practice of shaping research priorities produced very good results in terms of overall programme outcomes and impact.

In wider European context this case is a confirmation for a thesis that European countries shape their research agendas with a focus on these priorities, where they already dispose a competitive advantage and existing potential. Another important factor noticeable in the international context of this evaluation is that the necessity for more market oriented focus was noticed and introduced into Norwegian work programmes, by a shift from researcher driven to more innovation driven research.

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9.5 Poland

Introduction to the case

Poland joined European Union not so long ago. Its participation in Framework Programme activities was not very visible, and cannot be defined as highly influential, compared to the existing scientific potential and size of the economy. Poland obtained only 1,72 % of total NMP FP6 allocation, it's institutions co-ordinated only 1,7 % of all projects; only 3% of all participating institutions were from this country. Simultaneously there was no big national programme (or programmes) dedicated to financing NMP-related research in the past.

The Ministry of Science was structuring the funds based on National Framework Programme where nanoscience was located in sixth strategic research area (priority 6.1). Since 2008 the programme is called "National Programme for Scientific Research and Development Works" and nanotechnologies are located under in many other priorities (e.g. medicine, electronics and materials for different industries). The Polish approach was then to use nanotechnologies and nanoscience as an enabling technology, not as a stand-alone research field, with separate implementation priority.

The analysis conducted demonstrates that the use of country's scientific potential and existing and newly built research infrastructure associated with highly educated staff with long research traditions may be a very good basis for future developments in the NMP filed. This point of view resulted in development of a strategic document titled "Nanoscience and nanotechnology – National Strategy for Poland" published in 2006[131]. This document was a direct answer to world's developments in the field, assessing the potential, addressing issues of key importance for the coming years, and defining research directions. The most important aspect of this document, in the light of this evaluation of NMP in FP6 is the fact that Polish authorities are planning to use the potential of EU funding as a major financing instrument. One of main chapters of this document is proposing tasks to be done in the years to come in order to use European resources as much as possible. This is contradictory to the significant discouragement appearing among Polish research teams, resulting from low success rate in FP5 and FP6 calls for proposals as well as from long, complicated granting procedures, and many other reasons (such as: lack of procedural knowledge; lack of experience in projects implementation; lack of interested industry; lack of reliable international partners, and others)[132]. To conclude the picture the strategic SWOT analysis conducted lists common problems of the country in transition including such factors as lack of research infrastructure, scattered financing, no networking and integration, weak correlations with industry, lack of industrialization of results, and others aspects with regard also to societal and normative issues.

The main structural problem is the construction of efficient co-ordination mechanism and priorities building mechanism within the triangle: politics ⇔ economy ⇔ science.

There is a relatively weak contact between science (this environment is barely interested in practical use of own research and technology transfer), the economy/enterprises (sometimes sceptical towards nanotechnologies and generating weak demand for

[131] Document prepared by Interdisciplinary Group for Nanoscience and Nanotechnology, established by Directive No. 9/2006 issued by the Minister of Education and Science on the 15th of February 2006

[132] Source: "Nanoscience and nanotechnology – National Strategy for Poland" p. 44

innovation) and scientific political bodies (implementing own visions, not necessarily representing the existing needs of enterprises).

Facts and figures about the measures taken

The case of Poland is a typical example of a country struggling with lack of financial resources for research, but with a wide scientific basis for research development. Such a situation and approach is similar to many other new Member States from Central and Eastern Europe. Poland's institutions responsible for shaping research were also not able to influence to any substantial extent the European Framework Programme planning processes and participate in the process of definition of the European research priorities (which is also listed as one of the reasons for Polish research teams not to participate fully in the research done under the work programmes). The creation of Polish strategy did not induce changes of priorities or focus during the revision process of the work programmes in NMP FP6.

Poland is also not a key European player in the field with regard to government funding. The total financing (including grants described below) per year is set to around 5 mil euro per year. The Ministry of Science has granted in the period of 2002- 2006 almost 200 grants with the total amount equal to 8,6 mil euro. The expectations, postulated in the strategy, but never implemented, are setting up the ceiling for this kind of support at the level of 10-15 mil euro per year.

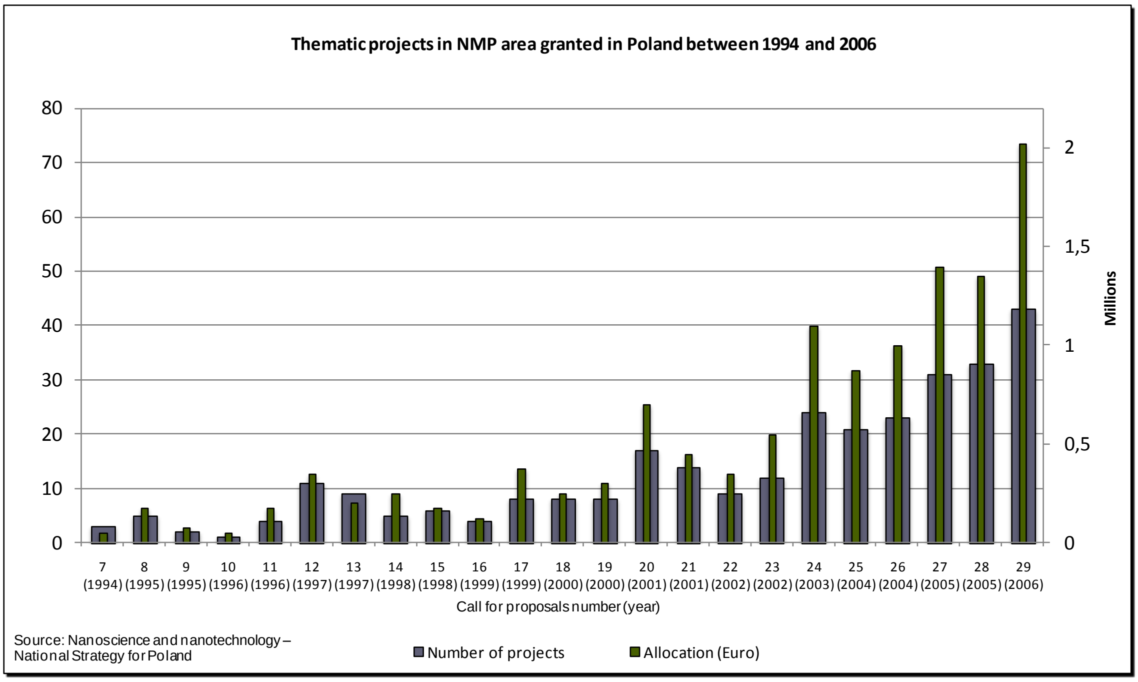

Figure 70. Thematic projects in NMP area granted in Poland between 1994 and 2006. Source – N&N National Strategy for Poland

The Strategy developed in 2006 is defining a detailed list of actions to be taken in order to achieve strategic goals. Strategy propositions with regard to research directions were to a large extent repeated in the "National Programme for Scientific Research and Development Works" (covering entire Polish research portfolio) published in 2008, but still is not followed by much higher financial and organizational implementing measures, that may move the country's relative position towards key players at the European scene.

As a result of evaluation of the current situation conducted on the stage of strategy preparations in the NMP field a list of detailed actions was developed, with main themes listed below:

- To accelerate decision-making procedures
- To enhance flexibility of national research programmes
- To deepen co-operation of research teams
- To widen strategic, long-term co-operation with the industry
- To ensure better financing possibilities
- To assure chances for young, talented researchers development
- To develop research infrastructure

The infrastructure and support for enterprises is to la arge extent supported already with European Structural Funds and Cohesion Fund, implemented successfully from 2004 and currently through National Development Plan (NDP) 2007-2013[133], still the total country financial allocations from different sources dedicated solely to NMP sphere are not possible to identify, as none of the NDP priorities and operational programmes is directly addressing the research in NMP. That is also the reason for concluding that existing evaluations of the structural fund's operational programmes are not giving any light into the subject of meeting objectives similar to those defined in NMP work programmes and ERA documents. There is no precise data about allocations in scientific/educational/enterprise infrastructure projects that may be precisely aligned to NMP only. Still, identified (biggest) projects in NMP financed under European funds amount to 426 mil euro in the period 2004-2008!
With regard to complementarity to European research priorities, the strategic support areas were defined[134] in the strategy. We are able to present here the main themes only with descriptive information about their compatibility with FP priorities:

- Nanoscale phenomena and processes, (full compatibility with FP7 priorities),
- Nanostructures, nanomaterials, (substantial compatibility with FP7 priorities),
- Nanoscale devices, and elaborating analytical and technological devices needed in the development of the basic strategic areas (full compatibility with FP7 priorities),
- Nanoanalitics and nanometrology (substantial compatibility with FP7 priorities),
- Processes and production equipment (substantial compatibility with FP7 priorities),

The analysis concerning the development stage of nanosciences and nanotechnologies in Poland against the backdrop of global and EU achievements indicates that the potential of Polish science is mainly concentrated in two research areas: "Nanomaterials and composites" and "Nanoscale phenomena and processes" (between 2000-2005 about 75% of projects carried out in this areas concern nanomaterials and basic research of phenomena and processes).

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[133] The National Development Plan is implemented with use of a number of detailed operational programmes including those which finance both research and business infrastructure and activities related to enterprises development. The two most important in the context of NMP would be Operational Programme "Increase Competitiveness of Enterprises" (2004-2006) Operational Programme Innovative Economy (2007-2013), supplemented also by Integrated Regional Operational Programmes and later on (form 2007) by Regional Operational Programmes in each of the country's regions.

[134] The full strategy document is available at http://www.pronet.org.pl/cms/upload/Raport_Nano-1-d229.pdf to large extent with English translation.

This set of priorities is confirming the position of Poland as a "follower" in the European club.
It is also proposed to include new areas: "Nanostructures" and "Nanoscale devices", because, similarly as the area "Nanomaterials and composites", they are based on the advanced cognitive research and, at the same time, they open a great perspective for the practical application of the results in many economic sectors.
Even with this existing strategic document the implementation is scattered to relatively small Ministry grants programme and different activities undertaken by research institutes and Universities. Results are not assessed in large scale, as there is no common implementation programme for NMP area that may integrate country's efforts and demonstrate the real impact on the economy in the long scale.

Main identified solutions

Identified solutions are to a large extent in the sphere of plans, with only partial implementation of some of the aspects listed below. Before the strategy creation and currently (during the period of NMP FP6 implementation), there were some financial tool used to facilitate the European appearance of Polish teams. One of those was to ensure government funding of participant-required share in project financed from other donors. Research teams being part of consortia financed from EU and other sources could count on reimbursement of maximum 60 % of necessary "own" share. Another measure was the research grants scheme (where the research teams were applying to the Ministry to regular calls for proposals twice a year.

Nevertheless in the strategy a wider approach was widely analysed and described[135], defining actions to be undertaken with regard to substantive, organizational and political issues. This includes such actions as:

- Creation and development of Road-mapping & Foresight Nano initiative on national level
- Creation of central steering institute for nanotechnologies
- Multi-year Financing Programme for NMP activities covering selected priority areas
- Creation of working group in the Ministry of Science and Education responsible for NMP
- Creation of co-ordinated research programmes (engaging industry and research centres)
- Creation of specialized research labs and data bank co-ordinating research infrastructure
- Creation of integrated web portal
- Creation of international doctoral studies system
- Co-ordination of actions between Ministry and FP Contact Point
- Creation of a working system to influence Polish participation in FPs (detailed task here include such ideas as: having more representatives in consultancy bodies to

[135] Ibidem

EC; introducing management system for Polish representatives in the relevant structures; actions to raise the quality of applications to FPs; lobbying to address better work programmes' priorities; promotion of bilateral agreements with other countries; amelioration of research institutes' units responsible for preparation of project proposals; system of financial promotion of research teams operating internationally)

- Change of the structure of research financing (more market oriented)
- Other organizational aspects with regard to liquidation of bureaucratic barriers, exchange of scientists, and patent process facilitation

As demonstrated the Polish strategy is listing many detailed actions to be undertaken, which may serve as a basis for future definition of detailed success indicators. Some (mostly organizational) actions have been implementation since 2007. Polish Nanotechnology Platform integrating the stakeholders has been created. Nanotechnology foresights are under implementation. Still the main problems and limitations exist and more advanced actions defined are to be challenged.

Central learning perspective in a European context

The identified solution of using as much as possible of the European funds is (in long term) reasonable. Together with other actions aimed at overcoming existing communication and organizational barriers, this may take Poland from the category of "Followers" towards the category of "Second movers" on the European scene. This planning process and existing potential might be an example for other countries with similar (especially financial) problems. A lot of actions might be undertaken on the organizational, educational and political level, ensuring better appearance of country's research teams in framework programmes. This kind of actions does not require huge financial resources, but rather a clear political will to implement the necessary changes, and simple organizational effectiveness.

Sources:

- www.nauka.gov.pl/fileadmin/user_upload/15/44/15445/DU_10_2005.pdf
- www.bip.nauka.gov.pl/_gAllery/54/32/5432/Krajowy_Program_Badan_Naukowych_i_Prac_Rozwojowych.pdf
- http://www.pronet.org.pl/cms/upload/Raport_Nano-1-d229.pdf
- Consultations and presentations from prof. Witold Łojkowski, Co-ordinator of Polish Nanotechnology Platform www.nanonet.pl

9.6 Conclusions

Since NMP FP6 is definitely the largest financing scheme in the field in Europe, the remaining country programmes are much smaller in financial terms. Also the structure of the programmes differs largely from NMP. In all analysed cases the European NMP is the only programme addressing the three main dimensions (N, M and P) and integrating them in one measure. All other actors do not use this approach and even the abbreviation "NMP" was a total "novelty" for scientists and officials not directly engaged in preparation of applications for framework programmes, interviewed by the evaluation team. Existing measures covering N&N research in most of cases are also entering the field of new materials (but in that case with regard to materials developed with use of N&N as enabling technology). Production processes are not in the focus and are not listed in this context. On the other hand many of European countries have wide research programmes that do address all the issues from NMP priority, but in all those cases the priority listing is much wider and simply covers a wide variety of research fields (which in case of EU are coved by other FP priorities). Another possible layout identified to address the research in the three areas is to finance separate smaller research programmes for different industries (eg. pharmacology, optics, transport, ICT and others). This approach is also used, sometimes associated or mixed with the previous one discussed. In this case again N&N is treated as an enabling technology, new materials are treated as a possible outcome of the research (not as a research field itself) and new processes and devices are not mentioned as a separate research foci.

Existing structures for planning and implementation of research in NMP areas presented in case studies differ to large extent. Three main approaches may be identified with regard to this strategic layout:

- Existing strategy and integrated implementation programmes co-ordinating actions and resources to address best identified weaknesses and threats and build on the base of existing strengths and opportunities identified (Germany and France with cross sector strategies identifying large portfolio of sectors and research priorities, Norway with more "nano-materials" oriented approach, selecting and adjusting carefully priority research areas).
- A main implementation programme and many other measures supporting developments in the field, but lacking overall strategy or action plan (e.g. Austria)
- Existence of complex strategy, not associated by strong implementing measures (e.g. Poland).

Programmes' priorities are designed in Member States (especially those investing larger amounts into research) with use of wide national consultations. They are shaped to make best use of the existing country potential and to meet the interests of national research teams, political bodies and industry lobbyists. The European NMP FP6 priorities are also shaped in a complex process, engaging national delegates and experts. To some extent engaged countries claim to influence the European priorities, this is especially in case of the frontrunners in the field.

With regard to the nature of results produced the conducted analyses demonstrate that MS tend rather to measure results produced on the project level, understanding that this kind of result in a longer term will lead to wider impact and fulfil the political goals. Still the findings presented confirm that a need for more market oriented research is noticeable in MS and this might be directly linked with the necessity for relevance and value of the results. "Relevance" in the meaning that research must be "relevant" for the producers (industry) and the "value" is to be measured with the number of market oriented products and amount of sales. That is also why countries create research centres where scientists and industry meet and co-operate together.

The issue of both qualitative and quantitative assessment of meeting objectives and measuring outcomes on strategic level in Member States historical programmes is rather illusive. A large number of the programmes is under implementation. The evaluations of analysed measures are conducted on project level (not referring to higher strategic objectives and impact). In many cases evaluations have not been conducted yet, or cover short periods of the programme cycle.
However a number of cross cutting issues is appearing in analysed strategies, actions plans and programmes, similar to current developments described in the European Action Plan, this includes such aspects as:

- Education and training as an important factor for assuring access to skilled workforce,
- Social dimension of the research, need for information and public debate,
- Fostering issues of health, safety, environment and consumer protection measures,
- International co-operation as an important factor for keeping the research teams at the frontier of knowledge,
- Co-operation (SMEs/industry/science) as a crucial point for successful commercialization of research,
- Creation and development of research infrastructure centres integrating the existing potential and addressing the needs of industry.

Chapter 10. Findings and recommendations

The third thematic priority (NMP) in FP6 affected Europe's competitive position and was an important programme that also influenced Member States' policies and research agendas. However, it cannot be directly linked to a revolution with regard to creating substantial scientific or industrial breakthroughs, although these were among the explicitly targeted objectives. The programme strengthened Europe's position as one of the world leaders in the respective scientific and industrial fields but did not enable Europe to outperform other key actors such as the United States or Japan.

The ex-post evaluation of NMP (FP6) at hand is one part of a two-piece overall assessment of the thematic priority NMP FP6. The preceding analyses were designed and conducted to evaluate NMP FP6 on a strategic level. Hence, they differ from "classic" evaluation exercises measuring effectiveness and efficiency on the project level. However, conducting an evaluation on a strategic level cannot be exercised without some reflections on the actual outcomes and outputs as well as the "physical" impact of the financed projects. These reflections have been applied in order to illustrate the outcomes and outputs on a more general and aggregated level.

This concluding chapter of the evaluation stresses the strategic approach to the evaluation. It reflects the overall state of development of the thematic priority NMP in FP6 by means of the impact generated. Therefore, it summarises how and to what extent NMP FP6 has contributed to the overall objectives of the European competitiveness and co-operation – in science, technology and development as well as in industry and beyond. Based on these summaries of the main results of the evaluation at hand, the following chapter also includes recommendations for improving NMP or other similar thematic priorities, their structure, and eventually their impact on strategic agendas' objectives.

Assessing the overall strategic conclusion of the ex-post evaluation one has to take into account that the NMP-programme has covered a broad and heterogeneous field of research and innovation from frontier research into material properties and phenomena on the nanoscale on one end – over the development of new multifunctional materials – to the application of new production processes and devices at the other. It must also be borne in mind that a considerable part of the NMP budget has been directed at consolidating European RTD by overcoming fragmentation, that is, considerable funds have been used for other aims than industrial application of NMP technologies. This means that this evaluation of NMP FP6 impacts takes into account the kind of results that the different policy agendas were meant and predicted to generate before drawing conclusions about the character and value of those results and before suggesting recommendations.

In general – and even under the assumption that many opinions expressed in interviews and survey results might suffer from a positive perception bias – NMP FP6 can be regarded as success both on the programme and project level. However, the thematic priority did not achieve all of its objectives to the full extent, which traces back to very ambitious aims rather than imperfections in design or implementation. The following overview will nevertheless summarise findings that indicate opportunities for improvement and display respective recommendations on NMP FP6 as a whole that could very well facilitate the design of future support measures in the field of NMP and its respective sub-areas (Nanotechnologies and nanosciences, knowledge based multifunctional materials and new production processes and devices).

10.1 Design and implementation

The **promotion and visibility** of the 'nanotechnology' sub-area (NMP-1) on the expense of the other areas has been present in NMP FP6, although NMP FP6 is the only measure that addresses the three main sub-areas (N, M, and P) integrated in one programme, e.g. the abbreviation "NMP" was unfamiliar to leading scientists not directly engaged in preparation of applications for NMP FP6, which were interviewed by the evaluation team although they did know that there was a nanotechnology programme. Despite the fact that, on a strategic level, no respective disadvantages or adverse effects were identified it cannot be excluded that especially the integration of the different sub-areas (in and by means of research projects) could have benefited from **a more integrated 'picture' of NMP FP6**.

The **structure** of NMP FP6 differs largely from those of MS programmes, at the time of its implementation this was the **only one addressing the three main sub-areas (N, M, and P) integrated in one measure**. Existing measures covering nanotechnologies research in most cases also relate to the development of new materials, but in such cases nanotechnologies are seen as an enabling component. Production processes are not mentioned at all in this context.

A Nanotechnology Action Plan has been commissioned, as have numerous surveys and analyses, aiming at an assessment of different aspects related to the state of nanotechnologies development in Europe. This also means that the internal European focus has been clearly **biased towards nanotechnologies**, in practise leaving the M and P dimensions in the periphery of research policy.

Recommendation: If the integration of these sub-areas is to be maintained in future support measures, the communication of the underlying rationale should be made clearer and more comprehensible to potential target groups. The importance and status of the M and P sub-areas should be raised and highlighted through the commissioning of reports, publications and application documents dealing with these dimensions and their functions and roles in relation to nanotechnologies. Consider incorporating these dimensions into the Nanotechnology Action Plan more explicitly (perhaps renaming it the NMP Action Plan).

The **relevance** of NMP FP6 is clearly reflected in the present evaluation by the participants' affirmative views regarding motivation, added value of participation and satisfaction with the programme design, whereas the administration-related implementation aspects were perceived as being less favourable. The main rationales stated for participating in the programme are the international collaboration opportunities, the access to scientific and research excellence, and the highly relevant thematic areas offered by NMP FP6. The survey also unambiguously indicates that value was added for participants by the increased prospects offered by the programme regarding community and network building, access to specialised knowledge and know-how, and intensified stakeholder involvement.

Europe as such is still much diversified with regard to the participation in the research into high technologies. The **Member States can be broadly clustered in three groups** – both in a technological and in political context: front runners, (fast) second movers and followers. In front running countries the most important research policy is probably linking the scientific community to industry in order to stimulate transfer of knowledge. In second mover countries the most appropriate focus might be a sector approach to the application of processes and devices, while the follower countries might benefit the most from access to European resources in Framework Programmes, and develop their respective fields of experience (similarly to second-movers) in selected sectors and thematic areas. Although neither the Framework Programme itself, nor thematic priorities within Framework Programmes are the appropriate vehicle to even the respective **differences**, they **play a vital role for application motivations, added value** etc. for users from these different countries.

The **revisions of the Work Programmes** in NMP FP6 have been well perceived and a majority of the participants assessed the reactions to changes in the scientific or industrial context of the programme as being appropriate. However, concerns regarding the transparency of such revisions and modifications have been raised. The process of the preparation of Work Programmes was designed in a way to assure that European intervention will cover a wide variety of research topics in line with ERA and wider European objectives, to safeguard that none of the important fields was left uncovered. The outcome of this process was **considered valuable** by both project coordinators and programme officers, indicating that NMP FP6 as a programme managed to achieve a large thematic adequacy in general.

The **shaping of NMP priorities** has been supported by a number of NMP-related European Technology Platforms, through efficient identification of research and technology development needs. The priorities and the topics were **relevant and reasonable** from the outset of NMP FP6, yet the selection and the focus of priorities, among which the industry focus, even improved towards the end of the programme.

Recommendation: Ensure and intensify stakeholder involvement through current platforms, and consider cross-linking those that are mutually relevant.

One of the main objectives of NMP FP6 was to create '**critical mass**' without any notion of what this might be. Since the term itself is not defined (neither on programme nor project level) and is not connected to any quantitative target measure, the analyses have to remain on a purely qualitative level. However, experts' and participants' **qualitative assessments indicate that NMP FP6 supported** the achievement of critical mass by means of **providing sufficient resources** for individual projects and therefore, the programme as such. Yet, the sub-area NMP-1 (nanotechnologies) seemed to have benefited much more in this regard compared to the other sub-areas (materials and production processes).

Infrastructure is perceived by experts as an important factor for ensuring the sustainability of the research in the future but it was neither directly funded in NMP FP6 nor did such facilities directly benefit from R&D projects funded under NMP FP6. The creation of a European research infrastructure is an important factor that **would facilitate many of the strategic objectives defined for NMP FP6**, and in a wider context, for shaping the future of ERA, influencing the development of human resources (along with the international dimension) and for assuring industry engagement, especially at the level of SMEs. Important investments in research infrastructure are made with use of structural funds interventions in new MS.

Recommendation: Include infrastructure as an important planning dimension for shaping future research priorities in Europe. In connection with this, existing translational centres that bridge the gap between prototypes and concept demonstrators into batch/production runs should be supported and developed. Also a higher coordination between EC services in charge of structural funds is needed to this regard.

From a global perspective, where Europe has to compete with other key players in the field, **the advantage of Europe is to specialize**, not to disperse the financial and organisational efforts across a wide range of research fields.

Recommendation: Include quantitative and qualitative technology mapping and foresight studies in NMP to identify key fields of European expertise in the NMP area, and to adjust funding levels according to identified key development research fields.

Although a majority of participants was fairly or highly **satisfied with the administrative requirements** (in general and of applying for funding in NMP FP6), and many of those who already conducted research in FP5 experienced an improvement in this regard, administrative and application processes are **still considered long lasting and complex**. New research teams without longstanding experience in such application and administration processes – often based in so-called 'follower' countries – might therefore be reluctant to apply for funding, especially since they also face the general uncertainty of a successful application, which also applies for participants from the industry sector. However, European Framework Programmes do not address cohesion issues of any kind but scientific excellence within the European Research Area.

Recommendation: Simplify application procedures aiming at enhancing participation of new research teams especially from "second mover" and "follower" countries. This should be associated with support measures for newcomers to receive necessary application support. Simplification might also be indicated with regard to the administration of projects granted in order to safeguard the participation of industry and new research consortia. However, it must be ensured that such measures do not interfere with the more general criteria of scientific excellence, a barrier that should under no circumstances be lowered.

Various synergic effects of **multidisciplinary projects** were observed by experts. Many of those have stated that the **support of an integration of research disciplines is a real achievement** of NMP FP6. Such work embraces, for example, the collaboration of biologists working with materials scientists and electrical engineers in application fields such as sensors/medical devices. This interdisciplinary approach opens up opportunities to achieve entirely new European industries and the creation of new markets.

Recommendation: The focus on encouraging and funding multi-disciplinary research projects should be maintained or intensified.

10.2 Results and impact on objectives

In sum, the different instruments (Networks of Excellence, STREP, Integrated projects, Coordinated Actions, Special Support Actions) appear as having their own respective sphere of contribution to strategic objectives in terms of both the objectives' origin: "scope of objectives" (parts of NMP objectives, all NMP objectives, NMP objectives plus some of the objectives "outside" NMP, all objectives including NMP) and the strength of the contribution. It can be concluded that the set of instruments contributed to the different objectives, and that the mixture of **instruments allowed NMP FP6 to have an impact on the achievement of the different goals,** but it becomes evident that there are blank spots that have not benefited from NMP FP6 as well.

Recommendation: Unless the significant overlaps of the impact or contribution sphere of the different instruments is intended, the targets of the different instruments applied in Framework Programmes should be made clearer and more distinct. Consequently, the fine-tuning of the instruments with regards to their targets should be considered.

The enabling nature and interdisciplinary relevance of the results produced in NMP FP6 show their **applicability and connection with research fields beyond NMP**, with the most linkages to Life Sciences and ICT, followed by Environment and Sustainability, in case of nanotechnologies (NMP-1) and materials (NMP-2) and to Environment and Sustainability, followed by ICT and Energy technologies for the production processes (NMP-3). The application areas of NMP FP6 results had a clear focus on the application fields instruments, chemicals and electronics for "N", evenly distributed focus in "M" and a focus on industrial- and mechanical engineering, consumer goods and civil engineering in the "P" area. Apart from a pronounced multidisciplinary character of the research in NMP FP6 the projects are heavily interlinked with technologies and scientific fields outside the grasp of NMP FP6. Therefore, **synergies both in terms of funding and potential market impacts could be achieved by linking the different thematic priorities** under Framework Programmes by means of joint calls.

Recommendation: The European Commission should consider increasing the number of joint calls of different thematic priorities in areas that are heavily interlinked and where such joint calls meet a respective demand on the researchers'/users' side.

In order for Europe to fulfil its global role much more attention has to be paid to the **barriers to dissemination into society** at large. Europe has globally a competitive advantage in addressing the evolutionary questions such as ethical, environmental, health, safety and privacy issues that, left unaddressed, develop into barriers for the dissemination and application of new technologies.

A common and complex regulatory system for nanotechnologies has not yet been created. **Safety regulations, toxicity and health risks and ethical issues related to NMP were hardly addressed** in NMP FP6. Although especially nanotechnology increasingly becomes a topic of both public and academic discussions on ethical and health issues, only a small percentage of project co-ordinators think that their project actually contributed to such arguments. Researchers themselves generally seem to be less concerned with ethics.

Recommendation: Intensified targeting of the major societal challenges using NMP in such areas as: healthcare for the ageing population, issues related to energy, protection of the environment, sustainability in all production processes, reduction of waste in materials. This can be done through planned co-operation with MS in addressing these issues strategically. Open debate on the creation of a system of NMP-related regulations ensuring the safe and responsible approach to research in NMP areas in Europe should be included in future. The Commission should further increase its efforts to raise awareness of the ethical, sustainability, safety etc. issues among both the public and the researchers. A Europe-wide public debate is recommended, to create awareness and understanding, building the policy upon the feedback from the consumers where feasible.

This shall be accompanied with actions to emphasize analysis, technology assessments and foresights, industry scenarios etc. taking a holistic and evolutionary approach to the avenues of new ways to meet customer requirements as well as growth, environmental, health and other societal expectations.

Regulatory works has to be continued in the NMP area, especially with nanotechnologies as well as new materials fields to ensure consumer trust in the long term. EU, OECD and MS activity in the field have to be co-ordinated to assure consumer safety, common understanding of regulations and trust building in the whole system.

The NMP-programme has been quite **successful in improving co-operation capacities** among the different national parts of the European scientific community in NMP-related areas. Sustainable and far-reaching collaborations have been established due to the NMP programme and the opportunities for follow-up research are plentiful. NMP FP6 has supported cooperation and networking to a significant extent. Capacities to establish and maintain cooperative relationships significantly improved for a majority of participants in NMP FP6. Cooperation and networking has **contributed to an increased level of knowledge in the new Member States and in those Member States that did not have a long tradition in NMP RTD**. The access to research results and knowledge through co-operation and networking is therefore considered as crucial for NMP RTD in these countries.

To what extent the knowledge related results constituted **first class knowledge** is difficult to estimate since it is not only undefined in strategic documents but also very much a question of individual perception or different research/technology field. The results indicate that for several reasons (time lags between the publication of calls and the start of projects granted, the necessity to cooperate, publication of research result, monitoring duties, etc.) **especially industrial cutting edge research was not largely involved**. However, qualitative assessments by experts indicate that the nanotechnology area seems to be the area which has come furthest in this respect in NMP FP6. Moreover, the above-mentioned difficulties in attracting first class knowledge industry-driven research may have an implication upon the overall performance of NMP FP6.

Recommendation: The Commission should define "first class knowledge" in detail to be able to measure the degree of achievement. Furthermore the time-frames between publishing calls and the start of the funded projects have to be shortened in order to attract top research projects from both academia and industry.

A major success factor in terms of research results being commercially utilised where appropriate is the dissemination of research results where companies are not part of the research teams anyway. Overall, the analyses show that the **dissemination of knowledge achieved in NMP FP6 projects rather addressed academia and not industry** (and the broader public). Individual project dissemination towards industry was perceived as not efficient in NMP FP6. However, research results – where industry is involved – can lose their attractiveness in terms of market potential once they are published.

Recommendation: Intensify dissemination activities towards industry and the broader public where industry is not actively involved in the research projects anyway. A possible solution could be to implement specifically targeted dissemination activities towards the relevant industrial sectors on the one hand and towards the broader public, on the other. Increase the use of PUDK/PUDF to this regard.

NMP FP6 is considered to have dealt, to a considerable extent, with key industrial challenges. However, being expected to address the whole spectrum of industrial sectors in Europe made it difficult to address each of them in total in NMP FP6.

