



December 21, 2012

## Self-assessment among project participants

Evaluation of the strategic research programme NABIIT - Report no. 2

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# 1 Introduction and key findings

This report presents the results of a self-assessment conducted among the organisations participating in projects supported by the strategic research programme “Interdisciplinary Use of Nanotechnology, Biotechnology and Information and Communication Technology” (NABIIT).

The findings of the desk study yield vital insights into the projects funded by the programme and the results from these projects, including comprehensive insights into the inputs, activities, outputs and realised or expected outcomes of projects supported by NABIIT, including perspectives from different types of project participants

This report is structured as follows:

- **Chapter 2, *Contribution to the evaluation of NABIIT***, explains how the self-assessment contributes to the overall evaluation of the NABIIT programme.
- **Chapter 3** provides a brief ***Introduction to the Self-assessment***, including to the approach taken and the response rate.
- **Chapters 4 through 13** present the results of the self-assessment surveys conducted with academic and company participants.
- **Chapter 14** present the results of a short, separate self-assessment survey conducted among international project participants.
- The report concludes in **Chapter 15** with a short presentation of the ***Methodology***.

## Data and method

- The self-assessment surveys are based on data on project participants collected by the Council for Strategic Research in connection with the evaluation. This data set deviates from the data presented in the desk study as it is based on different sources. Hence, the total population presented in this report are based on the data collected for the evaluation by the Council and form the basis of the self-assessment survey, but do not represent the total population of the NABIIT participants. Thus the results presented in this report reflect those of the self-assessment survey.
- The self-assessment questionnaires have been administered to all 154 organisations that according to the data participated in the 36 projects funded by NABIIT. The 125 participating organisations (hereafter referred to as “participants”) contributed to a total response rate of 81 percent based on:
  - 77 of 96 academic participants (80 percent)
  - 38 of 46 company participants (83 percent)
  - 10 of 12 international participants (83 percent).
- Separate questionnaires were sent to three main groups of respondents: academic participants (including two university hospitals), company participants, and international participants.
- Separate analysis of applications and grants from the Strategic and Independent Research Councils by individual researchers contributing to the projects.
- Since only 19 of 36 projects were completed at the beginning of the evaluation, the self-assessment survey can only provide a preliminary indication of results and outcomes achieved in the projects.

## Key findings

- **Staff assigned to NABIIT projects.** Both academic and company participants have, on average, assigned just over 3 members of staff to NABIIT projects; the full time equivalent of these staff members is however more than twice as high for academic participants than for company participants (i.e. 2.2 persons compared to 0.8).

- **Young researchers.** 73 academic participants hired a total of 146 Ph.D. students and 97 post.docs. (or, on average 2 Ph.D. students and 1,3 post.doc.s) in connection with their NABIIT projects. More than half these positions were filled with persons recruited from foreign institutions.

35 company participants hired a total of 8 Ph.D. students and 7 post.docs. All Ph.D. students were recruited from Danish institutions, but half the post.docs. were recruited from abroad.

- **Nature of the research projects.** About half the projects represent new research ventures for participants; the remaining projects represent a continuation or extension of key existing research activities in the participating organisations.

- **Influence on research profile and competences.** Most academic participants indicated that the project has helped strengthen existing or acquire new core research competences, or that it has helped them strengthen their international visibility and standing.

The majority of company participants stated that they have strengthened their competitive advantage within the research field addressed in the project; many also stated that they have gained new research knowledge or adopted new methods or skills.

- **Contribution to private or public sector innovation.** Respondents identified only a handful of concrete innovations developed in the NABIIT funded projects, though several respondents pointed to potential future applications of their research.

- **Barriers to commercialisation.** Respondents indicated several barriers to commercialisation of research in NABIIT projects, the most important of which were a lack of capital and/or incentives for academics to pursue to commercial exploitation. Other respondents explained that the market for potential applications of their research were either too immature or nonexistent, or pointed to difficulties in converting research results to commercial products.

Finally, numerous respondents argued that the research in their projects was too fundamental to be expected to yield commercial results in the short run.

- **Contribution to solving society's problems.** Many academic respondents argued that their research could be expected to help address societal challenges related to e.g. public health, the environment or food quality and safety. Company participants were however significantly more conservative in identifying their projects' contributions to societal challenges than their academic collaborators.

- **Research collaboration.** Key channels for interaction among project participants include joint research activities, informal exchanges of information and ideas, and provision of access to research tools and infrastructure. Academic participants also collaborate extensively through e.g. co-authorship of scientific publications and training of young researchers. In comparison, company participants often collaborate by providing access to insights or data in industry.

- **Contribution to the research collaboration.** Both academic and company participants describe their chief roles as providing expert advice and access to specialised research and testing facilities. Moreover, company participants are more likely than their academic counterparts to be responsible for the application or commercial exploitation of research results.

While 90 percent of academic participants contribute to core research activities, the same only holds true of 43 percent of company participants.

- **Project and research management.** Projects employ a combination of informal and formal approaches to research and collaboration management, e.g. frequent meetings, establishing of a steering group, or joint attendance of conferences.

- **Collaboration across disciplines.** More than half of the academic respondents indicated that research collaboration in their projects takes the form of *multi-disciplinary collaboration* (where different disciplines may cross-fertilize each other but are not integrated). A quarter of respondents indicated that they engaged in *interdisciplinary collaboration* (i.e. they worked closely together using jointly developed processes and methods). Finally, one fifth of the respondents stated that participants from different research fields work independently of each other and thus engage in limited interaction between research fields.

- **Research funding.** Both academic and company respondents were asked whether they would have sought funding elsewhere in the absence of funding from NABIIT: 15 and 13 percent of academic and company participants, respectively, would have sought funding for the same project elsewhere. 40 and 37 percent of academic and company participants, respectively, would have abandoned their project. Half of all participants would have sought alternative funding for a similar or related project.

