

# Evaluation Report



## ENEX Company Survey

### Output 1 / A2

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This project has been funded with support from the European Commission.

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## 1. Introduction

The Erasmus+ project 'ENEX – Expert in Nanotechnology Exploitation' aims at developing advanced training courses for professionals as well as for graduate and postgraduate students facing the rapidly growing importance of nanotechnology in industry, research and the society as a whole.

Nanotechnology (NT) is a strongly emerging area of research and activity, opening up new markets, and leading to new products, processes and services in almost all industrial sectors. As a result, there is an increasing demand of particularly qualified personnel in companies producing and using nanotechnology, but also in research organisations developing new technologies, in consulting firms and other institutions focusing on the nanotechnology research-to-market process. The ENEX training course will be based on an interdisciplinary approach combining nanotechnology modules with innovation management content.

To define the basic learning contents for the course, a company survey has been carried out as part of Intellectual Output 1 ('The ENEX Competence Profile'). The objective was to gather as much information as possible on the level of engagement of the main ENEX target groups in nanotechnology and innovation management, and to identify potential qualification needs in these areas.

Together with

- the findings from in-depth interviews with selected stakeholders in the area of NT innovation, as well as
- the feedback from pilot trainings organized by the ENEX project partners,

the responses of the ENEX company survey will be used as a guidance for the contents of the ENEX curricula and for defining a realistic frame for the ENEX training course.

## 2. Company survey

### 2.1 Methodology

The company survey was carried out by means of an online (Google Forms) questionnaire that was disseminated among industrial firms, science organizations and other target groups in the five ENEX partner regions/countries. The questionnaire was prepared in English as well as all national languages represented in the project (DE, NL, IT, PL, RO).

The partners used their regional networks to address relevant stakeholders for the survey, and in addition compiled new contact databases for the specific purpose of the mailing campaign. Furthermore, the questionnaire was linked to the ENEX project website ([www.enex-nano.eu](http://www.enex-nano.eu)) to enhance its dissemination and attract website visitors for taking part in the survey.

The survey started on 15 May 2015 and was organized as a continuous, open-end process, i.e. without a fixed closing date.

This evaluation report is based on the responses to the questionnaire in the time interval from 15 May 2015 to 15 February 2016 (9 months).

### 2.2 Questionnaire

The questionnaire covered 43 questions and was divided into five sections:

1. Basic company data: General information that is helpful for classifying the responses;

2. Nanotechnology: Questions relating to the engagement of companies in the field of nanotechnology;
3. Innovation management: Questions relating to the extent of innovation management realized in industrial companies and science organizations;
4. Education and training: Questions relating to qualification and demand for VET in companies in the areas of nanotechnology and innovation management;
5. Personal details of the respondent (optionally): Personal contact data were requested in case that the respondents were interested in receiving the summary of the survey.

The design of the questionnaire was optimized for time-saving completion, including a mixture of closed, matrix, multiple choice and open questions. The typical time frame for completing the questionnaire was between 10 – 15 minutes. To keep the questionnaire as simple as possible, all matrix questions were to rate by the respondents by means of a 3-scale axis allowing one of the three possible answers ‚Not important‘, ‚Important‘ or ‚Very important‘.

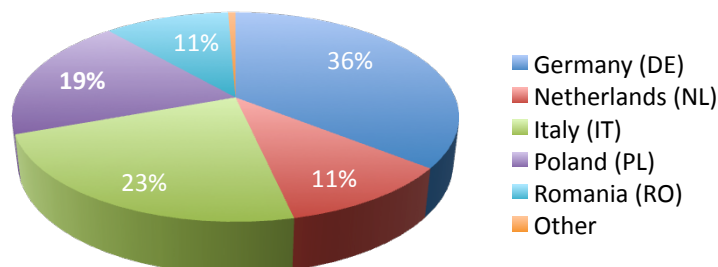
A copy of the questionnaire is included in the annex of this report.

### 3. Results

A total of 157 responses were received from all participating partner regions.

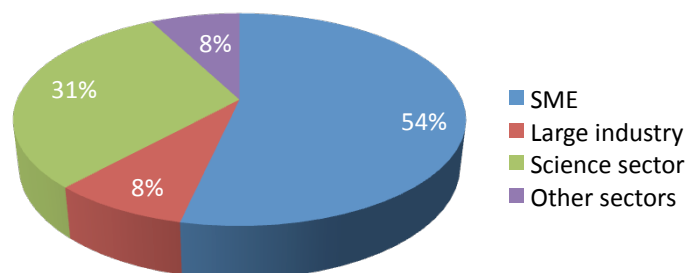
#### 3.1 Basic company data

Fig. 1 shows the geographical distribution of the responses to the questionnaire. The strongest feedback was obtained from Germany (56 responses), followed by Italy (36), Poland (30), Netherlands (17) and Romania (17).



**Fig. 1** Geographical distribution of responses (Question A.1).

Fig. 2 indicates that the survey has reached the main target groups of the ENEX project. The majority of responses (62%) came from industrial firms, above all SMEs (54%), 31% from science organizations (universities, R&D institutions) and the remaining 8% from other sectors (consulting firms, technology transfer agencies, associations/networks, etc.).

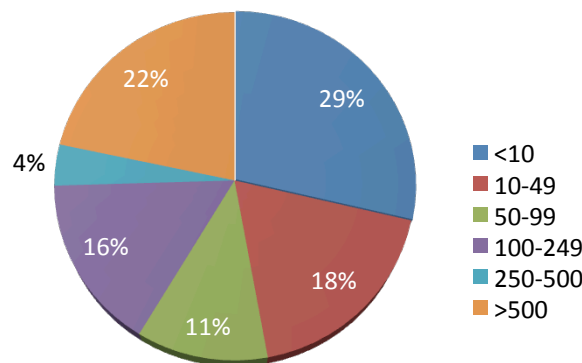


**Fig. 2** Type of company (Question A.3).

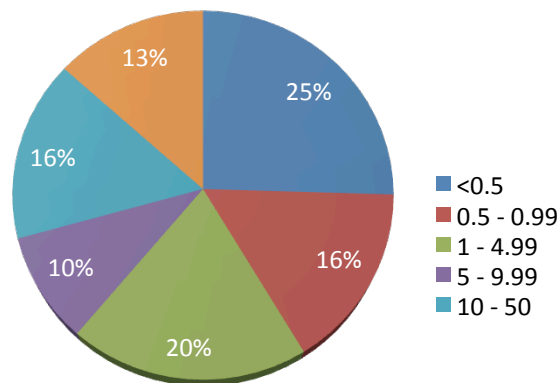
Fig. 3 – 7 provide basic statistical information on the respondents. The overall statistics of the respondents is well balanced. 29% of companies involved in the survey are small businesses (including start-ups) and have <10 staff, 47% of respondents have <50 staff. These figures correspond with those of average annual turnover: 25% of respondents have a turnover <0.5 m€, 41% a turnover <1 m€.

Fig. 5 and 6 reflect the high share of industrial firms in the survey: 47% of respondents have less than 25% of staff involved in R&D, but 41% of respondents have more than 25% of staff involved in production.

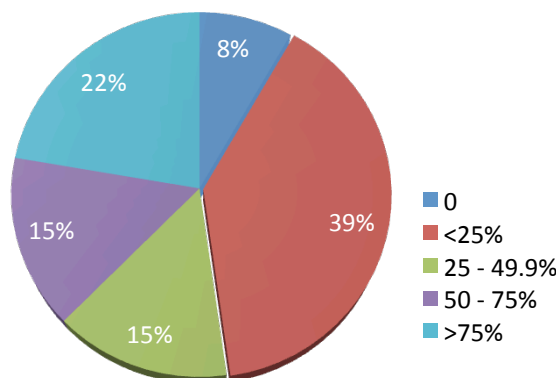
Every second employee has an academic degree in more than 50% of companies/ organizations participating in the survey (Fig. 7), indicating the high-tech character of the respondents.



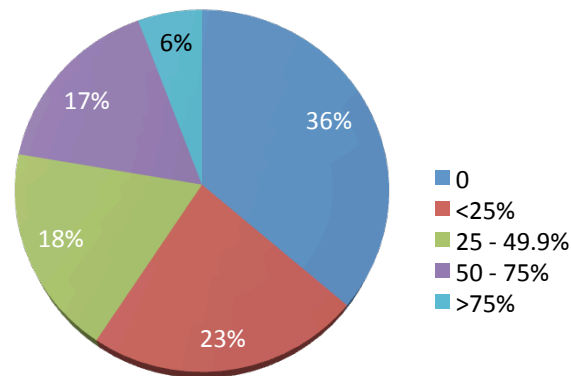
**Fig. 3** Number of employees of companies (Question A.5).



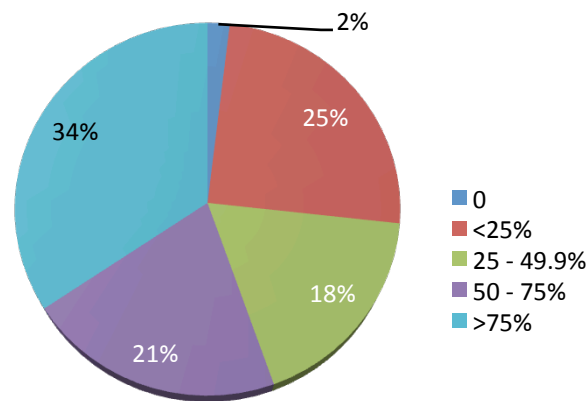
**Fig. 4** Average annual turnover (in m€) of companies (Question A.5).



**Fig. 5** Percentage of staff involved in R&D (Question A.5).



**Fig. 6** Percentage of staff involved in production (Question A.5).



**Fig. 7** Percentage of staff with an academic degree (Question A.5).

Fig. 8 – 10 provide a deeper insight in the industrial segments of the respondents. Fig. 8 shows their main target markets of today, Fig. 9 those envisaged for the next 5 years.

Fig. 10 shows a direct comparison of the respondents' most important target markets of today and those in 5 years (rating ,Very important'), indicating perspective, higher-than-average market developments in the segments of

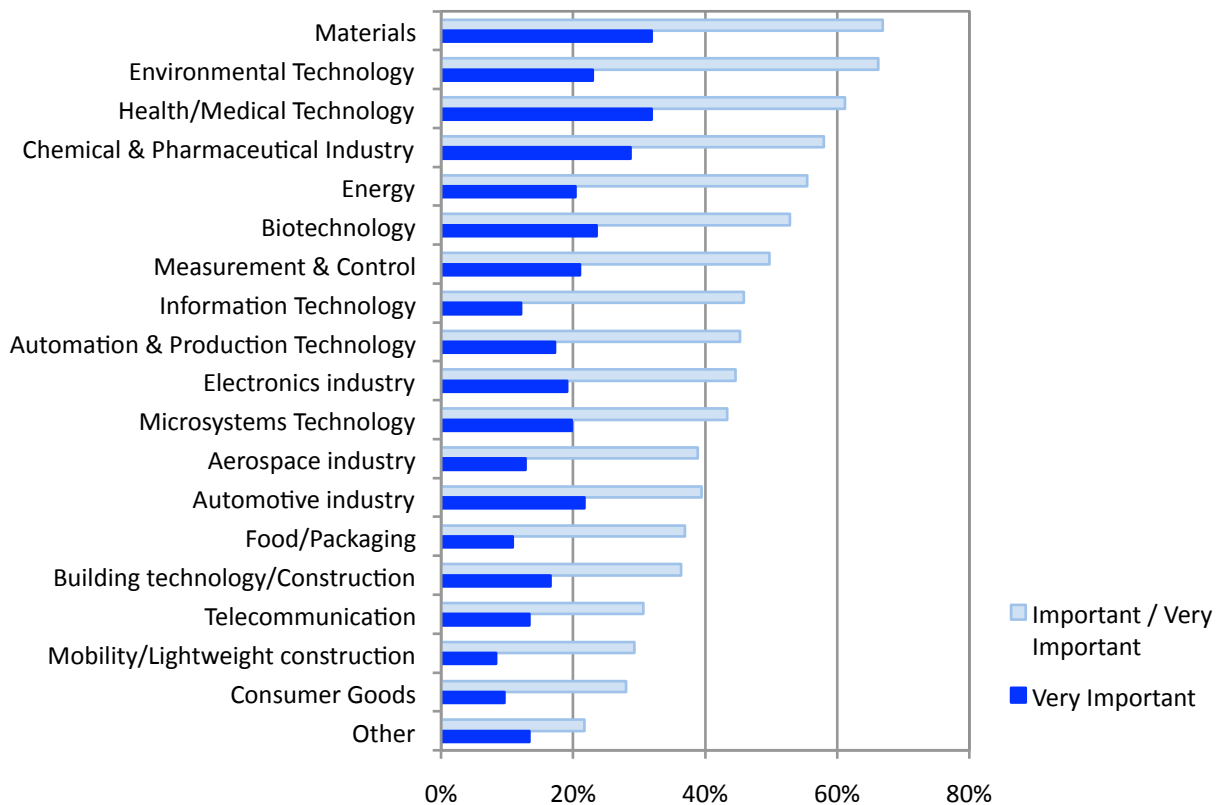
- *health/medical technology,*
- *biotechnology and*
- *environmental technology.*