There is a clear tendency in the Member States, the US and Japan to address key scientific, technical and industrial challenges in terms of transforming their old industries by adopting new, resource and energy saving technologies in the production of high value products and services. Main players in the field invest heavily in addressing the key RTD challenges in order to maintain a strong competitive position in the world. The European countries are planning their research activities in **strong correlation with key challenges addressed by the Framework Programmes.** However, a **greater market orientation of the research in Europe is considered to be a key European problem**. Following the information from interviews, the industry in Europe is not reacting fast enough, as compared to the US and active Asian countries.

There are several keys to the development of a well functioning European-wide system for NMP innovation: the currently more or less isolated parts of European innovation supply chain need to be linked, such as the creation, identification, and protection of ideas, and the exploitation of intellectual property rights, as well as the financing and commercial development of market-relevant technologies. A high credit was given to the European Technology Platforms (ETPs) for their role in addressing key industrial challenges, by shaping through their strategic road-maps, the content of the work programmes. Another inspiring example may be the Japanese Nanotechnology Business Creation Initiative, a structure integrating actors in a triple-helix concept in order to foster commercialization and support international cooperation.

Recommendation: A coherent and detailed strategy that enhances the commercialisation of NMP technologies, to the benefit of the European society, industry, and economy shall be considered. This work shall be based on important preparatory work such as qualitative and quantitative mapping of the European portfolio of NMP technologies by means of patent analysis, bibliometric and qualitative information.

Along those strategic lines the creation of a new type of policy instrument with the primary aim of bringing European technologies to the market (bridging the gap between applied research and industrial uptake) should be considered, e.g. a European NMP Commercialisation Platform gathering stakeholders committed to commercialisation, to enable action upon the ECs wish to increase commercialisation.

It is frequently pointed out that the European **venture capital** industry is much weaker than its US counterpart, and that this situation negatively affects commercialisation of European research. Whilst it is true that European venture capital firms have smaller amounts of assets directly under management, network based reasons are to blame for this situation. Venture capital in the US is very well connected with the research environment on an informal level. Both leading scientists and more junior researchers are part of strong networks that include VC firms. One example is that PhD students from research groups known to spawn market relevant inventions take up positions, e.g. as analysts in venture capital firms. This means that the VC firm has a good grasp of the research "pipeline", and is communicating more actively with the research institutes. In addition, the VC firm can at an early stage enlighten researchers as to the potential market value of research ideas.

Recommendation: In order to increase the commercial utilisation, measures should be developed and implemented providing venture capital actors with access to the research result pipeline, and allowing researchers (both in academia and industry) to obtain information on the market potential of their work. To initiate networking a respective platform or forum could be established but to intensify collaboration different incentives to induce long-term collaborations should be considered as well.

Another issue relating to venture capital is that there is a significant number of start-up companies in the United States that are at least partially based on technologies developed in European countries. This is in itself an indication for the fact that technologies spawned in Europe are of value to the market, but that the general European and most importantly financial framework for a commercial utilisation lags behind the US.

Recommendation: For Europe to increasingly benefit from the commercial potential of research it is advisable to find ways to more efficiently support start-up companies, e.g. by means of incubator facilities as well as decreasing the administrative and financial barriers for the foundation of companies.

Participating in NMP FP6 clearly had **positive effects on research related investments and R&D expenditures**, should they originate in the research consortia's own budgets or private third-party funding. However, these results have been achieved to a different degree. The main reasons for the weaker mobilisation of private capital lie in the uncertainty of an economic utilisation of the research conducted, the risk of failure and difficulties in handling IPR.

One conclusion of this evaluation is that valuable IPR is kept and created outside EU-funded projects. From the perspective of economic growth and the transformation of Europe's industry into a truly knowledge-intensive one, it is suboptimal that inventions are not also generated on project level to a greater degree, as this situation means that the funding will create very few visible commercially exploitable results. This is not so much a problem in projects aimed at supporting Europe wide collaborations and joint work on the basic science level, but is rather an issue in projects that have a stronger RTD focus.

Recommendation: The European Commission should intensify its investigation into the reasons behind the scarcity of inventions being transformed into innovations and eventually protected by means of IPR.

Although the detailed objectives designed for NMP in FP6 are largely addressed, the quantitative assessment of meeting those objectives is not possible, because of two independent factors: the first, because **NMP objectives are not quantified** (**not SMART**[136] as "*none of FP6's goals at this level can be described as*"[137]), and the second because comparable evaluations of national country measures (as mentioned above, NMP is almost unique with regard to its design anyway) do not exist. Still countries introduce their programmes' objectives with vague objective descriptions, and use similar sets of indicators when assessing the effectiveness of financed projects, taking into consideration such factors as: engaged enterprises (including SMEs), co-operation patterns and sustainable networks, number of PhD students or post graduate studies financed, number of publications, citations, conferences, IPRs (including patents). In this context the main effect indicator "number of commercialized scientific products" (transferred into the market) is increasingly important. In the context of this last indicator the effectiveness of research commercialization in USA and among important Asian actors is considered to be higher than in Europe.

[136] Smart= 'SMART' (Specific, Measurable, Attainable, Realistic and Timely), – normally seen as desirable characteristics of goals in planning

[137] CEC Expert Group. (2009). Ex-post Evaluation of the Sixth Framework Programmes for Research and Technological Development 2002-2006. Report. February 2009..

Recommendation: The European Commission as well as the Member States' governments should define objectives for support measures such as NMP by means of a SMART approach to the extent possible, which would also allow developing a monitoring and evaluation indicators system that will serve assessments of the impact of the programmes on the long run and respective comparisons.

10.3 Interaction with EU Member States

Overall **priorities and thematic areas in NMP FP6 are similar to those in national NMP-related programmes**. Strategic priorities focusing on the development of first class knowledge, industry and market orientation, environmental sustainability and technology transfer were similar to NMP in most of the MS. However, when it comes to the specific RTD areas and topics, national programmes are designed to invest into areas with the strongest research and development environments within the country, and to address issues faced by national industries. The complementary and added value approaches of the MS towards NMP F6 are reflected in the work of the Programme Committees in NMP FP6. The MS programmes invest in relevant and valuable research, concentrating on selected knowledge areas where the countries have or anticipate a competitive advantage. Therefore, national approaches to research and its commercialization are differing as well. Despite respective differences in national approaches, co-operation between academia and industry is addressed by all countries. In general Europe is seen as being a key actor in the field, but with regard to real market value and relevance of the research much is to be done on member state level, but also in NMP FP6. The programme objectives in MS are closely correlated to European objectives defined in Lisbon Strategy and other political documents, also with the important issues of addressing key industrial challenges and producing first class knowledge. The formulations used are different, the scope of the programmes differs, but the **main objectives are aligned**.

An important finding with regard to reaching the objectives assigned to **NMP** (increasing coordination of European and national RDT policies) is that it **had an impact on shaping the political agendas in MS** in general, especially in the nanotechnologies context. Many relevant country programmes were published after the introduction of NMP FP6 (after 2002), including forecasts, action plans and country strategies covering not only needs and problems in MS, but also mentioning NMP FP6 as an important measure to be used to develop the countries' position in the different sub-areas. Participation in NMP FP6 is also monitored in MS as an important factor demonstrating the relevance, internationalisation and orientation of national research. All relevant programmes analysed note the existence and postulate to make use of the resources available from the Framework Programmes. Their relations with regard to future planning/revision processes are therefore important.

NMP FP6 priorities were shaped in a complex process, engaging national delegates and experts. The **level of influence in the revision process** seemingly depended on how active the national delegates and experts were in the Programme Committee in NMP FP6 and how experienced they were in the revision process. To some extent engaged countries claim to influence the European priorities, especially in the case of the 'frontrunners' in the field. The followers do not have large influence in the process of planning European research priorities. On the other hand an awareness of the importance of these planning processes exists in less influential MS and therefore higher activity of their delegates is seen as an important factor to raise countries' influence.

Recommendation: The Commission should aim at increasing the transparency of negotiations and ensure information flow during planning and revision processes related to NMP. The Commission should find ways to allow a larger influence of "second movers" and "followers" in the process of planning and revising work programmes at European level.

An overview of the statistical information from **NMP FP6** indicates clearly that it was to a large extent **a "closed" programme, with some "newcomers" participating**. Connecting the above-mentioned finding to the opinions gathered from national case studies and interviews, with regard to the complexity of applying procedures and administrative burdens during projects implementation, leads to the conclusion that research groups are often discouraged, and hesitate to apply for EU funds without a solid support system in place.

Recommendation: Consider additional funding for dedicated project preparation, awareness building and support measures for new research teams in MS. Continue simplification of the reporting and accounting procedures.

PART III

Chapter 11. Appendixes

11.1 Glossary of terms and abbreviations used

ANR	French National Research Agency (L'Agence nationale de la recherche)
ANVAR	French Innovation Agency
APC	African, Caribbean and Pacific Group of States (ACP): South Africa, Kenya
APPC	Associated and Potential Candidate Countries: Romania, Bulgaria (before 2007), Turkey, Croatia, Serbia, Albania.
AT	Austria
BAuA	German Federal Institute for Occupational Safety and Health
BDPME	French SME Development Bank (Banque du Développement des PME)
BMBF	German Federal Ministry of Education and Research
BMVIT	Austrian Federal Ministry of Transport, Innovation and Technology
BMWi	German Federal Ministry of Economics and Technology
BRIC	Brazil, Russia, India, China.
CA	Co-ordination Action
CDG	Christian Doppler Research Association
CDI	Innovation Development Contract by OSEO (French Agency for Innovation Support)
CIR	French Research and Development (R&D) Tax Credit Mechanism (Le crédit d'impôt recherche)
CNDP	French National Commission for Public Debate
CNRS	French National Centre for Scientific Research (Centre National de la Recherche Scientifique)
CNRS	French National Centre for Scientific Research (Centre National de la Recherche Scientifique)
CO_2	Carbon dioxide
CP	Collaborative Project
CSA	Co-ordination and Support Action
DG	Directorate General
DG INFSO	Directorate-General for Information Society and Media
DG RTD	Directorate-General for Research
DVD	Digital Video Disc

E	European Research Area (ERA) Objectives
EC	European Commission
EECA	Eastern Europe and Central Asia: Belarus, Ukraine, Kazakhstan, Georgia.
EFTA	European Free Trade Association (Iceland, Norway, Switzerland, Lichtenstein)
EIF	European Investment Fund
ENP	European Neighbourhood Policy: Algeria, Israel.
ENSR	European Network for Social and Economic Research
ERA	European Research Area
ERA-NETs	European Research Area Networks
ERP	European Recovery Programme
ESIC	Exploitation Strategy and Innovation Consultants
ETP	European Technology Platform
EU	European Union
EU-10	New EU-10 (New Member States): Poland, Czech Republic, Slovenia, Hungary, Slovakia, Latvia, Lithuania, Estonia, Cyprus, Malta, (Romania and Bulgaria were not Member States during FP6
EU-15	Countries which became Member States of the European Union prior to 2004
EU-27	Member States of the European Union after 2007
EXIST	"Business Start-Up from Science" Programme
FFG	Austrian Research Promotion Agency
FP5	5th Framework Programme for Research and Technological Development (1998-2002)
FP6	6th Framework Programme for Research and Technological Development (2002-2006)
FP7	7th Framework Programme for Research and Technological Development (2007-2013)
FPs	Framework Programmes
FUNMAT	Norwegian National Consortium for Research within Functional Materials and Nanotechnology
FWF	Austrian Science Fund
G	Gothenburg Strategy Objectives
GMO	Genetically Modified Organism
HEIs	Higher Education Institutions
I	Integration of technologies for industrial applications
IA	Innovation Alliance in Germany
ICT	Information and Communication Technologies
IFE	Norwegian Institute for Energy Technology
IG	Interview Guide
IGF	German Joint Industrial Research Programme (Industrielle Gemeinschaftsforschung)
INNOWATT	German Innovative Growth Leaders Programme
IP	Integrated Project
IP SMEs	Integrated Project dedicated to Small and Medium Enterprises
IPR	Intellectual Property Rights

ISO	International Organisation for Standardization
IST-1	Applied IST research addressing major societal and economic challenges
JPA	Joint Programme of Activities
KMFA	Austrian Institute for SME Research
KMM-NoE	Network of Excellence "Knowledge-based Multicomponent Materials for Durable and Safe Performance"
KMU Innovativ	German Federal Government initiative for SMEs
L	Lisbon Strategy Objectives
LA	Latin American countries: Mexico, Argentina, Uruguay, Colombia.
LSP	Large scale integrating project
LWE	Largest World's Economies: the United States, Canada, Australia, Japan.
M	Knowledge-based Multifunctional Materials
MS	Member State of the European Union
N	Nanosciences and Nanotechnologies
N	NMP Work Programme Objectives
N&N	Nanosciences and Nanotechnologies
NANO	Nanosciences and Nanotechnologies
Nano INNOV	French Innovation Strategy for Nanotechnology
NANOMAT	Norwegian Programme for Nanotechnology and New Materials
nanoST	Norwegian National Strategy for Nanoscience and Nanotechnology
NCNET	National Center for Nano Engineering and Technology in Shangshai, China
NCNST	National Center for Nano Science and Technology in Beijing, China
NCP	National Contact Points
New EU-10	Countries which became Member States of the European Union in 2004
New EU-12	Countries which became Member States of the European Union in 2004 and 2007
NFN	National Research Networks of the Austrian Science Fund (Nationale Forschungsnetzwerke des FWF)
NFR	Research Council of Norway
NGO	Non-Governmental Organisation
NMP	Nanosciences and Nanotechnologies, Knowledge-based Multifunctional Materials, New Production Processes and Devices
NMP-1	Nanosciences and Nanotechnologies
NMP-2	Knowledge-based Multifunctional Materials
NMP-3	New Production Processes and Devices
NMP-4	Integration of technologies for industrial applications
NMP-5	Cross-cutting activities
NoE/NOE	Network of Excellence
non-EU	Countries which are or were not Member States of the European Union
NOR	Norway

NPC	National Programme Co-ordinators
NTNU	Norwegian University of Science and Technology
NTP	National Technology Platform
OECD	Organisation for Economic Co-operation and Development
OSEO	French Agency for Innovation Support
P	New Production Processes and Devices
PhD	Doctor of Philosophy
PL	Poland
PNANO	French Programme in Nanoscience and Nanotechnology
PO	Project Officer
PPP	Public-Private Partnerships
PRO INNO II	German Programme for promoting an increase in the innovation skills of SMEs
PUDK/PUDF	Plan for Using and Dissemination of Knowledge
PTJ	Project Management Forschungszentrum Jülich GmbH
PTKA-PFT	Production and Manufacturing Technologies Division of the Project Management Agency Forschungszentrum Karlsruhe
R&D	Research and Development
RTB	National network of technology centres for basis technological research (Réseau national des centrales de technologie pour la Recherche Technologique de Base)
RTD	Research and Technological Development
RTDI	Research, Technological Development and Innovation
S&T	Key scientific and technical challenges
SINTEF	Norwegian Foundation for Scientific and Industrial Research
SME	Small and Medium Enterprise
SMET CP	SME-targeted Collaborative Project
SFB	Special Research Programmes of the Austrian Science Fund (Spezialforschungsbereiche des FWF)
SSA	Specific Support Action
SSP	Small and medium scale focused research project
SSR Questionnaire	Science and Society Reporting Questionnaire
STI	Key scientific, technological and industrial challenges
STP	Specific Targeted Research Project
STREP	Specific Targeted Research Project
SWOT	Analysis of Strengths, Weaknesses, Opportunities, and Threats
UiB	University of Bergen in Norway
UiO	University of Oslo in Norway
UK	United Kingdom
USA	United States of America
WING	German Materials Innovations for Industry and Society
WP	Work Programme
ZUTECH	Initiative Programme Future Technologies for SMEs (Zukunftstechnologien für kleine und mittlere Unternehmen)

11.2 Project team and Guidance Group composition

The project team:

- Project manager: Harald Furre;
- From Oxford Research: Mariana Gustavsson, Bart Romanow, Eimantas Matulaitis, Harald Furre, Kim Møller, Tor Borgar Hansen;
- From KMFA: Iris Fischl, Sascha Ruhland, Sonja Sheikh;
- External expert: Mattias Karlsson Dinnetz.

The project Guidance Group was composed of:

- Mr. Eric Monnier – world expert in programme evaluation; managing director and co-founder of Euréval,
- Professor Dr Brian More – Business Development Manager, University of Coventry & Trustee of the Institute of Nanotechnology (UK),
- Professor Arie Rip – world-class expert in nanotechnology with broad experience in R&D evaluation,
- Mag. Leonhard Jörg, MSc – European expert in programme planning and implementation in the area of science and research,
- Mag. Dr. Margit Haas – Austrian state level expert in N&N programme implementations.

ENSR partners participating in the project (collecting data with regard to relevant country measures):

• Austria	Austrian Institute for SME Research
• Bulgaria	FED: Foundation for Entrepreneurship Development
• Cyprus	Economarket Bureau of Economic and Market Research
• Czech Republic	Business Development Institute Ltd., in co-operation with the Business School Ostrava
• Denmark	Oxford Research
• Estonia	PRAXIS Center for Policy Studies
• Finland	TSE Entre, Turku School of Economics
• France	CRÉDOC: Centre de Recherche pour l'Etude et l'Observation des Conditions de Vie
• Germany	IfM: Institut für Mittelstandsforschung
• Iceland	Center for Business Research, University of Iceland

- Ireland — ESRI: The Economic and Social Research Institute
- Italy — IULM University, Economics and Marketing Institute
- Latvia — BICEPS: Baltic International Centre for Economic Policy Studies
- Netherlands — EIM Business & Policy Research
- Poland — EEDRI: Entrepreneurship and Economic Development Research Institute, Academy of Management
- Portugal — Tecninvest
- Romania — Chamber of Commerce and Industry of Romania - Business Information Division
- Slovak Republic — Peritus
- Slovenia — Institute for Entrepreneurship and Small Business Management, Faculty of Economics and Business, University of Maribor, Maribor
- Spain — Ikei Research & Consultancy
- Sweden — Oxford Research AB
- Switzerland — KMU-HSG: Swiss Research Institute of Small Business and Entrepreneurship at the University of St. Gallen

More information about the network may be found at www.ensr.eu.

11.3 Objectives matrix

Table. Matrix on objectives and their respective operationalisation

Lisbon	ERA				NMP workprogramme				Barcelona			Gothen-burg
(Absorptive capacity of the) market regarding new products and processes					Increased use-orientation/orientation towards economically exploitable research	Key industrial challenges			Taking due account of market dynamics and competitive conditions in assessing R&D and innovation activities			
Business investments									Promoting high technology ventures linked to public sector research through close co-operation with the risk finance community and development of management skills			
Centres of excellence, Innovation poles	Centres of excellence	Networks of existing centres of excellence	Virtual centres of excellence	Excellent research institutions	Creating critical mass				Encouraging further development and visibility of poles and networks of excellence for higher education and R&D			
Competitiveness, economic growth, productivity												

Table. Matrix on objectives and their respective operationalisation

Lisbon	ERA				NMP workprogramme				Barcelona			Gothen-burg
Co-ordination of R&D and technology activities	Better use of instruments for R&D&I funding	Better use of resources for R&D&I funding	Common system of scientific and technical reference for implementation of policies	Common approach to financing large research facilities	Coherence of implementation of national and European R&D activities	Well-co-ordinated research programmes and priorities (national and EU)			Exploring the possibilities offered by European and national regulation of product and service markets to encourage R&D and innovation	Encouraging more systematic development and use of common European standards (e.g. ETPs)	Benchmarking national research policies: identifying good practices and innovative schemes to enhance the leverage effect of the various public support instruments on private investment in R&D; more effective use at regional, national and EU levels of these instruments	Co-ordination of policies
Creation of knowledge , excellence, pre-normative research					Creation of first-class knowledge	Strengthening of scientific and technological excellence in a particular research topic						
Dissemination of knowledge	Knowledge transfer	Effective knowledge-sharing			Improved knowledge management and protection (IPR)	Improved knowledge transfer	Improved technology transfer	Increased dialogue with the public	Improving EU IPR legal framework; pursuing progress in international harmonisation and enforcement of IPR systems; promoting use of good practise regarding IPR aspects; promoting more effective management of IPRs by producers and users of knowledge			
Education, skilled labour force, new career prospects	Young researchers				Utilisation of relevant results for education and training measures				Raising awareness of employment/skill needs/future career opportunities in S&T	Encouraging development and visibility of S&T careers in Europe		

Table. Matrix on objectives and their respective operationalisation

Lisbon	ERA				NMP workprogramme				Barcelona			Gothen-burg
Gender equality	Gender equality								Encouraging further women to enter S&T careers			
Increased industrial production					Contribution to an industrial breakthrough (i.e., radical innovations)	contribution to a transformation of industry in terms of an orientation towards a higher added value	Contribution to a transformation of industry in terms of more integrated approaches combining N&M&P	Contribution to a transformation of industry in terms of more integrated approaches combining NMP with other technologies				
Infrastructure, facilities for R&D	World-class R&D infrastructure											
Labour mobility	Mobility	Adequate flow of researchers			Increased mobility of (young) researchers				Facilitating life-long learning, knowledge transfer and career development through mobility of researchers within Europe as well as the entry of third country researchers	Removing obstacles to university-industry researcher mobility		
Science-industry links	Closer relations between R&D organisations				Interaction of research institutions and industry				Encouraging further the development of public-private R&D partnerships			
Making Europe a more attractive place to live and work in	Attraction for researchers from outside	Opening the ERA to the world										
More and better jobs												

Table. Matrix on objectives and their respective operationalisation

Lisbon	ERA				NMP workprogramme				Barcelona			Gothen-burg
Participation of industry in the programme					Increased integration of enterprises in general in R&D				Clearer and more consistent priorities for public R&D with more systematic participation of industry	Exploring the role that industrial associations at national and European levels could play in promoting awareness and the use of good R&D management practices		
SME					Increased integration of SMEs in R&D				Evolving towards more innovation-friendly public procurement rules and practices, improving opportunities for the participation of SMEs			
Start-ups									Exploring appropriate measures to support spin-offs from larger firms			

Table. Matrix on objectives and their respective operationalisation												
Lisbon	ERA				NMP workprogramme				Barcelona			Gothen-burg
Sustainability, resource challenges	Social and ethical values				Increased awareness of ethical issues and issues of sustainability							• Climate change and clean energy • Sustainable transport • Sustainable consumption & production • Conservation and management of natural resources • Public Health • Social inclusion, demography and migration • Global poverty and sustainable development challenges
	Cohesion in R&D (regions)	Bringing Eastern and Western European researchers together							Encouraging further initiatives to strengthen the public research base and its links with industry in the context of EU regional and cohesion policies and of the financial instruments targeted at candidate countries	Opening national R&D programmes more to transnational collaborations		

Table 71. **Matrix on objectives and their respective operationalisation, KMFA, 2010.**

Annotation: The different number of columns within one source (e.g. ERA) indicate the clustering process of the various and often very detailed objectives filtered out of the central documents. The number of columns per source does neither stand for the number of documents nor different subareas within the respective documents but the simple number of different objectives that remained after the clustering.

Sources:

Council of the European Union (2008): Consolidated Version of the treaty on European Union, Official Journal of the European Union, OJ C115, 9.5.2008

Commission of the European Communities (2005): Working together for growth and jobs. A new start for the Lisbon Strategy. Communication to the spring European Council, 2.2.2005. Brussels

Commission of the European Communities (2000): Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions - Towards a European research area. 18.1.2000. Brussels

Work programme of the thematic area 2003, 2004, 2005

European Commission (2002): More Research for Europe. Towards 3% of GDP. Communication from the Commission. 11.9.2002. Brussels

Presidency Conclusions of the Gothenburg European Council, 15-16 June 2001, Council of the European Union, Brussels, SN 200/1/01 REV 1

http://ec.europa.eu/environment/eussd/

11.4 Representativeness of the survey

Short description of the dataset:

The respective dataset of projects covered was described in detail in the following paragraphs in order to discuss issues such as the representativeness of the dataset or the general coverage of different types of projects. In general, the dataset reflects the actual distribution of different types of projects, sizes of research consortia etc. very well, which allows for the assumption that the dataset has to be seen as being representative for the most important project categorisations.

In total, 71% of the projects covered by the survey were finished before the survey was launched in September 2009.

The top-5 countries – in number of project co-ordinators responded - represented within the dataset are Germany (20%), Italy (14%), France and United Kingdom (each 11%) and Spain (7%) (see Table 72). The differences for each of countries between the dataset and NMP FP6 (database of the European Commission that includes all projects of NMP FP6) as a whole are never larger than 1 %.

Table. Dataset – countries represented		
Countries	All (%)	Survey (%)
Germany	19,5	20,3
Italy	13,4	14,3
United Kingdom	11,6	11,1
France	11,3	11,1
Spain	8,0	7,4
Sweden	4,1	4,6
Netherlands	4,1	4,1
Finland	3,3	4,6
Belgium	5,1	2,8
Austria	2,6	3,2
Ireland	2,3	3,2
Greece	2,3	2,3
Switzerland	2,3	2,3
Norway	1,5	2,3
Denmark	1,5	1,4
Portugal	1,8	0,9
Poland	1,3	0,9
Luxembourg	0,5	0,5
Slovakia	0,5	0,5
Turkey	0,5	0,5
Israel	0,8	0,0
Bulgaria	0,3	0,5
Hungary	0,3	0,5
Latvia	0,3	0,5
Czech Republic	0,3	0,0
Estonia	0,3	0,0
Romania	0,3	0,0
Source: Austrian Institute for SME Research, European Commission		

Table 72. Dataset – countries represented

In terms of the size of the research consortia, the following patterns appear: The majority (42%) of the projects, represented in the dataset, consists of 5-10 partners, 29% consist of 11-20 partners and 25% involve(d) more than 20 partners. Only 4% had less than 5 partners. Table 73. shows that the respective variations between the dataset and the population are very limited (1 to maximum 3 %).

Table. Dataset – size of research consortia		
Number of partners in the project	All (%)	Survey (%)
<5 partners	6	4
5-10 partners	43	42
11-15 partners	19	18
16-20 partners	8	11
>20 partners	24	25
Source: Austrian Institute for SME Research, European Commission		

Table 73. Dataset – size of research consortia

The majority of the projects covered by the survey are funded under the funding instrument "Specific Targeted Research Projects" (54%), followed by the group of "Integrated Projects" (27%), "Specific Support Actions" (9%), "Networks of Excellence" (6%) and the "Co-ordination Actions" (3%). The above-mentioned issue of representativeness can be seen as given since the variations between the dataset and the population are again negligible, differing from 1 to 3 % (see Table 74).

Table. Dataset – Type of instrument		
Type of instrument	All (%)	Survey (%)
Co-ordination Actions (CA)	4	3
Integrated Projects (IP)	24	27
Networks of Excellence (NoE)	6	6
Specific Support Actions (SSA)	9	9
Specific Targeted Research Projects (STP)	57	54
Source: Austrian Institute for SME Research, European Commission		

Table 74. Dataset – type of instrument

A more complex differentiation concerns the issue to which of the eligible scientific fields or areas of technology the projects can be allocated to. Following the internal rationale of NMP FP6 to fund nanotechnology (referred to as NMP-1 in the further analyses and figures), materials (NMP-2) and production processes (NMP-3) as well as projects aiming at an integration of the three (NMP-4), the projects were categorised as belonging to one of these categories based on the respective entries in the European Commission's database. With regard to this, the 31 % of the projects analysed belong to the field of materials, 23 % to production processes, 21 % to nanotechnology and integrating projects, respectively. As the following Table 75 reveals, there is a remaining number of projects that have not been classified in the above categories. However, in the Commission's database these projects have been assigned to three additional subgroups, called and NMP-5, NMP and IST. The operations underlying this allocation are at this point not traceable. For the sake of the project, the research team disregarded these projects for the analyses of the survey results per sub-area as there were a too small number of responses within the sub-area NMP-5 and no responses within the subareas NMP and IST1. Apart from that, the distribution of fields of activities of the projects within the dataset is almost exactly the same as for the population.

Table. Dataset – split of N – M – P		
N-M-P-split	All (%)	Survey (%)
Nanotechnologies and Nanosciences (NMP-1)	23	21
Knowledge-based Multifunctional Materials (NMP-2)	31	31
New Production Processes and Devices (NMP-3)	22	23
Integrating NMP-1, NMP-2 and NMP-3 (NMP-4)	18	21
Cross Cutting Activities (NMP-5)	4	4
NMP	2	0
IST1	0	0
Source: Austrian Institute for SME Research, European Commission		

Table 75. Dataset – split of N - M - P

Two additional, yet important characteristics of the projects analysed concern the issue of industry participation in general and SME participation in particular. From the percentage of project partners being companies and small- up to medium-sized companies, respectively, the research team developed the following categorisation: more than two-thirds of the partners being from industry/the SME sector leads to the categorisation as "high participation", between one- and two-thirds "medium participation" and between 1% up to one-third "low participation". With regard to this, the dataset itself is dominated by projects with medium or low participation from industry, while a large share shows no participation of industry whatsoever (17%) and only a very small minority can be referred to as a high participation (4%) (see Table 76). This appraisal is different for the issue of SME participation (see Table 77) insofar as the share of projects without any SME participation is more than twice as high as for general industry participation. Furthermore, the share of projects with low participation of small- and medium-sized companies is 58 % compared to 40 %. The following figures both show that the differences between the dataset and the population are very small (1-3%).

Table. Dataset – industry participation		
Industry participation	All (%)	Survey (%)
None (0% industry partners in the consortium)	20	17
Low (1%-33,33% industry partners in the consortium)	38	40
Medium (33,34%-66,66% industry partners in the consortium)	37	39
High (> 66,66% industry partners in the consortium)	5	4
Source: Austrian Institute for SME Research, European Commission		

Table 76. Dataset – industry participation

Table. Dataset – SME participation		
SME participation	All (%)	Survey (%)
none	36	38
low	58	58
medium	5	5
high	1	0
Source: Austrian Institute for SME Research, European Commission		

Table 77. Dataset – SME participation

As mentioned above, the dataset of projects that answered the online-questionnaire reflects the population of all projects funded under NMP FP6 in every relevant aspect in a representative manner. The distribution of individual project characteristics is almost identical.