- **Key alternative sources of funding** to NABIIT, as identified by respondents, include the Council for Independent Research, the Advanced Technology Foundation, the EU, or private foundations.

According to respondents, there are no or few other adequate sources of funding for interdisciplinary projects, particularly when these are large-scale projects and/or involve company participants.

- **Spin-off projects from NABIIT funded research.** 49 percent of academic respondents and 18 percent of company respondents have developed spin-off projects as a result of their NABIIT funded research.

- **The use of research infrastructure.** Academic respondents were asked to describe to what extent and how their project made use of the existing research equipment and facilities. The majority of respondents indicated that they make extensive use of existing research infrastructures in their own or other organisations in Denmark or abroad.

- **Dissemination activities.** Publications in scientific journals as a result of NABIIT funded projects are examined in a separate report, A bibliometric analysis of publications from NABIIT projects. The self-assessment survey therefore focused on non-academic dissemination activities.

Some respondents have developed webpages to present information on and scientific results from their NABIIT financed projects. Most dissemination activities are however targeted towards industry or the general public and employ communication such as talks, participation in non-academic conferences, teaching, publications in the popular press or trade journals, and various forms of popular science magazines or shows on radio or television.

- **Results of project participation.** Key results for both academic and company participants included participation in academic conferences and new or improved research tools, equipment or methods.

- **Outcome for research activities.** Participants experienced outcomes such as new or strengthened research insight or competences, or expansion of research activities into new research areas. Both academic and company participants gained an increased focus on the possibilities or potentials of combining biotechnology, nanotechnology and ICT.

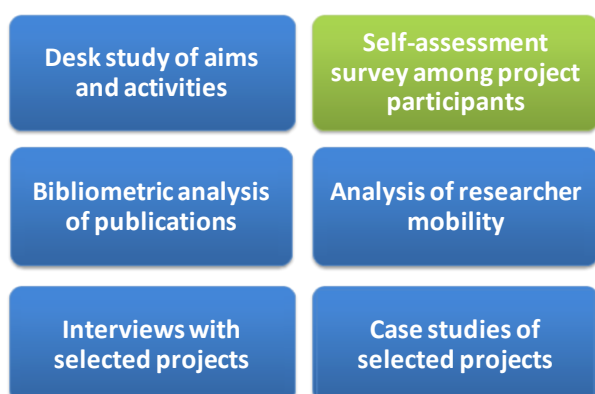
- **Outcomes on collaboration.** Both academic and company respondents improved their network to other research institutions in Denmark or abroad, and strengthened their ability and motivation to participate in interdisciplinary research collaboration.



## 2 Contribution to the evaluation of NABIIT

The self-assessment is one of six studies undertaken in connection with the evaluation of the NABIIT programme (cf. figure 2.1).

**Figure 2.1. NABIIT evaluation methodology**



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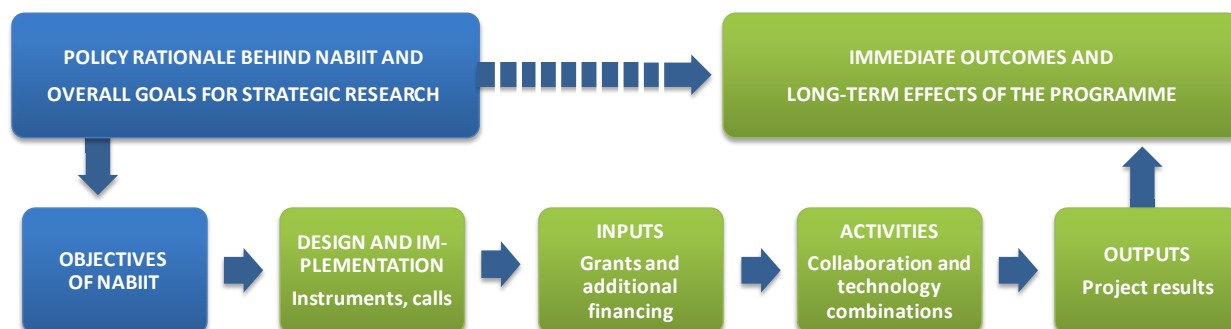
The evaluation is carried out on behalf of the Danish Council for Strategic Research by an independent, international peer review panel, assisted by the consultancy firm DAMVAD.

The evaluation of NABIIT is based on the evaluation design illustrated in figure 2.2. The self-assessment sheds light on the following evaluation

elements, which are also highlighted in green in figure 2.2:

- *Inputs* refer to the resources that have been invested in NABIIT-supported activities by NABIIT but also from other sources. Thus, inputs include NABIIT grants and additional funding (either provided by the participants or by other external sources of financing).
- *Activities* refer to the actual behaviour and activities that occur and create value in the projects supported by NABIIT. This includes understanding how project participants interact and collaborate and how they approach the combination of technologies.
- *Outputs* refer to the measurable results of investments under the NABIIT. It includes concrete results from projects funded by NABIIT (e.g. new knowledge, scientific publications, doctoral graduates, etc.).
- *Immediate outcomes and long-term effects of the programme*, which can only to a very limited extent be assessed at this point in time.

**Figure 2.2. Contribution of the desk study to the evaluation design**



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### 3 Introduction to the self-assessment

The self-assessment has been conducted as an online questionnaire, which was sent to the 154 participants in NABIIT subsidised projects. More precisely, the invitation to contribute to the self-assessment was sent to the contact person from every organisation that participates in a NABIIT funded project. These contact persons were asked to reply on behalf of the entire part of their organisation that participated in the project.

The questionnaire was tailored and administered to three separate groups of project participants:

- An extended self-assessment was conducted among *academic participants*, i.e. university research departments or centres at Danish universities. This group of respondents also included two university hospitals.
- A shorter self-assessment questionnaire was sent to *company participants* in companies in Denmark (including authorised technological services institutes, also known as GTS institutes).
- A short list of questions was sent to *international participants* including both academic and company participants.