Together with

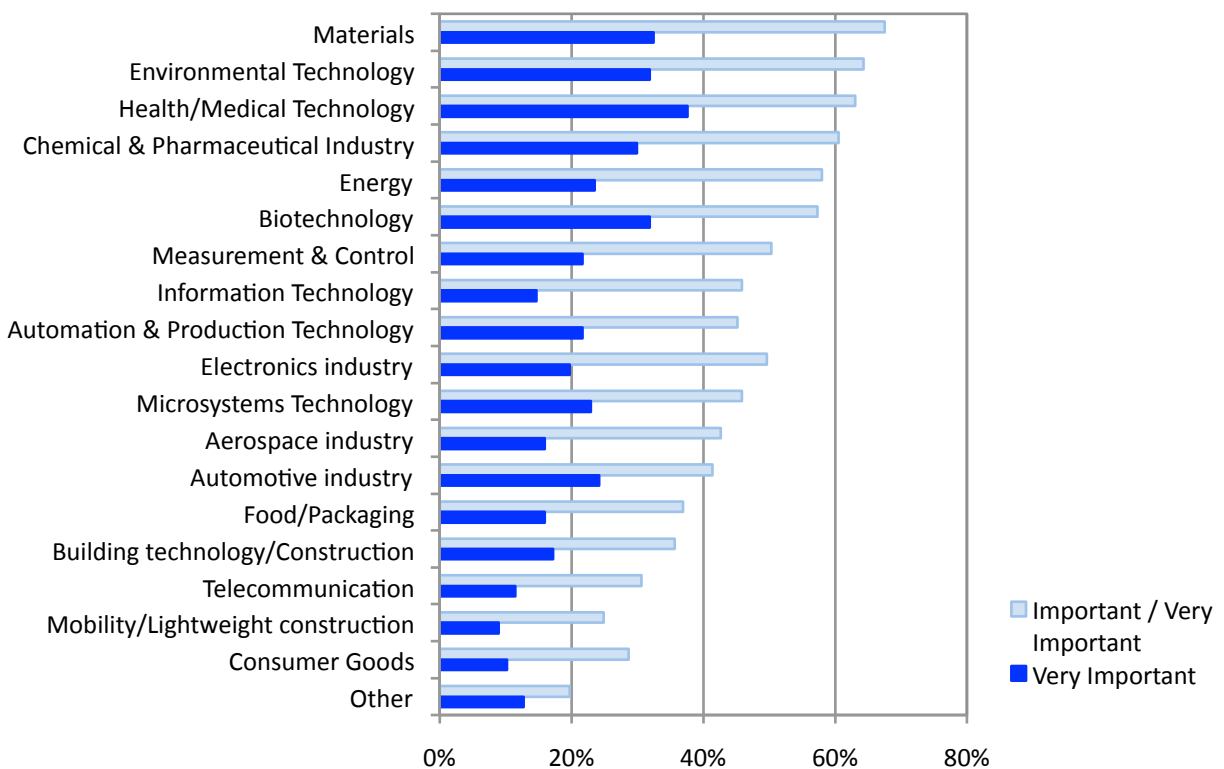
- *materials (cross-sectoral) and*
- *chemical & pharmaceutical industry,*

these sectors show significant potential for nanotech companies in the next future.

If responses with the two ratings ,Very important' and ,Important' are added, also the *energy sector* has to be considered as a major target market of the companies/ organizations involved in the survey.

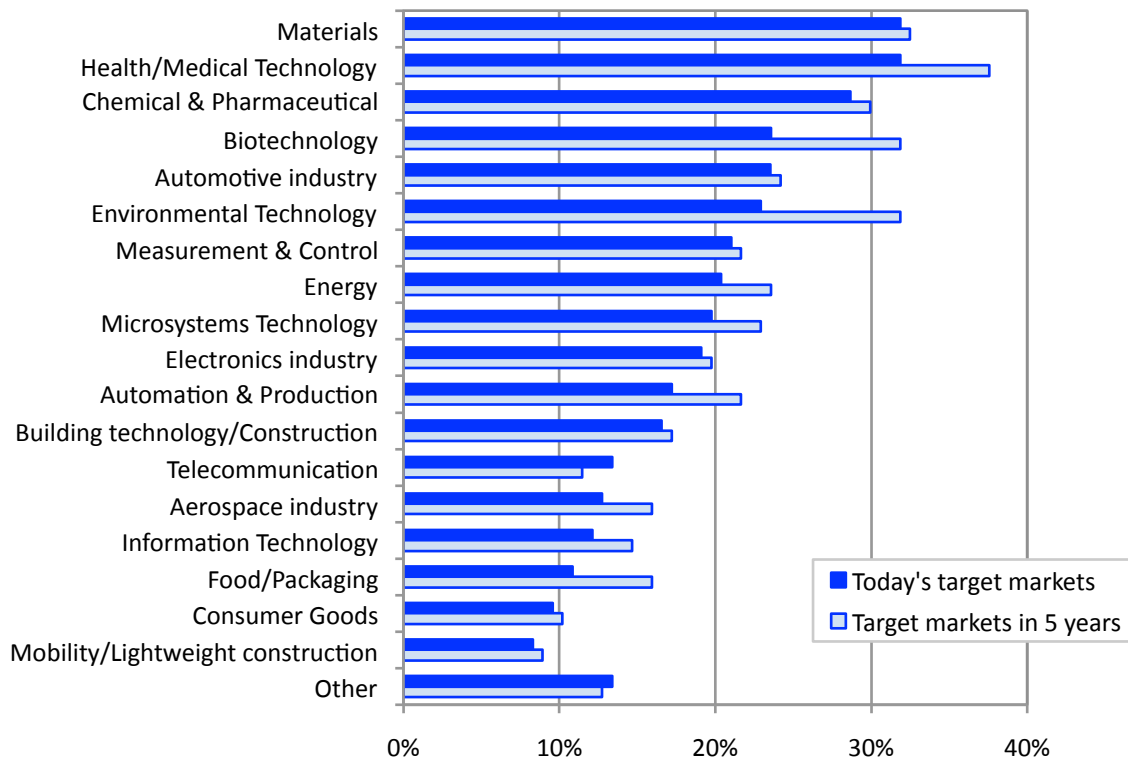


**Fig. 8** Important target markets of today (Question A.6).



**Fig. 9** Important target markets in 5 years from now (Question A.7).

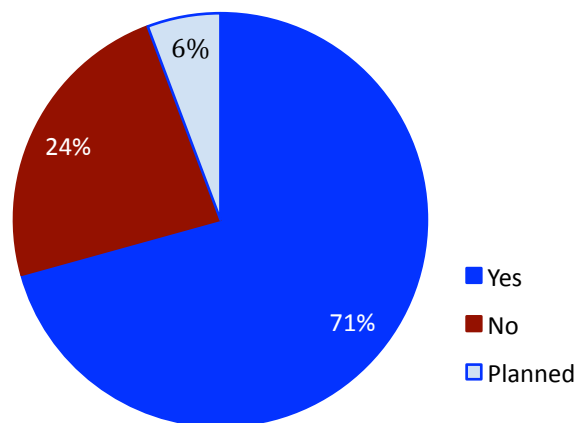




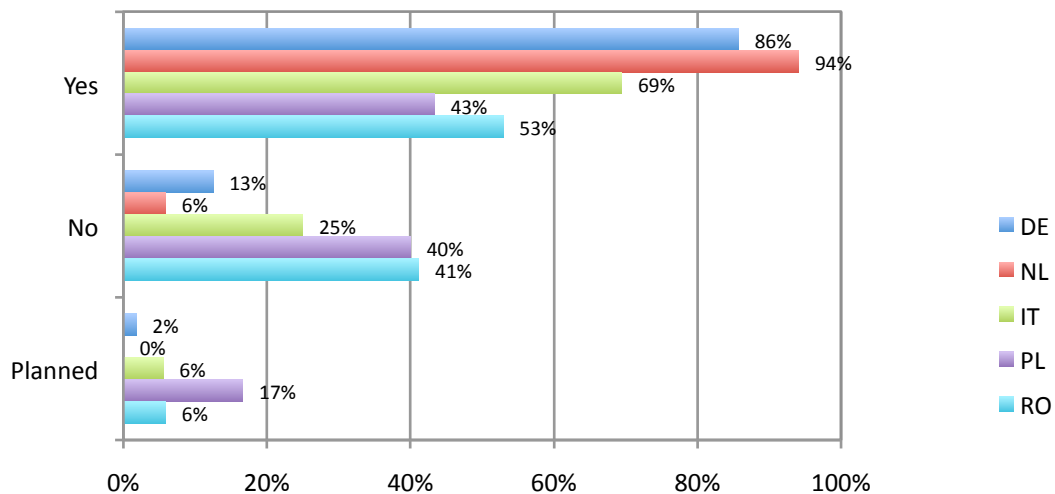
**Fig. 10** Comparison of the most important target markets of today and in 5 years from now (Question A.6/7).

### 3.2 Nanotechnology

71% of the respondents specified that they have already knowledge in nanotechnology, 6% declared that they are planning to acquire NT-related knowledge (Fig.11). Fig. 12 shows the same information broken down by partner region. According to Fig. 12, NT-related knowledge is highly present in Dutch (94%) and German companies (86%), followed by Italian companies/organizations (69%). Romanian and Polish respondents lag behind with 53% and 43%, resp.

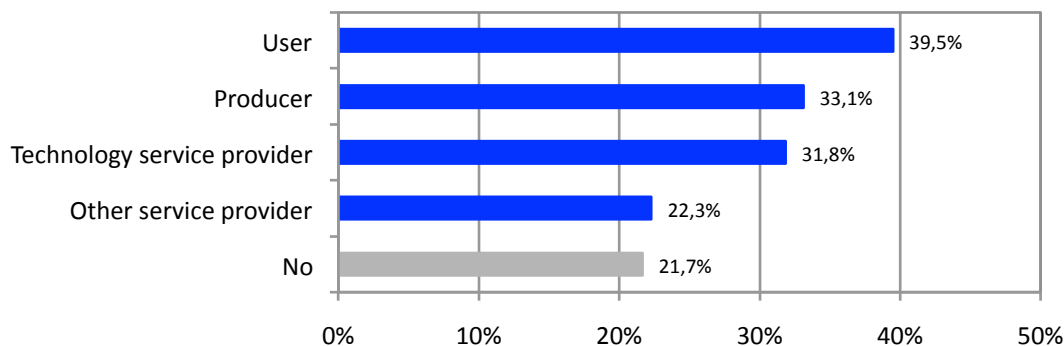


**Fig. 11** Does your company have knowledge/skills in the field of nanotechnology? (Question B.1).

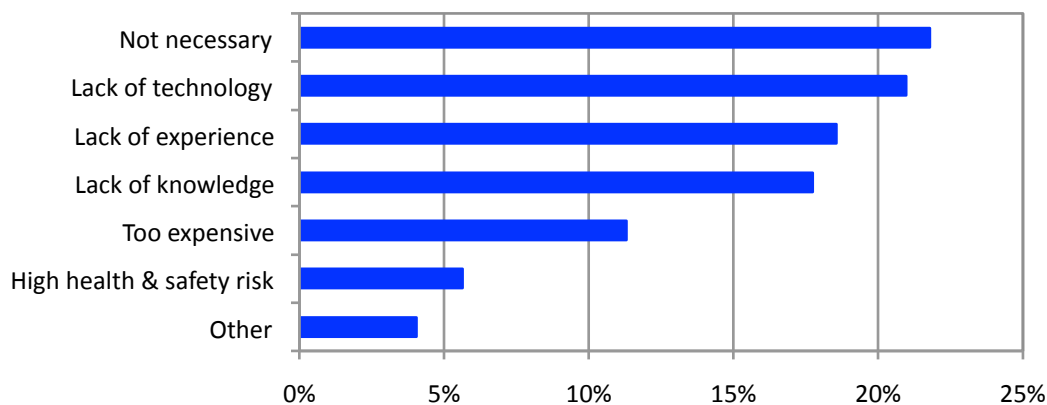


**Fig. 12** Does your company have knowledge/skills in the field of nanotechnology? (Question B.1).

39% of the respondents specified that they use nanotechnology. 33% of the respondents manufacture products based on NT, 32% provide technology services, 22% other services relating to NT (Fig. 13). Almost one quarter (22%) of the respondents neither use, nor produce nanotechnology or provide services in these areas, but have an interest in becoming more acquainted with NT. Respondents who do not use nanotechnology mentioned lacking technology, experience and knowledge as major reasons. Around 20% of non-NT users do not need nanotechnology for their business (Fig. 14).