11.5 Survey questionnaire

A. GENERAL INFORMATION		
A1.	Please indicate the actual start- and end date of the project you coordinate(d) within NMP FP6: start date (MM-YYYY): ___________ end date (MM-YYYY): ____________	All
A2.	To which of the following research fields apart from NMP was/is the project you coordinate(d) within NMP FP6 linked to? *(multiple answers possible)* a. Life Sciences b. ICT c. Energy technologies d. Environment and Sustainability e. Space and Aeronautics f. Transport g. Security h. Socio-economic and humanities i. Other (Please specify): ______________________	All
A3.	Please indicate the relevant fields of (potential) industrial applications for the project you coordinate(d) within NMP FP6. a. Electronics b. Instruments (also including optics, medical engineering) c. Chemicals and pharmaceuticals (also including biotech) d. Industrial engineering e. Mechanical engineering (also including machinery, defence sector) f. Consumer goods, civil engineering (also including construction) g. Others (please specify)	All
A4.	Is/was the project you coordinate(d) within NMP FP6 co-financed by other funding sources? a. Yes, by national funds b. Yes, by regional funds c. Yes, by private sources (apart from the consortium's resources) d. No	All
A5.	Please indicate the name of the funding source.	(if A4= a-c)
A6.	Where do you generally see problems in attracting private co-financing (apart from consortium's resources) for NMP related research projects? a. Uncertainty of the research results (high risk research) b. Lacking exclusivity of the research results ("public good") c. IPR d. Lacking existence of relevant industry e. Lacking awareness of private financers of NMP-related research f. Averseness to investments in NMP-related research g. Prospect of utilisation is too vague (e.g. basic research)	All
B. EXPERIENCE WITH FUNDED PROJECTS		
B1.	Have you been / are you involved in other research projects within the European Framework Programmes (FP) apart from the project you coordinate(d) within NMP FP6? Please indicate your role in the respective project(s). *Matrix : participation as coordinator - participation as partner* a. Yes, prior to my participation as coordinator in NMP FP6 (e.g. FP5)	All

	b. Yes, during my participation as coordinator in NMP FP6 c. Yes, following my participation as coordinator in NMP FP6 (e.g. FP7) d. No	
B2.	Please specify the research field(s) of the project(s) indicated in QB1. In case of interdisciplinary research projects, please indicate <u>all</u> respective research fields: *Matrix : prior to your participation in FP6 (e.g. FP5) – during your participation in FP6 – following your participation in FP6 (e.g. FP7)* a. Life Sciences b. ICT c. Energy technologies d. Environment and Sustainability e. Space and Aeronautics f. NMP g. Transport h. Security i. Socio-economic and humanities j. Other: ______________________	If B1= a and/or b and/or c
B3.	Have you been / are you involved in other NMP-related research projects <u>funded by an authority in your country</u> (national or regional level)? Please indicate your role in the respective project(s) *Matrix : participation as <u>coordinator</u> - participation as <u>partner</u>)* a. Yes, prior to my participation as coordinator in NMP FP6 b. Yes, during the participation as coordinator in NMP FP6 c. Yes, following my participation as coordinator in NMP FP6 d. No	All
B4.	Please specify the research field(s) of the project(s) indicated in Q B3. In case of interdisciplinary research projects, please indicate <u>all</u> respective research fields: *Matrix : prior to your participation in FP6 – during your participation in FP6 – following your participation in FP6* a. Life Sciences b. ICT c. Energy technologies d. Environment and Sustainability e. Space and Aeronautics f. NMP g. Transport h. Security i. Socio-economic and humanities j. Other: ______________________	If B3= a and/or b and/or c
C. MOTIVATION AND EXPERIENCE WITH PROGRAMME IMPLEMENTATION		
C1.	What was your motivation to apply for funding within NMP FP6 compared to other public funding sources (national, regional)? *Multiple answers possible* a. Higher funding rates b. More appropriate funding conditions c. Longer project duration d. More suitable thematic areas / priorities e. Possibility to conduct technologically more ambitious projects f. Chance to create new knowledge g. Access to new and / or more research partners h. Possibility to cooperate with international partners i. Higher reputation of research j. No adequate national or regional funding available	All

	k. Other: ____________________	
C2.	How would you assess the following implementation aspects of NMP FP6? *Rating scale: very satisfactory – fairly satisfactory – not very satisfactory – unsatisfactory* a. Financial endowment of the call related to your NMP FP6 project b. Administrative requirements c. Appropriateness of funding conditions d. Project duration e. Suitability of thematic calls f. Networking opportunities g. Quality of call documents h. Timeframe between publication and closure dates of individual calls i. Criteria for project selection j. Transparency of project selection procedure k. Contractual conditions l. Timeframe between project approval and kick-off m. Reporting requirements / monitoring	All
C3.	How would you assess the following support services? *Rating scale: very satisfactory – fairly satisfactory – not very satisfactory – unsatisfactory* a. Role of EU-project officers b. Support by your NMP National Contact Point (NCP) c. Support by your National Contact Point (NCP) for legal and financial aspects d. Support of (potential) exploitation of project results by the Exploitation Strategy and Innovation Consultants (ESIC)	All
C4.	How would you assess the following aspects of programme implementation within FP6 as compared to previous Framework Programmes (e.g. FP 5)? *Rating scale: significantly improved – somewhat improved – somewhat worsened – significantly worsened* a. Relevance of the thematic priorities b. Overall administration of the programme c. Monitoring/reporting requirements d. Endowment of the programme with resources e. Support by project officers	If B1 = a
C5.	Did the topics of the calls within NMP FP6 from your point of view address the most relevant issues at that respective time? a. Yes b. No	All
C6.	Which topics did you miss? _________________________	If C5 = b
C7.	To which extent was the choice of priorities and focus within NMP FP6 different or similar to those of the NMP-related programmes/ measures in your country? a. very different b. different c. similar d. same	All
C8.	Please give an indication of the differences:	If C7= a,b
C9.	Did NMP FP6 react and adapt appropriately to changes in the scientific or industrial scene affecting NMP technologies? a. Yes, very appropriately b. Yes, rather appropriately c. No, not very appropriately, d. No, not at all	All
C10.	Which changes in the scientific or industrial scene affecting NMP technologies were not (appropriately) considered by NMP FP6 from your point of view? ____	If C9=b-d

C11.	How would you assess your overall experience with the programme NMP FP6? a. Very satisfactory b. Fairly satisfactory c. Not very satisfactory d. Not satisfactory at all	All
C12.	What are the main reasons for your dissatisfaction?	If C11=c or d
D. COOPERATION ASPECTS AND PROJECT RESULTS		
D1.	Did the participation in NMP FP6 affect your research team's (consortium's) capacity to cooperate? *Rating scale: significantly improved, rather improved, somewhat improved, not improved* a. Capacity to maintain already established cooperative relationships b. Capacity to establish new cooperative relationships c. Capacity to cooperate with external research competences d. Capacity to cooperate with external industry partners e. Capacity to cooperate with research groups (R&D capacities) from other countries within the EU f. Capacity to cooperate with research groups (R&D capacities) from other countries outside the EU g. Capacity to form new research teams h. Capacity to form new long-term oriented international research networks i. Creation of / access to sustainable international business relations j. Access to / joint usage of physical R&D-related infrastructure	All
D2.	Did any of the following problems occur during the cooperation in the project you coordinate(d) within NMP FP6? *Multiple answers possible* a. Lack of / inadequate cooperation competences / resources in one or more project partners b. Extensive administrative costs of cooperation c. Failure to comply with internal agreements (e.g. financial, time limits etc.) d. Inadequate performance of one or more project partners e. Abuse of knowledge disclosed due to the project cooperation f. Problems related to intellectual property rights (IPR) g. Other (Please specify): ______________	All
D3.	Please indicate which of the following outputs the project you coordinate(d) within NMP FP6 generated in the field of cooperation and employment. *Multiple answers possible* a. establishment of new research teams b. attraction of skilled employees/researchers from EU countries c. attraction of skilled employees/researchers from outside the EU d. exchange of personnel with project partners e. Other: ______________	All
D4.	Have you cooperated / do you intend to cooperate with one or more partners of the project you coordinate(d) within NMP FP6 in another project? a. Yes, we *are planning* another project directly linked to our NMP FP6 project in cooperation with the <u>whole</u> consortium. b. Yes, we *already conducted* / *started* another project, directly linked to our NMP FP6 project in cooperation with the <u>whole</u> consortium. c. Yes, we *are planning* another project, directly linked to our NMP FP6 project in cooperation with <u>selected</u> partners. d. Yes, we *already conducted* / *started* another project, directly linked to our NMP FP6 project in cooperation with <u>selected</u> partners. e. No, we do not plan any further cooperation with members of the research team of our NMP FP6 project.	All

	f. don't know / n. a.	
D5.	To what extent do/did the following groups of users benefit from the results of the project you coordinate(d) within NMP FP6? *Rating scale to a great extent, to some extent, to a small extent, do not benefit at all* a. Researchers in the area „Nanotechnology and nanosciences“ b. Researchers in the area of „knowledge-based multifunctional materials” c. Researchers in the area and „new production processes and devices“ d. Researchers in other areas e. Industry in the area „nanotechnology and nanosciences“ f. Industry in the area of „knowledge-based multifunctional materials” g. Industry in the area and „new production processes and devices“ h. Industry in other areas i. NGOs j. Governmental organisations k. The broader public l. Other: _______________	All
D6.	Please specify "other areas": a. Life Sciences b. ICT c. Energy technologies d. Environment and Sustainability e. Space and Aeronautics f. Transport g. Security h. Socio-economic and humanities i. Other: _______________	If D5 = d and/or h
D7.	Please indicate the <u>nature of the results</u> of the project you coordinate(d) within NMP FP6. *Multiple answers possible* a. Publication(s) in high ranked journals b. Publication(s) in other refereed journals c. Creation of new knowledge/new research approach d. Integration/exploitation of new knowledge e. Integration/exploitation of existing knowledge f. Development of a technological product innovation (e.g. new goods or services) g. Development of a process innovation h. Technological development i. Demonstration project j. Patents and/or licenses k. Start-up and/or Spin-off companies l. Training, education measures m. Other: (please specify:____)	All
D8.	Please assess to which extent the project you coordinate(d) within NMP FP6 met / is likely to meet the research results originally planned. a. research results were / will be fully met b. research results were / will be partially met c. research results were / will not be met at all	All
D9.	Please explain the reasons behind the project you coordinate(d) within NMP FP6 missing its originally planned research results. ____	If D8 = b or c

E. PROJECT IMPACTS AND ADDED VALUE OF NMP FP6		
E1.	Please assess the contribution of the project you coordinate(d) within NMP FP6 to the following overall objectives of the EU (i.e. as included in the Lisbon Agenda, ERA-related documents and NMP Work Programme) related to an *increased orientation of R&D towards market*: *Rating scale: major contribution – medium contribution– minor contribution - no contribution* a. Increased orientation of R&D towards industrial usage, utilisation and exploitation b. Stimulation of implementation of new technologies in SME intensive sectors c. Additional investments in any R&D related business area (infrastructure, technology, machinery, human resources, R&D) d. Increased competitiveness of NMP-related R&D activities e. Development of industrial breakthroughs (i.e., radical innovations) f. Increased founding of new enterprises (start-ups, spin-offs) g. Increased participation of industry in NMP related research h. Increased participation of SME in NMP related research	All
E2.	Please assess the contribution of the project you coordinate(d) within NMP FP6 to the following overall objectives of the EU (i.e. as included in the Lisbon Agenda, ERA-related documents and NMP Work Programme) with regard to a *strengthened knowledge base and pooling of R&D activities in Europe* : *Rating scale: major contribution – medium contribution– minor contribution - no contribution* a. Creation of critical mass in NMP-related R&D b. Establishment of new centres of excellence c. Establishment of new industrial clusters (innovation poles) d. Improved integration/networking of/between existing centres of excellence and/or industrial clusters (innovation poles) e. Improved interaction of R&D institutions and industry f. Creation of excellent new knowledge g. Strengthening of existing scientific and technological excellence h. Improved access to (new) knowledge i. Improved knowledge and technology transfer j. Improved knowledge management and protection of intellectual property k. Transformation of industries towards more knowledge and research based ones l. More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) in industry m. More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) with other technologies in industry	All
E3.	Please assess the contribution of the project you coordinate(d) within NMP FP6 to the following overall objectives of the EU (i.e. as included in the Lisbon Agenda, ERA-related documents and NMP Work Programme) related to *human resources and labour market*: *Rating scale: major contribution – medium contribution– minor contribution - no contribution* a. Improved utilisation of research results for education and training measures b. Improved skills of labour force c. Improved career prospects for young researchers d. Increased labour mobility of (young) researchers e. Increased attractiveness of EU for researchers from outside the EU f. Creation of more jobs for highly skilled employees	All
E4.	Please assess the contribution of the project you coordinate(d) within NMP FP6 to the following overall objectives of the EU (i.e. as included in the Lisbon Agenda, ERA-related	All

	documents and NMP Work Programme) with regard to *societal and sustainability aspects of European R&D activities*: *Rating scale: major contribution – medium contribution– minor contribution - no contribution* a. Increased dialogue with the public b. Improved (conditions for) gender equality c. Increased awareness of ethical issues of NMP related research d. Increased awareness of issues of sustainability in NMP related research e. Containment of climate change / increased usage of renewable energy sources f. Increased sustainable production g. Increased sustainable consumption h. Increased sustainable transport i. Improved conservation and management of natural resources j. Improved handling of threats to public health	
E5.	Did the activities within NMP during the period of FP6 contribute to any of the following objectives related to European Integration from your point of view? *Rating scale: major contribution – medium contribution– minor contribution - no contribution* a. Improved coordination of research programmes and priorities (national and EU) b. Coherence of design and implementation of national and European R&D activities c. Reshaping of research agendas in Europe and beyond d. Increased integration of former EU accession countries in European R&D activities and structures e. Increased catching-up of former EU accession countries with regard to NMP-related research	All
E6.	Where do you see the added value of participating in NMP FP6 as compared to national or regional funding programmes in the field of NMP? *Multiple answers possible* a. Possibility for research in big consortia b. Possibility for research including all stakeholders – horizontal and vertical integration (e.g. research groups, future customers, future manufacturers, future sub-suppliers etc) c. Higher financial endowment of projects d. Higher scientific level of research e. Better access to international knowledge and know how f. Better access to industry g. Better access to knowledge/know-how in research institutions h. Build up of research networks i. Sustainable relationships in research j. Sustainable relationships with industry partners k. Other: _________	If B3 = a, b, or c
E7.	Did the participation in NMP FP6 lead to an increase of the consortium's R&D investments in further NMP-related research? y/n	All
E8.	Did the participation in NMP FP6 lead to an increase of private co-financing (apart from the consortium's own resources) in the consortium's further NMP-related research? y/n	All
E9.	What would you have done if the project you coordinate(d) within NMP FP6 would not have been funded by the European Commission? a. We would have undertaken the research project with our own financial resources without any modification b. We would have undertaken the research project with our own financial resources, but we would have reduced the scope of the project. c. We would have undertaken the research project with our own financial	All

	resources, but we would have reduced the technological ambition of the project d. We would have undertaken the research project with our own financial resources, but at a later date. e. We would have tried to find other public funding sources for our research project. f. We would not have been able to undertake the research project.	
E10.	General comments: ________________________	All

Table 78. Survey questionnaire

11.6 Additional survey results

Assessment of contributions of the projects to different objectives related to NMP FP6: by project instruments

Integrated Projects

Contributions of the projects in NMP FP6 to NMP-objectives					
Assessment of the co-ordinators (Integrated Projects) in %					
Source of objective	Objectives	Major contri-bution	Medium contri-bution	Minor contri-bution	No contri-bution
L/N	Improved interaction of R&D institutions and industry	50	41	7	2
N	Increased orientation of R&D towards industrial usage, utilisation and exploitation	49	40	11	
L/N	Creation of excellent new knowledge	49	35	14	2
L/N	Strengthening of existing scientific and technological excellence	47	47	4	2
N	Creation of critical mass in NMP-related R&D	46	38	14	2
N	Increased participation of SME in NMP related research	40	44	14	2
L/E/N	Improved knowledge and technology transfer	34	52	13	2
N	Development of industrial breakthroughs (i.e., radical innovations)	34	36	30	
L/N	Stimulation of implementation of new technologies in SME intensive sectors	32	50	16	2
N	Improved utilisation of research results for education and training measures	26	52	21	2
L/N	Transformation of industries towards more knowledge and research based ones	26	46	26	2
L/N	Increased participation of industry in NMP related research	23	56	19	2
N	More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) in industry	22	47	24	7
L/N	Increased awareness of issues of sustainability in NMP related research	19	46	30	5
N	More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) with other technologies in industry	18	42	33	7

Contributions of the projects in NMP FP6 to NMP-objectives					
Assessment of the co-ordinators (Integrated Projects) in %					
Source of objective	Objectives	Major contri-bution	Medium contri-bution	Minor contri-bution	No contri-bution
L/E/N	Increased labour mobility of (young) researchers	18	29	45	9
N	Increased dialogue with the public	11	34	48	7
E/N	Increased awareness of ethical issues of NMP related research	11	14	37	39
N	Improved knowledge management and protection of intellectual property	9	36	42	13
Source: Austrian Institute for SME Research					

Table 79. Contribution of the projects to objectives of the EU (objectives of the NMP-programme) – Assessment of co-ordinators of Integrated Projects (IP), n=54-58
Sources of objectives: L: Lisbon, E: ERA, N: NMP (work-programme)

Contributions of the projects in NMP FP6 to overall-objectives of the EU (Lisbon, ERA, Gothenburg)					
Assessment of the co-ordinators (Integrated Projects) in %					
Source of objective	Objectives	Major contri-bution	Medium contri-bution	Minor contri-bution	No contri-bution
L	Improved access to (new) knowledge	31	42	25	2
G	Increased sustainable production	30	27	25	18
L	Increased competitiveness of NMP-related R&D activities	27	62	11	
L/E	Improved integration/networking of/between existing centres of excellence and/or industrial clusters (innovation poles)	27	35	27	11
L/E	Improved career prospects for young researchers	19	46	28	7
G	Improved handling of threats to public health	14	12	18	56
L/E	Establishment of new centres of excellence	13	22	45	20
L	Improved skills of labour force	12	53	33	2
G	Containment of climate change / increased usage of renewable energy sources	12	18	28	42
L	Additional investments in any R&D related business area (infrastructure, technology, machinery, human resources, R&D)	11	46	35	7
L/E	Improved (conditions for) gender equality	9	33	41	17
G	Improved conservation and management of natural resources	9	16	38	38
L/E	Increased attractiveness of EU for researchers from outside the EU	7	29	40	24
L	Increased founding of new enterprises (start-ups, spin-offs)	6	20	41	33
L	Establishment of new industrial clusters (innovation poles)	5	27	42	25
G	Increased sustainable consumption	5	16	35	44
G	Increased sustainable transport	4	20	27	50
L/E	Creation of more jobs for highly skilled employees	2	60	37	2
Source: Austrian Institute for SME Research					

Table 80. Contribution of the projects to overall objectives of the EU (Lisbon, ERA, Gothenburg) – Assessment of co-ordinators of Integrated Projects (IP), n=54-58
Sources of objectives: L: Lisbon, E: ERA, G: Gothenburg

Networks of Excellence

Contributions of the projects in NMP FP6 to NMP-objectives					
Assessment of the co-ordinators (Networks of Excellence) in %					
Source of objective	Objectives	Major contri-bution	Medium contri-bution	Minor contri-bution	No contri-bution
L/N	Strengthening of existing scientific and technological excellence	85	15	0	0
N	Creation of critical mass in NMP-related R&D	79	21	0	0
L/N	Creation of excellent new knowledge	79	14	7	0
N	Improved utilisation of research results for education and training measures	57	43	0	0
L/E/N	Increased labour mobility of (young) researchers	57	36	7	0
L/N	Improved interaction of R&D institutions and industry	43	50	7	0
N	Increased orientation of R&D towards industrial usage, utilisation and exploitation	29	64	7	0
L/E/N	Improved knowledge and technology transfer	23	54	23	0
L/N	Increased awareness of issues of sustainability in NMP related research	23	23	38	15
L/N	Increased participation of industry in NMP related research	21	43	36	0
N	Increased dialogue with the public	14	36	50	0
N	More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) in industry	14	29	29	29
L/N	Stimulation of implementation of new technologies in SME intensive sectors	7	64	29	0
N	Increased participation of SME in NMP related research	7	43	50	0
N	More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) with other technologies in industry	7	36	21	36
N	Development of industrial breakthroughs (i.e., radical innovations)	7	36	36	21
E/N	Increased awareness of ethical issues of NMP related research	7	29	29	36
N	Improved knowledge management and protection of intellectual property	7	21	64	7
L/N	Transformation of industries towards more knowledge and research based ones	0	29	57	14
Source: Austrian Institute for SME Research					

Table 81. Contribution of the projects to objectives of the EU (objectives of the NMP-programme) – Assessment of co-ordinators of Networks of Excellence (NoE), n=14
Sources of objectives: L: Lisbon, E: ERA, N: NMP (work-programme)

Contributions of the projects in NMP FP6 to overall-objectives of the EU (Lisbon, ERA, Gothenburg)					
Assessment of the co-ordinators (Networks of Excellence) in %					
Source of objective	Objectives	Major contri-bution	Medium contri-bution	Minor contri-bution	No contri-bution
L/E	Improved integration/networking of/between existing centres of excellence and/or industrial clusters (innovation poles)	57	43	0	0
L	Improved access to (new) knowledge	57	43	0	0
L/E	Establishment of new centres of excellence	57	36	0	7
L/E	Improved career prospects for young researchers	50	43	7	0
L	Improved skills of labour force	43	50	7	0
L	Increased competitiveness of NMP-related R&D activities	43	29	29	
L/E	Increased attractiveness of EU for researchers from outside the EU	29	50	14	7
L/E	Improved (conditions for) gender equality	14	50	36	0
L	Establishment of new industrial clusters (innovation poles)	14	29	43	14
L/E	Creation of more jobs for highly skilled employees	7	43	50	0
G	Increased sustainable production	7	36	14	43
L	Additional investments in any R&D related business area (infrastructure, technology, machinery, human resources, R&D)	7	36	50	7
G	Containment of climate change / increased usage of renewable energy sources	7	21	21	50
G	Improved handling of threats to public health	0	36	7	57
L	Increased founding of new enterprises (start-ups, spin-offs)	0	36	29	36
G	Increased sustainable consumption	0	21	29	50
G	Increased sustainable transport	0	21	21	57
G	Improved conservation and management of natural resources	0	21	29	50
Source: Austrian Institute for SME Research					

Table 82. Contribution of the projects to overall objectives of the EU (Lisbon, ERA, Gothenburg), Assessment of co-ordinators of Networks of Excellence (NoE), n=14
Sources of objectives: L: Lisbon, E: ERA, G: Gothenburg

Specific Targeted Research Projects

Contributions of the projects in NMP FP6 to NMP-objectives					
Assessment of the co-ordinators (Specific Targeted Research Projects) in %					
Source of objective	Objectives	Major contri-bution	Medium contri-bution	Minor contri-bution	No contri-bution
L/N	Creation of excellent new knowledge	63	28	6	3
L/N	Strengthening of existing scientific and technological excellence	52	42	5	1
N	Creation of critical mass in NMP-related R&D	37	44	15	5
N	Increased orientation of R&D towards industrial usage, utilisation and exploitation	36	40	16	8
L/E/N	Increased labour mobility of (young) researchers	36	39	17	7
N	Improved utilisation of research results for education and training measures	30	46	19	5
L/N	Improved interaction of R&D institutions and industry	26	42	23	9
N	Increased participation of SME in NMP related research	26	37	19	18
L/N	Stimulation of implementation of new technologies in SME intensive sectors	24	36	30	10
N	More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) in industry	21	28	31	19
L/E/N	Improved knowledge and technology transfer	18	47	29	6
N	More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) with other technologies in industry	17	28	35	21
N	Development of industrial breakthroughs (i.e., radical innovations)	16	34	33	17
L/N	Transformation of industries towards more knowledge and research based ones	14	25	38	23
N	Increased dialogue with the public	13	30	41	16
L/N	Increased participation of industry in NMP related research	12	37	31	20
L/N	Increased awareness of issues of sustainability in NMP related research	11	34	25	30
E/N	Increased awareness of ethical issues of NMP related research	9	19	28	44
N	Improved knowledge management and protection of intellectual property	7	29	36	28
Source: Austrian Institute for SME Research					

Table 83. Contribution of the projects to objectives of the EU (objectives of the NMP-programme) – Assessment of co-ordinators of Specific Targeted Research Projects (STP), n=106-114 Sources of objectives: L: Lisbon, E: ERA, N: NMP (work-programme)

Contributions of the projects in NMP FP6 to overall-objectives of the EU (Lisbon, ERA, Gothenburg)					
Assessment of the co-ordinators (Specific Targeted Research Projects) in %					
Source of objective	Objectives	Major contri-bution	Medium contri-bution	Minor contri-bution	No contri-bution
L	Improved skills of labour force	46	29	20	6
L/E	Improved career prospects for young researchers	45	38	10	6
L	Increased competitiveness of NMP-related R&D activities	37	45	12	6
L	Improved access to (new) knowledge	35	43	19	4
L/E	Increased attractiveness of EU for researchers from outside the EU	25	34	23	19
L/E	Creation of more jobs for highly skilled employees	17	38	33	12
L/E	Improved (conditions for) gender equality	17	31	24	28
L/E	Improved integration/networking of/between existing centres of excellence and/or industrial clusters (innovation poles)	17	28	28	28
L/E	Establishment of new centres of excellence	13	32	29	26
G	Increased sustainable production	10	24	29	37
L	Increased founding of new enterprises (start-ups, spin-offs)	10	13	25	52
G	Improved handling of threats to public health	8	16	15	60
L	Additional investments in any R&D related business area (infrastructure, technology, machinery, human resources, R&D)	7	35	36	22
G	Containment of climate change / increased usage of renewable energy sources	6	8	22	63
G	Increased sustainable consumption	6	7	27	61
G	Improved conservation and management of natural resources	4	8	26	62
G	Increased sustainable transport	4	4	17	75
L	Establishment of new industrial clusters (innovation poles)	3	16	39	43
Source: Austrian Institute for SME Research					

Table 84. Contribution of the projects to overall objectives of the EU (Lisbon, ERA, Gothenburg), Assessment of co-ordinators of Specific Targeted Research Projects (STP), n=106-114 Sources of objectives: L: Lisbon, E: ERA, G: Gothenburg

Co-ordinated Actions/Specific Support Actions

Contributions of the projects in NMP FP6 to NMP-objectives					
Assessment of the co-ordinators (Co-ordinated Actions/Specific Support Actions) in %					
Source of objective	Objectives	Major contri-bution	Medium contri-bution	Minor contri-bution	No contri-bution
N	Increased orientation of R&D towards industrial usage, utilisation and exploitation	54	19	15	12
L/N	Strengthening of existing scientific and technological excellence	42	38	12	8
L/N	Increased awareness of issues of sustainability in NMP related research	38	42	12	8
L/N	Creation of excellent new knowledge	36	36	24	4
N	Improved utilisation of research results for education and training measures	28	40	24	8
L/N	Improved interaction of R&D institutions and industry	27	50	15	8
L/E/N	Improved knowledge and technology transfer	20	52	20	8
N	Increased dialogue with the public	20	40	12	28
L/N	Stimulation of implementation of new technologies in SME intensive sectors	19	46	23	12
L/N	Increased participation of industry in NMP related research	19	42	19	19
E/N	Increased awareness of ethical issues of NMP related research	17	26	4	52
N	Creation of critical mass in NMP-related R&D	16	40	32	12
L/E/N	Increased labour mobility of (young) researchers	16	28	32	24
N	Increased participation of SME in NMP related research	12	40	28	20
N	Development of industrial breakthroughs (i.e., radical innovations)	12	16	36	36
L/N	Transformation of industries towards more knowledge and research based ones	8	48	32	12
N	More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) with other technologies in industry	4	33	33	29
N	More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) in industry	4	32	36	28
N	Improved knowledge management and protection of intellectual property	4	15	31	50
Source: Austrian Institute for SME Research					

Table 85. Contribution of the projects to objectives of the EU (objectives of the NMP-programme) – Assessment of co-ordinators of Co-ordinated Actions/Specific Support Actions (CA/SSA), n=23-26
Sources of objectives: L: Lisbon, E: ERA, N: NMP (work-programme)

Contributions of the projects in NMP FP6 to overall-objectives of the EU (Lisbon, ERA, Gothenburg)					
Assessment of the co-ordinators (Co-ordinated Actions/Specific Support Actions) in %					
Source of objective	Objectives	Major contri-bution	Medium contri-bution	Minor contri-bution	No contri-bution
L	Improved access to (new) knowledge	40	48	12	0
G	Increased sustainable production	36	28	12	24
L	Increased competitiveness of NMP-related R&D activities	35	42	15	8
G	Increased sustainable consumption	32	12	20	36
G	Improved conservation and management of natural resources	28	12	36	24
L/E	Improved integration/networking of/between existing centres of excellence and/or industrial clusters (innovation poles)	24	44	12	20
L/E	Increased attractiveness of EU for researchers from outside the EU	19	15	38	27
G	Improved handling of threats to public health	17	33	17	33
L/E	Establishment of new centres of excellence	16	28	32	24
G	Containment of climate change / increased usage of renewable energy sources	16	20	28	36
L/E	Improved career prospects for young researchers	15	42	23	19
L	Improved skills of labour force	15	35	27	23
G	Increased sustainable transport	15	12	31	42
L	Additional investments in any R&D related business area (infrastructure, technology, machinery, human resources, R&D)	9	30	43	17
L/E	Improved (conditions for) gender equality	8	36	16	40
L	Establishment of new industrial clusters (innovation poles)	8	29	29	33
L/E	Creation of more jobs for highly skilled employees	8	19	31	42
L	Increased founding of new enterprises (start-ups, spin-offs)	0	13	29	58
Source: Austrian Institute for SME Research					

Table 86. Contribution of the projects to overall objectives of the EU (Lisbon, ERA, Gothenburg) – Assessment of co-ordinators of Co-ordinated Actions/Specific Support Actions (CA/SSA), n=23-26
Sources of objectives: L: Lisbon, E: ERA, G: Gothenburg

Assessment of contributions of the projects to different objectives related to NMP FP6: by NMP-sub-areas

Nanotechnologies and Nanosciences (NMP-1)

Contributions of the projects in NMP FP6 to NMP-objectives					
Assessment of the co-ordinators (NMP sub-area: Nanotechnologies and Nanosciences) in %					
Source of objective	Objectives	Major contri-bution	Medium contri-bution	Minor contri-bution	No contri-bution
L/N	Creation of excellent new knowledge	70	19	7	5
L/N	Strengthening of existing scientific and technological excellence	68	23	7	2
L/E/N	Increased labour mobility of (young) researchers	44	40	16	0
N	Improved utilisation of research results for education and training measures	41	48	11	0
N	Creation of critical mass in NMP-related R&D	38	52	7	2
N	Increased participation of SME in NMP related research	33	35	16	16
L/N	Improved interaction of R&D institutions and industry	30	36	20	14
N	Increased orientation of R&D towards industrial usage, utilisation and exploitation	23	45	23	9
L/E/N	Improved knowledge and technology transfer	23	40	33	5
L/N	Increased participation of industry in NMP related research	23	28	26	23
E/N	Increased awareness of ethical issues of NMP related research	21	33	24	21
L/N	Stimulation of implementation of new technologies in SME intensive sectors	20	39	30	11
N	Increased dialogue with the public	19	44	33	5
N	Development of industrial breakthroughs (i.e., radical innovations)	19	21	36	24
N	More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) in industry	16	26	40	19
N	More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) with other technologies in industry	14	30	30	26
L/N	Increased awareness of issues of sustainability in NMP related research	10	33	38	19
N	Improved knowledge management and protection of intellectual property	10	19	45	26
L/N	Transformation of industries towards more knowledge and research based ones	9	21	44	26
Source: Austrian Institute for SME Research					

Table 87. Contribution of the projects to objectives of the EU (objectives of the NMP-programme) – Assessment of co-ordinators of projects within the NMP-subarea Nanotechnologies and Nanosciences (NMP-1), n=41-44
Sources of objectives: L: Lisbon, E: ERA, N: NMP (work-programme)

Contributions of the projects in NMP FP6 to overall-objectives of the EU (Lisbon, ERA, Gothenburg)					
Assessment of the co-ordinators (NMP sub-area: Nanotechnologies and Nanosciences) in %					
Source of objective	Objectives	Major contri-bution	Medium contri-bution	Minor contri-bution	No contri-bution
L/E	Improved career prospects for young researchers	60	23	14	2
L	Increased competitiveness of NMP-related R&D activities	48	30	16	7
L	Improved access to (new) knowledge	47	35	19	0
L	Improved skills of labour force	42	44	12	2
L/E	Increased attractiveness of EU for researchers from outside the EU	42	28	23	7
L/E	Improved integration/networking of/between existing centres of excellence and/or industrial clusters (innovation poles)	23	37	19	21
L/E	Establishment of new centres of excellence	23	33	19	26
L/E	Improved (conditions for) gender equality	19	43	19	19
L/E	Creation of more jobs for highly skilled employees	19	40	40	2
L	Increased founding of new enterprises (start-ups, spin-offs)	17	15	29	39
L	Additional investments in any R&D related business area (infrastructure, technology, machinery, human resources, R&D)	15	29	34	22
G	Improved handling of threats to public health	10	19	17	55
G	Increased sustainable production	7	21	26	45
L	Establishment of new industrial clusters (innovation poles)	5	12	36	48
G	Improved conservation and management of natural resources	5	10	31	55
G	Increased sustainable consumption	5	7	26	62
G	Containment of climate change / increased usage of renewable energy sources	5	5	26	64
G	Increased sustainable transport	0	5	24	71
Source: Austrian Institute for SME Research					