The response rate for all three questionnaires is above 80%, as outlined in table 3.1. A response rate at above 80 % is considered high and thus satisfactory. This should also be seen in the light of nearly all grant holders provided their statements for the self-assessment. As they are perceived to have a superior overview of the projects, we be-

lieve that the self-assessment survey and this report are based on a solid foundation.

For a detailed description of the methodology, please see chapter 15.

The following chapters will present the main findings from the self-assessment surveys. As the self-assessments surveys consists of both open questions where the respondents have expressed their assessment in their own words and closed questions in pre-defined categories, this report includes both figures summarising quantifiable results as well as text boxes summarising qualitative statements provided by the respondents.

It should be noted that out of the 36 projects supported by NABIIT, only 19 have been completed at the time of evaluation. Hence, at this point it is merely possible for the evaluation to assess preliminary outputs and outcomes of the programme.

In the following we distinguish between the statements provided by academic participants and company participants. Some questions have only been directed at the academic participants and thus only their statements are included.

The results of the questions directed at the international participants are presented in a separate chapter, chapter 14.

**Table 3.1: Response rate**

Questionnaire	No. of invitations	No. of respondents	Response rate
Academic participants *	96	77	80 %
Company participants **	46	38	83 %
International participants	12	10	83 %
<b>Total</b>	<b>154</b>	<b>125</b>	<b>81 %</b>

Source: DAMVAD 2012. \* Includes two university hospitals. \*\* Includes eight GTS institutes.

## 4 Project staff and training of young researchers

This chapter presents findings from the self-assessment regarding

- The number of staff assigned to NABIIT funded projects by participating organisations
- Training of young researchers in connection with the projects.

### 4.1 Employees assigned to the project

On average, both academic participants and companies have more than three employees assigned to the project funded by NABIIT, cf. Table 4.1.

However, on average, less than one full time employee (as measured by working hours), is engaged with the project in the participating companies; for academic participants, the corresponding number is more than two employees. It should be noted that a significant proportion of the participants in NABIIT funded projects are not financed through the grant, but through co-financing.

**Table 4.1: Staff funded by the NABIIT grant (absolute numbers and full-time equivalent)**

	Academic participants				Company participants			
	Total	Min.	Max.	Ave.	Total	Min.	Max.	Ave.
Members of staff funded by the grant from NABIIT *	236	1	10	3.1	125	1	18	3.3
Full-time equivalent of all staff members (including Ph.D. students)	173	0.2	11.5	2.2	29	1	6	0.8

*Source: DAMVAD 2012. N (academic participants) = 77, N (company participants) = 38. \*) In the self-assessment survey, respondents were asked to indicate the number of staff in their organisation wholly or partially funded via the grant from NABIIT and the full-time equivalent of all staff assigned from their organisation to the project.*

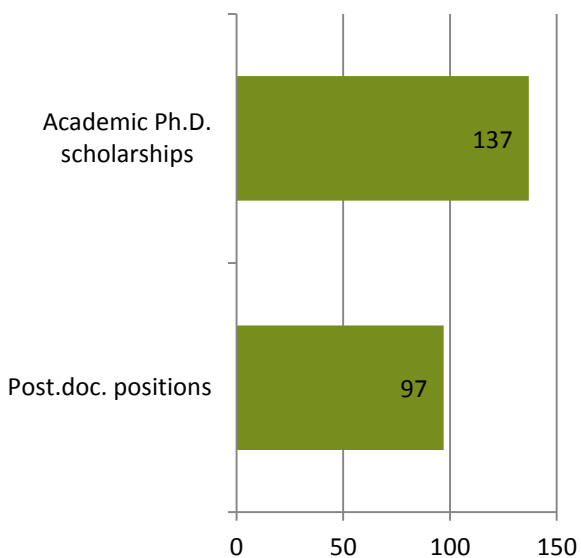
## 4.2 Training of young researchers

Academic participants were asked to state how many Ph.D.-students and post.doc.s they hired in connection with the NABIIT funded project.

As it is indicated in figure 4.1, 137 Ph.D. scholarships and 97 post.doc.s were granted at the public research institutions that participated in NABIIT projects.

Academic participants were also asked to indicate whether the Ph.D. and post.doc. positions were filled by a person from a Danish or foreign institution. Their answers are presented in figure 4.2, which shows that the distribution is almost equally weighted for Ph.D. positions, while a 58 percent of post.doc positions were filled by a person from a foreign institution.

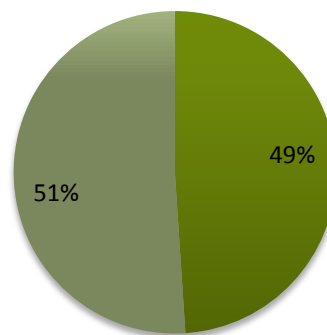
**Figure 4.1. Number of Ph.D. scholarships and post.doc positions granted at the public research institutions in connection with NABIIT projects**



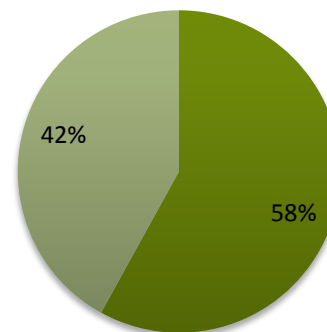
Source: DAMVAD 20012. N (academic participants) = 73.