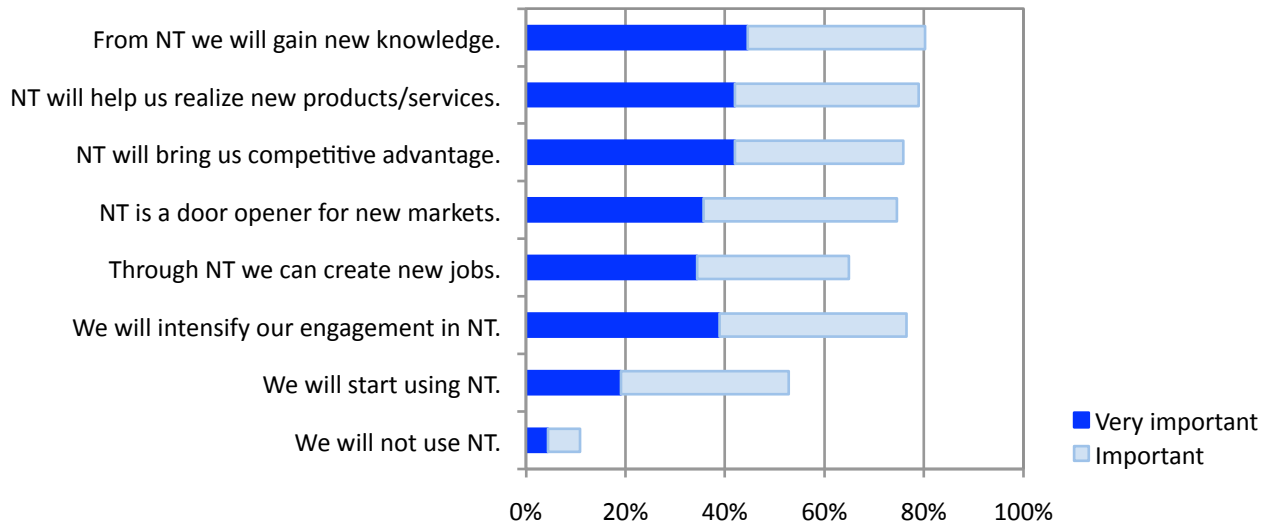


**Fig. 13** Does your company use nanotechnology or manufacture products/provide services based on nanotechnology? (Question B.2)



**Fig. 14** If your company does not use nanotechnology, what is the reason? (Question B.3)

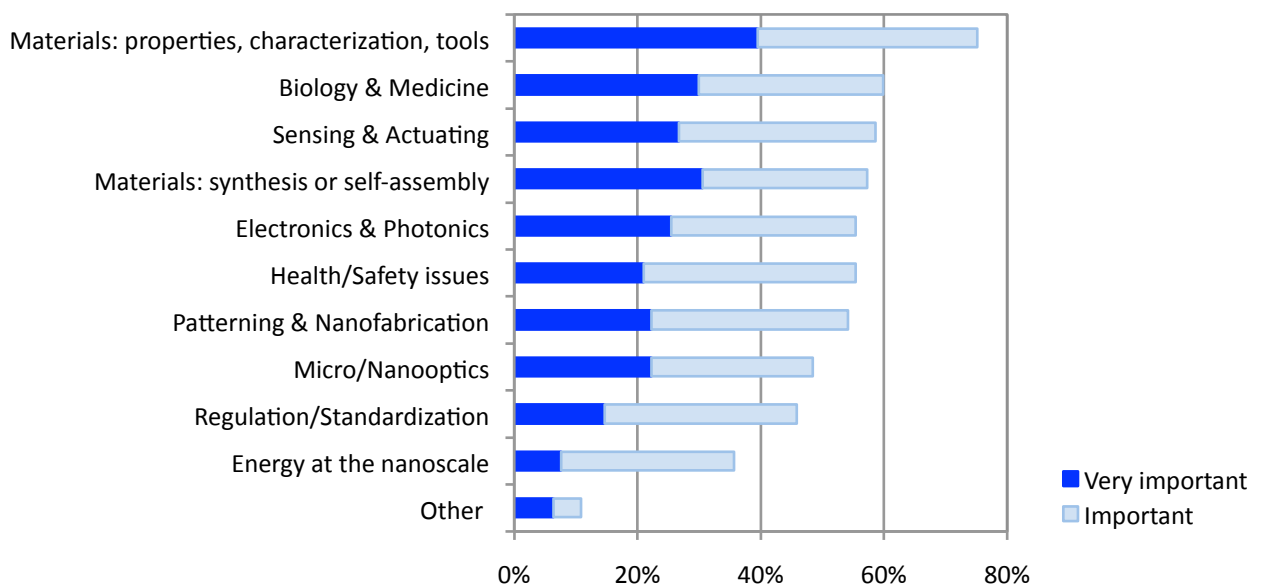
Almost 40% of respondents indicated that they want to intensify their engagement in NT, another 20% want to start using NT (Fig. 15), as nanotechnology is promising new knowledge, new products, new markets and competitive advantage.



**Fig. 15** What are the expectations of your company concerning nanotechnology for the next 5 years? (Question B.4)

The majority of respondents have a particular interest in *materials*, especially with regard to characterization, properties and tools (40%), but also with regard to synthesis and self-assembly (30%) (Fig. 16). Further major fields of interest are:

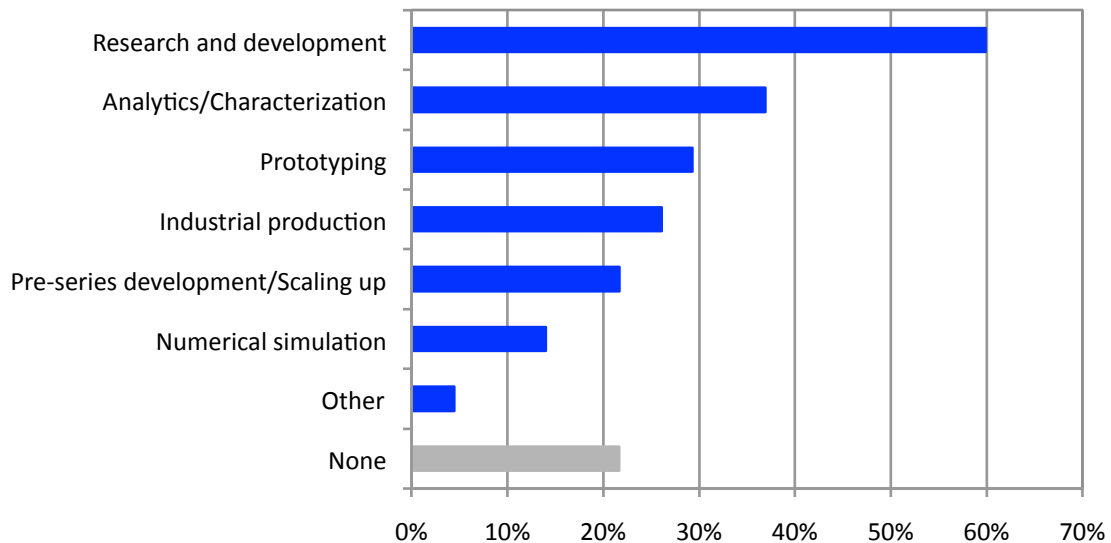
- *biology & medicine,*
- *sensors/actuators,*
- *electronics & photonics,*
- *health/safety issues,*
- *nanofabrication,*
- *micro/nano optics.*



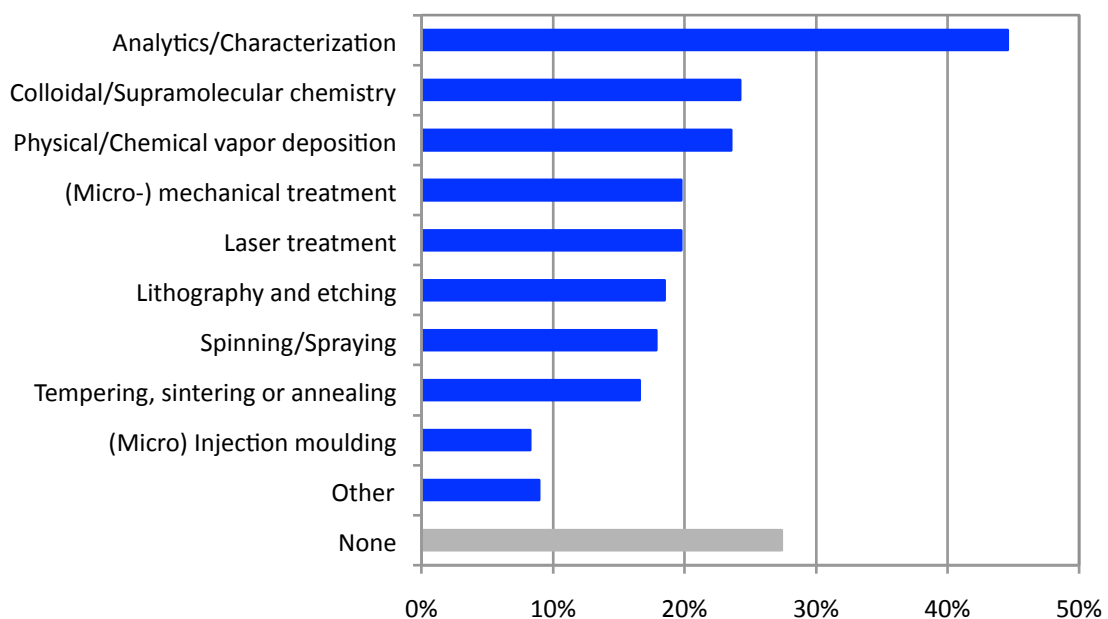
**Fig. 16** Which fields of nanotechnology are of particular interest/importance to your company? (Question B.5)

60% of respondents declared to be involved in R&D activities (Fig. 17). This information has to be carefully interpreted, as it is (1) strongly biased by science organizations participating in the survey, and (2) does not further differentiate between, for example, participation in joint R&D projects, advanced basic research or incremental product development.

Analytics/characterization (37% of responses in Fig. 17) surely represents a ,blockbuster' along the value chain, since characterization of materials, surface structures etc. has to be applied during the entire process from initial research to final production, in almost all industrial and scientific sectors. Prototyping, scaling-up and production become increasingly important in the transition from lab-scale to the final product.



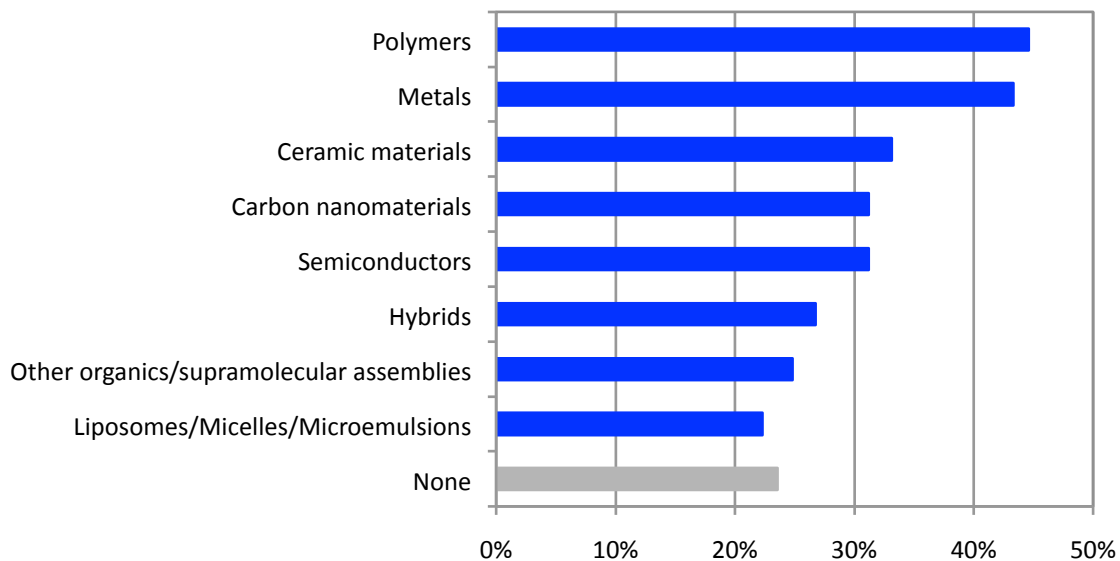
**Fig. 17** Which of the following steps of the nanotechnology value chain do you cover in your company? (Question B.6)



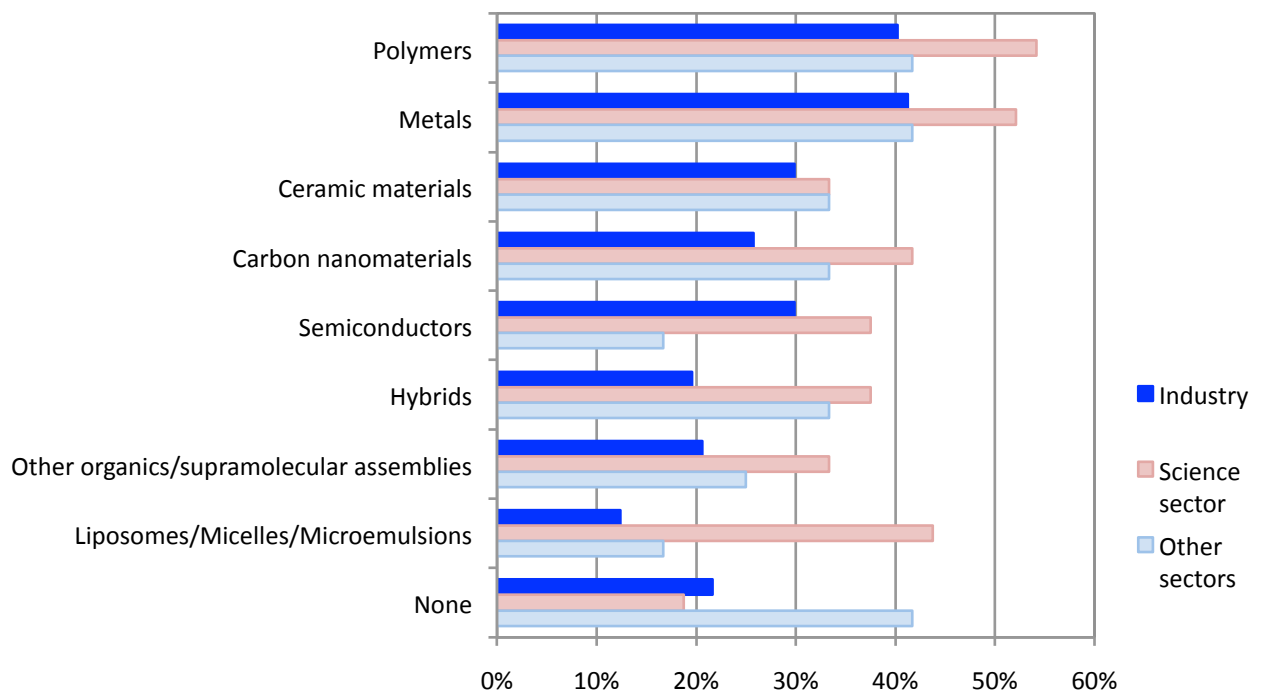
**Fig. 18** Which micro/nanotechnology processes/equipment do you use or focus on in your company? (Question B.7)

Fig 18 illustrates the most important micro/nanotechnology processes and/or equipment used (or focused on) in the respondents' companies/organizations. By far the most companies (44%) use *micro/nano analytics* in their innovation processes, followed by *colloidal/supramolecular chemistry* (24%) and *PVD/CVD processes* (23%).