Table 88. Contribution of the projects to overall objectives of the EU (Lisbon, ERA, Gothenburg) – Assessment of co-ordinators of projects within the NMP-subarea Nanotechnologies and Nanosciences (NMP-1), n=41-44
Sources of objectives: L: Lisbon, E: ERA, G: Gothenburg

Knowledge-based Multifunctional Materials (NMP-2)

Contributions of the projects in NMP FP6 to NMP-objectives					
Assessment of the co-ordinators (NMP sub-area: Knowledge-based Multifunctional Materials) in %					
Source of objective	Objectives	Major contri-bution	Medium contri-bution	Minor contri-bution	No contri-bution
L/N	Creation of excellent new knowledge	68	24	5	3
L/N	Strengthening of existing scientific and technological excellence	52	45	2	2
N	Increased orientation of R&D towards industrial usage, utilisation and exploitation	51	31	11	8
N	Creation of critical mass in NMP-related R&D	44	32	16	8
L/E/N	Increased labour mobility of (young) researchers	44	27	22	8
N	Improved utilisation of research results for education and training measures	35	43	17	5
L/N	Improved interaction of R&D institutions and industry	31	45	17	8
N	More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) in industry	30	25	29	16
N	Development of industrial breakthroughs (i.e., radical innovations)	25	40	19	16
N	More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) with other technologies in industry	25	28	30	18
L/E/N	Improved knowledge and technology transfer	22	50	23	5
L/N	Increased awareness of issues of sustainability in NMP related research	20	34	28	17
L/N	Transformation of industries towards more knowledge and research based ones	18	29	39	15
L/N	Stimulation of implementation of new technologies in SME intensive sectors	17	51	25	6
N	Increased dialogue with the public	17	29	35	19
N	Increased participation of SME in NMP related research	15	48	19	18
L/N	Increased participation of industry in NMP related research	15	47	23	16
E/N	Increased awareness of ethical issues of NMP related research	11	13	30	46
N	Improved knowledge management and protection of intellectual property	8	37	39	16
Source: Austrian Institute for SME Research					

Table 89. Contribution of the projects to objectives of the EU (objectives of the NMP-programme) – Assessment of co-ordinators of projects within the NMP-sub-area Knowledge-based Multifunctional Materials (NMP-2), n=61-65
Sources of objectives: L: Lisbon, E: ERA, N: NMP (work-programme)

Contributions of the projects in NMP FP6 to overall-objectives of the EU (Lisbon, ERA, Gothenburg)					
Assessment of the co-ordinators (NMP sub-area: Knowledge-based Multifunctional Materials) in %					
Source of objective	Objectives	Major contri-bution	Medium contri-bution	Minor contri-bution	No contri-bution
L	Improved access to (new) knowledge	42	42	12	5
L/E	Improved career prospects for young researchers	40	42	12	6
L	Increased competitiveness of NMP-related R&D activities	37	51	8	5
L	Improved skills of labour force	35	29	27	8
L/E	Improved integration/networking of/between existing centres of excellence and/or industrial clusters (innovation poles)	23	27	19	31
L/E	Establishment of new centres of excellence	21	32	29	19
L/E	Improved (conditions for) gender equality	19	36	20	25
G	Increased sustainable production	16	32	30	22
L/E	Increased attractiveness of EU for researchers from outside the EU	14	36	30	20
G	Containment of climate change / increased usage of renewable energy sources	14	11	21	54
L/E	Creation of more jobs for highly skilled employees	13	38	33	16
G	Increased sustainable consumption	11	8	39	42
G	Increased sustainable transport	10	8	24	59
G	Improved handling of threats to public health	8	23	14	55
L	Increased founding of new enterprises (start-ups, spin-offs)	8	20	25	48
L	Establishment of new industrial clusters (innovation poles)	8	20	43	30
G	Improved conservation and management of natural resources	8	8	34	50
L	Additional investments in any R&D related business area (infrastructure, technology, machinery, human resources, R&D)	6	41	33	19
Source: Austrian Institute for SME Research					

Table 90. Contribution of the projects to overall objectives of the EU (Lisbon, ERA, Gothenburg) – Assessment of co-ordinators of projects within the NMP-sub-area Knowledge-based Multifunctional Materials (NMP-2), n=61-65
Sources of objectives: L: Lisbon, E: ERA, G: Gothenburg

New Production Processes and Devices

Contributions of the projects in NMP FP6 to NMP-objectives					
Assessment of the co-ordinators (NMP sub-area: New Production Processes and Devices) in %					
Source of objective	Objectives	Major contri-bution	Medium contri-bution	Minor contri-bution	No contri-bution
N	Increased orientation of R&D towards industrial usage, utilisation and exploitation	54	35	6	4
L/N	Improved interaction of R&D institutions and industry	44	48	6	2
L/N	Creation of excellent new knowledge	42	38	21	
L/N	Strengthening of existing scientific and technological excellence	39	50	9	2
N	Creation of critical mass in NMP-related R&D	35	39	22	4
N	Increased participation of SME in NMP related research	33	38	19	10
L/E/N	Improved knowledge and technology transfer	32	57	4	6
L/N	Stimulation of implementation of new technologies in SME intensive sectors	31	40	21	8
L/N	Increased awareness of issues of sustainability in NMP related research	28	43	22	7
L/N	Transformation of industries towards more knowledge and research based ones	23	49	23	4
N	Improved utilisation of research results for education and training measures	23	49	23	4
L/N	Increased participation of industry in NMP related research	23	46	25	6
N	Development of industrial breakthroughs (i.e., radical innovations)	19	34	38	9
N	More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) in industry	15	43	23	19
N	Increased dialogue with the public	13	22	48	17
N	More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) with other technologies in industry	11	37	33	20
N	Improved knowledge management and protection of intellectual property	9	28	34	30
L/E/N	Increased labour mobility of (young) researchers	9	28	39	24
E/N	Increased awareness of ethical issues of NMP related research	2	13	33	51
Source: Austrian Institute for SME Research					

Table 91. Contribution of the projects to objectives of the EU (objectives of the NMP-programme) – Assessment of co-ordinators of projects within the NMP-sub-area New Production Processes and Devices (NMP-3), n=45-48
Sources of objectives: L: Lisbon, E: ERA, N: NMP (work-programme)

Contributions of the projects in NMP FP6 to overall-objectives of the EU (Lisbon, ERA, Gothenburg)					
Assessment of the co-ordinators (NMP sub-area: New Production Processes and Devices) in %					
Source of objective	Objectives	Major contri-bution	Medium contri-bution	Minor contri-bution	No contri-bution
G	Increased sustainable production	39	30	13	17
L	Improved access to (new) knowledge	38	47	13	2
L/E	Improved integration/networking of/between existing centres of excellence and/or industrial clusters (innovation poles)	30	35	26	9
L	Increased competitiveness of NMP-related R&D activities	26	62	11	2
L	Improved skills of labour force	19	42	29	10
L/E	Improved career prospects for young researchers	17	40	25	19
G	Improved conservation and management of natural resources	17	15	35	33
L	Additional investments in any R&D related business area (infrastructure, technology, machinery, human resources, R&D)	13	40	38	10
G	Increased sustainable consumption	13	13	27	47
G	Containment of climate change / increased usage of renewable energy sources	11	22	30	37
L/E	Establishment of new centres of excellence	7	27	42	24
G	Increased sustainable transport	7	9	28	57
L/E	Creation of more jobs for highly skilled employees	6	42	38	15
L/E	Improved (conditions for) gender equality	6	28	40	26
L	Establishment of new industrial clusters (innovation poles)	4	33	33	30
L/E	Increased attractiveness of EU for researchers from outside the EU	4	23	38	34
L	Increased founding of new enterprises (start-ups, spin-offs)	4	17	33	46
G	Improved handling of threats to public health	4	16	16	64
Source: Austrian Institute for SME Research					

Table 92. Contribution of the projects to overall objectives of the EU (Lisbon, ERA, Gothenburg) – Assessment of co-ordinators of projects within the NMP-sub-area New Production Processes and Devices (NMP-3), n=45-48
Sources of objectives: L: Lisbon, E: ERA, G: Gothenburg

"NMP-4": Integrating NMP-1 (Nanotechnologies and Nanosciences), NMP-2 (Knowledge-based Multifunctional Materials) and NMP-3 (New Production Processes and Devices)

Contributions of the projects in NMP FP6 to NMP-objectives					
Assessment of the co-ordinators (NMP subarea: "NMP-4": Integrating NMP-1 (Nanotechnologies and Nanosciences), NMP-2 (Knowledge-based Multifunctional Materials) and NMP-3 (New Production Processes and Devices) in %					
Source of objective	Objectives	Major contri-bution	Medium contri-bution	Minor contri-bution	No contri-bution
L/N	Strengthening of existing scientific and technological excellence	48	48	2	2
L/N	Creation of excellent new knowledge	47	40	11	2
N	Creation of critical mass in NMP-related R&D	37	42	19	2
N	Increased orientation of R&D towards industrial usage, utilisation and exploitation	36	49	13	2
L/N	Improved interaction of R&D institutions and industry	32	48	18	2
N	Increased participation of SME in NMP related research	28	37	30	5
L/N	Stimulation of implementation of new technologies in SME intensive sectors	25	45	27	2
N	Improved utilisation of research results for education and training measures	20	48	23	9
N	Development of industrial breakthroughs (i.e., radical innovations)	16	33	47	5
N	More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) in industry	14	40	26	21
L/N	Transformation of industries towards more knowledge and research based ones	14	37	33	16
L/E/N	Improved knowledge and technology transfer	12	52	31	5
L/E/N	Increased labour mobility of (young) researchers	12	50	31	7
L/N	Increased participation of industry in NMP related research	10	52	33	5
N	More integrated approaches combining nanotechnology/nanosciences (N), new materials (M) and new production technologies/processes (P) with other technologies in industry	9	35	40	16
E/N	Increased awareness of ethical issues of NMP related research	9	22	20	49
L/N	Increased awareness of issues of sustainability in NMP related research	7	38	18	38
N	Increased dialogue with the public	2	36	49	13
N	Improved knowledge management and protection of intellectual property	2	29	40	29
Source: Austrian Institute for SME Research					

Table 93. Contribution of the projects to objectives of the EU (objectives of the NMP-programme) – Assessment of co-ordinators of projects within the NMP-sub-area (NMP-4), n=41-45
Sources of objectives: L: Lisbon, E: ERA, N: NMP (work-programme)

Contributions of the projects in NMP FP6 to overall-objectives of the EU (Lisbon, ERA, Gothenburg)					
Assessment of the co-ordinators (NMP sub-area: "NMP-4": Integrating NMP-1 (Nanotechnologies and Nanosciences), NMP-2 (Knowledge-based Multifunctional Materials) and NMP-3 (New Production Processes and Devices) in %					
Source of objective	Objectives	Major contri-bution	Medium contri-bution	Minor contri-bution	No contri-bution
L	Increased competitiveness of NMP-related R&D activities	26	52	17	5
L	Improved skills of labour force	26	47	23	5
G	Improved handling of threats to public health	18	13	20	49
L/E	Improved career prospects for young researchers	17	62	19	2
L	Improved access to (new) knowledge	16	47	35	2
L/E	Improved integration/networking of/between existing centres of excellence and/or industrial clusters (innovation poles)	14	35	35	16
L/E	Increased attractiveness of EU for researchers from outside the EU	12	38	29	21
G	Increased sustainable production	11	20	31	38
L/E	Establishment of new centres of excellence	9	26	42	23
L/E	Improved (conditions for) gender equality	7	25	41	27
L/E	Creation of more jobs for highly skilled employees	5	51	33	12
L	Additional investments in any R&D related business area (infrastructure, technology, machinery, human resources, R&D)	2	37	46	15
G	Increased sustainable consumption	2	18	20	60
G	Containment of climate change / increased usage of renewable energy sources	2	16	20	62
G	Increased sustainable transport	2	13	13	71
L	Establishment of new industrial clusters (innovation poles)	0	23	44	33
G	Improved conservation and management of natural resources	0	16	22	62
L	Increased founding of new enterprises (start-ups, spin-offs)	0	14	36	50
Source: Austrian Institute for SME Research					

Table 94. Contribution of the projects to overall objectives of the EU (Lisbon, ERA, Gothenburg) – Assessment of co-ordinators of projects within the NMP-sub-area (NMP-4), n=41-45 Sources of objectives: L: Lisbon, E: ERA, G: Gothenburg

Contribution of the project co-ordinated within NMP FP6 to overall objectives of the EU with regard to societal and sustainability aspects of European R&D activities by NMP-sub-areas

Contributions of the projects in NMP FP6 to overall-objectives of the EU (with regard to societal and sustainability aspects of European R&D activities)					
Assessment of the co-ordinators – by sub-areas, in %					
	Major contribution	Medium contribution	Minor contribution	No contribution	Major contribution
Increased dialogue with the public	NMP-1	19	44	33	5
	NMP-2	17	29	35	19
	NMP-3	13	22	48	17
	NMP-4	2	36	49	13
Improved (conditions for) gender equality	NMP-1	19	43	19	19
	NMP-2	19	36	20	25
	NMP-3	6	28	40	26
	NMP-4	7	25	41	27
Increased awareness of ethical issues of NMP related research	NMP-1	21	33	24	21
	NMP-2	11	13	30	46
	NMP-3	2	13	33	51
	NMP-4	9	22	20	49
Increased awareness of issues of sustainability in NMP related research	NMP-1	10	33	38	19
	NMP-2	20	34	28	17
	NMP-3	28	43	22	7
	NMP-4	7	38	18	38
Containment of climate change / increased usage of renewable energy sources	NMP-1	5	5	26	64
	NMP-2	14	11	21	54
	NMP-3	11	22	30	37
	NMP-4	2	16	20	62
Increased sustainable production	NMP-1	7	21	26	45
	NMP-2	16	32	30	22
	NMP-3	39	30	13	17
	NMP-4	11	20	31	38
Increased sustainable consumption	NMP-1	5	7	26	62
	NMP-2	11	8	39	42
	NMP-3	13	13	27	47
	NMP-4	2	18	20	60
Increased sustainable transport	NMP-1	0	5	24	71
	NMP-2	10	8	24	59
	NMP-3	7	9	28	57
	NMP-4	2	13	13	71
Improved conservation and management of natural resources	NMP-1	5	10	31	55
	NMP-2	8	8	34	50
	NMP-3	17	15	35	33
	NMP-4	0	16	22	62
Improved handling of threats to public health	NMP-1	10	19	17	55
	NMP-2	8	23	14	55
	NMP-3	4	16	16	64
	NMP-4	18	13	20	49
Source: Austrian Institute for SME Research					

Table 95. Contribution of the projects, co-ordinated within NMP FP6, to overall objectives of the EU with regard to societal and sustainability aspects of European R&D activities by NMP-sub-areas

NMP-1= Nanotechnologies and Nanosciences
NMP-2= Knowledge-based Multifunctional Materials
NMP-3= New Production Processes and Devices
NMP-4= Integrating NMP-1, NMP-2 and NMP-3

Linkages of the NMP FP6 projects to other research fields – by instruments

Linkages of the NMP FP6 projects to other research fields (Assessment of the co-ordinators, in %)				
	Integrated Projects (IP)	Networks of Excellence (NoE)	Specific Targeted Research Projects (STP)	Co-ordination Actions (CA) / Specific Support Actions (SSA)
Environment and Sustainability	35	21	23	58
ICT	29	43	36	23
Life Sciences	23	36	30	19
Other	19	29	17	27
Energy technologies	15	29	21	23
Transport	17	7	6	15
Space and Aeronautics	17	0	6	4
Security	8	7	4	0
Socio-economic and humanities	2	0	2	8
Source: Austrian Institute for SME Research				

Table 96. Linkages of the NMP FP6 projects to other research fields (Assessment of the co-ordinators, by instrument, in %), n=52, 108, 14, 26; multiple answers were possible

Linkages of the NMP FP6 projects to other research fields – by NMP-sub-areas

Linkages of the NMP FP6 projects to other research fields (Assessment of the co-ordinators, in %)				
	NMP-1	NMP-2	NMP-3	NMP-4
ICT	34	24	36	40
Environment and Sustainability	24	27	55	19
Life Sciences	46	21	9	33
Other	20	24	18	19
Energy technologies	7	26	30	9
Transport	2	13	14	9
Space and Aeronautics	5	15	9	0
Security	2	2	5	7
Source: Austrian Institute for SME Research				

Table 97. Linkages of the NMP FP6 projects to other research fields (Assessment of the co-ordinators, by NMP-sub-area, in %), n= 41, 62, 44, 43; multiple answers were possible

NMP-1= Nanotechnologies and Nanosciences
NMP-2= Knowledge-based Multifunctional Materials
NMP-3= New Production Processes and Devices
NMP-4= Integrating NMP-1, NMP-2 and NMP-3

Relevant fields of (potential) industrial applications for NMP FP6 projects – by instruments

Application fields for NMP FP6 projects (Assessment of the co-ordinators, in %)				
	Integrated Projects (IP)	Networks of Excellence (NoE)	Specific Targeted Research Projects (STP)	Co-ordination Actions (CA) / Specific Support Actions (SSA)
Instruments (also including optics, medical engineering)	31	64	42	44
Chemicals and pharmaceuticals (also including biotech)	31	64	40	36
Industrial engineering	59	43	21	48
Electronics	19	64	44	36
Mechanical engineering (also including machinery, defence sector)	45	21	29	44
Consumer goods, civil engineering (also including construction)	34	43	14	40
Others	10	14	9	12
Source: Austrian Institute for SME Research				

Table 98. Application fields for NMP FP6 projects (Assessment of the co-ordinators, by instrument, in %), n= 58, 117, 14, 25; multiple answers were possible

Relevant fields of (potential) industrial applications for NMP FP6 projects – by NMP-sub-areas

Application fields for NMP FP6 projects (Assessment of the co-ordinators, in %)				
	NMP-1	NMP-2	NMP-3	NMP-4
Instruments (also including optics, medical engineering)	52	40	27	47
Chemicals and pharmaceuticals (also including biotech)	55	43	24	36
Electronics	55	37	33	31
Industrial engineering	17	32	67	29
Mechanical engineering (also including machinery, defence sector)	17	32	61	31
Consumer goods, civil engineering (also including construction)	10	25	49	11
Others	5	10	8	13
Source: Austrian Institute for SME Research				

Table 99. Application fields for NMP FP6 projects (Assessment of the co-ordinators, by NMP-sub-area, in %), n= 42, 68, 49, 45; multiple answers were possible

NMP-1= Nanotechnologies and Nanosciences
NMP-2= Knowledge-based Multifunctional Materials
NMP-3= New Production Processes and Devices
NMP-4= Integrating NMP-1, NMP-2 and NMP-3

Effects on research team's (consortium's) capacity to co-operate – by instruments

Effects on research team's (consortium's) capacity to co-operate					
Assessment of the co-ordinators, in %					
		Significantly improved	Rather improved	Somewhat improved	Not improved
Capacity to maintain already established co-operative relationships	NoE	50	36	14	0
	STP	45	38	15	2
	IP	39	42	12	7
	CA/SSA	38	50	12	0
Capacity to establish new co-operative relationships	NoE	93	0	7	0
	IP	58	37	5	0
	STP	55	27	16	2
	CA/SSA	54	31	15	0
Capacity to co-operate with external research competences	NoE	79	7	14	0
	IP	44	42	11	4
	STP	37	40	19	4
	CA/SSA	35	35	31	0
Capacity to co-operate with external industry partners	IP	41	43	13	4
	NoE	36	50	14	0
	CA/SSA	27	38	27	8
	STP	21	41	23	16
Capacity to co-operate with research groups (R&D capacities) from other countries within the EU	NoE	57	29	14	0
	IP	53	39	9	0
	STP	47	32	19	2
	CA/SSA	27	62	12	0
Capacity to co-operate with research groups (R&D capacities) from other countries outside the EU	IP	20	18	18	45
	STP	15	17	27	41
	CA/SSA	8	50	19	23
	NoE	0	36	29	36
Capacity to form new research teams	NoE	36	29	36	0
	IP	26	42	26	5
	STP	26	34	24	16
	CA/SSA	16	40	28	16
Capacity to form new long-term oriented international research networks	NoE	64	29	7	0
	IP	32	32	29	7
	STP	29	38	21	12
	CA/SSA	24	36	32	8
Creation of / access to sustainable international business relations	IP	14	29	36	21
	NoE	14	50	21	14
	STP	9	23	34	35
	CA/SSA	0	27	42	31
Access to / joint usage of physical R&D-related infrastructure	NoE	36	21	43	0
	IP	13	33	28	26
	STP	11	22	37	30
	CA/SSA	0	16	48	36
Source: Austrian Institute for SME Research					

Table 100. Effects on research team's (consortium's) capacity to co-operate (Assessment of the co-ordinators, by instrument, in %), n=54-57. 114-117, 14, 25-26

NoE: Networks of Excellence IP: Integrated Projects STP: Specific Targeted Research Projects CA/SSA: Co-ordinated Actions/Specific Support Actions

Effects on research team's (consortium's) capacity to co-operate – by NMP-sub-areas

Effects on research team's (consortium's) capacity to co-operate					
Assessment of the co-ordinators, in %					
		Significantly improved	Rather improved	Somewhat improved	Not improved
Capacity to maintain already established co-operative relationships	NMP-2	52	33	12	3
	NMP-1	41	39	16	5
	NMP-3	37	49	14	0
	NMP-4	34	48	14	5
Capacity to establish new co-operative relationships	NMP-1	66	16	16	2
	NMP-3	59	31	10	0
	NMP-2	52	33	13	1
	NMP-4	50	36	14	0
Capacity to co-operate with external research competences	NMP-3	43	35	18	4
	NMP-2	42	36	18	4
	NMP-1	41	36	18	5
	NMP-4	36	45	18	0
Capacity to co-operate with external industry partners	NMP-3	35	43	16	6
	NMP-2	30	37	24	9
	NMP-1	23	37	16	23
	NMP-4	23	52	18	7
Capacity to co-operate with research groups (R&D capacities) from other countries within the EU	NMP-1	48	27	25	0
	NMP-3	47	43	10	0
	NMP-2	46	34	16	3
	NMP-4	45	43	11	0
Capacity to co-operate with research groups (R&D capacities) from other countries outside the EU	NMP-1	19	14	33	35
	NMP-3	16	27	18	39
	NMP-2	11	23	18	48
	NMP-4	10	17	33	40
Capacity to form new research teams	NMP-1	28	30	30	12
	NMP-2	26	33	18	23
	NMP-3	24	43	27	6
	NMP-4	23	40	33	5
Capacity to form new long-term oriented international research networks	NMP-2	38	32	17	12
	NMP-3	31	37	24	8
	NMP-1	28	35	28	9
	NMP-4	23	37	30	9
Creation of / access to sustainable international business relations	NMP-3	14	29	31	27
	NMP-2	11	24	36	29
	NMP-1	9	23	35	33
	NMP-4	5	28	40	28
Access to / joint usage of physical R&D-related	NMP-1	19	24	36	21

Effects on research team's (consortium's) capacity to co-operate					
Assessment of the co-ordinators, in %					
		Significantly improved	Rather improved	Somewhat improved	Not improved
infrastructure	NMP-2	14	20	42	25
	NMP-3	11	21	36	32
	NMP-4	7	30	28	35
Source: Austrian Institute for SME Research					

Table 101. Effects on research team's (consortium's) capacity to co-operate (Assessment of the co-ordinators, by NMP-sub-area, in %), n=42-44, 65-67, 47-49, 43-45

NMP-1= Nanotechnologies and Nanosciences
NMP-2= Knowledge-based Multifunctional Materials
NMP-3= New Production Processes and Devices
NMP-4= Integrating NMP-1, NMP-2 and NMP-3

User groups benefited from NMP FP6 projects – by instrument

User groups benefited from NMP FP6 projects					
Assessment of the co-ordinators, in %					
		To a great extent	To some extent	To a small extent	Do not benefit at all
Researchers in the area "Nanotechnologies and Nanosciences"	NoE	57	36	7	0
	STP	48	29	12	12
	CA/SSA	38	33	10	19
	IP	20	40	28	12
Researchers in the area "Knowledge-based Multifunctional Materials"	NoE	43	43	7	7
	STP	34	32	18	16
	IP	34	44	14	8
	CA/SSA	29	43	19	10
Researchers in the area "New Production Processes and Devices"	IP	49	30	15	6
	CA/SSA	38	50	8	4
	STP	36	32	24	8
	NoE	23	46	23	8
Researchers in other areas	CA/SSA	18	27	41	14
	IP	17	46	28	9
	STP	11	40	35	13
	NoE	8	50	25	17
Industry in the area "Nanotechnologies and Nanosciences"	CA/SSA	16	47	16	21
	NoE	15	69	15	0
	STP	15	29	37	19
	IP	15	32	30	23
Industry in the area "Knowledge-based Multifunctional Materials"	CA/SSA	23	36	32	9
	IP	20	42	28	10
	STP	15	35	21	29
	NoE	7	57	21	14

User groups benefited from NMP FP6 projects					
Assessment of the co-ordinators, in %					
		To a great extent	To some extent	To a small extent	Do not benefit at all
Industry in the area "New Production Processes and Devices"	IP	40	35	18	7
	CA/SSA	30	48	17	4
	STP	21	34	30	15
	NoE	8	46	23	23
Industry in other areas	IP	19	31	33	17
	NoE	9	36	18	36
	STP	6	29	29	35
	CA/SSA	5	33	29	33
NGOs	CA/SSA	17	28	11	44
	STP	4	5	17	74
	NoE	0	0	50	50
	IP	0	14	31	56
Governmental organisations	CA/SSA	41	23	18	18
	STP	11	17	16	57
	NoE	10	10	40	40
	IP	7	20	32	41
The broader public	CA/SSA	20	35	25	20
	NoE	18	36	36	9
	IP	9	39	39	14
	STP	6	25	41	27
Source: Austrian Institute for SME Research					

Table 102. User groups benefited from NMP FP6 projects (Assessment of the co-ordinators, per instrument, in %), n=36-58, 14, 81-114, 18-24

NoE: Networks of Excellence
IP: Integrated Projects
STP: Specific Targeted Research Projects
CA/SSA: Co-ordinated Actions/Specific Support Actions

User groups benefited from NMP FP6 projects – by NMP-sub-area

User groups benefited from NMP FP6 projects					
Assessment of the co-ordinators, in %					
		To a great extent	To some extent	To a small extent	Do not benefit at all
Researchers in the area "Nanotechnologies and Nanosciences"	NMP-1	75	23	2	0
	NMP-2	45	38	13	5
	NMP-4	22	37	22	20
	NMP-3	10	33	28	28
Researchers in the area "Knowledge-based Multifunctional Materials"	NMP-2	57	31	11	2
	NMP-1	27	41	23	9
	NMP-4	21	38	12	29

User groups benefited from NMP FP6 projects					
Assessment of the co-ordinators, in %					
		To a great extent	To some extent	To a small extent	Do not benefit at all
	NMP-3	16	39	26	18
Researchers in the area "New Production Processes and Devices"	NMP-3	62	33	4	0
	NMP-4	47	23	21	9
	NMP-1	28	28	28	16
	NMP-2	23	48	27	2
Researchers in other areas	NMP-1	19	41	30	11
	NMP-3	18	53	18	13
	NMP-4	17	42	36	6
	NMP-2	5	31	47	16
Industry in the area "Nanotechnologies and Nanosciences"	NMP-1	33	33	26	7
	NMP-2	11	41	38	10
	NMP-3	8	33	25	33
	NMP-4	8	25	36	31
Industry in the area "Knowledge-based Multifunctional Materials"	NMP-2	22	47	23	8
	NMP-1	16	34	18	32
	NMP-3	13	39	26	21
	NMP-4	10	35	25	30
Industry in the area "New Production Processes and Devices"	NMP-4	30	35	21	14
	NMP-1	14	40	21	24
	NMP-2	14	38	41	7
	NMP-3	8	48	28	18
Industry in other areas	NMP-3	51	32	15	2
	NMP-4	19	27	35	19
	NMP-1	9	31	31	29
	NMP-2	6	19	26	49
NGOs	NMP-1	13	6	26	55
	NMP-2	3	10	15	73
	NMP-3	0	19	28	53
	NMP-4	0	6	18	76
Governmental organisations	NMP-1	27	11	22	41
	NMP-2	12	20	14	53
	NMP-3	11	25	25	39
	NMP-4	3	16	22	59
The broader public	NMP-1	15	33	44	8
	NMP-2	9	31	33	26
	NMP-3	6	37	31	26
	NMP-4	5	15	54	26
Source: Austrian Institute for SME Research					

Table 103. User groups benefited from NMP FP6 projects (Assessment of the co-ordinators, per NMP-sub-area, in %),

NMP-1= Nanotechnologies and Nanosciences
NMP-2= Knowledge-based Multifunctional Materials
NMP-3= New Production Processes and Devices
NMP-4= Integrating NMP-1, NMP-2 and NMP-3

Motivation compared to other public funding

Motivation for the application for funding within NMP FP compared to other public funding sources (national, regional); Assessment of the co-ordinators, in %)	
	%
Access to new and / or more research partners	65
Possibility to conduct technologically more ambitious projects	54
Chance to create new knowledge	49
More suitable thematic areas / priorities	40
No adequate national or regional funding	36
Higher reputation of research	34
More appropriate funding conditions	27
Longer project duration	25
Higher funding rates	22
Source: Austrian Institute for SME Research	

Table 104. Motivation for the application for funding within NMP FP compared to other public funding sources (national, regional). Assessment of all co-ordinators, n=216; multiple answers were possible

Motivation for application – by NMP-sub-areas

Motivation for the application for funding within NMP FP compared to other public funding sources (national, regional); Assessment of the co-ordinators, in %)				
	NMP-1	NMP-2	NMP-3	NMP-4
Possibility to co-operate with international partners	89	90	73	69
Access to new and / or more research partners	73	60	63	64
Possibility to conduct technologically more ambitious projects	48	54	59	53
Chance to create new knowledge	52	51	43	49
More suitable thematic areas / priorities	50	34	45	27
No adequate national or regional funding	39	35	29	36
Higher reputation of research	36	37	27	31
Longer project duration	32	16	22	38
More appropriate funding conditions	32	34	24	18
Higher funding rates	25	22	10	29
Other	2	1	6	0
Source: Austrian Institute for SME Research				

Table 105. Motivation for the application for funding within NMP FP compared to other public funding sources (national, regional). Assessment of the co-ordinators, by NMP-sub-area, in %, n=44, 68, 49, 45; multiple answers were possible.

NMP-1= Nanotechnologies and Nanosciences
NMP-2= Knowledge-based Multifunctional Materials
NMP-3= New Production Processes and Devices
NMP-4= Integrating NMP-1, NMP-2 and NMP-3

Added value of the participation – by instrument

Added value of participating in NMP FP6 compared to national or regional funding programmes in the field of NMP (Assessment of the co-ordinators, in %)				
	Integrated Projects (IP)	Networks of Excellence (NoE)	Specific Targeted Research Projects (STP)	Co-ordination Actions (CA) / Specific Support Actions (SSA)
Build up of research networks	78	92	77	93
Better access to international knowledge and know how	81	67	70	79
Sustainable relationships in research	66	67	67	71
Possibility for research in big consortia	75	75	63	50
Higher scientific level of research	53	42	65	43
Better access to knowledge/know-how in research institutions	53	25	51	71
Possibility for research including all stakeholders - horizontal and vertical integration (e.g. research groups, future customers, future manufacturers, future sub-suppliers etc)	66	33	51	50
Sustainable relationships with industry partners	69	25	49	36
Better access to industry	53	33	36	36
Higher financial endowment of projects	50	25	40	43
Other	3	0	2	0
Source: Austrian Institute for SME Research				

Table 106. Added value of participating in NMP FP6 compared to national or regional funding programmes in the field of NMP (Assessment of the co-ordinators, by instrument, in %). n=32, 81, 12, 14; multiple answers were possible

Added value of the participation – by NMP-sub-area

Added value of participating in NMP FP6 compared to national or regional funding programmes in the field of NMP (Assessment of the co-ordinators, in %)				
	NMP-1	NMP-2	NMP-3	NMP-4
Build up of research networks	90	67	80	86
Better access to international knowledge and know how	66	76	80	66
Sustainable relationships in research	76	63	63	66
Possibility for research in big consortia	72	70	63	52
Higher scientific level of research	79	61	40	48
Possibility for research including all stakeholders - horizontal and vertical integration (e.g. research groups, future customers, future manufacturers, future sub-suppliers etc)	41	63	53	48
Better access to knowledge/know-how in research institutions	45	52	50	48
Sustainable relationships with industry partners	34	57	43	55
Higher financial endowment of projects	38	41	50	38

Added value of participating in NMP FP6 compared to national or regional funding programmes in the field of NMP (Assessment of the co-ordinators, in %)				
	NMP-1	NMP-2	NMP-3	NMP-4
Better access to industry	45	39	37	38
Other	3	2	0	3
Source: Austrian Institute for SME Research				

Table 107. Added value of participating in NMP FP6 compared to national or regional funding programmes in the field of NMP (Assessment of the co-ordinators, by NMP-sub-area, in %). n= 29, 46, 30, 29; multiple answers were possible

NMP-1= Nanotechnologies and Nanosciences
NMP-2= Knowledge-based Multifunctional Materials
NMP-3= New Production Processes and Devices
NMP-4= Integrating NMP-1, NMP-2 and NMP-3

11.7 List of interviewed experts and interview sampling

Table: Sample Group Coverage	
Group	Number of interviewees
Business	7
Policy	6
Research	15
Reviewers	3
NPC	4
NCP	6
Commission	5
OECD	2
Total	**48**
Source: Oxford Research 2009.	