**Figure 4.2: Distribution of Ph.D. and post.doc. positions among candidates from Danish and foreign institutions**

- Ph.D. positions filled by a person from a foreign institution
- Ph.D. positions filled by a person from a Danish institution



- Post.doc. positions filled by a person from a foreign institution
- Post.doc. positions filled by a person from a Danish institution

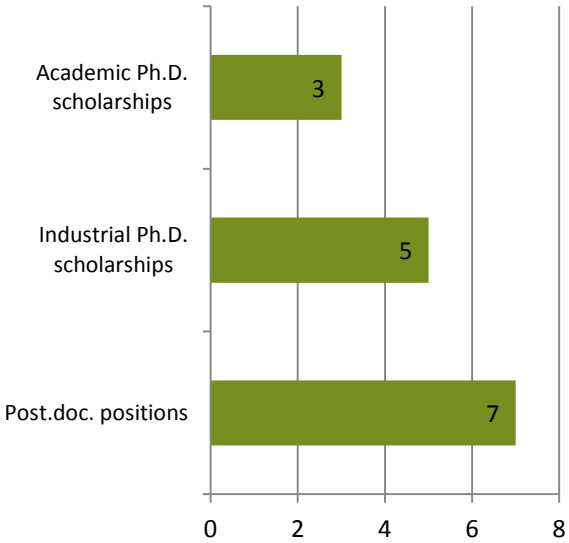


Source: DAMVAD 20012. N (academic participants) = 65.

Figure 4.3 shows the number of young researchers that were employed by company participants in connection with the NABIIT projects: three Ph.D. scholarships, five industrial Ph.D. positions and seven post.doc positions.

Company participants were also asked to indicate the country of origin of the young researchers they recruited. All Ph.D. positions were filled by a person from a Danish institution.

**Figure 4.3: Number of Ph.D. scholarships and post.doc. established in companies in connection with the NABIIT funded projects**

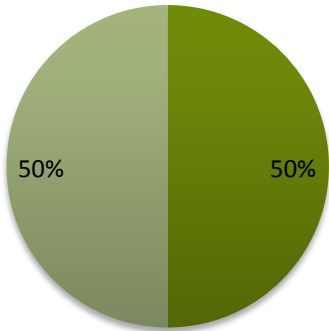


Source: DAMVAD 20012. N (company participants) = 35. Please note that this figure presents the sum of all the company participants' replies and, as such, the same Ph.D. and post.docs may be counted more than once. .

For post.doc positions, there was an equal distribution of candidates from Danish and foreign institutions, as shown in figure 4.4.

**Figure 4.4: Distribution of post.doc. positions in Danish companies among candidates from Danish and foreign institutions**

- Post.doc. positions filled by a person from a foreign institution
- Post.doc. positions filled by a person from a Danish institution



Source: DAMVAD 20012. N (company participants) = 35

## 5 Research activities in the project

This chapter presents findings from the self-assessment regarding

- The relationship of the research undertaken to participants' other R&D activities
- The influence that participation has had on organisations' overall research profile and competences
- Company participants' contribution to the projects.

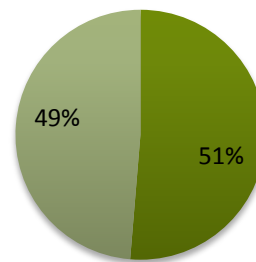
### 5.1 Nature of the research projects

Figure 2 shows that for both academic and company participants, about half of the projects are based on new research ventures, while the remaining projects represent a continuation or extension of key existing research activities in the participating organisations.

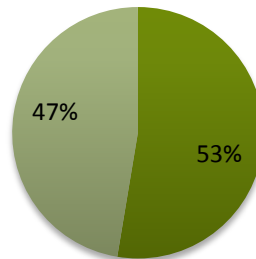
**Figure 5.1: Is the project a new research area or related to established research areas?**

- New research area for the organisation
- Closely related to key, established research areas and core competences in the organization

#### Academic participants



#### Company participants



Source: DAMVAD 2012. N (academic participants) = 76, N (company participants) = 38

## 5.2 Influence on research profile and core competences

Participants were asked to indicate how their involvement in the NABIIT funded project has influenced their organisation's research profile and competences.

The vast majority of public scientists indicated that the project has helped strengthen particular, core research competences. Many academic respondents also explain that participating in the project has helped them to develop new competences and/or research activities in the project, or that the project has helped raise international awareness of their competences and activities.

Some academic respondents explain that their participation in the project has enhanced their ability to combine technologies.

Only a small number of respondents indicate that their participation in the project has not had any significant impact on their research profile or competences.

Responses from academic participants are summarised in the box on the right, and illustrated using specific examples from the participants' self-assessment questionnaires.

### Main impacts of participation on academic participants' research profile and core competences

#### Strengthened core competences

- Application of new theoretical areas and methods
- Expansion and development of competences
- Project participation has helped consolidate existing research activities and build up competences
- New competences obtained through the project have formed the basis for new research activities

#### Enabled activities in new research field

- Existing competences have been used to design and develop new activities through the project

#### Improved profile and greater academic recognition

- Activities have increased the international awareness of the organisation
- Project has enabled publications leading to a strengthened profile within the scientific community – both nationally and internationally

#### Improved ability to combine technologies

- Technological combinations have enabled new insights and results
- Led to launch of new interdisciplinary projects
- The project provided a platform for collaboration across different technological specialisations

#### Strengthened research resources

- Project has made it possible to hire specialists and thus expanded/strengthened our research profile

Source: DAMVAD 2012. Based on 71 respondents

The majority of the company participants stated that they have strengthened their competitive advantage within the research field addressed in the project. Many respondents stressed that the project has enabled them to better understand their field of research, adopt new methods, gain new knowledge or obtain technical skills and competences, which can be applied to their R&D.

A few companies stated that participating in the NABIIT funded project had not had any influence on the research profile or core competences of the company.

Responses from company participants are summarised in the box below, and illustrated using specific examples from the questionnaires.

**Main impacts of participation on company participants' research profile and core competences**

**Competitive advantage**

- Better and deeper understanding of the company's existing research areas
- Further development of key research areas
- Adoption of new methods, applicable to the company's business areas
- Obtained new technical skills or competences
- The project made it possible to test ideas, which would not have been possible otherwise to test

*Source: DAMVAD 2012. Based on 35 respondents*



## 6 Breakthroughs, innovations and commercial exploitation

This chapter presents key findings from the self-assessment regarding the outputs of the NABIIT funded projects, including breakthroughs, innovations and commercial exploitation of research results.