Fig. 19 and 20 provide information on the materials that are used (or focused on) in the companies participating in the survey. In Fig. 20 the statistics are broken down by sector. The most important materials used are *polymers* and *metals*. Ranking next are ceramic materials, semiconductors and carbon nanomaterials, the latter relate more to the science sector. Liposomes/micelles/ microemulsions are less present at industry level, but are substantially investigated in universities and R&D organizations.



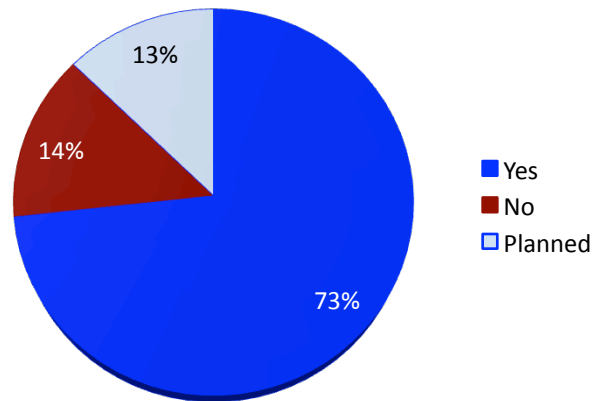
**Fig. 19** Which materials do you use or focus on in your company? (Question B.8)



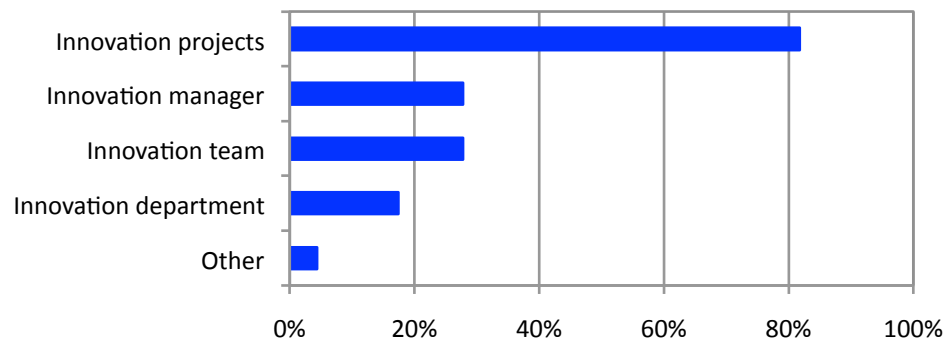
**Fig. 20** Materials used (or focused on) by respondents broken down by sector.

### 3.3 Innovation management

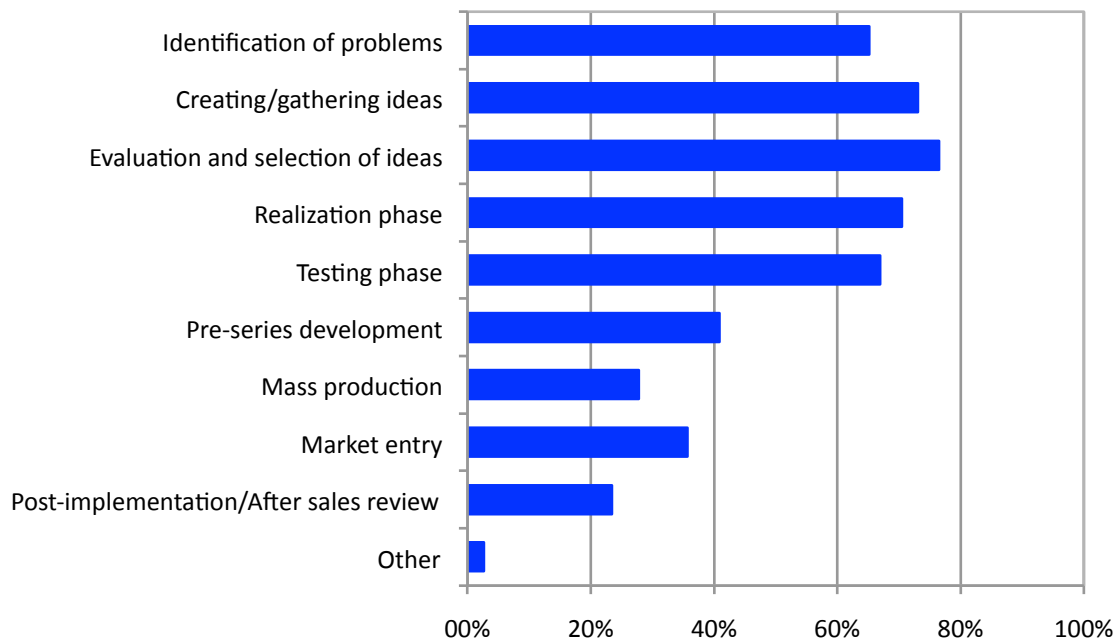
The vast majority of respondents (73%) declare that their companies/organizations carry out innovation management, further 13% are in the preparatory stage (Fig. 21). More than 80% of respondents organize innovation management on a project basis (Fig. 22).



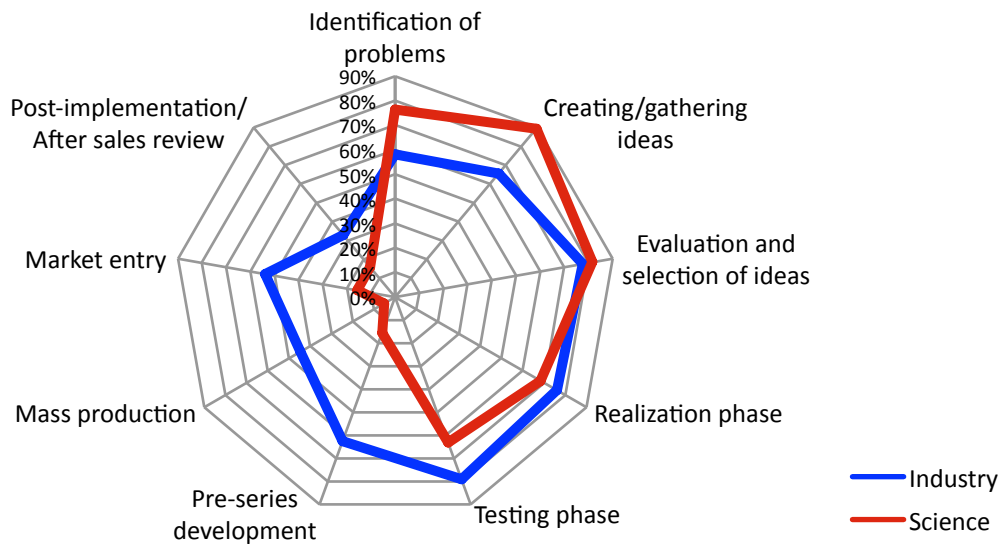
**Fig. 21** Does your company carry out innovation management? (Question C.1)



**Fig. 22** In which form does your company carry out innovation management? (Question C.1)



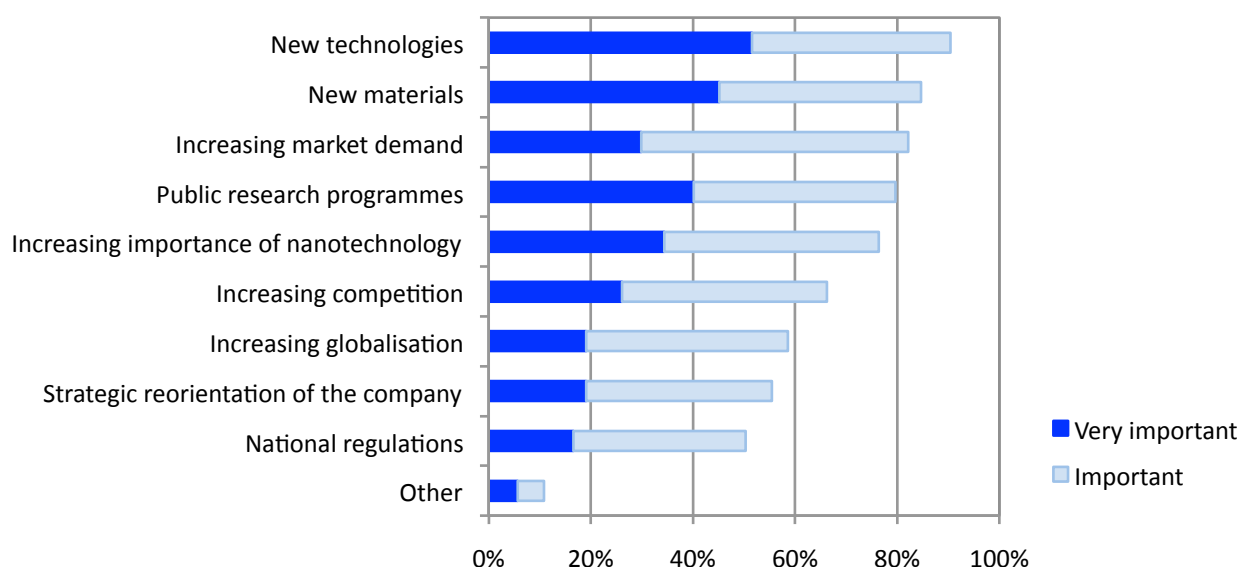
**Fig. 23** Which innovation phases are considered in the context of innovation management? (Question C.1)



**Fig. 24** Which innovation phases are considered in the context of innovation management? (Comparison of different sectors)

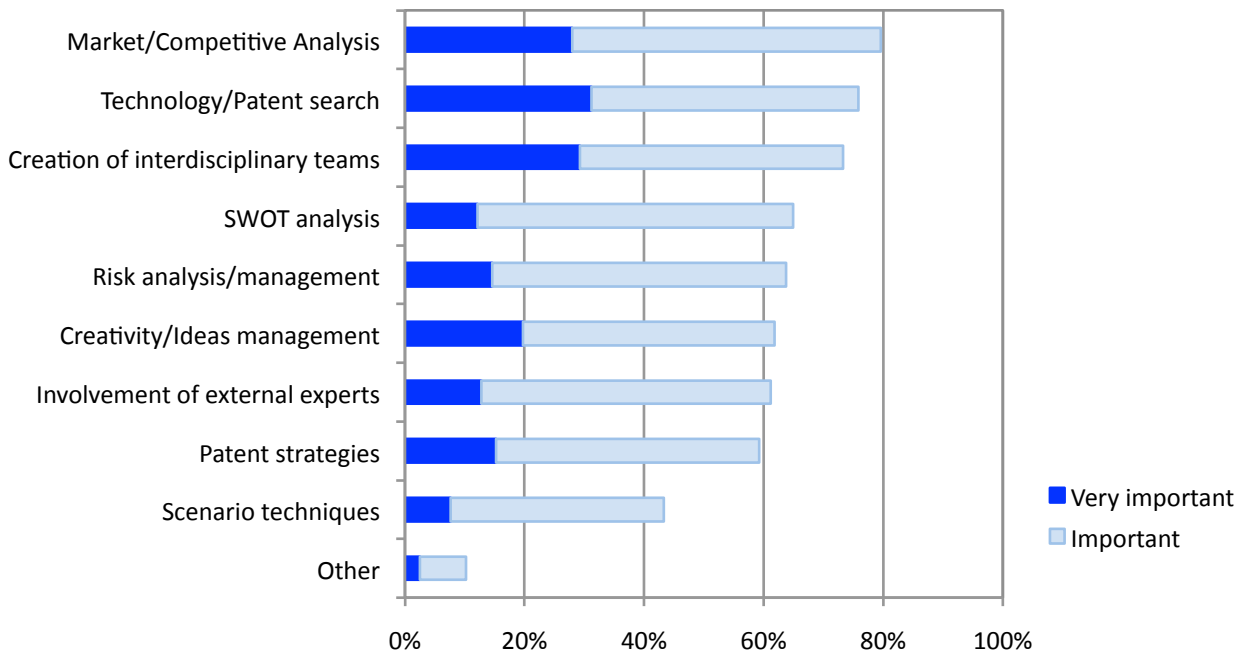
Fig. 23 and 24 show the involvement of respondents in different phases of the innovation process. The radar chart in Fig. 24 illustrates the well-known situation that science organizations focus on research and development activities, starting with idea creation/invention and ending (more or less) with lab-scale development and testing. Scaling-up, pilot production and mass production is left to industrial firms.