Table 108. Sample Group Coverage, Source: Oxford Research AS.

Table: Interview Sample Country Coverage						
Countries	Nr. interviews	Big	Small	Old	New	Other
Germany	8	1		1		
Finland	2		1	1		
UK	4	1		1		
Spain	2	1		1		
Netherlands	6		1	1		
Norway	1					1
Singapore	1					1
Italy	2	1		1		
Poland	1	1			1	
Hungary	2		1		1	
Estonia	1		1		1	
France	3	1		1		
Ireland	1		1	1		
Sweden	3		1	1		
Austria	1		1	1		
Russia	1					1
Total	**39**	**6**	**7**	**10**	**3**	**3**
Source: Oxford Research 2009.						

Table 109 Interview Sample Country Coverage, Source: Oxford Research AS.

Table: Interviewees details with codes used in the study					
	Business	Organization	Country	Area	Code
1.	Andrea E. Reinhardt	Member of the board of MINAM and ZIRP microTEC	Germany	N	**AR**
2.	Dmitriy Lisenkov	Russian Corporation of Nanotechnologies (Rusnano)	Russia	NMP	**DL**
3.	Oliver Panzer	European Research Services GmbH	Germany	NMP	**OP**
4.	Tom Crawley	Spinverse	Finland	NMP	**TC**
	Policy	Organization	Country	Area	Code
5.	Lerwen Liu	NanoGlobe Pte	Singapore	NMP	**LL**
6.	Markku Lämsä	Tekes	Finland	NMP	**ML**
7.	Christian Inglis	Technology Strategy Board	UK	NMP	**CI**
	Research	Organization	Country	Area	Code
8.	Peter Grünberg	Forschungszentrum Jülich	Germany	N	**PG**
9.	Susan Anson	FZK	Germany	NMP	**SA**
10.	Arben Merkoçi	Catalan Institute of Nanotechnology	Spain	NP	**AM**
11.	Albert Polman	FOM Amsterdam	The Netherlands	M	**AP**
12.	Antonio Luque	Polytechnic University of Madrid	Spain	NMP	**AL**
13.	Christian Simon	SINTEF	Norway	M	**CS**
14.	Andreas Jordan	MagForce Nanotechnologies AG	Germany	NP	**AJ**
15.	Dieter Bimberg	Conference Committee & AGeNT-D	Germany	NM	**DB**
	Business	Organization	Country	Area	Code
16.	Guido Florussen	IBS PRECISION ENGINEERING BV	Netherlands	NP	**GF**
17.	Caocci Mauro	CIMATEC	Italy	N	**MC**
	Reviewers	Organization	Country	Area	Code
18.	Chris Adams	XeF6 Consulting	UK		**CA**
19.	Hemmes Kas	TU DELFT	Netherlands		**HK**
20.	Reinhard Ditz	Life Science Products Division R&D	Germany		**RD**
	NPC	Organization	Country	Area	Code
21.	József Gyulai	National Office for Research and Technology	Hungary		**JG**
22.	Zsuzsa Mokry	National Office for Research and Technology	Hungary		**ZM**
23.	Gerd Schumacher	Project Management Jülich	Germany		**GS**
24.	Nadia Giaretta	Direzione per lo Sviluppo Economico, la Ricerca	Italy		**NG**
	NCP	Organization	Country	Area	Code
25.	Jaroslaw Piekarski	The Institute of Fundamental Technological	Poland		**JP**
26.	Reinbrand Visman	SenterNovem	Netherlands		**RV**
27.	Matthijs Soede	NCP FP7	Netherlands		**MS**
29.	Jenny Melia	Enterprise Ireland	Ireland		**JM**
30.	Françoise Roure	Conseil général des technologies de l'information	France		**FR**
31.	Philippe Larédo	Ecole des Ponts	France	N	**PL**
32.	Peter Kearns	OECD			**PK**
33.	Jacqueline Allan	OECD			**JA**

	European Commission	Organization	Country	Area	Code
34.	Renzo Tomellini	European Commission			**RT**
35.	Christos Tokamanis	European Commission			**KT**
36.	Jyrki Suominen	European Commission, Project Officer		P	**JS**
37.	Susanne Becker	European Commission, Project Officer		M	**SB**
38.	Georgios Katalagarianakis	European Commission, Project Officer		P	**GK**
39.	Heico Frima	European Commission, Project Officer		N	**HF**
40.	Anne de Baas	European Commission, Project Officer		M	**AB**
	Exploratory Interviews	Organization	Country	Area	Code
41.	Jöns Hilborn	Uppsala University, Dpt. Materials Chemistry	Sweden	M	**JB**
42.	Peter Axegård	Innventia, Research Institute	Sweden		**PA**
43.	Bert Hill	Volvo Technology Corporation	Sweden	P	**BH**
44.	Marc Morrison	Institute of Nanotechnology	UK	N	**MM**
45.	Otilia Saxl	Institute of Nanotechnology	UK	N	**OS**
46.	Patrick Boisseau	CEA-Leti Grenoble	France	N	**PB**
47.	Arie Rip	University of Twente	The Netherlands		**AR**
48.	Gerald Kern	Austrian Research Promotion Agency (FFG)	Austria		**GKE**

Source: Oxford Research 2009.

Table 110 Table: Interviewees details with codes used in the study

11.8 Interview guide

The following interview guide has been used during the semi-structured interviews conducted under this evaluation. The adjustments of the questions posed were done to obtain maximum information from the interviewees representing different groups of stakeholders.

The interviewees were asked to read and reflect upon the IG beforehand and to come with their reflections on the questions they know most about, based on their experience and knowledge of NMP FP6, instead of bringing facts and trying to answer all the questions in the IG. During the process, the focus was shifted on to more specific questions and an effort was made to get more in-depth, reflective answers from the interviewees.

The IG was to address two levels of knowledge that the target groups were expected to possess:

a. Project-level group, including members of NMP FP6 consortia: project leaders, researchers and industrial partners, NCPs (although some of them proved to have strategic knowledge, having been acting as national experts or delegates in the FPs).

b. Strategic-level group, including reviewers and national experts in NMP FP6, NPCs, officials from the Commission involved in NMP FP6 (including Project Officers) and other international organizations.

As a result, a separate IG for the NPCs and one IG for the Commission officials were developed on the basis of the existing IG, which focuses on those areas where the interviewees had most knowledge of.

Comments	Main Questions	Support Questions
Introduction	1. Could you tell us about your **involvement** in NMP FP6?	• What was your experience with the programme? • What were your expectations with the programme?
Part I. A set of questions regarding the attainment ERA objectives in the FP6 will follow:		
Objectives reached Note: Use the list of ERA objectives Give the	2. Thinking back to FP6 (2002-2006), what was in your opinion **most important contribution** to ERA? 3. What was **most difficult to achieve**? Why? 4. Do you agree that the NM PFP6 have contributed to a large extent to increasing multidisciplinary approaches, integration of actors, sectors and disciplines, while being quite inefficient with regards to **dissemination and exploitation** of project results? 5. How do you think the NPM FP6 have performed with regards to breakthroughs in new	• **Breakthroughs** in new applicable knowledge and long-term R&D? • Widening **the scope for industrial research** (including ethical issues, environment, health, energy etc.)? • Creating **first class knowledge** and solutions to deal with industrial challenges? • New approaches of **integration and exploitation** of

interviewee time to think	applicable knowledge and its **commercialization** on the market? 6. How do these objectives compare with the national nano-programmes achievements in your country/ Member States? (Optional) Can you comment on the following comment given by an expert: '*National programmes however, can in principle create such effects (ed. stronger impact on ERA objectives) due to their alignment to specific national contexts, which NMP cannot provide*' (Prof. Arie Rip). Do you agree that MS alone can have a stronger impact on ERA by providing specific national contexts, which EU missed to provide? If YES, than can you describe the specific context which is provided by the MS and cannot be provided by the EU in this sense. (Optional) Can you comment on the following comments given by an expert: '*First class knowledge is created in individual institutions and industrial challenges are met by large companies.* (OS) AND '*Collaboration of course gives rise to knowledge. However, the creation of first class knowledge – and dealing with associated intellectual property issues - is easier the fewer the partners in a project. The more partners in a project, the more everyone guards sensitive knowledge.*" (JH)	existing/new knowledge? • **Dissemination of results** in terms of know-how and knowledge? • Increasing **multidisciplinary**, cross-sector and life-cycle approaches? • **Integration of actors**, sectors, expertise, disciplines, technologies, activities and funds? • **Private-public partnerships**? • An active role of **SME's** • **Commercialization** of technology: start-ups, spin-offs, and licensing activities? • **International co-operation** beyond the EU? • Increased **career** opportunities? • Reduction of legal and practical **barriers** that hamper mobility across institutions, sectors and countries? • More efficient **co-use of scientific equipment** (instrumentation) across institutes, universities and borders (Sustainability/Goteborg etc)
	In order to make the best out of your time with us, we would like to continue the interview with the set of questions that you think you can contribute most, with your knowledge and experience.	
Part II. A set of questions with regards to NMP FP6 results will follow:		
Results	7. Can you identify and describe any **major achievements** of the NMP FP6?	• How do these achievements contribute to the production of first-class knowledge in Europe? • How do these achievements contribute to dealing with key industrial challenges in Europe? • How do these outcomes compare with the developments in the MS?
Results	8. How did the **dissemination** of results work in NMP FP6, in your opinion?	• Which problems and hinders to dissemination could you identify? • How does this compare with the situation in your country/ the MS?
Results	9. How effective do you consider was the **exploitation** of the projects results in NMP FP6?	• Knowledge produced, technologies and processes developed etc
Part III. A set of questions regarding NMP FP6 impacts on ERA and wider European objectives will follow		
Impacts	10. What impact has the NMPs FP6 made on priority setting in R&D in Europe? 11. What impact has the NMPs FP6 made on the emergence of new teams and innovative	• Ex. **Priorities** such reduction of overlaps, increased synergies, joint/shared evaluation and monitoring

	approaches in Europe and beyond? 12. What role do you think the NMP FP6 has played in Europe's relative position regarding NMP development in relation to other countries, such as US, Japan, China, Russia?	
Impacts	13. Have you noticed any **impact** of the NMP FP6 upon **MS NMP policies**?	• Any **reforms** undertaken at national level to incorporate a European perspective and transnational coherence? • Influences of **revisions** of NMP-work programmes? • Improved **co-ordination** between national and regional research funding? • Less dispersion of **resources** and duplication of efforts? • More (sustainable) **collaboration** after project termination? • Any co-use of **research infrastructures** (less duplication of equipment)? • Increased **business investments** in Nano R&D (e.g. initiated by tax incentives)? • Establishment of **innovation pools** (bringing together business, universities and investors)?
Impacts	14. Have you noticed any **impact** of the NMP FP6 upon **wider European objectives**? 15. (Optional) What role do you think NMPs have played with regards to intensified exploitation of **intellectual property rights**. 16. (Optional) What role do you think NMPs have played in sustainable development issues such as **CO_2-neutrality** and energy efficiency?	• Lowering regulation and administrative **barriers** to professional recognition? • Intensified exploitation of **intellectual property rights** cross Europe? • Strengthening **private investment**? • Increasing **private risk capital** for research? • More **networking** between business and the science base? • Increased sustainability in terms of **CO_2-neutrality** in materials and processes? • Lighter and more durable **materials**? • Increased **energy efficiency**? • New energy **technologies**? • New **production processes** and devices?
Part IV. A set of questions with regards to NMP FP6 relevance and effectiveness will follow		
Relevance & Effectiveness NMP FP6	17. How relevant do you think the **priorities** were in NMP FP6? * 18. How did the NMP priorities in MS look like in the MS during 2002-2006? *	
Relevance & Effectiveness NMP FP6	19. What was NMP FP6 good at? What was NMP FP6 bad at?	

Relevance & Effectiveness NMP FP6	20. If you are acquainted with the **monitoring process** of the work programmes, how do you assess the monitoring process of the FP6 programme? *	• Did the monitoring of the programme allow for appropriate reactivity and adaptation to changes on the scientific or industrial scene affecting NMP technologies? • Can you assess the monitoring process in comparison to the monitoring process in the national programmes?
Relevance & Effectiveness NMP FP6	21. If you are acquainted with the **revision process** of the work programmes, how do you think the revision process worked in NMP FP6?	• Can you assess the monitoring process in comparison to the monitoring process in the national programmes?
Relevance & Effectiveness NMP FP6	22. Was the level of **funding** provided to individual topics or area commensurate with the objectives assigned or the needs to reach critical mass? *	• If No, why?
	23. Did the programme allow **new groups** or sectors as well as new and emerging research teams to join, against established or traditional partners?	
Relevance & Effectiveness NMP FP6	24. Was the allocation of resources between different **FP6 instruments** appropriate in relation to the proposed objectives?	• Integrated Projects, Specific Targeted Research Projects, Networks of Excellence, Co-ordination Action, Specific Support Action, Researcher mobility
Part V. Lessons and Recommendations		
Lessons	25. Which **major lessons** have you learnt when working with NMP FP6?	With regards to: • Results, objectives, relevance and effectiveness of the programme, sustainable collaborations after project termination
Recommendations	26. Do you have any recommendations for the Commission with respect to developing **first class knowledge** and solutions dealing with major industrial challenges. 27. Do you have any recommendations for the EU Commission with respect to increased **commercialisation** of technologies? 28. Do you have any recommendations with regards to **increasing the role of SMEs** in NMP research and development? 29. Do you have any recommendations for the Commission with respect to exploitation of **intellectual property rights** cross Europe? 30. Do you have any recommendations for the Commission with respect to strengthening **private investment** in NMP-related R&D?	

Table 111. Interview guide

11.9 Additional recommendations from interviews

The following overview includes recommendations and suggestions for improvements of NMP and similar support measures that were stated in expert interviews but did not fulfil the necessary methodological requirements in terms of a triangulation of opinions, i.e. comparable statements would have to be made by at least three independent, unconnected experts. However, the evaluation team believes that those statements nevertheless contain important and valuable remarks, which should not be disregarded. At the same time, the reader is advised not to overestimate their individual importance. Please also note that these statements were taken directly from the respective interview minutes and have not been processed in any way. To facilitate the comprehension the statements have been allocated to different headlines.

Programme design and implementation

"… continue and increase cooperative calls, a large variety of projects is very good, GDs should be reformed, EU/FP projects is a good quality of the project, which facilitates attracting investments in the developing of the technology. The Finish model is a good example of attracting private investment."

"The reviews are not covering all topics, there is a large overlap. There must be a change to organize better the formulation process of the proposals. Then we will be sure to have lower redundancy and have a clear way for defining commercialization rules. You have to be able to make the decision there."

"So good European nano programme would be the one based on facilities, FET-like frame and the scientific industry, plus shared programme with application programmes (as you need sharing) on the nano dimensions of health nano dimensions of materials one, energy one, etc. and the sixth point is that each of those application programmes should have what I call a normative and societal and ethical dimension in the relation to the market (without trust – no investment). This is absolutely central. You may go on any market and ask the people there how they work on this market, they always relate to norms and standards. They would say that they shape and define the market. There must be a market infrastructure for the market to exist, if there is no low and justice you cannot sell the product."

"… innovation is not linear, but programmes are currently designed as if it was. The thought is that national labs should develop ideas and technologies and that companies should then put deploy them in the market place. Innovation is a very complicated and difficult process that is not fully understood. Companies should be involved in the research from an early stage."

"… [we need] economic studies to be undertaken to find other ways of financing the deployment of technologies in the market place."

"So a significant efficiency enhancement of EU FPs would be to reduce the level of complexity administration in those areas."

"If you talk about the implementation and exploitation, there are some things that need to be addressed with a stronger time relevance and commitment to do things preferentially in Europe, but having the boundary conditions in such a way that the alternative of not doing it in Europe is not really there, because we have the best trained people, we have the best environment, we have the project history in such a way that it's very difficult to do the same thing in another place in the world in a range of a couple of years. So putting all these things into a cohesive scenario, all the way starting from R&D concepts to discovery concepts, to large cycle management and projecting this into the set-up and the lay out of the funding structures and the research agendas could be one way of dealing with this. I know it's extremely difficult because you would have to take the scenarios and would have to turn the directorates upside down. But if you want to meet the challenges you have to really change the structure instead of just continuing what you've been doing."

"The recommendations I have is that there should be a way - on the national level - to counter the fact that it is fundamental to have a connection to people on reviewing boards when one applies for money. I think the EU is non-bureaucratic as compared to Sweden, and therefore the EU should perhaps take over more national funds (in Sweden and perhaps other countries) and device a greater degree of top-down approach. But the EU should get rid of the exaggerated focus on SMEs. When it comes to private-public partnerships, cultures are very different, so I suggest bringing in more academic researchers in private firms. They should recruit more people with solid academic background. Forestry as a sector has been bad at this, and generally as countries, Finland, Germany, and France have been successful in doing this."

"… the need for less project administration in terms of less paper work, better functioning of electronic reporting and better payment conditions."

"The key recommendation is to support research which is dictated by these key industrial challenges. And, of course, you need to know what those key industrial challenges are. And there is not really a general agreement of what the key industrial challenges are. So, you have to fix them. And then develop this first class knowledge, and then so on. Developing of first class knowledge in the hope that it would be used purely for the reason that it is first class - that don't work anymore."

"to have a massive investment in the internet conferencing facilities - this is suggested to cut down rapidly the travel costs and time spent on that. (...) For example travel for 1,5 hour meeting of 20 people from entire Europe seems to be total waste of money."

Commercialisation

"Another issue which describes the challenge of commercialization is the big gap of knowledge on the side of the investors. They are very conservative and ignorant and do not understand the benefits of the new technologies. The communication is not very good between the researchers and the investors. You have to educate these investors and develop better communication with them. One step in dealing with this problem was taken by the Singaporean government which launched incubations programmes."

"With regards to strengthening the competiveness of the EU, The EU Commission should have a clear vision of how are we turning the clear knowledge into value. This is something which was not explicit in FP6. But if we look at what was stimulated by FP6, the ETP idea brought a significantly strengthened involvement of industry in these discussions. ETP was a successfully transferred scenario from other industries such automotives and telecommunications. In chemicals this has turned out to be a quite valuable tool. This is something that NMP FP6 can be credited for."

"… need of Best Practices from other fields of research on how to bring technology to the market."

"So if you want to do technology transfer you have to create bodies that are knowledgeable about research, can help the SMEs within the industries with intricate questions on the topic itself. So you have to have people willing to visit the industry and demonstrate what is... and they have to be knowledgeable. And that is often missing in all our transfer activities that we do. These people are too superficial in their technical knowledge."

"And we have the European Development Bank. I think there are also some projects where they come in and give some very cheap loans to companies."

IPR

"Intellectual property rights-There must be a help from the Commission to apply for extra patent if its sound under the project, but not planned in the application. There must be a flexible tool to assure assistance in patenting process."

"… you give the projects' consortia more freedom to adjust and change their work plans, than you could generate probably more direct project related to IPR that would be closer to exploitation."

SME

"[To] Increase the role of SMEs, simplify the administration and paper work."

"Funding should support SMEs to a greater degree than now, and it is really the people in the SMEs that should be funded and not their specific ideas. Now you force them to describe their ideas, and the funding body's panels will say that there are hundred reasons why this would not work, while it really only takes one for a concept to work."

"Taking up SMEs in a later stage of the project should be made possible. Because what happens in the projects, you have to make the proposal, to set up things, then the project starts. In the beginning is more research and development, but towards the end the process is moving towards application, in production processes, production lines etc Then comes the validation. But at that stage there already have gone 4 years from the beginning of the project. This is too long for an SME. So there should be a possibility for the consortia to reserve an amount of money for the SMEs and at the mid-term make a call for the SMEs."

"SMEs involvement - simpler access, make it easier for them to participate, give them less administrative efforts, to provide resources to allow a more qualified submission of second-stage applications, which would provide opportunities for the partners to get familiar with each others, so that at the time of the project start you have a project team and not waist up to year until you have enough interaction between the project partners. So a relatively small financial effort could increase the project efficiency, would do a tremendous benefit."

Involvement of industry

"It is needed to stimulate the big and medium international companies to participate in the EU projects and participation of these companies in the R&D in the new MS."

International/European cooperation

"… the vast knowledge base outside of the EU and argues for more cooperation with, among others, the US … points to a global strategic manufacturing initiative which could be useful to link into, despite the initiative lags funding at present."

Dissemination

"Universities should support the development of society, and publishing the results for all to use freely perhaps best does that. The concept of patents really is contrary to the thought of the university to disseminate knowledge.".

11.10 Statistical information about NMP FP6 priority

Table: Allocations per country					
No.	Participant Country Name	Total projects costs per country	Total EU contribution per country	EU contribution/Total country cost %	Country share in total NMP FP6
A	B	C	D	E=D/C	F=D/total column D
1	Germany	501 756 104	301 857 597	60,2 %	20,9 %
2	United Kingdom	230 491 447	165 462 122	71,8 %	11,5 %
3	France	284 290 989	153 858 343	54,1 %	10,7 %
4	Italy	249 576 511	152 613 086	61,1 %	10,6 %
5	Spain	192 754 105	110 186 487	57,2 %	7,6 %
6	Netherlands	119 461 583	74 309 769	62,2 %	5,2 %
7	Belgium	108 783 013	67 910 655	62,4 %	4,7 %
8	Sweden	98 066 537	67 527 316	68,9 %	4,7 %
9	Switzerland	95 852 412	45 429 916	47,4 %	3,1 %
10	Finland	66 340 998	44 688 793	67,4 %	3,1 %
11	Austria	72 550 121	43 714 063	60,3 %	3,0 %
12	Greece	46 745 735	31 099 524	66,5 %	2,2 %
13	Poland	40 131 127	24 967 890	62,2 %	1,7 %
14	Denmark	36 465 324	24 168 789	66,3 %	1,7 %
15	Portugal	34 111 422	23 870 838	70,0 %	1,7 %
16	Ireland	21 674 315	18 793 096	86,7 %	1,3 %
17	Israel	25 346 362	18 420 712	72,7 %	1,3 %
18	Norway	19 416 273	11 758 922	60,6 %	0,8 %
19	Czech Republic	14 559 367	10 500 902	72,1 %	0,7 %
20	Slovenia	18 276 832	8 872 072	48,5 %	0,6 %
21	Hungary	10 479 938	7 663 966	73,1 %	0,5 %
22	Russian Federation	8 406 829	7 095 586	84,4 %	0,5 %
23	Romania	9 592 726	5 779 253	60,2 %	0,4 %
24	Turkey	5 694 025	3 915 671	68,8 %	0,3 %
25	Slovakia	4 482 519	3 324 415	74,2 %	0,2 %
26	Bulgaria	3 511 146	2 582 052	73,5 %	0,2 %
27	Luxembourg	8 660 767	2 453 387	28,3 %	0,2 %
28	Latvia	2 367 396	1 899 199	80,2 %	0,1 %
29	South Africa	3 291 399	1 596 700	48,5 %	0,1 %
30	China (People's Republic of)	2 592 603	1 107 658	42,7 %	0,1 %
31	Lithuania	1 084 588	947 099	87,3 %	0,1 %
32	Estonia	1 189 642	803 472	67,5 %	0,1 %
33	Remaining (24 countries)	6 403 404	3 310 642	68,1 %	0,1 %
	Total	2 344 407 560[138]	1 442 489 990	61,5 %	100,0 %
Source: Oxford Research 2009, data from EC.					

Table 112. Allocations per country in details , Source: Oxford Research AS, data from EC.

[138] According to two EC databases the total amount allocated for NMP FP6 projects is different. In the database NMP_contracts_basic_details_from_FP6_CUR_DM with project basic information the total is 2 346 557 673,96 and in the file NMP_contract_participant_persons_basic_dets_from_FP6_CUR_DM presenting contracts from different project partners the total is slightly different - 2 344 407 559,98 Euro . This is due to changes in participant's allocations. The total EC contribution stays the same in both databases.

Participant Country Name	CA	IP	NoE	SSA	STP	Total
Albania				17 880		17 880
Algeria		147 000				147 000
Argentina		76 000				76 000
Australia	-	-				-
Austria	404 364	28 864 220	3 226 722	355 078	10 863 679	43 714 063
Belarus				10 260	43 020	53 280
Belgium	1 382 292	37 138 414	10 232 528	891 820	18 265 601	67 910 655
Brazil				99 500		99 500
Bulgaria	40 580	1 301 102	251 371	53 340	935 659	2 582 052
Canada		-			82 500	82 500
China (PR of)		-		156 778	950 880	1 107 658
Colombia				17 940		17 940
Croatia				35 640		35 640
Cyprus		274 120	-	3 814	158 107	436 041
Czech Republic	53 010	5 015 537	2 126 004	120 293	3 186 057	10 500 902
Denmark	244 064	9 684 660	2 466 714	23 040	11 750 312	24 168 789
Estonia		160 072		84 848	558 552	803 472
Finland	265 824	29 201 444	1 948 731	522 557	12 750 237	44 688 793
France	2 005 631	79 994 476	22 570 750	1 303 282	47 984 204	153 858 343
Georgia				11 100		11 100
Germany	2 562 225	182 146 242	25 322 037	3 534 165	88 292 927	301 857 597
Greece	414 916	15 884 800	4 196 009	28 360	10 575 439	31 099 524
Hungary	101 020	3 601 629	1 131 882	62 470	2 766 965	7 663 966
Iceland	-				105 000	105 000
India		101 200			262 585	363 785
Ireland	174 892	6 701 807	626 479	55 652	11 234 266	18 793 096
Israel	531 882	8 478 260	2 129 472	44 778	7 236 320	18 420 712
Italy	1 338 535	83 159 962	14 477 094	1 814 005	51 823 491	152 613 086
Kazakhstan				27 050		27 050
Kenya				18 328		18 328
Latvia	54 164	48 233	423 330	3 076	1 370 396	1 899 199
Liechtenstein	25 000					25 000
Lithuania	8 283	262 860		3 209	672 747	947 099
Luxembourg		799 331	1 297 914		356 141	2 453 387
Malta	30 462				314 104	344 566
Mexico				42 320	81 600	123 920
Netherlands	1 233 263	45 366 834	7 803 509	763 047	19 143 117	74 309 769
Norway	193 487	6 324 605	1 138 065	581 467	3 521 299	11 758 922
Poland	258 763	11 836 352	5 720 415	532 279	6 620 080	24 967 890
Portugal	367 545	13 567 206	2 476 645	181 206	7 278 236	23 870 838
Romania	172 546	2 390 335	1 186 970	56 840	1 972 562	5 779 253
Russian Federation	44 332	1 289 811	1 946 363	11 400	3 803 680	7 095 586
Serbia and Montenegro	13 725	40 000		38 340	103 700	195 765
Slovakia	50 146	1 926 456	173 448	106 712	1 067 653	3 324 415
Slovenia	150 757	2 978 072	1 899 244	77 707	3 766 292	8 872 072
South Africa		1 500 000	-	96 700		1 596 700
Spain	752 134	73 402 018	13 354 060	564 799	22 113 476	110 186 487
Sweden	379 041	44 798 350	4 424 883	686 703	17 238 340	67 527 316
Switzerland	373 186	24 741 524	5 046 499	69 319	15 199 389	45 429 916
Thailand					197 820	197 820
Turkey	100 018	1 170 526	1 193 003	86 124	1 366 000	3 915 671
Ukraine		90 966	-	32 700	420 400	544 066
United Kingdom	1 824 458	87 809 520	18 431 601	1 486 572	55 909 972	165 462 122
Uruguay		261 800				261 800
Viet Nam					126 661	126 661
Total	**15 550 545**	**812 535 742**	**157 221 743**	**14 712 498**	**442 469 462**	**1 442 489 990**

Table 113. EC allocations per country and type of instrument (euro) Source: Oxford Research AS, data from EC.

	Share in country allocation per instrument					
Participant Country Name	CA	IP	NoE	SSA	STP	Total in NMP
Germany	0,85 %	60,34 %	8,39 %	1,17 %	29,25 %	20,93 %
United Kingdom	1,10 %	53,07 %	11,14 %	0,90 %	33,79 %	11,47 %
France	1,30 %	51,99 %	14,67 %	0,85 %	31,19 %	10,67 %
Italy	0,88 %	54,49 %	9,49 %	1,19 %	33,96 %	10,58 %
Spain	0,68 %	66,62 %	12,12 %	0,51 %	20,07 %	7,64 %
Netherlands	1,66 %	61,05 %	10,50 %	1,03 %	25,76 %	5,15 %
Belgium	2,04 %	54,69 %	15,07 %	1,31 %	26,90 %	4,71 %
Sweden	0,56 %	66,34 %	6,55 %	1,02 %	25,53 %	4,68 %
Switzerland	0,82 %	54,46 %	11,11 %	0,15 %	33,46 %	3,15 %
Finland	0,59 %	65,34 %	4,36 %	1,17 %	28,53 %	3,10 %
Austria	0,93 %	66,03 %	7,38 %	0,81 %	24,85 %	3,03 %
Greece	1,33 %	51,08 %	13,49 %	0,09 %	34,01 %	2,16 %
Poland	1,04 %	47,41 %	22,91 %	2,13 %	26,51 %	1,73 %
Denmark	1,01 %	40,07 %	10,21 %	0,10 %	48,62 %	1,68 %
Portugal	1,54 %	56,84 %	10,38 %	0,76 %	30,49 %	1,65 %
Ireland	0,93 %	35,66 %	3,33 %	0,30 %	59,78 %	1,30 %
Israel	2,89 %	46,03 %	11,56 %	0,24 %	39,28 %	1,28 %
Norway	1,65 %	53,79 %	9,68 %	4,94 %	29,95 %	0,82 %
Czech Republic	0,50 %	47,76 %	20,25 %	1,15 %	30,34 %	0,73 %
Slovenia	1,70 %	33,57 %	21,41 %	0,88 %	42,45 %	0,62 %
Hungary	1,32 %	46,99 %	14,77 %	0,82 %	36,10 %	0,53 %
Russian Federation	0,62 %	18,18 %	27,43 %	0,16 %	53,61 %	0,49 %
Romania	2,99 %	41,36 %	20,54 %	0,98 %	34,13 %	0,40 %
Turkey	2,55 %	29,89 %	30,47 %	2,20 %	34,89 %	0,27 %
Slovakia	1,51 %	57,95 %	5,22 %	3,21 %	32,12 %	0,23 %
Bulgaria	1,57 %	50,39 %	9,74 %	2,07 %	36,24 %	0,18 %
Luxembourg	0,00 %	32,58 %	52,90 %	0,00 %	14,52 %	0,17 %
Latvia	2,85 %	2,54 %	22,29 %	0,16 %	72,16 %	0,13 %
South Africa	0,00 %	93,94 %	0,00 %	6,06 %	0,00 %	0,11 %
China (PR of)	0,00 %	0,00 %	0,00 %	14,15 %	85,85 %	0,08 %
Lithuania	0,87 %	27,75 %	0,00 %	0,34 %	71,03 %	0,07 %
Estonia	0,00 %	19,92 %	0,00 %	10,56 %	69,52 %	0,06 %
Ukraine	0,00 %	16,72 %	0,00 %	6,01 %	77,27 %	0,04 %
Cyprus	0,00 %	62,87 %	0,00 %	0,87 %	36,26 %	0,03 %
India	0,00 %	27,82 %	0,00 %	0,00 %	72,18 %	0,03 %
Malta	8,84 %	0,00 %	0,00 %	0,00 %	91,16 %	0,02 %
Uruguay	0,00 %	100,00 %	0,00 %	0,00 %	0,00 %	0,02 %
Thailand	0,00 %	0,00 %	0,00 %	0,00 %	100,00 %	0,01 %
Serbia and Montenegro	7,01 %	20,43 %	0,00 %	19,58 %	52,97 %	0,01 %
Algeria	0,00 %	100,00 %	0,00 %	0,00 %	0,00 %	0,01 %
Viet Nam	0,00 %	0,00 %	0,00 %	0,00 %	100,00 %	0,01 %
Mexico	0,00 %	0,00 %	0,00 %	34,15 %	65,85 %	0,01 %
Iceland	0,00 %	0,00 %	0,00 %	0,00 %	100,00 %	0,01 %
Brazil	0,00 %	0,00 %	0,00 %	100,00 %	0,00 %	0,01 %
Canada	0,00 %	0,00 %	0,00 %	0,00 %	100,00 %	0,01 %
Argentina	0,00 %	100,00 %	0,00 %	0,00 %	0,00 %	0,01 %
Belarus	0,00 %	0,00 %	0,00 %	19,26 %	80,74 %	0,00 %
Croatia	0,00 %	0,00 %	0,00 %	100,00 %	0,00 %	0,00 %
Kazakhstan	0,00 %	0,00 %	0,00 %	100,00 %	0,00 %	0,00 %
Liechtenstein	100,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %
Kenya	0,00 %	0,00 %	0,00 %	100,00 %	0,00 %	0,00 %
Colombia	0,00 %	0,00 %	0,00 %	100,00 %	0,00 %	0,00 %
Albania	0,00 %	0,00 %	0,00 %	100,00 %	0,00 %	0,00 %
Georgia	0,00 %	0,00 %	0,00 %	100,00 %	0,00 %	0,00 %
Total	1,08 %	56,33 %	10,90 %	1,02 %	30,67 %	100,00 %

Table 114. EC allocations per country and type of instrument (%)Source: Oxford Research AS, data from EC.