### 6.1 Main achievements, breakthroughs and innovations

A stated aim of the NABIIT programme is to contribute to the development of breakthroughs and innovations through combinations of technologies. Respondents were therefore asked to indicate major (realised or expected) achievements, breakthroughs and innovations achieved as a result of the NABIIT funded project.

It should be noted that since most of the projects are still ongoing or only recently terminated, it is only possible to provide a preliminary indication of breakthroughs or outcomes achieved in the projects. The assessment of the preliminary indication of breakthroughs and outcomes is not included in this report as it requires technical and professional insights and thus is to be carried out by the panel which is carried out later in the evaluation process. For assessments of breakthroughs and outcomes please refer to the main evaluation report.

### 6.2 Contribution to private sector innovation

Respondents were asked how their research was expected to contribute to innovation in the private sector. The self-assessments provide very few examples of concrete innovations.

Academic respondents pointed to a number of potential applications of their projects' research re-

sults to innovation in the private sector. These are summarised in the box below.

#### Projects' potential applications in private sector innovation, according to academic respondents

- **Production and development** e.g. sustainable materials
- **Refinement of techniques and instruments** e.g. laser, sensors
- **New methods** e.g. treatment of massive sequencing and interpretation of data, safety assessments
- **New technologies** e.g. coating, software

*Source: DAMVAD 2012. Based on 65 respondents*

Company participants stressed that they have acquired new knowledge, which may at some point enable or contribute innovation, and which often has several potential applications in the company's activities. Several company respondents did however state that their involvement in the project has provided them with insight into new tools and methods, which may allow for the development of improved methods of measurement of neurotransmitters or lower production costs. Such methods may be "new to the company" but do not constitute so-called "new to the world" innovations that have emerged as a direct result of activities in NABIIT funded projects.

Finally, some company respondents point to possible future uses of research from NABIIT funded projects; examples hereof are listed below.

#### Projects' potential contribution to private sector innovation, according to company respondents

##### Research gives new possibilities within

- Wireless sensor technology
- Coat plate heat exchangers without significant loss of efficiency
- New strategies for drug release

- Methods and technologies for safe use of nanoparticles in treatment of human diseases
- Improved measurements of neurotransmitters
- Antimicrobial systems and surfaces
- Safe and cheap dental implants

Source: DAMVAD 2012. Based on 26 respondents

### 6.3 Contribution to public sector innovation

Respondents were also asked to evaluate the contribution of their research results to innovation in the public sector.

Some respondents stated that their research has resulted or is expected to result in the development new methods with wide applicability also for various parts of the public sector (particularly within health care and environmental issues).

Many respondents, however, had no specific reflections concerning the contribution of their work to innovation in the public sector.

The box below summarises the main responses from academic participants.

Company respondents had very few inputs to this question in the self-assessment.

#### Projects' potential contribution to public sector innovation, according to academic respondents

##### Basis for further research

- Results may be used in university labs
- Hospitals may use results in their research efforts

##### New methods

- Sensor technologies, safety assessments, data handling

##### Healthcare

- Results may be used for various developments in diagnostics and treatments

Source: DAMVAD 2012. Based on 51 respondents

### 6.4 Commercialisation of research results

NABIIT funded projects are expected to pursue the commercial exploitation of research result. Given that many of the projects in NABIIT are ongoing, and the remaining projects have only recently been completed, it is only possible to undertake a preliminary analysis of commercialisation efforts and results in the projects at the time of this evaluation.

A total of 52 academic participants provided insights into the commercialisation, or lack hereof, in the survey.

A small number of academic respondents state that they do not know whether their projects will yield commercialisable results. The vast majority of academic participants, however, indicate that their project is not expected to yield commercialisable results; many further stress that this was never an explicit objective of the project.

Some respondents indicated that the project has created new knowledge in the form of concepts, methods or techniques, which may lead to commercialisable results in the future.

In contrast, some academic respondents state that results of their projects have been commercialised, typically by the industrial partners in the projects, or that they are currently making efforts to commercialise results.

Examples of project outputs that have been or are expected to be commercialised are various forms of software, commercial tools for manipulation of atoms for simulations, lasers, catalysts and sensors.

A few academic respondents argued that their industry partners are part of the explanation for why commercialisable results have not been generated in their projects, typically because the companies have not been interested in pursuing or funding the commercial exploitation of results (if, for example, they do not believe that there is a sufficient market for the research output).

Responses from company respondents accumulated to 24 answers and they are, to a certain degree, aligned with those of the public participants: most companies explain that the projects they participated in either have yet or are not expected to yield commercialisable results. In addition, most company participants stress that the main purpose of the projects, they have contributed to, is to yield new knowledge, and not to generate innovations or other commercialisable outputs.

Nonetheless, approximately one fourth of company respondents indicate that their project have generated or are expected to generate results that can be exploited commercially.

## 6.5 Barriers to commercialisation

Respondents were also asked to indicate that they see as the main barriers to the commercialisation of research outputs from their NABIIT funded projects.

Most of the academic participants highlight the lack of capital and funding opportunities. Some also argued that incentives for academics to devote the time needed to commercialise research output are insufficient.

Other respondents pointed to market constraints, for example that the market for the technologies or components that they have developed is not ma-

ture enough to allow for successful commercialisation, or that the market is not ready to absorb them. Meanwhile, some respondents also pointed to technical complications, for example that the outputs from their research have not met expectations.

Finally, a small number of respondents identified matching difficulties as barriers, especially regarding finding the right industry partner willing to commercialise the results.

Key barriers – and specific examples – highlighted by academic participants are summarised in the box below.