The major driving forces of innovation processes relating to nanotechnology are found to be the *new technologies* available and *advanced materials* (Fig. 25). Public research programmes also play a vital role in triggering innovation processes and overcoming innovation barriers.



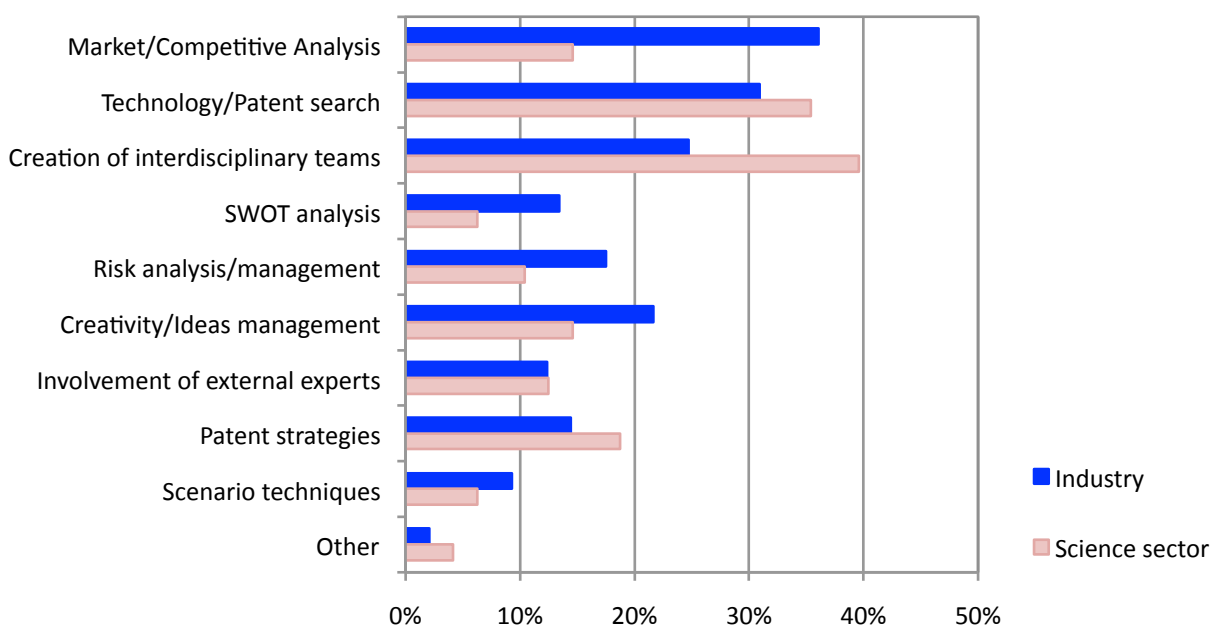
**Fig. 25** Which factors trigger innovation processes in the field of nanotechnology? (Question C.3)

*Market research* and *patent search* are crucial elements in managing innovation processes (Fig. 26). In the context of nanotechnology-related innovation, it is also of critical importance to form interdisciplinary teams that manage, monitor and evaluate innovation processes.



**Fig. 26** Which instruments/tools/methodologies do you use in the framework of innovation management? (Question C.4)

A closer look at the applied innovation instruments in industry and science show significant differences (Fig.27). Whereas market research is of utmost importance for companies, it plays only a minor role at university level. The creation of interdisciplinary teams is more strongly established in science organizations than in industry. Risk management and innovation tools such as SWOT analysis and scenario techniques are more present in companies than in R&D institutions.

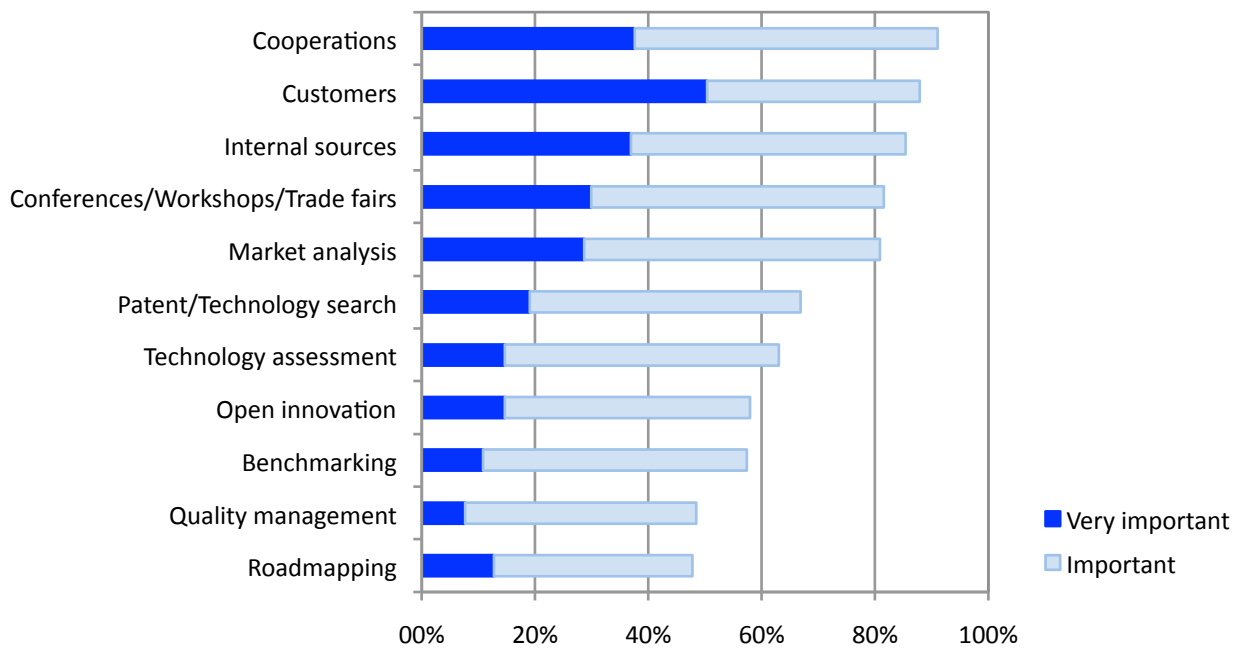


**Fig. 27** Which instruments/tools/methodologies do you use in the framework of innovation management? (Comparison between different sectors/target groups)

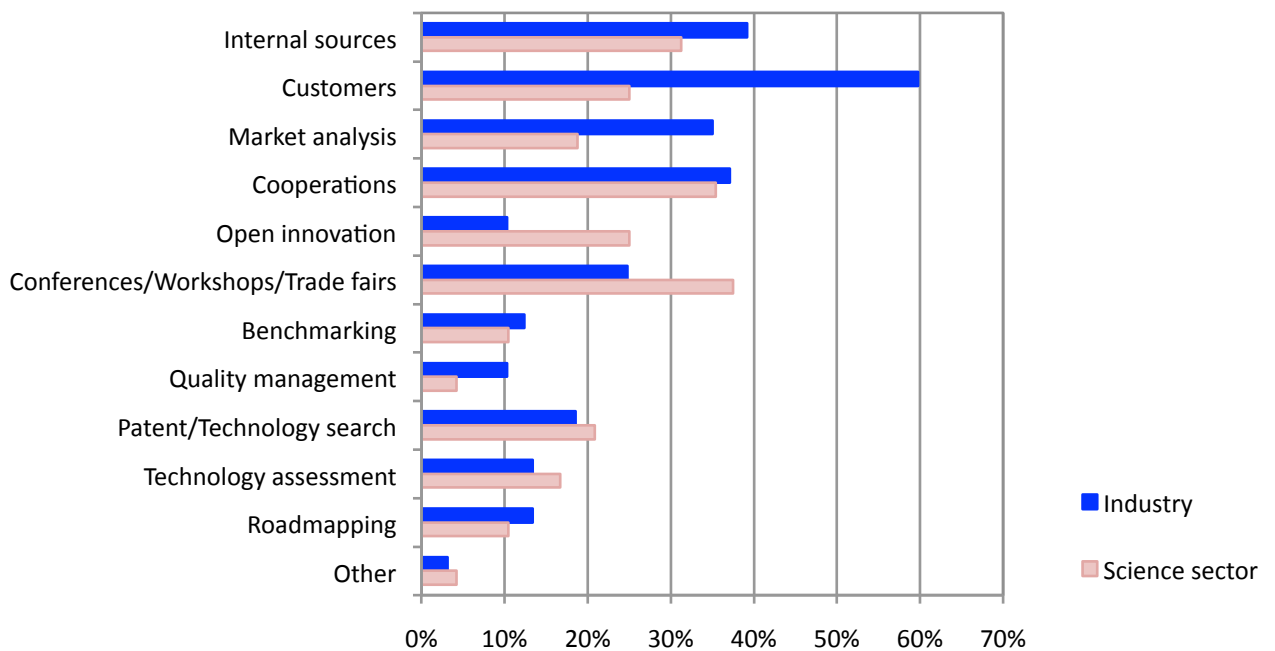


Fig. 28 and 29 provide evidence that *cooperations* (intersectoral, company/company), communication with *customers*, but also *internal human resources*, participation in *conferences* (and again *market analysis*) are important sources of new products and services.

The dialogue with customers, cooperations, internal sources and market research are decisive for idea generation in industry, whereas the attendance of conferences and *open innovation* are more present in the science sector (Fig. 29).

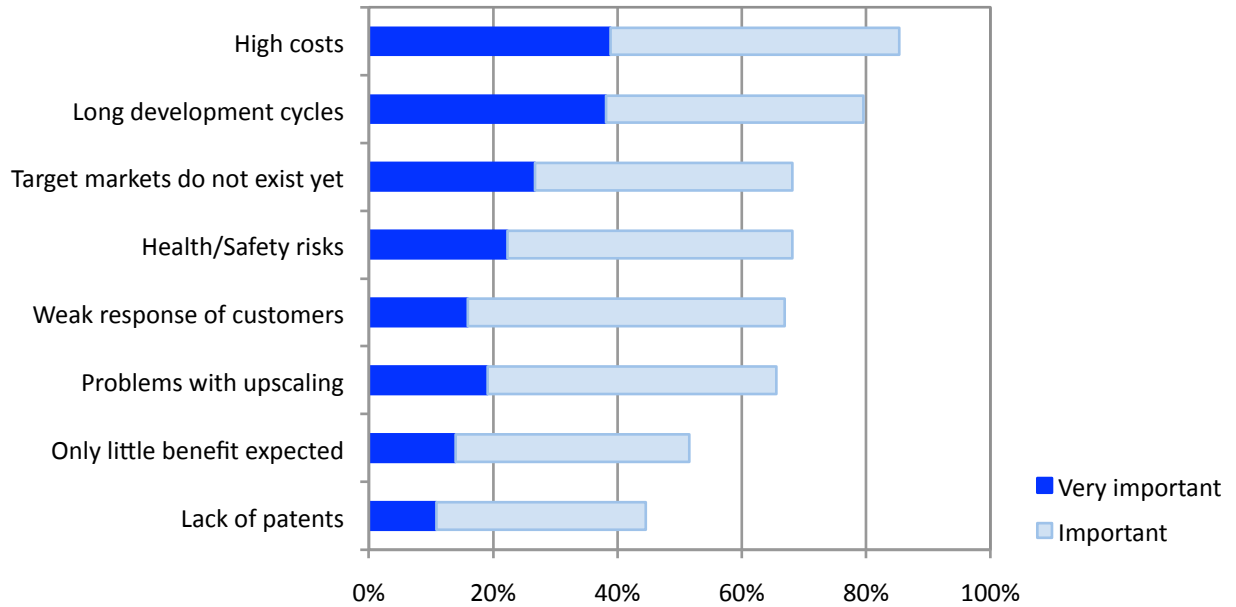


**Fig. 28** From which sources do you gain stimulations and ideas for new products/services? (Question C.5)



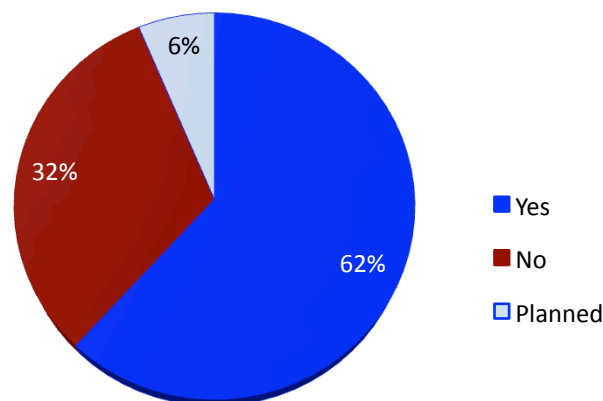
**Fig. 29** From which sources do you gain stimulations and ideas for new products/services? (Comparison between different sectors/target groups)

High costs and long development cycles are the worst innovation barriers in the field of nanotechnologies (Fig. 30). In particular the respondents from the East European partner regions rated the NT-related costs as highest innovation obstacle.



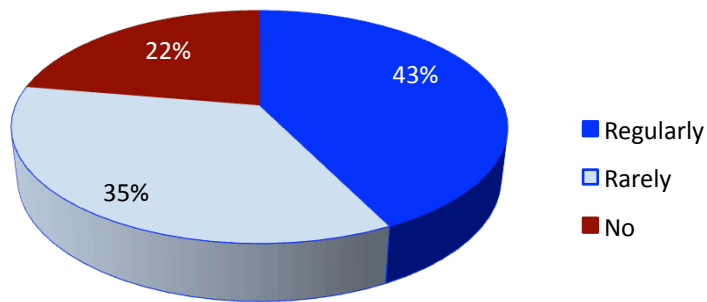
**Fig. 30** How do you rate innovation barriers in the field of „nano“?