Instrument	Total cost	Total EC contribution	Number of projects per instrument	Sum of projects' partners	Average total project cost per project	Average project budget per participant	Average EC contributions per project	Average project EC contributions per participant
CA	16 701 913	15 550 545	16	371	1 043 870	45 019	971 909	41 915
IP	1 366 828 583	812 535 742	95	2 505	14 387 669	545 640	8 553 008	324 366
NoE	297 944 376	157 221 743	22	441	13 542 926	675 611	7 146 443	356 512
SSA	18 464 020	14 712 498	36	247	512 889	74 753	408 681	59 565
STP	644 468 668	442 469 462	220	1 961	2 929 403	328 643	2 011 225	225 635
Total	2 344 407 560	1 442 489 990	389	5 525	6 026 755	424 327	3 708 200	261 084

Table 115. Averages per project type and participant. Source: Oxford Research AS, data from EC.

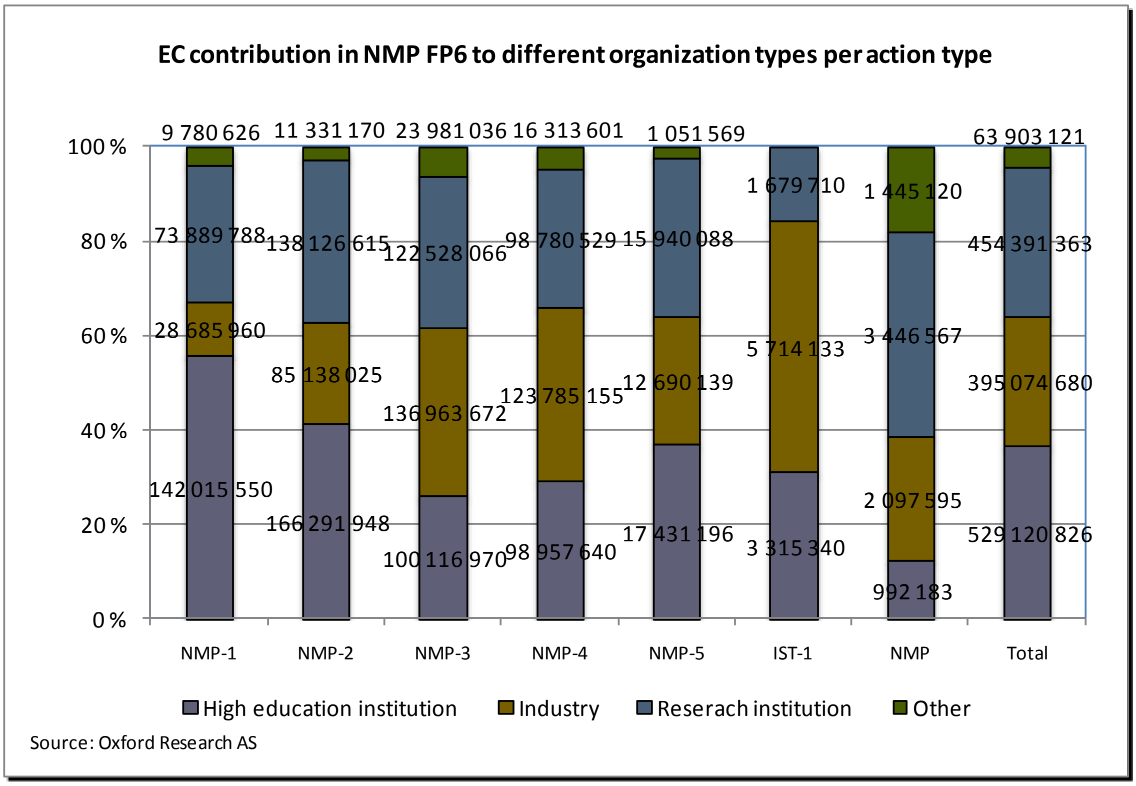


Figure 116. EC contribution in NMP FP6 to different organization types per action type. Source: Oxford Research AS, data from EC.

Table: List of all NMP FP6 calls for proposals:
Call for proposal symbol , area, activities and instruments covered, publication date
1. FP6-2003-ACC-SSA-NMP: Targeted Specific Support Actions (SSA) for Associated Candidate Countries Activity(s) called: NMP; Publication date: 02 April 2003
2. FP6-2002-NMP-1: Thematic call in the area of "Nano-technologies and nano-sciences, knowledge-based multifunctional materials, and new production processes and devices" Activity(s) called: NMP; Publication date: 17 December 2002
3. FP6-2006-TTC-TU-Priority-3: Specific call to promote the participation of partners from Targeted Third Countries in projects for which contracts are already signed or under negotiation in priority thematic areas of research. Activity(s) called: NMP; Publication date: 15 February 2006
4 - FP6-2003-ACC-SSA-General: Specific Support Actions (SSA) for Associated Candidate Countries Activity(s) called: Life sciences, genomics and biotechnology for health; Information Society Technologies; NMP; Aeronautics and space; Food quality and safety; Sustainable development, global change and ecosystems; Citizens and Governance in a knowledge-based society; Publication date: 02 April 2003
5 FP6-2003-NMP-TI-3-main: Thematic call in the area of 'Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices' Activity(s) called: NMP; Publication date: 13 December 2003
6. FP6-2004-NMP-TI-4: Thematic call in the area of 'Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices ' Activity(s) called: NMP; Publication date: 08 December 2004
7. FP6-2002-NMP-2: Dedicated call for SMEs in support to the development of new knowledge based added value products and services in traditional less RTD intensive industries Activity(s) called: NMP; Publication date: 17 December 2002
8. FP6-2003-NMP-STEEL-3: Dedicated call in the area of 'Very low CO_2 Steel Processes', launched in co-ordination with the 2003 and 2004 calls of the Research Fund for Coal and Steel, as referred to in the Council Decision 2003/78/EC (O.J. L29/28 of 05.02.03) Activity(s) called: NMP; Publication date: 13 December 2003
9. FP6-2002-IST-NMP-1: Thematic call in the area of "manufacturing, products and services engineering in 2010" Activity(s) called: Information Society Technologies; NMP; Publication date: 17 December 2002
10. FP6-2004-NMP-SME-4: Dedicated call for IPs for SMEs in the area of 'Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices' "Now only open to those who have submitted a first stage proposal." Activity(s) called: NMP; Publication date: 08 December 2004

11. FP6-2004-NMP-NI-4: Thematic call in the area of 'Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices' "Now only open to those who have submitted a first stage proposal." Activity(s) called: NMP; Publication date: 08 December 2004
12. FP6-2003-NMP-TI-3-ncp: Thematic call in the area of 'Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices' Activity(s) called: NMP; Publication date: 13 December 2003
13 .FP6-2004-NMP-NSF-1: Thematic call in the area of 'Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices ' Activity(s) called: NMP; Publication date: 15 June 2004
14. FP6-2003-NMP-SME-3: Dedicated call for IPs for SMEs in the area of 'Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices' Activity(s) called: NMP; Publication date: 13 December 2003
15. FP6-2003-NMP-NI-3: Thematic call in the area of 'Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices - NI ' Activity(s) called: NMP; Publication date: 13 December 2003
16. FP6-2004-IST-NMP-2: Second Joint Call between thematic priorities 2 and 3 Activity(s) called: Activity(s) called: Information Society Technologies; NMP; Publication date: 15 June 2004

Table 117. List on NMP FP6 calls for proposals, Source: Oxford Research AS, data from EC.

Calls for proposals	EC Contribution	Number of contracts
EC-INTERNAL-1	250 000	1
FP6-2002-IST-NMP-1	46 596 336	9
FP6-2002-NMP-1	459 065 989	118
FP6-2002-NMP-2	33 626 834	6
FP6-2003-ACC-SSA-NMP	466 980	9
FP6-2003-ADHOCSUBV	580 000	2
FP6-2003-NMP-NI-3	242 783 998	23
FP6-2003-NMP-SME-3	70 440 563	12
FP6-2003-NMP-STEEL-3	19 996 966	1
FP6-2003-NMP-TI-3-MAIN	119 258 194	68
FP6-2003-NMP-TI-3-NCP	662 470	1
FP6-2004-IST-NMP-2	87 456 480	31
FP6-2004-NMP-NI-4	157 313 332	21
FP6-2004-NMP-NSF-1	4 980 111	5
FP6-2004-NMP-SME-4	81 776 775	15
FP6-2004-NMP-TI-4	117 234 962	67
Total	1 442 489 990	389

Table 118. Allocations per call and number of contracts for each call. Source: Oxford Research AS, data from EC.

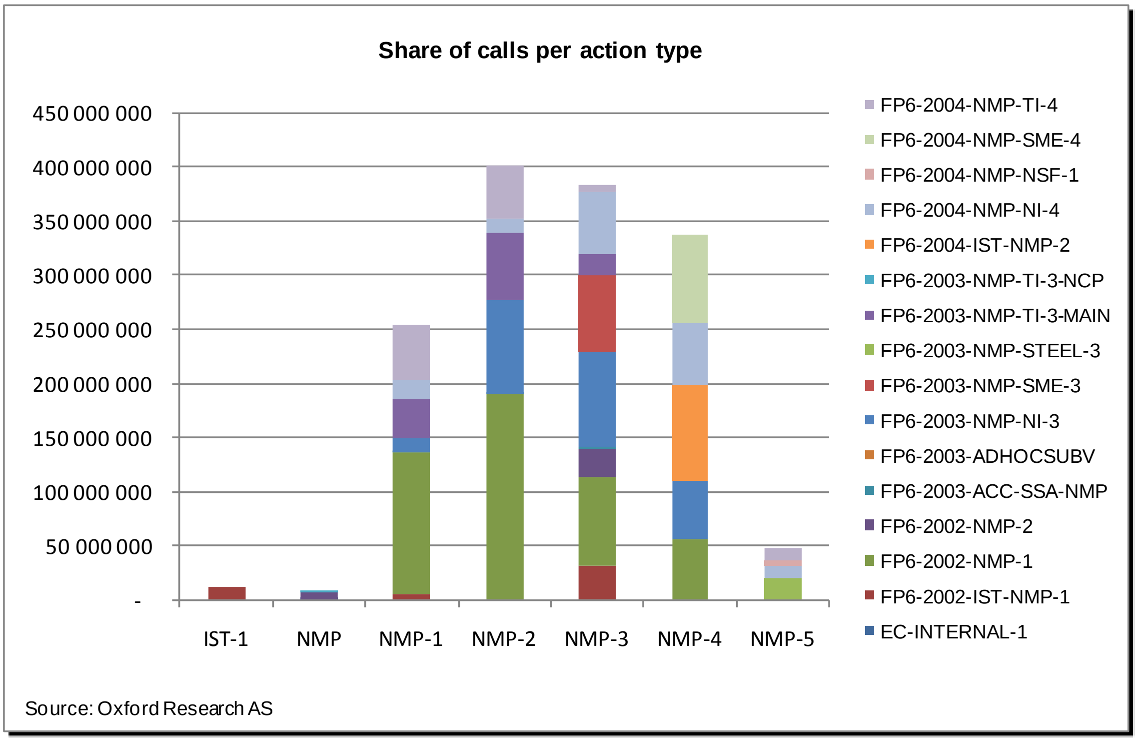


Figure 119. Financial share of calls per action type. Source: Oxford Research AS, data from EC.

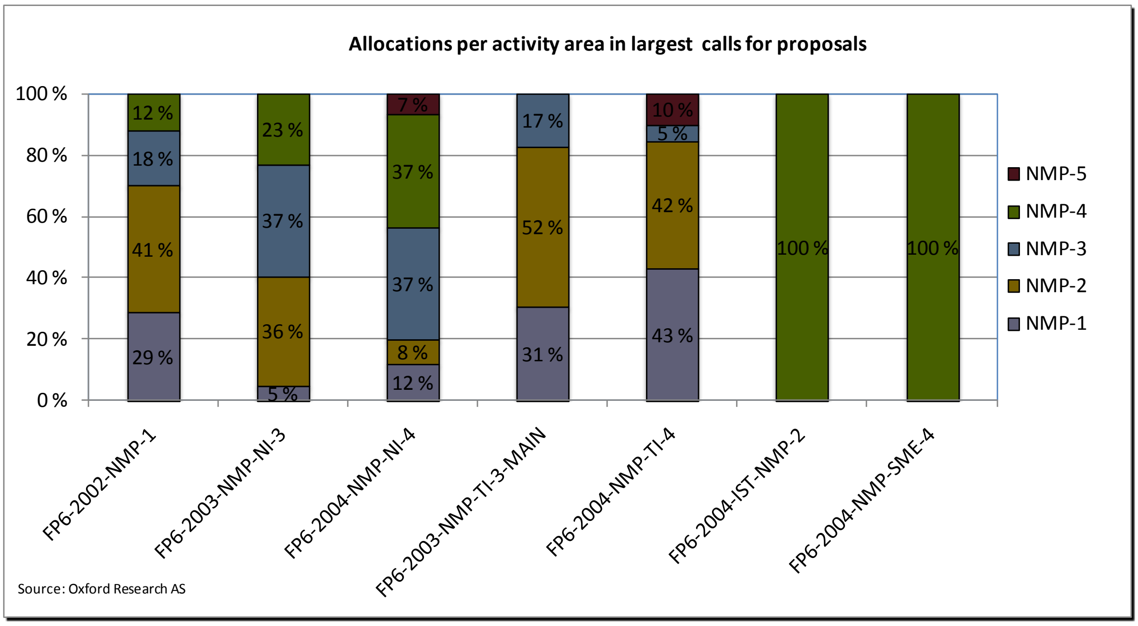
Action type	IST-1	NMP	NMP-1	NMP-2	NMP-3	NMP-4	NMP-5	Total
Call ID								
EC-INTERNAL-1		250 000						250 000
FP6-2002-IST-NMP-1	10 709 183		5 000 000		30 887 153			46 596 336
FP6-2002-NMP-1			131 429 673	190 498 996	82 010 511	55 126 809		459 065 989
FP6-2002-NMP-2		6 438 995			27 187 839			33 626 834
FP6-2003-ACC-SSA-NMP		50 000	146 980	150 000	120 000			466 980
FP6-2003-ADHOCSUBV		580 000						580 000
FP6-2003-NMP-NI-3			11 901 786	86 705 402	88 676 810	55 500 000		242 783 998
FP6-2003-NMP-SME-3					70 440 563			70 440 563
FP6-2003-NMP-STEEL-3							19 996 966	19 996 966
FP6-2003-NMP-TI-3-MAIN			36 422 412	62 364 144	20 471 639			119 258 194
FP6-2003-NMP-TI-3-NCP		662 470						662 470
FP6-2004-IST-NMP-2						87 456 480		87 456 480
FP6-2004-NMP-NI-4			18 997 720	12 344 766	57 494 028	57 976 861	10 499 957	157 313 332
FP6-2004-NMP-NSF-1							4 980 111	4 980 111
FP6-2004-NMP-SME-4						81 776 775		81 776 775
FP6-2004-NMP-TI-4			50 473 353	48 824 450	6 301 201		11 635 958	117 234 962
Total	10 709 183	7 981 465	254 371 924	400 887 758	383 589 744	337 836 925	47 112 992	1 442 489 990

Table 120. Allocations per call and action type (euro). Source: Oxford Research AS, data from EC.

Action type	IST-1	NMP	NMP-1	NMP-2	NMP-3	NMP-4	NMP-5	Total
Call ID								
EC-INTERNAL-1		100,0 %						0,0 %
FP6-2002-IST-NMP-1	23,0 %		10,7 %		66,3 %			3,2 %
FP6-2002-NMP-1			28,6 %	41,5 %	17,9 %	12,0 %		31,8 %
FP6-2002-NMP-2		19,1 %			80,9 %			2,3 %
FP6-2003-ACC-SSA-NMP		10,7 %	31,5 %	32,1 %	25,7 %			0,0 %
FP6-2003-ADHOCSUBV		100,0 %						0,0 %
FP6-2003-NMP-NI-3			4,9 %	35,7 %	36,5 %	22,9 %		16,8 %
FP6-2003-NMP-SME-3					100,0 %			4,9 %
FP6-2003-NMP-STEEL-3							100,0 %	1,4 %
FP6-2003-NMP-TI-3-MAIN			30,5 %	52,3 %	17,2 %			8,3 %
FP6-2003-NMP-TI-3-NCP		100,0 %						0,0 %
FP6-2004-IST-NMP-2						100,0 %		6,1 %
FP6-2004-NMP-NI-4			12,1 %	7,8 %	36,5 %	36,9 %	6,7 %	10,9 %

FP6-2004-NMP-NSF-1							100,0 %	0,3 %
FP6-2004-NMP-SME-4						100,0 %		5,7 %
FP6-2004-NMP-TI-4			43,1 %	41,6 %	5,4 %		9,9 %	8,1 %
Total	0,7 %	0,6 %	17,6 %	27,8 %	26,6 %	23,4 %	3,3 %	100,0 %

Table 121. Allocations per call and action type (%). Source: Oxford Research AS, data from EC.



Note: remaining 9 calls cover only 12,3 % of allocation.

Figure 122. Allocations per activity area in largest calls for proposals. Source: Oxford Research AS, data from EC.

Table: Participants per country[139]									
Country name	Number of records of participating institutions per country	Number of projects co-ordinated per country	Share of co-ordinated projects to all NMP FP6 projects	Number of industry institutions participating	Share of industry (including SMEs) to all records per country	Number of records SMEs are listed as participants	Share of SMEs records to all records per country	Number of projects co-ordinated by industry	Including Number of projects co-ordinated by SMEs
A	B	C	D=C/total C	E	F=E/total B	F	G=F/total B	H	I
Germany	962	76	20 %	405	42 %	121	13 %	12	4
Italy	595	52	13 %	252	42 %	102	17 %	12	8
UK	585	45	12 %	187	32 %	73	12 %	9	4
France	567	44	11 %	203	36 %	63	11 %	5	1
Spain	401	31	8 %	133	33 %	55	14 %	5	2
Netherlands	262	16	4 %	98	37 %	27	10 %	4	
Belgium	234	20	5 %	84	36 %	48	21 %	7	3
Switzerland	190	9	2 %	69	36 %	25	13 %		
Sweden	191	16	4 %	50	26 %	21	11 %	1	
Poland	165	5	1 %	39	24 %	10	6 %		
Finland	150	13	3 %	50	33 %	18	12 %	1	
Austria	145	10	3 %	51	35 %	22	15 %	5	3
Greece	132	9	2 %	48	36 %	32	24 %		
Portugal	118	7	2 %	40	34 %	14	12 %		
Denmark	105	6	2 %	44	42 %	23	22 %	4	3
Czech Rep.	73	1	0 %	28	38 %	14	19 %		
Israel	67	3	1 %	20	30 %	8	12 %		
Ireland	64	9	2 %	22	34 %	9	14 %		
Slovenia	54		0 %	17	31 %	5	9 %		
Romania	54	1	0 %	12	22 %	8	15 %		1
Hungary	50	1	0 %	13	26 %	5	10 %		
Russian	44		0 %	3	7 %	4	9 %		
Norway	49	6	2 %	17	35 %	6	12 %	1	
Slovakia	35	2	1 %	6	17 %	2	6 %		
Turkey	30	2	1 %	8	27 %	4	13 %		
Bulgaria	28	1	0 %	8	29 %	5	18 %		
China	22		0 %	6	27 %	2	9 %		
Latvia	16	1	0 %	2	13 %	1	6 %		
Estonia	12	1	0 %	3	25 %	4	33 %		
Lithuania	10		0 %	2	20 %		0 %		
Rest	77	2	1 %	10	13 %	2	3 %		
Total	5487	389	100 %	1930	35 %	733	13 %	66	29
Source: Oxford Research 2009, data from EC.									

Table 123. Participation per country, Source: Oxford Research AS, data from EC.

[139] Please note that one organization may participate in many projects, in that case it's counted as again!

Table: Participants per instrument and call for proposal					
	Type of institution				
Project instruments and action types	Research institutions	High education institutions	Industry	Other type	Total
CA	119	122	81	50	372
NMP	8	3	1	15	27
NMP-1	7	11		7	25
NMP-2	16	33	10	2	61
NMP-3	88	75	70	26	259
IP	558	537	1209	177	2481
IST-1	4	6	10	0	20
NMP	13	5	33	2	53
NMP-1	49	55	50	8	162
NMP-2	107	114	143	18	382
NMP-3	211	172	573	92	1048
NMP-4	154	163	374	55	746
NMP-5	20	22	26	2	70
NoE	145	249	31	15	440
NMP-1	32	58	7	4	101
NMP-2	75	120	18	9	222
NMP-3	27	48	3	2	80
NMP-4	11	23	3	0	37
SSA	90	61	31	65	247
NMP				4	4
NMP-1	19	13	4	32	68
NMP-2	10	6	6	5	27
NMP-3	43	26	15	19	103
NMP-5	18	16	6	5	45
STP	499	808	578	62	1947
NMP-1	139	307	94	11	551
NMP-2	210	310	245	28	793
NMP-3	54	66	105	10	235
NMP-4	70	99	124	11	304
NMP-5	26	26	10	2	64
Total	1411	1777	1930	368	5487

Table 124. Participation per instrument and call for proposal, Source: Oxford Research AS, data from EC.

Table: Participation structure per action type in %					
Action type	Research institutions	High education institutions	Industry	Other type (not specified)	Total
NMP-1	49 %	17 %	27 %	7 %	17 %
NMP-2	39 %	28 %	28 %	4 %	27 %
NMP-3	22 %	44 %	25 %	9 %	31 %
NMP-4	26 %	46 %	22 %	6 %	20 %
NMP-5	36 %	23 %	36 %	5 %	3 %
NMP	10 %	40 %	25 %	25 %	2 %
IST-1	30 %	50 %	20 %	0 %	0 %
Total	32 %	35 %	26 %	7 %	100 %
Source: Oxford Research 2009					

Table 125. Participation structure per action type in %. Source: Oxford Research AS, data from EC.

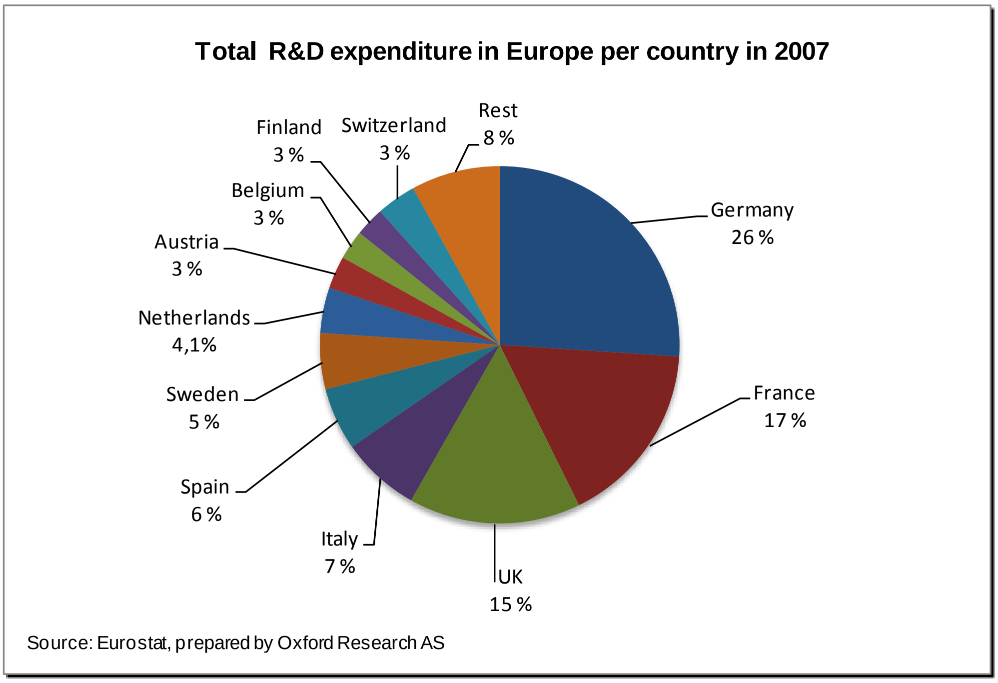


Figure 126. Total R&D expenditure in Europe per country in 2007 (%) Source: Oxford Research AS, data from EUROSTAT.

11.11 Overview of MS NMP-related programmes

Country	Name	AGENCY	ADMIN TYPE	SECTORS OVERVIEW	START/END
Austria	TechnoKontakte	TechnoKontakte GmbH	private	manufacturing	1996-
Austria	ERP Technology Programmes	AWSG	government agency	bio, nano, ener, env	1995-
Austria	AWS: Life Science Austria (LISA)	AWSG	government agency	pharma	2002-
Austria	IV2Splus Intelligente Verkehrssysteme und Services plus	Austrian Research Promotion Agency	government agency	ICT, nano, mat, trans	2007-2012
Austria	Austrian NANO initiative	Austrian Research Promotion Agency	government agency	nano	2003-2010
Belgium	Wallonia – Mobilising Programmes	DGTRE (Directorate General for Research, Technology and Energy) of the Ministry of the Walloon Region	ministry	wide	1995-
Belgium	Flanders: Strategic Basic Research financing channel	IWT	government agency	wide	2003-
Bulgaria	National Science Fund	Ministry of Education, Youth and Science National Science Fund	ministry	wide	2003-
Cyprus	Thematic Actions – DESMI 2003-2005, DESMI 2006)	Research Promotion Foundation	foundation	wide	2003-2006
Czech Rep.	INNOVATION – OP Enterprise and Innovation 2007-2013	Ministry of Industry and Trade with CzechInvest as the implementing agency.	ministry	wide	2007-2013
Czech Rep.	POTENTIAL – OP Enterprise and Innovation 2007-2013	Ministry of Industry and Trade with CzechInvest as the implementing agency.	ministry	wide	2007-2013
Czech Rep.	NRP II – TP1: Sustainable Prosperity	Ministry of Industry and Trade	ministry	wide	2006-2011
Czech Rep.	IMPULS	Ministry of Industry and Trade	ministry	wide	2004-2010
Czech Rep.	TANDEM	Ministry of Industry and Trade	ministry	wide	2004-2010
Czech Rep.	INNOVATION Operational Programme Industry and Entrepreneurship 2004 – 2006	Ministry of Industry and Trade with CzechInvest as the implementing agency.	ministry	wide	2004-2006
Denmark	Strategic programme for nanoscience and technology	The Danish Council for Independent Research (Det Frie Forskningsråd) Responsible from 2003-2004 The Danish Council for Strategic Research (Det Strategiske Forskningsråd) responsible from 2004-2005	research council	nano	2003–2005
Denmark	Strategic Programme on the Interdisciplinary Application of Nanotechnology, Biotechnology and Information and Communications	The Danish Council for Strategic Research (Det Strategiske Forskningsråd)	research council	ICT, nano, bio	2005–2008

	Technology				
Denmark	The Danish National Advanced Technology Foundation	The Danish National Advanced Technology Foundation	foundation	ICT, nano, bio	2004-
Denmark	Strategic research within sustainable energy and environment	The Danish Council for Strategic Research (Det Strategiske Forskningsråd) under Danish Agency for Science, Technology and Innovation (DASTI – Forskning og Innovationsstyrelsen). Contact DASTI.	government agency	eng, env	2004-
Denmark	High-tech Networks	Council for Technology and Innovation	research council	ICT, nano, bio	2004-2007
Estonia	R&D Financing Programme	Enterprise Estonia	government agency	wide	2001-2015
Finland	NewPro – Advanced Metals Technology - New Products	Tekes	government agency	mat	2004-2009
Finland	SymBio – Industrial Biotechnology	The Academy of Finland	government agency	nano	2006-2010
Finland	Research Programme on NanoScience (FinNano)	Tekes	government agency	bionano	2006-2011
Finland	Tekes programmes	Tekes	government agency	wide	1983-
Finland	Functional Materials	Academy of Finland	research institution	wide	2006-2010
Finland	Research Programme on Sustainable Production and Products (KETJU)	Tekes	government agency	wide	2007-2013
France	Innovation Development Contract (CDI)	OSEO The French Agency for Innovation (OSEO)	government agency	wide	2005-
France	Technology Platforms (PFT)	Ministry in charge of research, ministry of education and regional authorities	ministry	wide	2000-
France	PNANO	ANR Agence Nationale de la Recherche	government agency	nano	2005-
France	National network of technology centres for basic technological research	Ministry in charge of research, ministry of education and regional authorities	ministry	wide	2003-
Germany	Innovation Alliances	BMBF Federal Ministry of Education and Research	ministry	wide	2009-2012
Germany	"Nano Initiative - Action Plan 2010"	BMBF Federal Ministry of Education and Research	ministry	nano	2002-
Germany	SME innovative: Nanotechnology - NanoChance	Forschungszentrum Jülich (PTJ)	research institution	nano	2006-
Germany	Framework Programme: Materials Innovations for Industry and Society (WING)	Forschungszentrum Jülich (PTJ)	research institution	wide	2004-
Germany	Framework Concept for the Production of Tomorrow	Projektträger Forschungszentrum Karlsruhe	research institution	wide	1999-
Greece	"Joint ventures for research and technological development in sectors of national priority"	Geek Ministry of Development	ministry	wide	2002-2008