### Key barriers to commercialisation of research results, according to academic participants

#### Scarce resources – and lack of incentives

- For example because patenting activities require a substantial investment of time and money
- The current incentive structure for public scientists does not promote commercialisation

#### Technical complications

- Technologies/materials are not meeting expectations
- Technologies are still too premature to be commercialised and need significant further development
- Technologies are not strong enough to outperform existing technologies available on the market

#### Market and capital constraints

- Lack of venture capital or capital at the university to pursue commercialisation of scientific results
- Lack of funding from scientific proof of principle to commercial proof of principle ("pre-seed" money)

#### Matching barriers

- Difficult to find the right industry partner – who is

interested in commercialising results

Source: DAMVAD 2012. Based on 58 respondents

Company respondents were also asked to identify key barriers to commercialisation of outputs from NABIIT funded projects. Some companies pointed to the lack of resources for commercialisation activities or a lack of interest from the university partners in developing results into commercialisable technologies or components. The majority of company respondents, however, identified difficulties in converting project results into products or processes of practical, commercial as the main barrier.

Key barriers to commercialisation identified by company respondents are summarised below.

#### Key barriers to commercialisation of research results, according to company participants

##### Technical barriers

- Converting research findings to commercial use
- Technology is too immature to allow for commercial exploitation

##### Market and/or capital constraints

- Lack of funding for commercialisation efforts
- The value for customers is not found to be significant enough compared to development costs
- The estimated market size is too small to warrant further development of the technology

##### Organisational barriers

- Lack of motivation/incentive for university partners to cooperate on commercialisation efforts

##### Regulatory barriers

- No regulatory acceptance of methods
- The technology lacks approval (e.g. from FDA or EFSA).

Source: DAMVAD 2012. Based on 31 respondents

## 6.6 Contribution to solving challenges to society

Respondents were asked to indicate the extent to which their research could help address major societal challenges.

The majority of the scientists indicated that the results of their NABIIT supported research projects are expected to help address societal challenges related to e.g. public health, environmental concerns or food quality and safety.

Only a few respondents stated that no societal challenges have been or will be addressed by their NABIIT funded research.

The challenges the academic participants have addressed or are addressing through their NABIIT funded projects are summarised below.

#### Societal challenges addressed by NABIIT funded projects, according to academic participants

##### Healthcare

- Diagnosis or treatment of disease
- Drug discovery and development
- Handling of massive sequencing data and interpretation of genetic information

##### Environmental concerns

- Pollution
- Environmental monitoring
- Safety and homeland security

##### Food quality and safety

- Health of farm animals
- Improved packaging of food

Source: DAMVAD 2012. Based on 55 respondents

Based on the self-assessment, it is not possible to determine the extent to which the NABIIT funded research projects do in fact address societal challenges.

Interestingly, company participants were more conservative in identifying their projects' contributions to societal challenges than their academic collaborators. Nonetheless, some company respondents pointed to specific problems or challenges that they believed their projects could help address; these challenges are summarised in the box below.

**Societal challenges addressed by NABIIT funded projects, according to company participants**

**Examples of societal challenges that can be addressed from project research**

- New cancer medicine with fewer side effects and better efficacy than existing drugs
- Early and inexpensive diagnosis of patients, where liquids are related (eg. water and milk)
- Computer-aided drug discovery
- Improved instrument performance
- Sensor for leakage monitoring of colostomy bags
- Automated diagnosis of disease in cattle on large farms
- Improved welfare of animals and more efficient milk production

*Source: DAMVAD 2012. Based on 17 respondents*

## 7 Research collaboration

This section presents the results of the survey regarding research collaboration.

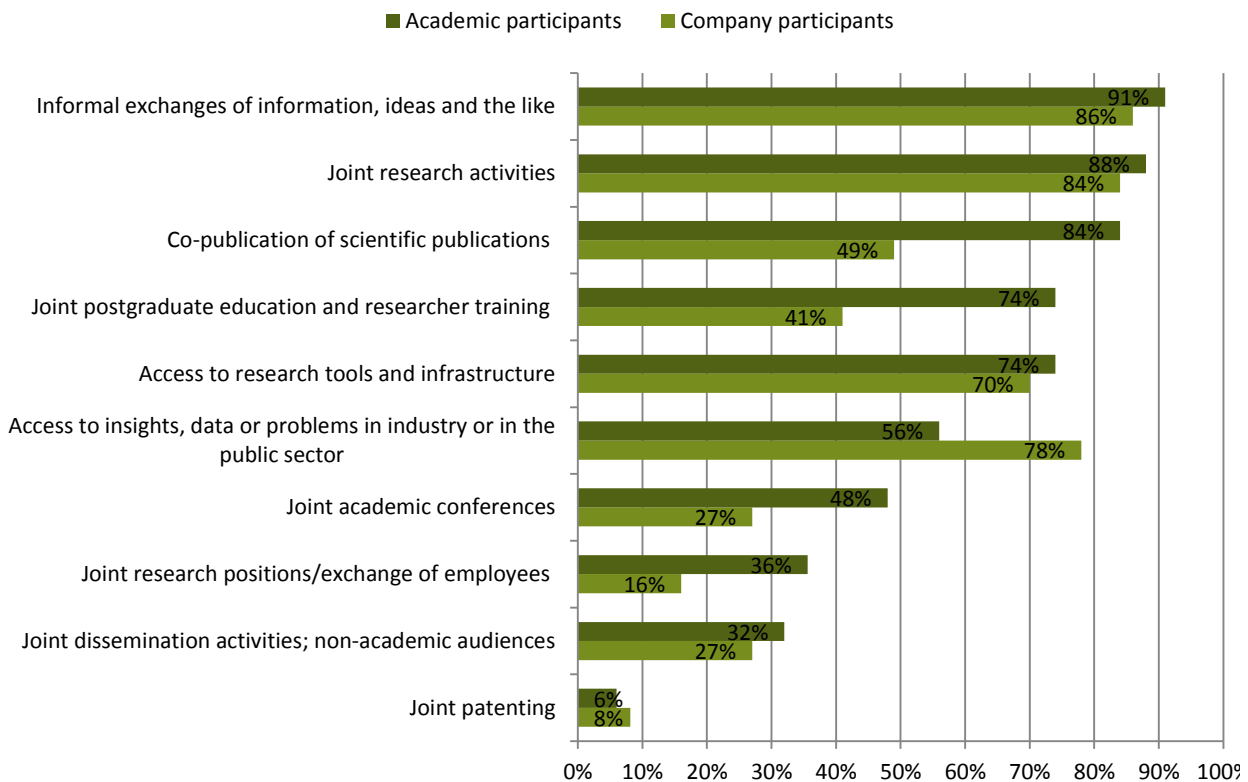
### 7.1 Collaboration among participants

Figure 7.1 highlights the types of interaction that project participants have engaged in with their project partners. The vast majority of both academic and company respondents indicate that informal exchanges of information and ideas constitute the main type of interaction.