Fig. 31 – 33 provide information on the organization of R&D and the management of intellectual property in companies. 62 % of the companies involved in the survey have their own R&D department, further 6% plan to set up an R&D department (Fig. 31).

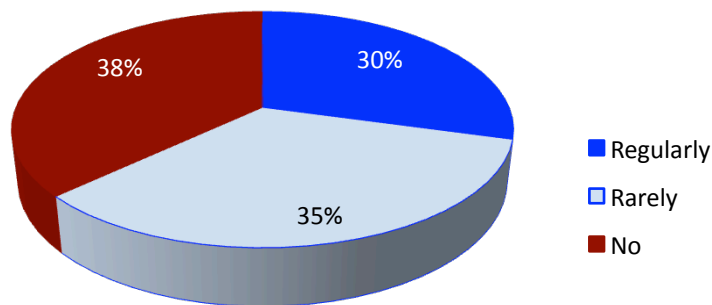


**Fig. 31** Does your company have its own R&D department? (Question C.7)

43% of respondents regularly file patent applications, another 35% rarely (Fig. 32). The registration of trade marks is less pronounced than the application of patents. 30% of respondents declare to register trademarks regularly, 35% rarely (Fig. 33).



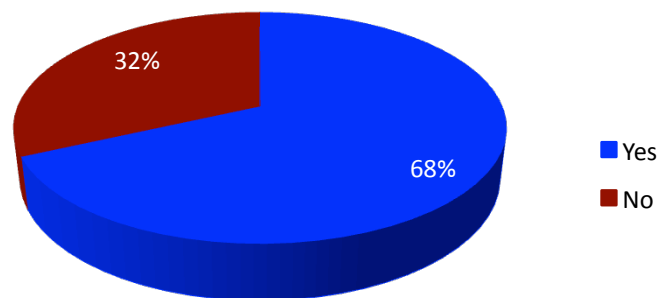
**Fig. 32** Do you patent your products/technologies? (Question C.8)



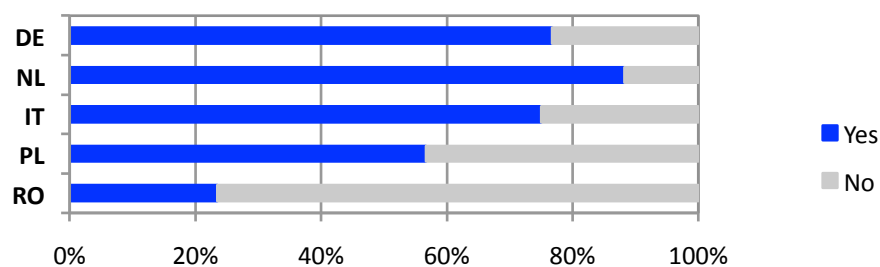
**Fig. 33** Do you register trade marks for your products/services? (Question C.9)

### 3.4 Education & training

Two third of the respondents declared to have qualified staff with knowledge/skills in nanotechnology (Fig. 34). An interregional comparison shows differences between the partner regions (Fig. 35). NT-related knowledge is less advanced in Poland and Romania than in the western ENEX partner regions.

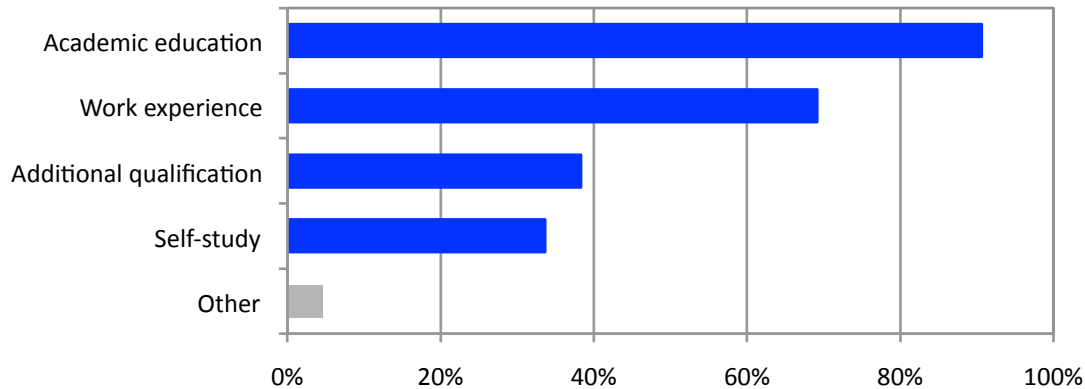


**Fig. 34** Do you have qualified staff with knowledge/skills in the field of nanotechnology? (Question D.1)

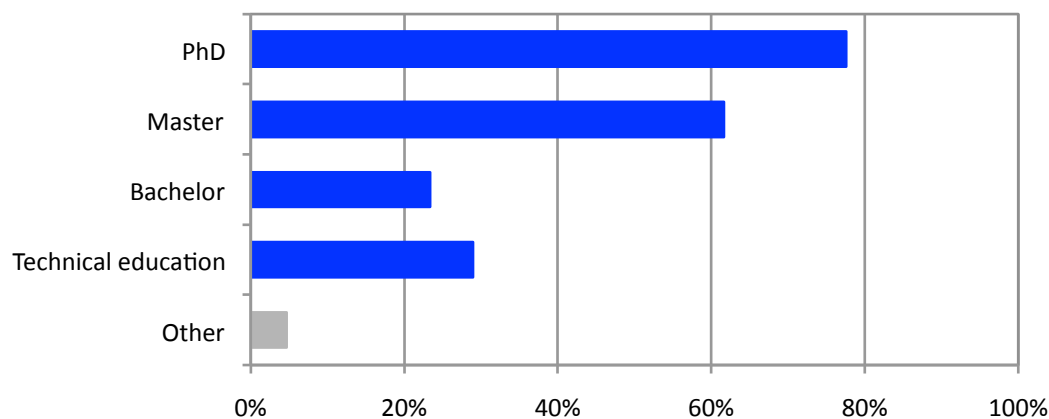


**Fig. 35** Do you have qualified staff with knowledge/skills in the field of nanotechnology? (Interregional comparison)

Staff with a qualification in nanotechnologies usually have an *academic background* (91% of respondents): PhD (69%), Master (61%) and Bachelor (22%), or *work experience* (69% of respondents). Additional qualification and self-study are ranking three and four with 38% and 34%, resp. (Fig. 36 and 37).

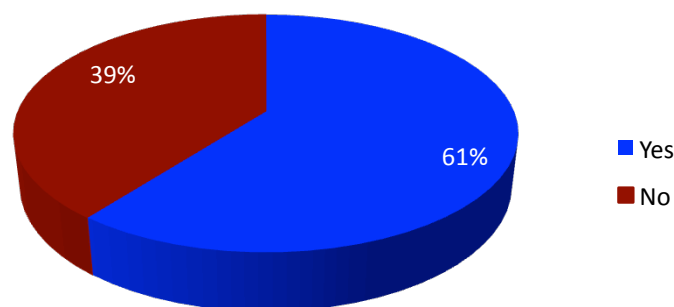


**Fig. 36** *If you have qualified staff with knowledge/skills in the field of NT, how did they acquire this knowledge/skills? (Question D.1)*



**Fig. 37** *If you have qualified staff with knowledge/skills in the field of NT, what degree of qualification do they have? (Question D.1)*

61% of respondents plan to allocate/employ (more) human resources in the field of NT in future (Fig. 38).

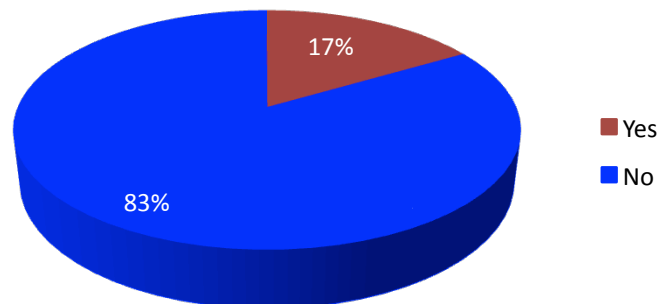


**Fig. 38** *Do you plan to allocate (more) human resources in the field of nanotechnology in future? (Question D.2)*

17% of respondents claimed that they had encountered difficulties in the past to identify and recruit staff with qualifications in nanotechnology (Fig. 39). Exemplary reasons mentioned were (no order of priority):

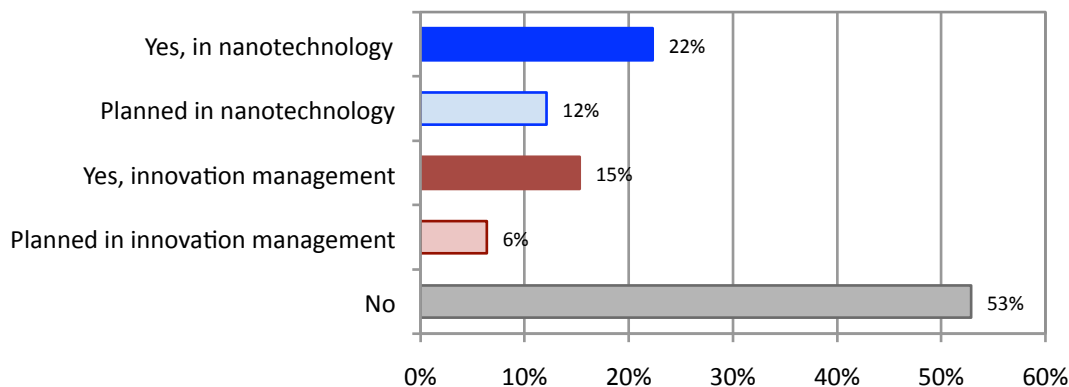
- *Mismatching education, no 'combinability' of theory and application. (DE)*
- *Knowledge and competences in nanotechnology were either very special, but irrelevant for the company or missing entirely. (DE)*
- *Lack of qualified candidates. (DE)*
- *University educational programs do not sufficiently match the technical needs of companies. (IT)*
- *Lack of suitable profiles in Tuscany. (IT)*
- *Poor preparation for measurement techniques and processes. (IT)*
- *Difficult to find Dutch experts. (NL)*
- *Lack of experience. (PL)*
- *Poor training in the field. (RO)*
- *Only little availability of experts on the labour market, particularly with special knowledge of marketing nano products. (ES)*

As can be seen from the region of origin of comments (specified in brackets), the problem of mismatch between company needs and academic education is present in all partner regions involved in the ENEX project.



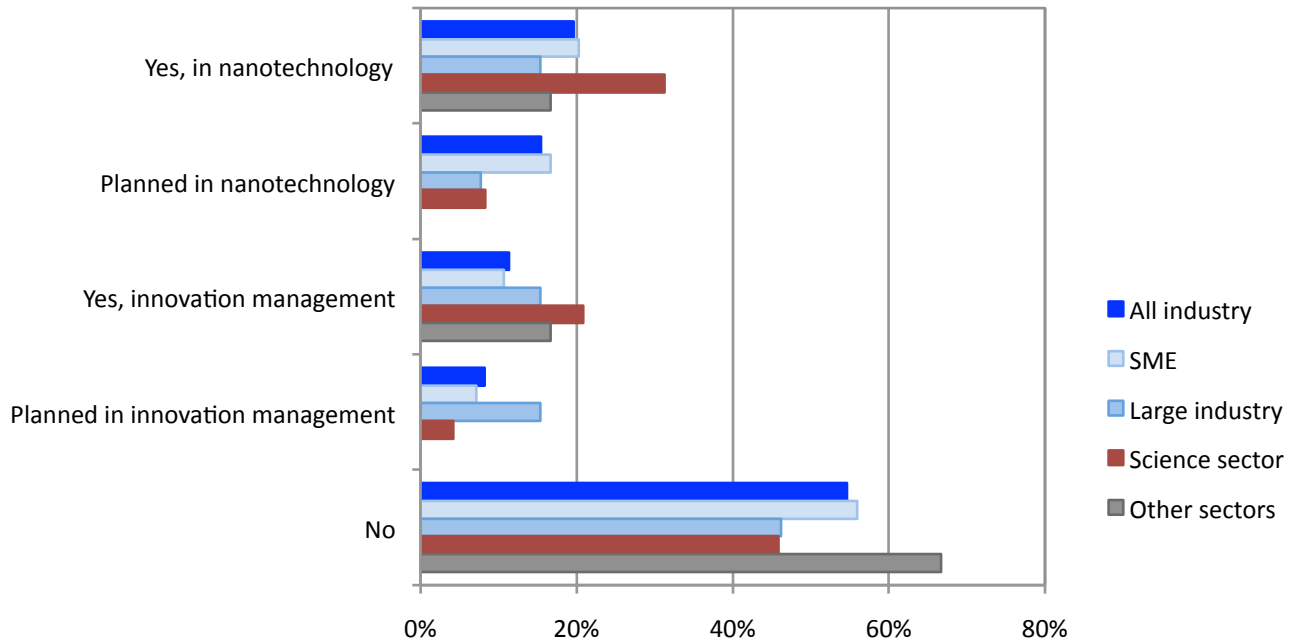
**Fig. 39** *If you already employ nanotechnology experts, have you experienced any problems in the past when recruiting qualified staff in the field of nanotechnology? (Question D.3)*

22% of respondents indicated that they use VET offers relating to nanotechnology, 12% plan to do so. Concerning innovation management, 15% of respondents make use of VET offers, 6% intend to use education offers (Fig. 40).