Greece	International co-operation in industrial research and development activities at pre-competitive phase	Geek Ministry of Development	ministry	wide	2005-2007
Hungary	NAP Nano: Setting up a Nanotechnology Research Laboratory	National Office for Research and Technology	government agency	nano	2006-2008
Hungary	National Technology Programme / "Jedlik Ányos" Programme – support for application oriented R&D	National Office for Research and Technology	government agency	wide	2000-
Hungary	Application-oriented co-operative RTD activity (AKF, GVOP 3.1.1)	National Office for Research and Technology	government agency	wide	2004-2006
Iceland	Postgenomic Biomedicine Nanoscience and Nanotechnology	Icelandic Centre for Research (RANNIS)	research institution	bio, nano, health	2005-2010
Ireland	Centres for Science, Engineering and Technology	Science Foundation Ireland	foundation	ICT, bio, nano,	2002-
Ireland	China Ireland Research Collaboration Fund	Royal Irish Academy	research institution	ICT, bio, mat,	2003-2006
Italy	Technological Districts	Italian Ministry of Education, University and Research	government agency	wide	2004-
Italy	PON – National Operating Programme	Italian Ministry of Education, University and Research	government agency	ICT, mat,	2000-2006
Italy	Funds to sustain Innovation and Technology Development in Enterprises	Italian Ministry of Education, University and Research	government agency	wide	2006-2008
Latvia	Support to international R&D collaboration (EUREKA) (in national language)	Latvian Council of Science	research council	nano, mat	2005-2009
Latvia	State research programme "Organic synthesis and biomedicine"	Latvian EUREKA National Project Co-ordination (NPC) Centre	research institution	wide	2000-
Latvia	State research programme "Material science"	Ministry of Education and Science	ministry	bio, health,	2005-2009
Lithuania	High technologies development programme	Lithuanian State Science and Studies Foundation	foundation	wide	2003-2006
Lithuania	Support to Priority Research and Experimental Development Trends in Lithuania	The Lithuanian State Science and Studies Foundation	foundation	wide	2003-2005
Lithuania	The Programme of Industrial Biotechnology Development in Lithuania for 2006-2010	The Lithuanian State Science and Studies Foundation	foundation	bio	2007-2010
Malta	National Research & Innovation Funding Programme	Malta Council for Science & Technology	research council	wide	2006–
Netherlands	Point-One (www.point-one.nl)	SenterNovem	government agency	wide	2006-2012
Netherlands	IOP (Innovation-oriented research programme)	SenterNovem	government agency	wide	1979-2015

Netherlands	Decree Subsidies Investment Knowledge Infrastructure (Besluit Subsidies Investeringen Kennisinfrastructuur; BSIK)	SenterNovem	government agency	wide	2004-2010
Netherlands	Sustainable Hydrogen Programme	Advanced Chemical Technologies for Sustainability (ACTS), part of the Dutch Research Council NWO	research council	energy	2002-2013
Norway	NANOMAT – Nano technology and new materials	Research Council of Norway	research council	wide	2002-2015
Norway	BIA – User-driven Research based Innovation	Research Council of Norway	research council	wide	2006-
Norway	RENERGI – Clean energy for the future	Research Council of Norway	research council	energy, env	2004-2013
Norway	Programme for natural gas power with improved environmental performance (Climit)	Research Council of Norway (research projects) and Gassnova (prototype and demonstration projects)	research council	energy, env	2005-
Poland	Support to applied research projects undertaken by science institutions	Ministry of Science and Education	government agency	wide	2002-
Portugal	NEOTEC Initiative	AdI – Agencia de Inovação (Innovation Agency)	government agency	ICT,	2004-2006
Romania	1999-2006 National R&D and Innovation Plan	Ministry of Education and Research – National Authority for Scientific Research	ministry	wide	1997-2006
Romania	Core R&D Programmes	Ministry of Education and Research – National Authority for Scientific Research	ministry	wide	2003-
Slovakia	Support of Industry Research and Pre-Competitive Development (SIRPCD)	The Slovak Innovation and Energy Agency	government agency	wide	2004-2008
Slovakia	Development of progressive technologies for efficient economy	Ministry of Economy	ministry	bio, mat, production,	2003-2006
Slovakia	Programme for support of research and development	The Slovak Research and Development Agency	government agency	wide	2002-2007
Slovakia	Scheme for Support of Research and Development	The Slovak Research and Development Agency	government agency	wide	2004-2007
Slovenia	Applied projects, and also Research programmes and Basic projects where the area of NMP is also strongly represented (but statistically not separately evidenced)	Slovenian Research Agency (ARRS)	government agency	wide	1995-
Spain	National Strategic Consortia for Technical Research (CENIT)	Centre for the Development of Industrial Technology (CDTI)	government agency	wide	2005-2011
Spain	CONSOLIDER Programme	Ministry of Education and Science (MEC)	ministry	bio, health, nano	2006-2010
Spain	Materials National Program	Ministry of Education and Science, ministry –now Ministry of Science and Innovation	ministry	materials/nano	1998-

Spain	Nanomaterials and nanotechnology strategic call	Ministry of Education and Science	ministry	nano	2004-2007
Spain	Complementary actions to support European Projects	Ministry of Education and Science –now Ministry of Science and Innovation	ministry	wide	2000-
Spain	Frontier Radical Science Program EXPLORA	Ministry of Science and Innovation	ministry	wide	2006-
Sweden	VINNVÄXT - Regional growth through dynamic innovation systems	The Swedish Research Council (VR), the Swedish Governmental Agency for Innovation Systems (VINNOVA)	research council	wide	2006-2015
Sweden	ProEnviro	The Swedish Research Council (VR), the Swedish Governmental Agency for Innovation Systems (VINNOVA)	government agency	wide	2002-2013
Sweden	Green Nano	Swedish Foundation for Strategic Research (SSF) and the Foundation for Strategic Environmental Research (Mistra)	foundation	wide	2008-2010
Sweden	Designed material incl. nanomaterial Opportunities testing and concept verification for R&D-orientated companies	Swedish Governmental Agency for Innovation Systems (VINNOVA)	government agency	nano, env,	2008-2010
Sweden	Multidisciplinary BIO	Swedish Governmental Agency for Innovation Systems (VINNOVA)	government agency	wide, bio	2006-2007
Sweden	Micro and Nanosystems A programme for research, development, which links life sciences with micro/nanoscience and IT	Swedish Governmental Agency for Innovation Systems (VINNOVA)	government agency	bio nano	2004-2008
Sweden	Berzelius Centres	Swedish Governmental Agency for Innovation Systems (VINNOVA)	government agency	nano, photon., electro.	2002-
Switzerland	NCCR Nanoscale Science	Swiss National Science Foundation (SNSF)	foundation	nano	2001-2012
Switzerland	National Centres of Competence in Research (NCCR)	Swiss National Science Foundation (SNSF)	foundation	wide	2001-
Switzerland	Nanotechnology and Microsystems	The Innovation Promotion Agency (CTI)	government agency	nano	2004-2007
Switzerland	ManuFuture	The Innovation Promotion Agency (CTI)	government agency	wide	2005-
Switzerland	National Research Programme NRP 47: "Supramolecular Functional Materials"	Swiss National Science Foundation (SNF)	foundation	nano, mat.	1998-2005
UK	Environmental Nanoscience Initiative (ENI)	Natural Environment Research Council (NERC)	research council	nano	2006-2014
UK	Basic Technology Research Programme	The Engineering and Physical Sciences Research Council (EPSRC)	research council	wide	2000-
UK	Technology Programme	Technology Strategy Board – TSB	government agency	wide	2004-
UK	Micro and Nanotechnology	Technology Strategy Board – TSB	government agency	wide	2003-

	Manufacturing Initiative				

Table 127. Overview of MS programmes relevant to NMP FP6, Source: Oxford Research AS.

89 different support measures were identified in Europe that support RTD in subjects relevant to NMP. Some of them are on the strategy level, some are minor programmes funded with small budgets. One of the first outcomes of this process is the statement that national measures differ to a very large extent. This is due first of all to the fact that in most of cases (74 out of 89) the measures are dedicated not explicitly to NMP but to a large variety of different research areas. Only 15 programmes are exclusively financing research in NMP (marked with grey colour in the table above). This might be again a good confirmation that nanotechnology and nanoscience is rather a general topic, enabling technology for conducting research in many sectors and not a self-standing application field, which might be treated separately from industry sectors.

The second part of differences in this context is budgetary allocation. It was impossible to calculate real allocations dedicated only to NMP related research. To do that we would have to analyse all financial reports from all projects financed under those 89 identified national measures. One must bear in mind that some of the programmes are still ongoing, and projects are under implementation, some has been finished, but in most of cases detailed evaluations has not been conducted, and monitoring reports are simply hidden in implementing institutions' archives, some of them are confidential.

Another factor blurring the whole picture is that in some of the countries research in the field of NMP (as part of general research and high education support, including infrastructure development) has been implemented through operational programmes created within EU structural funds. This creates a situation where allocations dedicated to RTD infrastructure development including NMP field have been united with EU money available from other European budget lines, and supplemented with necessary in that case national input to structural funds projects. In general data available in this field do not show a real allocation dedicated to NMP in all member states using multiple sources of funding.

For those of the national measures identified as financing only NMP-relevant activities, most of the resources are administrated directly by ministries and their relevant agencies:

		Potential beneficiaries		
Country	Name	Research/educational/ technical inst.	Companies	SME's
Austria	TechnoKontakte		X	X
Austria	ERP Technology Programmes		X	X
Austria	AWS: Life Science Austria (LISA)			X
Austria	IV2Splus Intelligente Verkehrssysteme und Services plus	X	X	X
Austria	Austrian NANO initiative	X	X	X
Belgium	Wallonia – Mobilising Programmes	X	X	X
Belgium	Flanders: Strategic Basic Research financing channel	X	X	X
Bulgaria	National Science Fund	X		
Cyprus	Thematic Actions – DESMI 2003-2005, DESMI 2006)	X	X	X
Czech Rep.	INNOVATION – OP Enterprise and Innovation 2007-2013	X	X	X

Czech Rep.	POTENTIAL – OP Enterprise and Innovation 2007-2013		X	X
Czech Rep.	NRP II – TP1: Sustainable Prosperity	X	X	X
Czech Rep.	IMPULS	X	X	X
Czech Rep.	TANDEM	X	X	X
Czech Rep.	INNOVATION Operational Programme Industry and Entrepreneurship 2004 – 2006	X	X	X
Denmark	Strategic programme for nanoscience and technology	X	X	X
Denmark	Strategic Programme on the Interdisciplinary Application of Nanotechnology, Biotechnology and Information and Communications Technology	X	X	X
Denmark	The Danish National Advanced Technology Foundation		X	X
Denmark	Strategic research within sustainable energy and environment	X	X	X
Denmark	High-tech Networks	X	X	X
Estonia	R&D Financing Programme	X	X	X
Finaland	NewPro – Advanced Metals Technology - New Products	X	X	X
Finaland	SymBio – Industrial Biotechnology	X		
Finaland	Research Programme on NanoScience (FinNano)	X	X	X
Finaland	Tekes programmes	X	X	X
Finaland	Functional Materials	X		
Finaland	Research Programme on Sustainable Production and Products (KETJU)	X	X	X
France	Innovation Development Contract (CDI)			X
France	Technology Platforms (PFT)	X	X	X
France	PNANO	X	X	X
France	National network of technology centres for basic technological research	X		
Germany	Innovation Alliances	X	X	X
Germany	"Nano Initiative – Action Plan 2010"	X	X	X
Germany	SME innovative: Nanotechnology – NanoChance			X
Germany	Framework Programme: Materials Innovations for Industry and Society (WING)	X	X	X
Germany	Framework Concept for the Production of Tomorrow	X	X	X
Greece	"Joint ventures for research and technological development in sectors of national priority"	X	X	X
Greece	International co-operation in industrial research and development activities at pre-competitive phase	X	X	X
Hungary	NAP Nano: Setting up a Nanotechnology Research Laboratory	X		
Hungary	National Technology Programme / "Jedlik Ányos" Programme – support for application oriented R&D	X	X	X
Hungary	Application-oriented co-operative RTD activity (AKF, GVOP 3.1.1)	X	X	X
Iceland	Postgenomic Biomedicine Nanoscience and Nanotechnology	X		
Ireland	Centres for Science, Engineering and Technology	X		
Ireland	China Ireland Research Collaboration Fund	X		
Italy	Technological Districts	X	X	X
Italy	PON - National Operating Programme	X	X	X
Italy	Funds to sustain Innovation and Technology Development in Enterprises	X	X	X
Latvia	Support to international R&D collaboration (EUREKA) (in national language)	X	X	X

Latvia	State research programme "Organic synthesis and biomedicine"			X
Latvia	State research programme "Material science"	X	X	X
Lithuania	High technologies development programme	X	X	X
Lithuania	Support to Priority Research and Experimental Development Trends in Lithuania	X	X	X
Lithuania	The Programme of Industrial Biotechnology Development in Lithuania for 2006-2010	X	X	X
Malta	National Research & Innovation Funding Programme	X	X	X
Netherlands	Point-One (www.point-one.nl)	X	X	X
Netherlands	IOP (Innovation-oriented research programme)	X	X	X
Netherlands	Decree Subsidies Investment Knowledge Infrastructure (Besluit Subsidies Investeringen Kennisinfrastructuur; BSIK)	X	X	X
Netherlands	Sustainable Hydrogen Programme	X		
Norway	NANOMAT – Nano technology and new materials	X	X	X
Norway	BIA – User-driven Research based Innovation	X	X	X
Norway	RENERGI – Clean energy for the future	X	X	X
Norway	Programme for natural gas power with improved environmental performance (Climit)	X	X	X
Poland	Support to applied research projects undertaken by science institutions	X		
Portugal	NEOTEC Initiative	X	X	X
Romania	1999-2006 National R&D and Innovation Plan	X	X	X
Romania	Core R&D Programmes	X		
Slovakia	Support of Industry Research and Pre-Competitive Development (SIRPCD)	X	X	X
Slovakia	Development of progressive technologies for efficient economy	X	X	X
Slovakia	Programme for support of research and development	X	X	X
Slovakia	Scheme for Support of Research and Development		X	X
Slovenia	Applied projects, and also Research programmes and Basic projects where the area of NMP is also strongly represented (but statistically not separately evidenced)	X		
Spain	National Strategic Consortia for Technical Research (CENIT)	X	X	X
Spain	CONSOLIDER Programme	X		
Sweden	VINNVÄXT - Regional growth through dynamic innovation systems	X	X	X
Sweden	ProEnviro	X	X	X
Sweden	Green Nano	X		X
Sweden	Designed material incl. nanomaterial Opportunities testing and concept verification for R&D-orientated companies	X	X	X
Sweden	Multidisciplinary BIO	X	X	X
Sweden	Micro and Nanosystems A programme for research, development, which links life sciences with micro/nanoscience and IT	X	X	X
Sweden	Berzelius Centres	X	X	X
Switzerland	NCCR Nanoscale Science	X		
Switzerland	National Centres of Competence in Research (NCCR)	X		
Switzerland	Nanotechnology and Microsystems	X	X	X
Switzerland	ManuFuture	X	X	X
Switzerland	National Research Programme NRP 47: "Supramolecular Functional Materials"	X		

UK	Environmental Nanoscience Initiative (ENI)	X		
UK	Basic Technology Research Programme	X		
UK	Technology Programme	X	X	X
UK	Micro and Nanotechnology Manufacturing Initiative	X	X	X

Table 128. Overview of possible beneficiaries of the country programmes. Source: Oxford Research AS.

Most of the national programmes are allocating resources to research institutions and educational institutions as primary beneficiaries. Only 3 programmes out of 89 analysed were dedicated only and specifically to SMEs.

The general conclusion here is that almost all of them finance all three types of beneficiaries. In most of the cases definitions of objectives of the programmes indicate that the collaboration between research institutions and industry (including SMEs) is a highly important factor. Networking initiatives are important factor also on national level.

Country	NAME	Overview of objectives of selected country programmes
Austria	Austrian NANO initiative	• The Austrian NANO Initiative funds collaborative research. The collaborative setting is similar to what can be seen in EU-FP with networks of research institutes, universities and firms working on problem driven basic research and applied research questions with a medium term perspective (5-7 years) with regard on large scale Cluster projects. It was perceived that the Austrian funding system lacks funding instruments for midterm research activities of collaborative RTD between science and industry with the aim to build up critical masses. Goals: • Broadening the co-operation basis between science and industry • Strengthening research competence in fields of application relevant to Austrian enterprises • Accelerating technology transfer and increasing the economic utilisation of nanotechnology • Improving access to know-how and to co-operation partners abroad • Decreasing insecurities and information deficits with regard to health risks and environmental risks • Establishing nanotechnology in the context of public perception of Austria as a research location, of science communication and of promoting young researchers List of policy priorities: • R&D co-operation (joint projects, PPP with research institutes); • Policy measures concerning excellence, relevance and management of research in Universities; • Research Infrastructures; • Direct support of business R&D (grants and loans) Overview of policy priorities: • Establishment of poles and networks of excellence in a specific field (Nanotechnology) • Clustering activities on national level • Information on and awareness of new technological options
Belgium	Flanders: Strategic Basic Research financing channel	The SBO financing channel provides financial support to all R&D actors that perform strategic basic research in Flanders. It aims to mobilize and combine the necessary expertise regardless of the nature of the R&D actor. The establishment of consortia with cross-organizational co-operation is explicitly encouraged. The project is in line with the core task of Flemish innovation policy as identified in the policy plan 2006 for science and innovation: knowledge transfer to Flemish SME's and mobilizing knowledge where innovation is not spontaneous. Overview of policy priorities Co-operation on all levels of actors is an intervention that improves interaction in the entire Science & Innovation system in Flanders. The SBO financing policy is not directly aimed at SME's. However, SME's can also apply for these funds and will benefit from the desired transfer of knowledge.

Denmark	Strategic Programme on the Interdisciplinary Application of Nanotechnology, Biotechnology and Information and Communications Technology	• The goal of the programme is to strengthen and contribute to new research at the interface between nanotechnology, biotechnology and information and communication technology, in order to making possible international breakthrough and/or important social utility value, including economic relevance. • The programme prioritised in the call for 2005 projects that: – Support collaboration between Danish research groups covering to or more of the actual research areas – Collaboration between industry and public research groups • The programme will fund: – Strategic networks and – Minor, strategic research projects. • Prioritised are projects that: – Identify and develop future possibilities for innovation and solving of social problems – Are on a international high level of research quality – Are across established knowledge areas – Based on near collaboration between research groups, firms and other groups interested in research Background and rationale: • Denmark is dependent on the use of new knowledge and competence for securing the further development of the society. Good, future oriented research is here a key issue. Many other countries have strengthened the research input in nanotechnology, biotechnology and ICT. If Denmark does not invest in this research fields Denmark will lag behind in the application of the scientific results. • The development in all three technology areas will be important for several industrial branches in Denmark, where Danish industry traditionally has a strong position. The programme is focussing on synergetic effects by supporting research at the interfaces between these technologies. Policy priorities: • Strategic Research policies (long-term research agendas); • R&D co-operation (joint projects, PPP with research institutes); • Stimulation of PhDs
France	PNANO RTB	With regard to the organisation of research and development, nanotechnologies' characteristics are reflected in the ANR programme: need for multidisciplinary actions, convergence between knowledge and technologies, bridging the gap between fundamental research to applications The programme PNANO aims to explore new approaches to structuring matter and to discovering new properties at the molecular level by combining top-down and bottom-up approaches. It furthermore aims to implement these new properties, effects in innovative and disruptive functions for information, and communication processing techniques, through technological development, architecture integration and specific instrumentation, and simulation methodologies and techniques. This programme continues and expands; ideas initially proposed under the Blanc programme were implemented into an engineering science programme concerning information and communication technologies.

Germany	"Nano Initiative – Action Plan 2010"	• The underlying rationale is characterized by a new strategy for funding and support of nanotechnology. Hence, the Federal Ministry of Education and Research (BMBF) focuses the strategy on – The creation of new jobs and markets – Leading-edge innovations – Networking of research institutions and actors – Using chances of European and international co-operation – Strengthening of SMEs and new spin-offs – Supporting young scientists – Initiating societal discourses concerning nanotechnology's chances and risks • Primarily aims to open up the application potential of nanotechnology through research collaborations (leading-edge innovations) that strategically target the value-added chain. In addition, the BMBF is working to counteract the danger of a shortage of qualified scientists and technicians through its education policy activities. • The key to creating new markets and new job-opportunities is to vigorously channel research funding towards innovation. Innovations form the foundation of Germany's competitiveness and, as a result, the basis for growth and employment. The BMBF is taking on this challenge and is shaping its innovation policy in the area of nanotechnology funding accordingly. The primary goals of this effort are to enhance the economy's profile in global competition, to consolidate and extend economic strengths, and to seize upon new developments in technology, the economy and society. A higher-profile effort to promote research in the area of nanotechnology should focus primarily on areas where special economic leverage can be exploited. This would include creating jobs with secure futures, preserving and expanding technological leadership, integrating ranges of services, and supporting German companies as system leaders in the global market. • Research efforts are being focused on key areas of innovation, i.e. on strategic technological developments pursued jointly by industry and the scientific community with a pooling of research capacities and funds across multiple technologies. Policy priorities: • Strategic Research policies (long-term research agendas) • R&D co-operation (joint projects, PPP with research institutes)
Hungary	National Technology Programme / "Jedlik Ányos" Programme – support for application oriented R&D	Supported projects are required to contribute to: • Realising application-oriented research and development, especially by firms, underpinning innovations with wide-ranging socio-economic impact • Achieving internationally competitive scientific and technological results • Competitive products, technologies and services with high intellectual added value • Strengthening the innovative capability of enterprises, • Achieving long-term, strategic R&D objectives of enterprises, • The complex solution of the economic-social challenges by strengthening the co-operation between enterprises, • The formation of strategic partnerships between firms and the R&D sector • Developing competitive products and services that can be utilised in the economy, • The supply of young researchers by involving PhD students and young post-doctors in the projects • Enhancing the competitiveness of the economy • Facilitating the Hungarian preparation for the 7th Research and Development Framework Programme of the European Union. The projects should be implemented using mostly Hungarian financial resources and other matching funds. Annual calls of the scheme define various thematic priorities (sub-programmes).

		The most recent call of this scheme, published in February 2009, invites project proposals in the following fields (sub-programmes): 1. Life sciences (A1) 2. Competitive Industry (A2) 3. Competitive Agriculture and food industry (A3) 4. Liveable and Sustainable Environment (A4) 5. Security and safety researches (D5) Background and rationale: • The scheme is aimed at supporting large scale, integrated projects, with potential major long-term impacts on competitiveness and quality of life through the development of innovative products, procedures, services, technologies and materials with scientific breakthroughs or significant intellectual added value. These projects have to be conducted jointly by publicly financed research organisations and businesses, thus the scheme promotes academia-industry co-operation. Reverse brain-drain, engaging PhD students and post-docs in R&D projects, as well as increased mobility of researchers are also promoted. Policy priorities: • R&D co-operation (joint projects, PPP with research institutes) • Direct support of business R&D (grants and loans) • Relation between teaching and research
Ireland	Centres for Science, Engineering and Technology	Overview: • The Centres for Science, Engineering and Technology (CSET) measure is one of the main funding programmes established by Science Technology Ireland (SFI). • The aim of the CSET programme is link scientists and engineers in partnerships across academia and industry to address crucial research questions, foster the development of new and existing Irish-based technology companies, attract industry that could make an important contribution to Ireland and its economy, and expand educational and career opportunities in Ireland in science and engineering. • It is a key requirement of the programme that CSET-funded centres must exhibit outstanding research quality, intellectual breadth, active collaboration, flexibility in responding to new research opportunities, and integration of research and education in biotechnology and ICT. The objectives of the Centres for Science, Engineering and Technology programme are as follows: – Create centres formed by clusters of internationally competitive researchers from the third-level sector and industry, particularly Irish-based industry. – Support excellence in research and education as measured by international merit review. – Exploit opportunities in science, engineering and technology where the complexity of the research agenda requires the advantages of scope, scale, dynamism, synergy, duration, equipment and facilities that a centre can provide. – Promote organisational connections and linkages within and among campuses, industry, other research bodies, private-sector research laboratories and international collaborators. – Support frontier investigations across disciplines that underpin biotechnology, ICT, or both, and are essential to developing and strengthening Ireland's industrial base. – Engage intellectual talent within Ireland in advanced research and education. – Foster science and engineering in service to society, especially in research areas that promise to create new technologies. Industry collaboration is an important feature of the CSET programme; consequently, CSET projects must include an industry partner.

		Background and rationale: • The aim of the Centres for Science, Engineering and Technology programme is to encourage research that brings together academic and industrial partners. The programme was developed by Science Foundation Ireland which was established by the Irish government to manage and administer the national technology foresight investment fund for biotechnology and information communications technology (ICT). Policy priorities: • Strategic Research policies (long-term research agendas) • Support infrastructure (transfer offices, training of support staff) • Knowledge Transfer (contract research, licenses, research and IPR issues in public/academic/non-profit institutes) • R&D co-operation (joint projects, PPP with research institutes)
Netherlands	Point-One (www.point-one.nl)	The programme objective of P1 is to establish a dynamic network of companies and knowledge institutes that is world-leading in terms of development and application of knowledge in the areas of nanoelectronics, embedded systems and mechatronics. Point-One works along four modules: Module I • International R&D projects for European road-map implementation • Aligned with EUREKA clusters and Joint Technology Initiatives Module II • National R&D projects for bottom-up ideas • Complementing the European road-map Module III • Projects to strengthen the high-tech ecosystem • SME stimulation, human capital agenda, regional networks Module IV • Focused university-industry co-operation • Jointly defined PhD/post-doctoral projects "The programme Point-One has been extended with Phase2 in 2008. The "Programme for High tech Systems" has been integrated with Point-One. As a result the working field (nano-electronics and embedded systems) has been extended with mechatronics and robotics." (Ministry of Economic Affairs, 2008)

Norway	NANOMAT – Nano technology and new materials	Overview: • The aim of this initiative within nanotechnology and materials technology (NANOMAT) is to enforce basic knowledge in order to pave the way for new knowledge-based and research-intensive industry, and provide a sustainable revitalisation of established Norwegian industry. The programme aims at inducing research of high international quality. It has set two major priorities: – To develop new materials, with the focus on functional materials – To focus on selected parts of nanotechnology Background and rationale: • The paramount objectives of this basic, long-term initiative in materials research and nanotechnology are to: 1. Ensure that Norwegian research maintains high international standards in selected fields, making Norway an interesting partner for European and international research through a co-ordinated Norwegian campaign; 2. Enhance expertise in technologies which to an ever greater extent will make their mark on and control our everyday routines and freedom of action; 3. Pave the way for new knowledge-based, research-intensive industry and more value added, based on new products and new technology in sensors and smart materials, microtechnology, new energy technology, new environmental technology, new process technology, etc.; 4. Develop a national pool of expertise in materials technology as the basis for a sustainable revitalisation of established Norwegian industry; – technology for improving the efficiency of processes, cleaning, recycling and recirculation; – realising additional value added from national oil and gas resources; 5. Develop a materials technology platform for products and technology that improve quality of life, e.g. in medicine/medical technology, biotechnology, environmental technology, food technology and energy production; 6. Develop cutting-edge international expertise on selected topics and boost participation in the EU's framework programme. Policy priorities: • Strategic Research policies (long-term research agendas) • Policy measures concerning excellence, relevance and management of research in Universities • Research Infrastructures
Slovakia	Programme for support of research and development	This programme supports basic research of superior quality, applied research and development in all science disciplines and technology including support of interdisciplinary and multidisciplinary research based on top quality The Agency yearly publishes a general calls for scientific research projects. These calls are related to specified themes that include: 1. Impact of environment and nutrition on quality of life 2. Technologies for information society (include nanotechnology for information technologies) 3. Biotechnology 4. Progressive production technologies (include nanotechnology, new progressive technologies, new products with a high added value) 5. Actual socio-economic problems In addition to these priorities, the call is open also for projects with a high scientific value without any thematic restrictions.

		Policy priorities: • R&D co-operation (joint projects, PPP with research institutes) • Direct support of business R&D (grants and loans) • Support to sectoral innovation in manufacturing
Spain	National Strategic Consortia for Technical Research (CENIT)	• This Programme, which is a part of the INGENIO 2010 initiative, aims to fund projects that may improve the technical and scientific capabilities of the participating companies and research groups. These projects will also extend co-operation among different role-players in the research and development process. The funding of big integrated and long term projects of industrial research, is foreseen with ambitious objectives, oriented towards planned research in future areas with international potential. • Its main objectives are, in summary, the increase in public and private co-operation on R&D matters. More precisely, the CENIT Programme is aimed at promoting the development of big project that will increase the scientific and technological capacity of national companies and research groups. As well as this, this programme seeks to spread co-operation in research among involved agents, as well as encouraging SMEs to take part. Finally, it also facilitates the access of the participants to international programmes, such as the EU framework programme. • The National Strategic Consortia, which are to be financed equally by the public and private sectors, will mean a rise in the research and development expenditures, which could increase up to 1,000 million euro throughout the next five years. CENIT will give priority to proposals with financial backing from one or more of the Autonomous Communities. • The CENIT programme will also host the Torres Quevedo programme, an initiative aimed at promoting the inclusion of university doctors in the private sector. For more information regarding the Torres Quevedo programme, please refer to its specific Research Programme template, available here. • Another action foreseen within the CENIT Programme is the creation of a Fund of Funds for investing in private venture capital, in an attempt to tackle the lack of tradition of the Spanish markets in financing R&D&Innovation. Background and rationale: • The Spanish National Plan for R&D and innovation (2008-2011) consists of six Instrumental Working Lines (IWL): (1) Human Resources; (2) R&D and Innovation Projects; (3) Institutional reinforcement; (4) Scientific and technological infrastructure; (5) Use of knowledge and technology transfer; and (6) Articulation and internalisation of the system. Each of those lines has one or several National Programmes and each of those has one or several subprogrammes.

		• The IWL consists of three national programmes: 1. National Programme of Networks 2. National Programme of public-private co-operation 3. National Programme of Internationalisation of the R&D • The aim of the National Programme of public-private co-operation is the encouragement of stable co-operation in R&D and innovation between public and private organisations that carry out research by financing R&D projects that increase the knowledge production of the R&D&I system. There is a special emphasis on seeking large projects that improve the scientific and technological capabilities of the firms and national research groups, extending the co-operative culture in R&D and innovation; preparing consortia to obtain easier access to international finance for R&D (such as the Framework Programme of the EU) and mobilising the participation of SMES in large projects. • The programme consists of three instruments (sub-programmes) with different specific characteristics. 1. Sub-programme CENIT 2. Sub-programme for Singular Strategic Projects 3. Sub-programme for co-operative public-private projects in relation with transport and infrastructures Policy priorities: • Strategic Research policies (long-term research agendas) • Knowledge Transfer (contract research, licenses, research and IPR issues in public/academic/non-profit institutes) • R&D co-operation (joint projects, PPP with research institutes)
Switzerland	NCCR Nanoscale Science	The strategic goals of the measure are to create a strong presence in a strategic field in scientific and economic terms through long term cutting-edge research projects, advancing the already excellent "research infrastructure" and to bridge the gap between basic science and industrial application. • The "NCCR Nanoscale Science" focuses at research concerning the nanometer scale. In order to foster this field, it funds projects of universities and public research institutions. Projects are selected in a bottom-up approach based on a peer-review process. Because research in this area involves knowledge from several traditional disciplines like biology, chemistry, physics and engineering, the "NCCR Nanoscale Science" aims to provide an interface between research institutions and industry. The already strong collaboration with industry should be continued and fostered as will the transfer of knowledge and technology. Furthermore, new spin-off companies should be created. With an involvement of doctoral and post-graduate students, a PhD programme, the promotion of world-class scientists and the organisation of an international summer school, etc. the programme should significantly contribute to education and training in this field. Policy priorities: • Policy measures concerning excellence, relevance and management of research in Universities • Public Research Organisations • R&D co-operation (joint projects, PPP with research institutes) • Stimulation of PhDs

UK	Basic Technology Research Programme	• The Basic Research Technology Programme is a cross-council Programme established to provide funding and support for the development of tools and concepts applicable to a diverse range of scientific research fields in order to create new generic capabilities and an overall a UK technology research capability. The projects, funded through the BRTP have to be: 1) innovative and 2) have an impact over two or more technological fields. More specifically they should help develop new technologies or adapt and/or combine existing technologies in order to change the way science is researched. The calls cover the interests of all Research Councils, encompassing all research disciplines, including micro and nanotechnology and advanced materials and supporting multidisciplinary research as an important part of basic technology. The high level objective of the programme is to engage research institutions active in applied technology research into carrying out basic, more long-term and potentially revolutionary research.