This is closely followed by joint research activities, which more than 80 percent of both groups of respondents have engaged in during their collaboration. Access to research tools and infrastructure is another frequent channel of collaboration, which both groups of respondents have made use of.

Academic participants (84 percent) were however more likely to engage in co-publication of scientific articles with project partners than company participants (49 percent). Moreover, academics are also (not surprisingly) more likely than companies to take part in joint academic conferences and postgraduate education, as well as researcher training.

**Figure 7.1: Types of interaction with partners in the project (multiple answers possible)**



Source: DAMVAD 2012. N = (academic participants) = 77, N (company participants) = 38.

Companies are however more likely to engage in interaction that revolves around access to insights, data or problems in industry or the public sector (78 percent compared to 56 percent for academic participants).

**7.2 The role of the participants**

In the following, we look into the roles that participants held or have in NABIIT funded projects. The answers provided by the academic participants and by companies are indicated in figure 7.2.

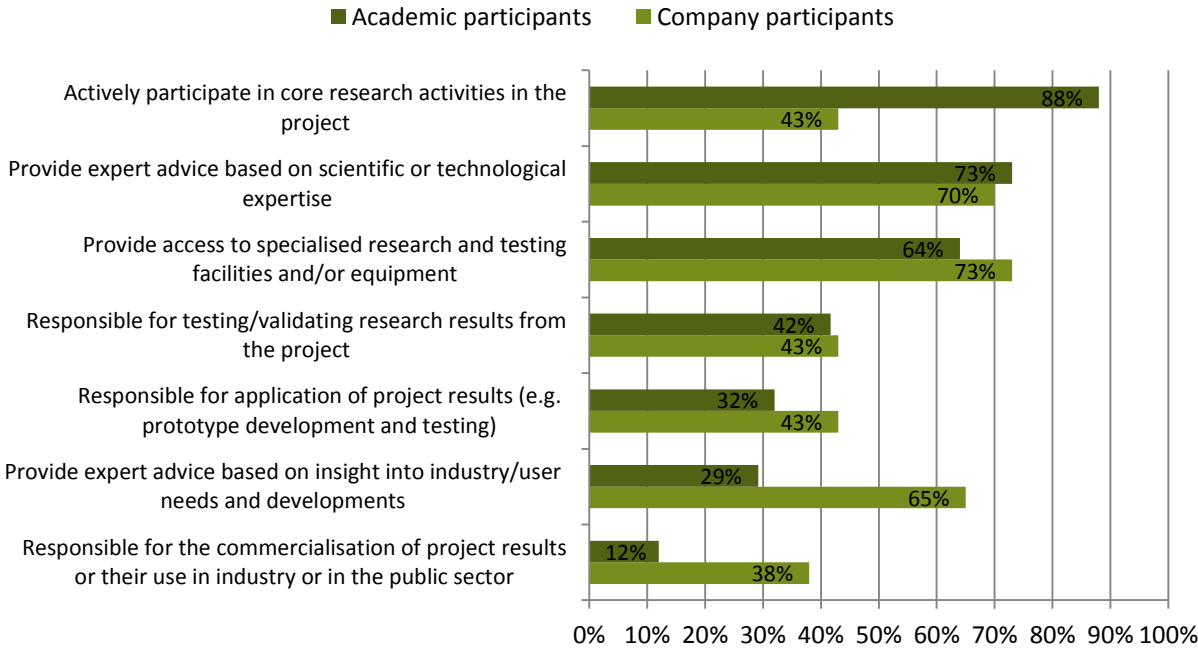
Academic participants provide expert advice (73 percent) and access to research and testing facilities (64 percent).

Companies also perceive their chief roles in the projects to be to provide expert advice and access to specialised research facilities (70 and 73 percent, respectively).

Companies also provide advice based on their insights into industry and user needs and developments (65 percent). Company participants are also more likely than academic participants to be responsible for the practical application of research results through prototype development and pilot testing, and for commercialisation activities.

It is interesting to note that while 90 percent of academic participants contribute to core research activities, the same is only true of 43 percent of company participants.

**Figure 7.2: The participants' own role in the project (multiple answers possible)**



Source: DAMVAD 2012. N (academic participants) = 77, N (company participants) = 38.

### 7.3 Companies' contribution to the projects

On a related note, company participants were asked how they, as a company, contributed to the NABIIT funded project.

Their statements indicated that most companies contribute to projects by developing, experimenting or testing relevant technologies. Examples are development of technologies with specific properties, testing of software, or providing testing facilities and system and engineering work.

Some companies also explained that they contributed to the project with project management skills.

### 7.4 User involvement

The self-assessment examined how, if at all, potential users from either the public or private sector were involved in NABIIT funded projects, and how their involvement may have affected the research.

Projects mostly involved actual or potential users in industry (who were often also the companies that took part of the project).

Most academic respondents stressed that users contribute by providing feedback and participating in scientific discussions, particularly in the initial phases of the project. A large number of academic respondents also stated that users take part in defining goals and testing results/prototypes, in the development phase of e.g. lasers or materials, or in scientific publications of project results.

Some respondents however experienced that users from industry were too disconnected or too loosely affiliated with the project to make a significant contribution.

Academic respondents' assessment of the involvement and contribution of users is summarized in the box below.