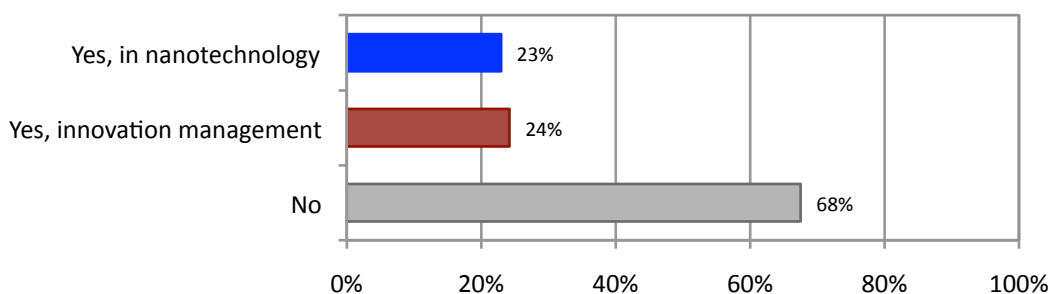
**Fig. 40** *Does your company make use of vocational education & training (VET) offers in the field of nanotechnology or innovation management? (Question D.4)*

Fig. 41 shows the use of education offers broken down by sector. The comparison between the different sectors addressed in the survey confirms the pronounced role of education offers in R&D institutions, as might have been expected.



**Fig. 41** Does your company make use of vocational education & training (VET) offers in the field of nanotechnology or innovation management? (Comparison between different sectors/target groups)

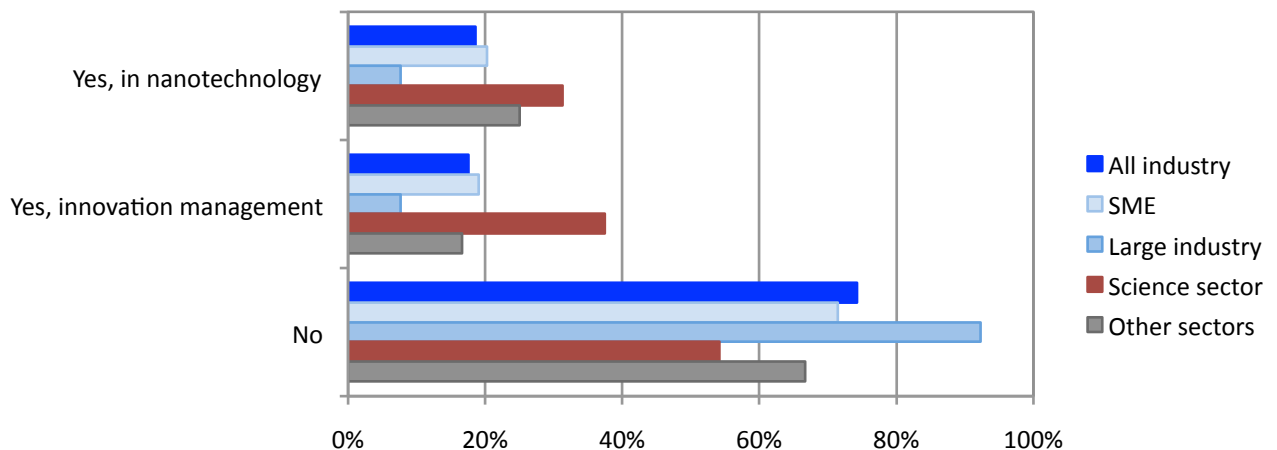
About two third of all respondents see no further necessity for VET programmes in their companies/organisations with regard to nanotechnology and innovation management (Fig. 42). However, the remaining respondents specified a need in VET in nanotechnology (23%) and/or in innovation management (24%).



**Fig. 42** Is there any (further) need in your company for VET in the field of nanotechnology or innovation management? (Question D.5)

The demand for education programmes differs from sector to sector. On the basis of the responses received science organisations have a higher demand in education and training in the disciplines considered, especially in the field of innovation management (Fig. 43).

Another remarkable result is that there is obviously substantially less demand for further education in nanotechnology as well as innovation management in large companies than in SMEs.



**Fig. 43** *Is there any (further) need in your company for VET in the field of nanotechnology or innovation management? (Comparison between different sectors/target groups)*

The following fields of interest were specified by the respondents (only exemplary; equal or similar answers appear only once; no weighting or relative ranking of the answers):

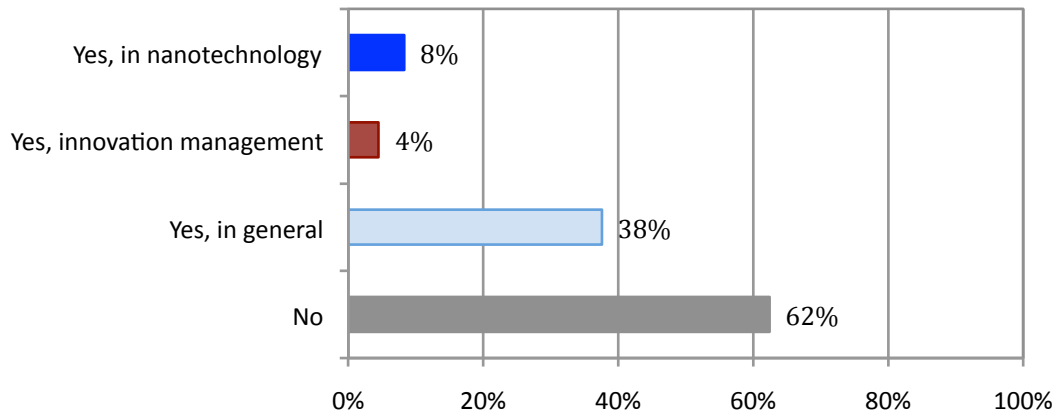
#### Nanotechnology:

- *Materials development: suspensions, hybrid material.*
- *Manufacturing and design of nano structures and their characterization.*
- *Technologies for nanocomposites.*
- *Coating technologies, nanostructured surface technologies.*
- *Applied nanotechnology for medical technology, environmental technology or pharmaceutical issues.*
- *Safety and handling of nano(materials).*
- *Environmental sustainability.*
- *Water treatment, waste treatment.*
- *Construction technology, energy, ICT.*
- *More advanced trainings in the field of nano for engineers.*
- *Nano-production.*
- *Manufacturing, process reliability, applications.*
- *Nanomaterials with special applications (health, restoration, conservation of cultural heritage).*
- *Nanotechnology applied to electroplating and finishing jewels.*

#### Innovation management:

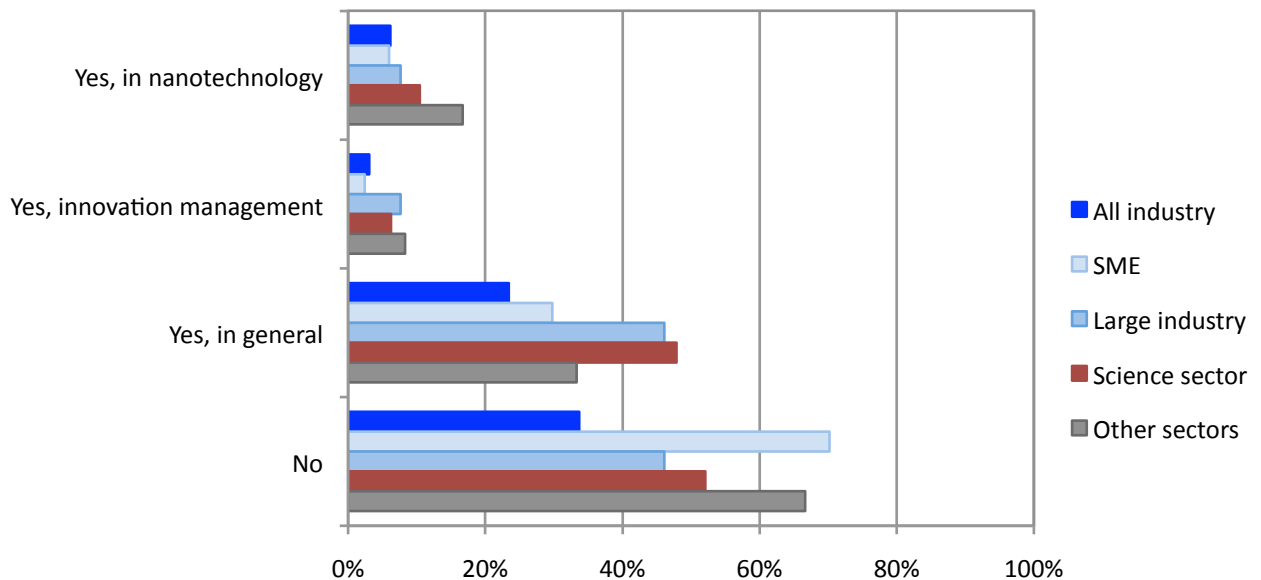
- *Details of innovation management, patent strategies, marketing.*
- *Management and market entry of nanotechnology products.*
- *Innovation tools.*
- *Idea generation, project management.*
- *Quality management, organization models.*
- *Market analysis.*
- *Innovation transfer.*

Finally, the last question of the survey related to the experience with e-learning concepts in vocational education and training at company level. 38% of respondents declared that they had general experience with e-learning in VET, 8% of respondents had experience with NT-related e-learning, and 4% with e-learning related to innovation management. 62% do not have any experience with e-learning concepts in VET (Fig. 44).



**Fig. 44** Do you already have experience with e-learning concepts in VET? (Question D.6)

A comparison of the experience with e-learning in the differed sectors/target groups addressed in the survey shows that in SMEs the use of e-learning concepts in general (and hence also in nanotechnology and innovation management) is significantly below average (Fig. 45). About 70% of the SMEs responding to the survey declared that they do not have any experience with online education and training concepts.



**Fig. 45** Do you already have experience with e-learning concepts in VET? (Comparison between different sectors/target groups)



#### 4. Summary and conclusions

A company survey has been carried out as part of Intellectual Output 1 ('The ENEX Competence Profile') in order to define the basic learning contents for the e-learning course 'ENEX – Expert in Nanotechnology Exploitation'. The objective was to gather as much information as possible on the level of engagement of the main ENEX target groups in nanotechnology and innovation management, and to identify potential qualification needs in these areas.

- A total of 157 companies/organizations from all ENEX partner regions responded to the online questionnaire. The responses covered the main ENEX target groups and came from industry (97), thereof 84 from SMEs and 13 from large companies, science organizations (48) and other sectors (12). 71% of the companies involved have knowledge/skills in nanotechnology, 73% carry out innovation management.
- In particular *materials*, *health/medical technology*, *biotechnology*, *environmental technology*, moreover *chemical & pharmaceutical industry* and the *energy sector* were identified as perspective major application markets/fields of activity in which a larger share of the respondents of the survey are already positioned or which they would like to develop.
- NT fields of primary interest were found to be - above all - *materials*, to a less extent *biology & medicine*, *sensors & actuators*, *electronics & photonics*, *health/safety issues*, *nanofabrication*, and *micro/nano optics*.
- As far as materials are concerned, the companies involved in the survey focus on *polymers* and *metals*, followed by *ceramics*, *semiconductors* and *carbon nanomaterials*. *Liposomes/ micelles/microemulsions* play a major role only in science institutions.
- The most important (nano) technology processes in the respondents' companies are *micro/nano analytics*, furthermore *colloidal/supramolecular chemistry* and *thin film technologies (PVD/CVD)*.
- Major driving forces of innovation processes relating to nanotechnology are found to be the *new technologies* and *new materials* available.
- With regard to innovation management, *market analysis*, *patent search* and the *creation of interdisciplinary teams* were regarded as the most important innovation 'tools'.
- *Cooperations*, communication with *customers* and *internal human capital* are the most important sources for new products.
- The importance of *intellectual property rights* is evident from the reported figures: 78% of the companies involved apply – regularly or rarely - for patents, 65% register trademarks.
- Although 68% of the respondents have already qualified staff with knowledge/skills in nanotechnology, 61% of the companies plan to allocate more human resources in the field of nano in future.
- 22% of the companies involved have used VET offers in nanotechnology, 15% of the companies have done this in innovation management. Almost one quarter of the respondents expressed a demand for VET in the field of 'nano' and/or innovation management.

- 
- In general terms, the use of electronic VET concepts in companies can be considered as underdeveloped. This might be caused either by a rather limited supply of online education offers or by a reluctance of companies to integrate electronic learning concepts in their VET portfolios. Only 8% of the companies involved in the survey have experience with digitalized VET concepts in nanotechnology, even less in innovation management (4%).

As a conclusion, *digitalization of education and training offers* for industry remains a big challenge for the future, in particular in the case of SMEs.

Together with

- the findings from in-depth interviews with selected stakeholders in the area of NT innovation,
- the feedback from pilot trainings organized by the ENEX project partners, as well as
- a benchmark of existing education and training offers in the areas of nanotechnology and innovation management,

the responses of the ENEX company survey will be used as a guidance for the contents of the ENEX curricula and for defining a realistic frame of the ENEX training course.

## 5. Acknowledgement

The author wishes to thank all those who participated in the survey and contributed to producing this report.

The author further wishes to clarify that the evaluation reported here is based on a descriptive statistical analysis of the responses received, and in particular does not claim to be representative of all actors and stakeholders engaging in the area of nanotechnology, neither in the five partner regions involved in the survey, nor as a whole.