USA	National Nanotechnology Initiative	The Four goals of the National Nanotechnology Initiative are:
		1. Maintain a world-class research and development programme aimed at realizing the full potential of nanotechnology
		2. Facilitate transfer of new technologies into products for economic growth, jobs, and other public benefit
		3. Develop educational resources, a skilled workforce, and the supporting infrastructure and tools to advance nanotechnology
		4. Support responsible development of nanotechnology
		Each of the goals has a defined different list of ongoing activities and plans for the future:
		
		Goal 1 activities:
		• Support to single investigations
		• Multi-investigator/team efforts
		• Establishing large multidisciplinary research centres.
		
		Plans are described that give directions:
		• Sustain funding of exploratory research
		• Continue to invest in synergistic research
		• Continue funding to R&D research
		• Focus on specific areas of activity:
		    • Integration of physical and biological sciences
		    • New instrumentation and tools for advancing nanotechnologies
		    • Development of unifying tools for modelling, simulation and visualisation
		    • Science of self-assembly
		    • New approaches to the fabrication operation of active nanostructures
		    • Collective effects in assemblies and systems of nanostructures
		    • Nanoscale manufacturing approaches including R&D on scale-up, reproducibility, process control, and integration into useful devices and systems
		• Establishment of focused R&D objectives within each of the programme component areas
		• Initiate programmes to foster creation of scientific and engineering platforms.
		• Promote awareness and engagement in international activities

		Goal 2 activities: • Establishment of industry liaison groups • Support meeting of researchers • Foster integration among industry, academia and government • Include industry partners in research centres • Small Business Innovation • Participate in standards Plans in Industrial Outreach are: • Encourage the use of NNI-supported user facilities businesses • Expand industry liaison to sectors that are beyond those already engaged • Continue to fund multidisciplinary research teams • Encourage exchange of researchers • Promote greater utilization of agency programmes Plans in Manufacturing Research are: • Establish centres focused on nanomanufacturing research • Support R&D focused on pre-competitive nanomanufacturing issues Additional activities include: • Engage with regional, local, and nanotechnology initiatives • Implement new mechanisms of licensing intellectual property rights • Support to US Patent and Trademark Office • Provide and co-ordinate input to nanotechnology with respect to export/import restrictions etc • Engage in international collaboration Goal 3 current activities: In education: • Provide hands-on training of undergraduate and postdoctoral student s and researchers • Award funding directly to students • Support development of educational programmes • Bring nanoscience into education of students in all age groups • Support development of science centres and museum exhibits In infrastructure: • Establish and maintain geographically distributed user facilities for all researchers • Support additional infrastructure within the Federal laboratory enterprise

		Plans cover: • Bring more students and teachers to research laboratories • Creation of first Centre for Learning and Teaching in Nanoscale Science and Engineering • Promoting partnerships between industry, educational institutions and workforce systems Plans in Infrastructure: • Develop specific programmes to ensure ongoing support for existing infrastructure centres • Maximise awareness and utilization of infrastructure resources • Create infrastructure to facilitate use of instrumentation and equipment from distant locations • Establish facility specifically aimed at providing support for use of nanotechnology related to cancer treatment Goal 4 current activities: In environment, health and safety implications: • Study potential health risk of nanomaterials • Facilitate communication among member agencies in regulatory decision making • Engage in international dialogue on environmental, health and other societal issues • Conduct research on the fate and transport of manufactured nanomaterials For ethical, legal, and other societal issues: • Support efforts to create a variety of opportunities for a dialogue on nanotechnology • Asses and analyse public understanding of nanotechnology • Analyse nanotechnology impact on economic growth • Incorporate research on societal implications at some university-based nanotechnology centres Plans in the area of environmental, health and safety implications: • Expand support for research into environmental and health implications of nanotechnology • Assist in establishing procedures for working safely with nanomaterials • Co-ordinate different committees actions Plans for Ethical, Legal and other societal issues: • Foster and encourage forums of dialogue • Create and distribute new information materials • Support research on societal dimensions of nanotechnology • Establish a centre for nanotechnology research related to societal implications.

		A number of Program Component Areas has been established that relate to areas of investment that are critical to accomplishing above goals, these are: • Fundamental nanoscale phenomena and processes • Nanomaterials • Nanoscale devices and systems • Instrumental research, metrology and standards for nanotechnology • Nanomanufacturing • Major research facilities and instrumentation acquisition • Societal dimensions
Japan	Third Science and technology basic plan	The second basic plan emphasized R&D on national/social issues, especially those relating to the life sciences, information and telecommunications, environmental sciences, and nanotechnology/materials, and funds were preferentially allocated to those four areas. The third basic plan deems those four areas as areas in which R&D activities should be promoted primarily, and intends to allocate resources preferentially to those areas. Reviewing the results of R&D investments, research levels have steadily improved, and industry-university-government collaboration has been promoted. In addition, research findings have been returned to the economy and society. These results, initially beginning with innovative findings and inventories, were developed by overcoming significant difficulties, including the so-called "Valley of Death." In the course of the development, public R&D investments were made appropriately at suitable times from the initial research phase to the practical application phase, and leading industry-university collaborations were made in the final phase. Future efforts will be made to use the country's potential S&T capability that improved by investments in the period of the previous two plans, to create innovation in a broad range of social and economic areas (the innovation generating new social and economic values with advanced scientific findings and technical inventions combined with human insights), enhance industrial competitiveness, resolve a wide range of social issues such as safety and health, and ensure the sustainable prosperity of the Japanese economy and public life. The separate actions are addresses towards promoting comprehensive and strategic review and study on the impact that nanotechnology has on society. They will enhance measures to resolve bioethical issues that have been growing rapidly in close relation with society. In order to maximize research results, focusing on strategic projects that concentrate the research competency of universities, research organizations and business enterprises is growing in importance. Furthermore the training of nanotechnology specialists is a very important issue. In addition, improved networks for communication and exchanging information and a more desirable research environment with greater support for industry are in focus.

Table 129. Overview of objectives of selected country programmes, Source: Oxford Research AS, data from respective country documents and CORDIS database.

An important conclusion from the interviews with national programme managers and other relevant experts is, that in many cases of programmes founded/updated after introduction of NMP FP6 (after 2002) the national programmes (in the parts related to NMP-similar activities) were designed on the basis of the principle of additionality with FP6/FP7. Some of interviews indicated that the whole national strategies were from the very beginning created with an idea of attracting as much as possible of the European resources. This in most of cases was related to those countries with limited own resources, but with existing scientific potential including new such member states like Poland, Czech Rep. Bulgaria, Slovakia, Slovenia, Lithuania, but also smaller countries with a well developed international co-operation like Norway.

11.12 NMP area and topic levels with track of changes in Work Programmes during 2003-2005

Table below presents an analysis of all NMP area and topic levels with track of changes in Work Programmes over the years. Empty fields in Work Programmes columns mean that there was no call for the topic listed under this programme. The filled in fields indicate what kind of instrument was foreseen to be used for the topic under the programme.

Topics within the area were in general rarely repeated. Only 5 topics appeared twice in two WPs, none of them was repeated in all three work programmes. Over the years the number of instruments used per topic was reduced. In first WP most of the topics appearing had 3 different instruments to choose from, later on a concentration can be seen, as the topics in general are addressed with one instrument only in the following WPs. One may also observe that the number of instruments used has been reduced within the same topic (in the rare cases when the topic was repeated from one programme to another).

All those changes with regard to composition of the work programmes indicate that there was a large effort made into active revision of those documents. The topics were actively changed over the years, and the use of instruments was more concentrated.

	Work programme (WP)		
List of NMP PF6 areas and topics:	WP 2003 12.2002	WP 2004 12.2003	WP 2005 12.2004
1. Nanotechnologies and nanosciences			
1.1. Long term interdisciplinary research into understanding phenomena, mastering processes and developing research tools			
- Expanding knowledge in size dependent phenomena	NoE; STP; CA		
- Self organisation and self assembling	IP; NoE; STP	STP	
- Molecular and biomolecular mechanisms and engines	IP; NoE; STP		
- Molecular motors		STP	
- Expanding knowledge in size dependent phenomena		SSA	
- Towards "converging" technologies			STP
- Standardisation for nanotechnology			SSA
1.2. Nanobiotechnologies			
- Interfaces between biological and non biological systems	IP; NoE; STP		
- Possible topics announced in 2003 for 2004: Nanostructured materials and nanopowders			
- New knowledge on interfaces for new applications		STP	
- Using nature as model for new nanotechnology based processes			STP
1.3. Nanometre scale engineering techniques to create materials and components			
- Engineering techniques for nanotubes and related systems	IP; NoE; STP		
- Nanostructured surfaces		IP	
- Industrially relevant production of nanoparticles		IP	
- Three dimensional nanostructures based on elements other			STP

than carbon			
1.4. Development of handling and control devices and instruments			NONoE
- Handling and control instrumentation at the level of single atoms or molecules and/or < 10 nm	IP; NoE; STP; CA		
- Possible topics announced in 2003 for 2004: "Nanorobots"			
- Characterisation and/or manipulation devices and techniques		STP	
1.5. Applications in areas such as health and medical systems, chemistry, energy, optics, food and the environment			
- Road-maps for nanotechnology	SSA		
- Possible topics announced in 2003 for 2004: Applications in the fields of energy and chemistry, with focus on catalysis			
- Impact on human health and environment		SSA; CA	
- Ethical, legal, social aspects of research in nanotechnology		SSA	
- Nanotechnology based targeted drug delivery			IP
- Interaction of engineered nanoparticles with the environment and the living world			STP
2. Knowledgebased Multifunctional Materials			
2.1. Development of fundamental knowledge			
- Understanding materials phenomena	NoE; STP; CA	NoE; CA	
- Modelling and design of multifunctional materials		STP	
- Interfacial phenomena in materials			STP
- New generation of tools for advanced materials characterisation			STP
- Methods of computational modelling of multifunctional materials			CA
2.2. Technologies associated with the production, transformation and processing of knowledge-based multifunctional materials and biomaterials			
- Mastering chemistry and creating new processing pathways for multifunctional materials	IP; NoE; STP; CA		
- Surface and interface science and engineering	IP; NoE; STP; CA		
- Possible topics announced in 2003 for 2004: Biomaterials			
- Materials processing by radically innovative technologies		STP	
- Development of nanostructured materials		IP	
- "Intelligent" biomaterials for tissue repair and regeneration		STP	
- Tribologyrelated surface engineering for multifunctional materials		IP	
- Advanced materials processing			CA
- Development of nanostructured porous materials			IP
- Multifunctional ceramic thin films with radically new properties			STP
2.3. Engineering support for materials development			
- New materials by design	IP; NoE; STP; CA		

- Materials by design: Bioinspired materials and Organic/Inorganic Hybrid materials		STP	
- New knowledge-based higher performance multimaterials for macroscale applications	IP; NoE, STP, CA	IP	
- Possible topics for 2004: Nanostructured materials and nanopowders,			
- Measurement and testing of new multifunctional materials		CA	
- Mapping and foresight activities on multifunctional materials		SSA	
- Materials by design: multifunctional organic materials			STP
- Materials for solid state ionics			STP
3. New Production Processes and Devices			
3.1. Development of new processes and flexible, intelligent manufacturing systems			
- New production technologies, based on nanotechnology and new materials	STP		
- New and user friendly production technologies, and their incorporation into the factory of the future	IP; NoE; STP; CA	IP; CA	
- Creation of "knowledge communities" in production technologies	IP; NoE; CA; SSA		
- New production technologies for high added value products, exploiting and using nanoscale precision engineering techniques		IP	
- Support to the development of new knowledge-based added value products and services in traditional less RTD intensive industries	IP dedicated to SMEs	IP dedicated to SMEs	
- New production technologies for new microdevices using ultra precision engineering techniques			IP
- Next generation of flexible assembly technology and processes			IP
- New concepts for global delivery			STP
- Road mapping and foresight studies on the future of manufacturing (Manufuture)			SSA
- Co-ordination of European Manufacturing Research Activities			CA
3.2. Systems research and hazard control			NoNoE
- Radical changes in the "basic materials" industry (excluding steel) for cleaner, safer and more eco-efficient production	IP; STPS		
- Sustainable waste management and hazard reduction in production, storage and manufacturing	NoE; CA; SSA		
Possible Topics for 2004: Support to the development of new knowledge based and sustainable processes and products/services IP dedicated to SMEs "Low CO_2 steel processes" IP			
- Hazard reduction in production plant and storage sites		IP	
3.3. Optimising the life-cycle of industrial systems, products and services			NoNoE

- Optimisation of "production use consumption" interactions	NoE; CA		
- Increasing the "user awareness"	SSA		
- Support to the development of new knowledgebased and sustainable processes and eco innovation		IP dedicated to SMEs	
- New life-cycle optimised, safety and environmental technologies for industrial production		STP	
- Increasing the "user awareness" for sustainable consumption		CA, SSA	
4. Integration of nanotechnologies, new materials, and new production technologies for improved construction, chemicals and surface transport			
4.1. Systems, instruments and equipment for better diagnosis and/or surgery, including for remote operations	IP; NoE; CA		
4.2. Tissue engineering, new biomimetic and biohybrid systems	IP; NoE; STP; CA		
4.3. New generation of sensors, actuators and systems for health, safety and security of people and environment	IP, NoE, STP		
Possible topics for 2004: Towards a human-friendly living environment: "from atoms to buildings" Support to the development of new knowledge based added value products and services IP dedicated to SMEs			
4.4. Human-friendly, safe and efficient construction		IP	
4.5. New generation of multifunctional materials and technologies for surface transport		IP	
4.6. Mastering chemicals and creating new eco-efficient processes and synthesis routes		IP; NoE	
4.7. Multifunctional material based factory of the future			IP
4.8. New construction products and processes for high added value applications			IP
4.9. Mastering "Industrial Biotechnology" Environmental Technology for sustainable production of added value products			IP
4.10. Multifunctional technical textiles for construction, medical applications and protective clothing			IP dedicated to SMEs
4.11. Simultaneous engineering and production of integrated high-tech components for European transport			IP dedicated to SMEs
4.12. Biomaterials technologies for implants			IP dedicated to SMEs
4.13. Nanotechnological approaches for improved security systems			IP dedicated to SMEs
5. Cross-priorities actions and links to other research actions			
5.1. "Very low CO_2 and greenhouse gas steel production processes" target 2020		IP	
5.2. Integrating technologies for the fast and flexible manufacturing enterprise		IP; STP; SSA	
5.3. Biosensing systems for health		IP; STP; SSA	
5.4. NanoPhotonics and NanoElectronics		IP; NoE; STP; SSA	
5.5. Basic materials and industrial process research on functional materials for fuel cells			STP
5.6. Improved, energy efficient hydrogen storage systems especially for transport			STP

5.7. Co-operation with Third Countries in the field of nanotechnology, advanced multifunctional materials and new ways of production research			SSA
6. Co-ordination of activities in an enlarged Europe		Presented in 2004	
7. 2004 Work Programme Update relating to: JOINT CALL between the IST and the NMP priorities and CO-ORDINATED CALL between the NMP priority and the National Science Foundation (NSF)		WP update 06.2004	
7.1. ISTNMP1 Integrating Technologies for the Fast and Flexible Manufacturing Enterprise		IP; STP; SSA	
7.2. ISTNMP2 Biosensors for Diagnosis and Healthcare		IP; STP; SSA	
7.3. ISTNMP3 Materials, Equipment and Processes for Production of NanoPhotonic and NanoElectronic Devices		IP; STP; SSA	
7.4. ISTNMP3 Materials, Equipment and Processes for Production of NanoPhotonic and NanoElectronic Devices		IP; STP; SSA	
Source: Oxford Research 2010.			

Note : None of the possible topics announced in WP from 2002 was repeated within next editions.

Table 130. Topics in NMP FP6 defined in WPs. Source: Oxford Research AS, data from EC.

Table: Number of times the instrument was available in each of the work programmes					
Work Programme	IP	NoE	STP	CA	SSA
WP I	16	18	16	13	4
WP II	21	3	16	5	12
WP III	11	0	12	3	3
Total	48	21	44	21	19
Source: Oxford Research 2010.					

Table 131. Number of times the instrument was available in each of the work programmes. Source: Oxford Research AS, data from EC.

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11.14 Changes in NMP FP7

This chapter presents a summary of major changes implemented in FP7 in comparison with FP6. The changes resulted from monitoring and evaluation processes conducted by EC in order to raise efficiency and effectiveness of the programmes implemented. Also some of the findings of this evaluation study confirm that these processes were necessary and addressed major needs existing among policy makers, implementation institutions and project participants.

11.14.1 Changes in instruments used

The whole FP7 is structured into 4 specific programmes plus a fifth specific programme on nuclear research (namely: Co-operation, Ideas, People, Capacities, and Euratom) and has a budget of € 50521 million. FP7 Co-operation (under which NMP is Theme 4) has a 64% share of the total FP7 budget. In the mid-term assessment of FP6 NMP, a recommendation was made to increase the FP7 NMP budget at least four times in order for the EU to remain competitive in nanotechnology and manufacturing as a global region. The total FP6 NMP budget was € 1429 million[140], whilst the foreseen budget for FP7 NMP is € 3475 million[141]. This shows an increase of approx. 2.4 times, which is just over half of what was recommended by the expert group.

Under the FP7, the NMP theme is implemented through the following main funding schemes[142]:

- **Collaborative Projects (CP)** are research projects carried out by consortia with participants from different countries, aimed at developing new knowledge, new technology, products, demonstration activities or common resources for research. The size, scope and internal organisation of projects can vary from field to field and from topic to topic.[143] Collaborative Projects allow two types of projects to be financed: 1) small or medium scale focused research projects (SSP); and 2) large scale integrating projects (LSP).[144] In 2010 three Public-Private Partnerships are also included under Collaborative Projects.[145]

- **Networks of Excellence (NoE)** are used to promote durable integration of key competencies, where still needed, so as to support integrating research activities in strategic areas for European competitiveness. These Networks should show clear impacts

[140] Web source: http://cordis.europa.eu/fp6/nmp.htm

[141] Web source: http://cordis.europa.eu/fp7/budget_en.html

[142] European Commission C(2009) 5893 of 29 July 2009, p. 6.

[143] Web source: http://www.mcst.gov.mt/page_fp7.aspx?id=17

[144] European Commission C(2009) 5893 of 29 July 2009, p. 6.

[145] As outlined in the FP7 NMP Work Programme 2010, due to the economic downturn a contribution of EUR 100 million will be made towards the three initiatives of Public-Private Partnerships ("Factories of the future", "Energy-efficient buildings" and "Green cars") in 2010 under the Theme 4. Beyond the PPP initiatives, the core objectives of Theme 4 remain stable.

in structuring and reinforcing research capacities in the fields covered by the Theme.[146] Networks of excellence have not been implemented in 2008, 2009, and are not foreseen in 2010.

- **Co-ordination and Support Actions (CSA)** may relate to co-ordination, networking or supporting activities at European and international, national or regional level. The organisation of events, studies, conferences, exchanges, providing trans-national access to research infrastructures, where relevant, organisation and management of joint or common initiatives may be included, as well as activities aimed at supporting the implementation of the Theme, such as dissemination, information and communication and activities to stimulate and encourage the participation of civil society organisations.[147] These actions may also be implemented by means other than calls for proposals.[148]

The changes between the main Funding Schemes in FP6 and FP7 are visualised in the figure below and new Funding Schemes are described in more detail in the subsequent paragraphs.

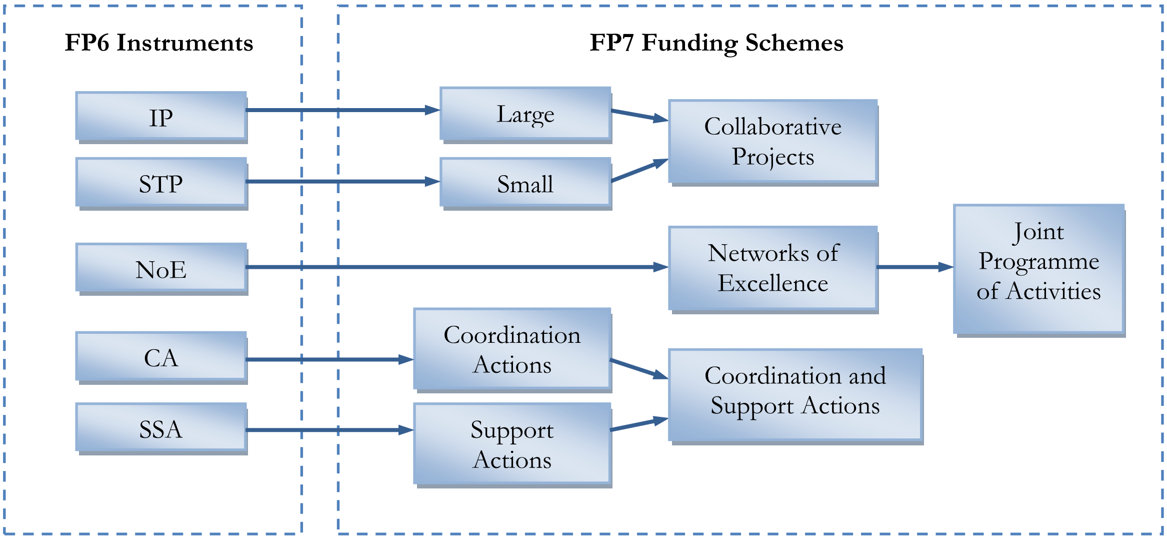

Figure 132. Changes in the main Funding Schemes; Source: Frameworks NW, January 2007149

[146] European Commission C(2007) 5765 of 29 November 2007, p. 7.

[147] European Commission C(2009) 5893 of 29 July 2009, p. 6.

[148] Web source: http://www.mcst.gov.mt/page_fp7.aspx?id=17

[149] Web source: http://www.frameworksnw.co.uk/documents/FP7simplification_and_participation.pdf

Collaborative projects (CP)

Notably, STPs and IPs are joined together in FP7 NMP under a single title of Collaborative Projects (CP). According to an ex-post evaluation of FP6 programmes in RTD[150], this change "abolished the distinction between IPs and STPs so that network sizes can match needs". However, CPs can still be divided into two types of projects: 1) small and medium scale research projects; and 2) large scale integrating projects. All CPs are implemented via separate calls and evaluated using the two-stage process.

Small and medium scale research projects (SSP) consist either of, or a combination of: a) a research and technological development project designed to generate new knowledge which would improve European competitiveness and/or address major societal needs; b) a demonstration project designed to prove the viability of new technologies offering potential economic advantage but which cannot be commercialised directly (e.g. testing of product-like prototypes). Project management activities may also be financed. This type of projects could also include innovation-related activities, in particular with respect to the management of the knowledge produced and the protection of intellectual property.[151] A minimum number of participants under this funding scheme are 3 (at least 3 independent legal entities, each of which is established in a Member State or Associated Country, and no 2 of which are established in the same Member State or Associated Country) but an optimum is 6-15. The project duration is 18-36 months and a maximum EC contribution is € 4 million.

Large scale integrating projects (LSP) are larger scale actions, including a coherent integrated set of activities tackling multiple issues and aimed at specific deliverables; they have a large degree of autonomy to adapt content and partnership and update the work plan, where appropriate. They consist of a combination of most or all of the following: a) objective-driven research and development; b) a demonstration project designed to prove the viability of new technologies offering potential economic advantage but which cannot be commercialised directly (e.g. testing of product-like prototypes); c) innovation activities relating to the protection and dissemination of knowledge, socio-economic studies of the impact of that knowledge, activities to promote the exploitation of the results, and, when relevant, "take-up" actions; these activities are inter-related and should be conceived and implemented in a coherent way; d) training of researchers and other key staff, research managers, industrial executives (in particular for SMEs), and potential users of the knowledge produced within the project. Such training activities should contribute to the professional development of the persons concerned; e) any other specific type of activity directly related to the project's objectives (as identified in the relevant work programme or call for proposals); f) project management activities.[152] A minimum number of participants under this funding scheme are 3 but an optimum is 10-20. The project duration is 36-60 months and a minimum EC contribution is € 4 million.

In FP7 NMP, IP SMEs were named as SME-targeted Collaborative Projects (SMET CP).[153] A minimum number of participants under this instrument are 3, and there are no upper of lower limits in EC contributions. However, SME-targeted Collaborative Projects will only be processed on the condition that the SME involvement is 35% or more of the requested EC contribution.

[150] Evaluation of FP6 programmes for RTD. Web source: http://ec.europa.eu/research/reports/2009/pdf/fp6_evaluation_final_report_en.pdf

[151] Web source: http://www.mcst.gov.mt/page_fp7.aspx?id=17

[152] Web source: http://www.mcst.gov.mt/page_fp7.aspx?id=17

[153] Web source: http://www.wbc-inco.net/call/59760.html

Co-ordination and Support Actions (CSA)

Co-ordination Actions (CA) and Specific Support Actions (SSA) from FP6 NMP refer to the Co-ordination and Support Actions (CSA) in FP7 NMP. CSAs are divided into two types of actions: 1) Co-ordination Actions (CA); and 2) Support Actions (SA). In general, CSAs aim at either co-ordinating or supporting research activities and policies (networking, exchanges, trans-national access to research infrastructures, studies, conferences, etc.). These actions may also be implemented by means other than calls for proposals. CSAs are evaluated in a single stage process.

Co-ordination Actions (CA) have to be carried out by a consortium of minimum three participants, normally from three different countries. The co-ordination or networking actions cover organisation of events (including conferences, meetings, workshops or seminars), studies, exchanges of personnel, exchange and dissemination of good practices, and, if necessary, the definition, organisation and management of joint or common initiatives together of course with management of the action. The co-ordination and networking actions normally stretches over a longer period.[154] An optimum number of participants under CAs are 10-30 and the project duration range is 18-36 months.

Support Actions (SA) aim to contribute to the implementation of the Framework Programme and the preparation of future Community research and technological development policy or the development of synergies with other policies, or to stimulate, encourage and facilitate the participation of SMEs, civil society organisations and their networks, small research teams and newly developed or remote research centres in the activities of the thematic areas of the Co-operation programme, or for setting up of research-intensive clusters across the EU regions. The specific support actions can be of different types covering different activities: monitoring and assessment activities, conferences, seminars, studies, expert groups, high level scientific awards and competitions, operational support and dissemination, information and communication activities, support for transnational access to research infrastructures or preparatory technical work, including feasibility studies, for the development of new infrastructures, support for co-operation with other European research schemes, the use by the Commission of external experts, management or a combination of these. Support Actions (SA) may be carried out by a single participant (but an optimum size is 1-15), which can be based in any member state, associated country or a third country. Therefore there are no restrictions on the size of the consortium.

Networks of Excellence (NoE)

As noted in ex-post evaluation of FP6 programmes for RTD[155], both new instruments – IPs and NoEs – were not as successful as initially hoped. These instruments did not attract enough industry attention at the consultations phase which might have influenced instability of the concept as it changes several times in FP6. Furthermore, NoEs were to some extent peripheral to their core activities and did not reduce the fragmentation in the ERA. The expert group concluded that NoEs had "failed to address the problem they were designed to tackle" and that "achieving the intention of the NoEs to alter the structure of research capacity in Europe requires different treatment". According to the FP7 NMP Working Programmes, Networks of Excellence were left out in FP7 NMP as they have not been called in 2008, 2009, and are not foreseen in 2010. In fact, there were very few calls for NoEs throughout the FP7, and it was suggested in the review of Networks of Excellence that they should in selected cases be

[154] Web source: http://www.mcst.gov.mt/page_fp7.aspx?id=17

[155] Evaluation of FP6 programmes for RTD. Web source: http://ec.europa.eu/research/reports/2009/pdf/fp6_evaluation_final_report_en.pdf

continued in the form of Joint Research Initiatives (JRIs). Another source[156] suggests that NoEs may be implemented in support of a Joint Programme of Activities (JPA).

11.14.2 Simplification of FP7

In 2005 the DG RTD announced the simplification of FP7, which was based on three principles: Flexibility, Rationalisation and Coherence.[157] The Flexibility principle includes tools to achieve FP7 objectives efficiently. The Rationalisation perspective includes: a better balance between risks and controls; avoiding procedures, rules and requests that have no added value; reducing delays. And the Coherence perspective includes clarifying rights and obligations; consistent and user-friendly communication; matching objectives and means; taking into account participants' own practices and pre-existing rules.[158]

There are 10 concrete measures that are being used in the simplification process[159]:

1. **The use of Funding Schemes.** Funding Schemes are based on FP6 with a broader flexibility of use. Actions are implemented through a simple set of funding schemes, rather than pre-defining the instruments in a fixed way. Each specific programme, work programme or a call for proposals will determine the type of funding scheme, categories of participants and types of activities.
2. **Better communication.** More consistent and high-quality communication is ensured by providing only necessary information, which will be compiled in a clearer, more user-friendly style (with no duplications) and allows a uniform interpretation, in particular of legal and financial provisions.
3. **Information requested from participants.** All financial and legal information is submitted only once and kept in a central database. Each participant has a single registration number for all RTD projects. The reporting of project implementation is enhanced by including only information, which is necessary for proper and efficient project follow-up. Also the FP7 more extensively uses electronic tools.
4. **Simplified examination of operational and financial capacity.** An assessment of financial viability of participants is based on a single public list of criteria that must be fulfilled and documents that are required so that participants would know exactly what is required. More flexible and user-friendly solutions guarantee the Community's financial interest without imposing an undue burden on participants.
5. **Full operational autonomy entrusted to consortia.** More flexibility of implementation is entrusted to consortia in order to ensure management autonomy, allowing them to achieve their project objectives under the best possible conditions. The grant agreement provisions are adapted not only to participants' usual accounting principles, but also according to their usual management practices. The Commission will rationalise the number of audit certificates requested.[160] The Commission is also to provide training for project co-ordinators and establish help-desks for project management.

[156] Web source: http://www.mcst.gov.mt/page_fp7.aspx?id=17

[157] Web source: http://ec.europa.eu/research/future/pdf/ec_2005_0431_1_en.pdf

[158] Web source: http://www.eubuero.de/service/veranstaltungen/ws051205/Download/dat_/fil_1763

[159] Web source: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52005SC0431:EN:NOT

[160] Web source: http://ec.europa.eu/research/consultations/pdf/ws-simplif-8-9-minutes13_en.pdf

6. **Streamlining the Commission selection process.** Requesting for approval of Programme Committee(s) and Commission services before granting individual grants was replaced by a simple information procedure, which reduces the "time to start" for projects. The Programme Committee(s) is still reviewing and approving work programmes and major policy issues.
7. **Optimisation of the research budget use.** It is to ensure that funds allocated to research can be used for other research projects if a project has to be stopped in mid-stream. This measure may include adjustments to the Financial Regulation applicable to the general budget of the European Communities and its implementing rules.
8. **More extended use of lump sum and flat-rate financing.** Under FP7 the Commission intends to make use of all 3 possible forms of grants (reimbursement of eligible costs, lump sums and flat rate financing). With a view to simplification, lump sum and flat-rate financing is used as much as possible.[161]
9. **Removing complex cost reporting models and clarifying definition of eligible costs.** The definition of eligible costs is simplified be removing the need of cost-reporting models, which gives the possibility to each participant to decide whether to justify its full direct and indirect costs or to have a flat rate for indirect costs. To ensure continuity with FP6, it is proposed that a flat rate of up to 20 % of the direct eligible costs, minus the eligible costs of subcontracting, will be foreseen in the rules for participation and dissemination of results.
10. **Simplified support rates per type of activity.** The support rates will be determined only by type of activity. The eligible costs will continue to be reimbursed for the whole project consortium rather than per each participant. The state aid rules will determine the total amount of funding.

[161] Web source: http://ec.europa.eu/research/consultations/pdf/ws-simplif-8-9-minutes13_en.pdf

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