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## ENEX Company Questionnaire

### Introductory remarks:

- The Erasmus+ project '*ENEX – Expert in Nanotechnology Exploitation*' aims at developing advanced training courses for professionals as well as graduate and postgraduate students facing the rapidly growing importance of nanotechnology in industry, research and the society as a whole.
- Nanotechnology is a strongly emerging area of research and activity, opening up new markets, and leading to new products, processes and services in almost all industrial sectors. As a result, there is an increasing demand of particularly qualified personnel in companies producing and using nanotechnology, but also in research organisations developing new technologies as well as consulting firms and other institutions focusing on the nanotechnology research-to-market process. The ENEX training courses will be based on an interdisciplinary approach combining nanotechnology modules with innovation management content.
- This survey shall help to identify specific needs with regard to nanotechnology and product/process innovation management in companies, R&D institutions and consulting firms and to define/refine the right learning contents for the ENEX course.
- For the sake of convenience, the term '*company*' in this questionnaire shall refer to any kind of business processing, producing, using and/or focusing on nanotechnology (i.e. manufacturing companies, research institutes, university departments, consulting firms, technology transfer agencies, trade associations etc.).
- Please be assured that the information disclosed by your company for this survey will be kept strictly *confidential*. Feedback on the questionnaire will be summarized in a final report which will be made available to all participants interested in this information.
- If you have any further questions regarding this questionnaire, please contact *Heinz Brueckelmann, [umfrage@enex-nano.eu](mailto:umfrage@enex-nano.eu)*.

Many thanks in advance for your cooperation!

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**(A) Company Data**

---

**A.1 Where is your company located (region, country)?**

**A.2 In which year was the company established?**

**A.3 Type of company (select all relevant)**

- |   |  |
|---|--|
| <input type="checkbox"/> Large industry                   | <input type="checkbox"/> Manufacturer                |
| <input type="checkbox"/> SME                              | <input type="checkbox"/> Development/Engineering     |
| <input type="checkbox"/> Start-up/Spin-off/Spin-out       | <input type="checkbox"/> Wholesaler                  |
| <input type="checkbox"/> R&D institution (non-university) | <input type="checkbox"/> Technology service provider |
| <input type="checkbox"/> University                       | <input type="checkbox"/> Consulting company          |
| <input type="checkbox"/> Association/Network              | <input type="checkbox"/> Technology transfer agency  |
| <input type="checkbox"/> Other <input type="text"/>       |  |

**A.4 Is the company an independent entity?**

- Yes                       No

**A.5 Statistical data relating to company size and organization:**

**Number of employees of your company**

- <10       10-49       50-99       100-249       250-500       >500

**What is the company's average annual turnover (M€)?**

- <0.5       0.5-1       1-5       5-10       10-50       >50

**How much percent of staff are involved in R&D?**

- 0               <25               25-50               50-75               >75

**How much percent of staff are involved in production?**

- 0               <25               25-50               50-75               >75

**How much percent of staff have an academic degree?**

- 0               <25               25-50               50-75               >75

**A.6 Which target markets are of importance to your company today?**

*(select all relevant)*

- |  |   |
|--|---|
| <input type="checkbox"/> Automotive Industry               | <input type="checkbox"/> Aerospace Industry                 |
| <input type="checkbox"/> Biotechnology                     | <input type="checkbox"/> Chemical & Pharmaceutical Industry |
| <input type="checkbox"/> Health/Medical Technology         | <input type="checkbox"/> Environmental Technology           |
| <input type="checkbox"/> Energy                            | <input type="checkbox"/> Materials                          |
| <input type="checkbox"/> Information Technology            | <input type="checkbox"/> Telecommunication                  |
| <input type="checkbox"/> Electronics Industry              | <input type="checkbox"/> Microsystems Technology            |
| <input type="checkbox"/> Measurement & Control             | <input type="checkbox"/> Automation & Production Technology |
| <input type="checkbox"/> Building technology/Construction  | <input type="checkbox"/> Food/Packaging                     |
| <input type="checkbox"/> Mobility/Lightweight construction | <input type="checkbox"/> Consumer Goods                     |
| <input type="checkbox"/> Other <input type="text"/>        |   |

**A.7 Which target markets will be of importance to your company in 5 years from now? (select all relevant)**

- |  |   |
|--|---|
| <input type="checkbox"/> Automotive Industry               | <input type="checkbox"/> Aerospace Industry                 |
| <input type="checkbox"/> Biotechnology                     | <input type="checkbox"/> Chemical & Pharmaceutical Industry |
| <input type="checkbox"/> Health/Medical Technology         | <input type="checkbox"/> Environmental Technology           |
| <input type="checkbox"/> Energy                            | <input type="checkbox"/> Materials                          |
| <input type="checkbox"/> Information Technology            | <input type="checkbox"/> Telecommunication                  |
| <input type="checkbox"/> Electronics Industry              | <input type="checkbox"/> Microsystems Technology            |
| <input type="checkbox"/> Measurement & Control             | <input type="checkbox"/> Automation & Production Technology |
| <input type="checkbox"/> Building technology/Construction  | <input type="checkbox"/> Food/Packaging                     |
| <input type="checkbox"/> Mobility/Lightweight construction | <input type="checkbox"/> Consumer Goods                     |
| <input type="checkbox"/> Other <input type="text"/>        |   |

**A.8 What are your geographical target markets?**

- Local/regional       National       International

**(B) Questions relating to nanotechnology**

---

**B.1 Does your company have knowledge/skills in the field of nanotechnology?**

- Yes       No       Planned

**B.2 Does your company use nanotechnology or manufacture products/provide services based on nanotechnology?**

- |  |   |
|--|---|
| <input type="checkbox"/> User                        | <input type="checkbox"/> Producer               |
| <input type="checkbox"/> Technology service provider | <input type="checkbox"/> Other service provider |
| <input type="checkbox"/> None of them                |   |

**B.3 If your company does not use nanotechnology, what is the reason?**  
(select all relevant)

- |   |  |
|---|--|
| <input type="checkbox"/> Lack of knowledge  | <input type="checkbox"/> Lack of experience          |
| <input type="checkbox"/> Lack of technology | <input type="checkbox"/> High health and safety risk |
| <input type="checkbox"/> Too expensive      | <input type="checkbox"/> Not necessary               |
| <input type="checkbox"/> Other _____        |  |

**B.4 What are the expectations of your company concerning nanotechnology for the next 5 years?** (select all relevant)

- We will start using nanotechnology.
- We will intensify our engagement in nanotechnology.
- Nanotechnology is a door opener for new markets.
- Nanotechnology will help us realize new products/services.
- Nanotechnology will bring us competitive advantage.
- From nanotechnology we will gain new knowledge.
- Through nanotechnology we can create new jobs.
- We will **not** use nanotechnology.
- Other \_\_\_\_\_

**B.5 Which fields of nanotechnology are of particular interest/importance to your company?** (select all relevant)

- |  |   |
|--|---|
| <input type="checkbox"/> Materials: synthesis or self-assembly | <input type="checkbox"/> Materials: properties, characterization, tools |
| <input type="checkbox"/> Biology & Medicine                    | <input type="checkbox"/> Electronics & Photonics                        |
| <input type="checkbox"/> Patterning & Nanofabrication          | <input type="checkbox"/> Energy at the nanoscale                        |
| <input type="checkbox"/> Sensing & Actuating                   | <input type="checkbox"/> Micro/Nanooptics                               |
| <input type="checkbox"/> Health/Safety issues                  | <input type="checkbox"/> Regulation/Standardization                     |
| <input type="checkbox"/> Not important                         | <input type="checkbox"/> Other _____                                    |

**B.6 Which of the following steps of the nanotechnology value chain do you cover in your company?** (select all relevant)

- |  |  |
|--|--|
| <input type="checkbox"/> Numerical simulation  | <input type="checkbox"/> Research and development              |
| <input type="checkbox"/> Prototyping           | <input type="checkbox"/> Pre-series development/Scaling up     |
| <input type="checkbox"/> Industrial production | <input type="checkbox"/> Analytics/Characterization techniques |
| <input type="checkbox"/> None                  | <input type="checkbox"/> Other _____                           |

**B.7 Which micro/nanotechnology processes/equipment do you use or focus on in your company?** (select all relevant)

- Colloidal/Supramolecular chemistry
- (Micro-) mechanical treatment
- Laser treatment
- Physical/Chemical vapor deposition
- Lithography and etching

- 
- (Micro) Injection moulding
  - Tempering, sintering or annealing
  - Spinning/Spraying
  - Analytics/characterization
  - None
  - Other

**B.8 Which materials do you use or focus on in your company? (select all relevant)**

- Carbon nanomaterials
- Ceramic materials
- Liposomes/Micelles/Microemulsions
- Metals
- Polymers
- Semiconductors
- Other organics/supramolecular assemblies
- Hybrids
- None
- Other

**(C) Questions relating to innovation management**

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**C.1 Does your company carry out innovation management?**

- Yes                       No                       Planned

**If 'Yes', in which form?**

- Innovation department
- Innovation manager
- Other
- Innovation team
- Innovation projects

**If 'Yes', which of the following innovation phases are considered?  
(Select all relevant)**

- Identification of problems
- Creating/gathering ideas
- Evaluation and selection of ideas
- Realization phase
- Testing phase
- Pre-series development
- Mass production
- Market entry
- Post-implementation/After sales review
- Other

**C.2 How are innovation processes initialized in your company?**

- Reaction on an acute problem
- Future-oriented challenge
- Demand-oriented approach ('Market Pull')
- Technology-oriented approach ('Technology Push')
- Other

**C.3 Which of the following factors trigger innovation processes in the field of nanotechnology?**

	Not important	Less important	Very important
<input type="checkbox"/> Increasing importance of nanotechnology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Increasing globalisation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Increasing competition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Increasing market demand	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> New materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> New technologies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> National regulations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Public research programmes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Strategic reorientation of the company	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Other <input style="width: 150px;" type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**C.4 Which of the following instruments/tools/methodologies do you use in the framework of innovation management?**

- |  |   |
|--|---|
| <input type="checkbox"/> Market/Competitive analysis     | <input type="checkbox"/> Technology/Patent search                         |
| <input type="checkbox"/> Involvement of external experts | <input type="checkbox"/> Creation of interdisciplinary teams              |
| <input type="checkbox"/> Scenario technique              | <input type="checkbox"/> SWOT analysis                                    |
| <input type="checkbox"/> Creativity/Ideas management     | <input type="checkbox"/> Risk analysis/management                         |
| <input type="checkbox"/> Patent strategies               | <input type="checkbox"/> Other <input style="width: 150px;" type="text"/> |

**C.5 From which sources do you gain stimulations and ideas for new products/services?**

- |   |   |
|---|---|
| <input type="checkbox"/> Internal sources         | <input type="checkbox"/> Customers  |
| <input type="checkbox"/> Market analysis          | <input type="checkbox"/> Cooperations                                     |
| <input type="checkbox"/> Open Innovation          | <input type="checkbox"/> Conferences/Workshops                            |
| <input type="checkbox"/> Benchmarking             | <input type="checkbox"/> Quality management                               |
| <input type="checkbox"/> Patent/Technology search | <input type="checkbox"/> Technology assessment                            |
| <input type="checkbox"/> Roadmapping              | <input type="checkbox"/> Other <input style="width: 150px;" type="text"/> |



**C.6 How do you rate the following innovation barriers in the field of „nano“?**

	Not important	Less important	Very important
<input type="checkbox"/> High costs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Long development cycles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Health/Safety risk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Lack of patents	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Problems with upscaling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Target markets do not exist yet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Weak response of customers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Only little benefit expected	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**C.7 Does your company have its own R&D department?**

- Yes                       No                       Planned  
 R&D is (partly) outsourced/subcontracted.

**C.8 Do you patent your products/technologies?**

- Regularly               Rarely               No

**C.9 Do you register trade marks for your products/services?**

- Regularly               Rarely               No

**(D) Questions relating to education & training**

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**D.1 Do you have qualified staff with knowledge/skills in the field of nanotechnology?**

- Yes                       No

**If 'Yes', how did they acquire this knowledge/skills?**

- Academic education                       Additional qualification  
 Work experience                       Self-study  
 Other \_\_\_\_\_

**If 'Yes', what degree of qualification do they have?**

- PhD                       Master  
 Bachelor                       Technical education  
 Other \_\_\_\_\_

**D.2 Do you plan to allocate (more) human resources in the field of nanotechnology in future?**

- Yes                       No

**D.3 If you already employ nanotechnology experts, have you experienced any problems in the past when recruiting qualified staff in the field of nanotechnology?**

- Yes  No

**If 'Yes', what kind of problems?**

**D.4 Does your company make use of vocational education & training (VET) offers in the field of nanotechnology or innovation management?**

- Yes, in nanotechnology  Planned in nanotechnology  
 Yes, in innovation management  Planned in innovation management  
 None of them

**D.5 Is there any (further) need in your company for VET in the field of nanotechnology or innovation management?**

- Yes, in nanotechnology  Yes, in innovation management

**If 'Yes', in which areas?**

**D.6 Do you already have experience with e-learning concepts in VET?**

- Yes, in nanotechnology  Yes, in innovation management  
 Yes, in general  No

## **(E) Personal details**

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**E.1 Your position in the company**

**If you are interested in the receipt of the summary of this survey, please fill in your personal contact data below.**

**E.2 Your personal contact data**

Name   
First name   
Company   
Address   
Email   
Telephone