#### The role of private sector users in the project, according to academic scientists

##### Define goals and testing of results/prototypes

- Testing of research material
- Project planning
- Experiments combining prototypes with software
- Influenced the choice of the research directions

##### Provide feedback and discussions

- Important insight into requirements for commercialisation and the state-of-the-art in competing techniques
- Idea generation
- Providing practical know-how through feedback
- Participated in workgroup meetings and co-publication

Source: DAMVAD 2012. Based on 53 respondents

Academic scientists were also asked to assess to what extent users from the public sector were involved in the project. The vast majority of scientists however explained that users from the public sector were neither relevant nor involved.

The 27 respondents that mentioned involving users from the public sector in their projects specified three groups of users: (1) involving hospital scientists and staff in the project's core research activities, (2) having representatives from the public administration on the advisory board for the project and, (3) providing science based advice to decision makers and other employees in the public administration.



## 7.5 Modes of interaction

In the self-assessment survey, respondents were asked to provide a brief description of how collaboration takes place in the project. Most scientists described the frequency with which they gathered for meetings or other kinds of exchange of knowledge. The statements provided by the scientists indicate that there are numerous different approaches to contact, collaboration and communication in NABIIT funded projects.

These approaches can be categorised into four overall models for interaction within project groups, as summarised in the box on the right

A common characteristic across all four models is the frequent and regular use of communication between project participants through e-mail or phone. Regardless of how often participants meet face to face through meetings, they communicate using other forms of interaction on a regular basis.

Most scientists indicated that they met on a regular or daily basis supplemented by larger meetings a few times a year, and with occasional ad hoc meetings where all participants were present. The second most common model of interaction was bi-annual meetings supplemented by frequent communication through e-mail or phone. A smaller group of scientists engage in meetings every month as their means of interacting with partners.

A few scientists indicate that Ph.D. and post.docs. lead the frequent interaction of the project whereas other participants meet less frequently.

### Four models of interaction within projects, based on answers from academic participants

#### Regular/daily meetings

- Regular communication via e-mail and phone
- Consortium meetings at regular intervals
- Workshops and seminars

#### Meetings every month

- Regular communication via e-mail and phone
- Quarterly follow-up meetings
- Half-year assemblies

#### Bi-annual meetings or less frequent

- Regular communication via e-mail and phone
- Ad hoc meetings if urgent
- Bi-annual large group meetings

#### Ph.D. students and post.docs. lead the way – often with a high frequency of interaction

- Regular communication via e-mail and phone
- Ph.D. and post.docs. interact daily with frequent meetings
- Full partner workshops 2-3 times per year
- Other ad hoc meetings

Source: DAMVAD 2012. Based on 70 respondents

## 7.6 Project and research management

Academic respondents were also asked to describe both formal and informal practices that had successfully contributed to research management or management of collaboration in their projects. Most respondents indicated that a combination of informal and formal types of interaction is vital for good collaboration. Please see specific examples in the box below.

### Effective procedures for project management, according to academic participants

- Frequent professional and social meetings
- Small size of project group allowed for many informal meetings
- Formal structure with a steering group and one project manager
- Open-minded discussions with an emphasis on building mutual trust among collaborators
- Celebration of great team achievements
- Close interaction and coordination among/with PhD students and post.docs.
- Joint attendance of key conferences
- Clear milestones that are closely monitored
- Principal investigator is responsible for following up on work progress among participants
- In one project, principal investigators had a “rolling management” position, where they were each responsible for administration, meetings etc. for six months at a time, which helped to create a strong sense of common responsibility

Source: DAMVAD 2012. Based on 58 respondents

## 7.7 Changes to project plans

Respondents from participating academic institutions were asked whether changes had been made to the original plan for their NABIIT funded project and, if so, why and how it had changed. A large number of participants indicated that no changes had been made to their project plan.

All respondents who stated that changes had been made to their project plans explained these changes with delays to their project. Examples of such delays and their impact on project plans can be seen in the box below.

### Examples of causes of delays in projects, according to academic respondents

- Difficulties in recruitment of Ph.D.s. and post.docs.
- Changes in staff assigned to project
- Maternity leave among key staff
- Technical challenges in testing, coding or experimenting
- Implementation of new methods takes longer than expected
- Change in the focus of the project
- Financial difficulties of industry partner
- Activities took longer time than expected when drafting project plans

Source: DAMVAD 2012. Based on 58 respondents

## 7.8 Conflict management

Academic respondents were also asked to provide examples of a conflict or challenge to collaboration between participants in the project, and to explain how this conflict or challenge was resolved.

The majority of respondents indicated that they have not experienced any conflicts in their NABIIT funded projects. The remaining statements identified a variety of issues, which are listed in the box below.

### Types of conflicts and collaboration issues in projects, according to academic participants

#### Delay in parts of the project affects entire project

#### Industry partner went out of business

- Was in one project resolved by finding a new project participant with similar competences

#### Integrating industry partners in the research project

- Was in one project resolved by placing a Ph.D. from the industry at the university to help integrate partners and ensure ongoing communication

#### Deciding on the order of appearance in author lists

- Issues were discussed and agreed upon at meetings, e.g. in the steering group

#### Technical problems

- Resolved by buying access to needed knowledge

#### Cultural conflicts arising from different methodological approaches

- Resolved through open discussions regarding differences and suggested approaches

Source: DAMVAD 2012. Based on 43 respondents

## 8 Interdisciplinarity in NABIIT projects

A section of the self-assessment survey focused on the nature and outcomes of interdisciplinary research collaboration, which is a general goal for programmes under the Council for Strategic Research.

This section was only included in the self-assessment questionnaire for academic participants. Therefore, no results are reported for company participants.

### 8.1 The nature of interdisciplinary collaboration

Academic participants were asked to assess the nature of interdisciplinarity in the collaborative projects. As indicated in figure 8.1, more than half of the respondents indicated that research collaboration in their projects takes the form of *multidisciplinary collaboration*, i.e. involving participants from different fields working on a joint research topic from within their own field while including

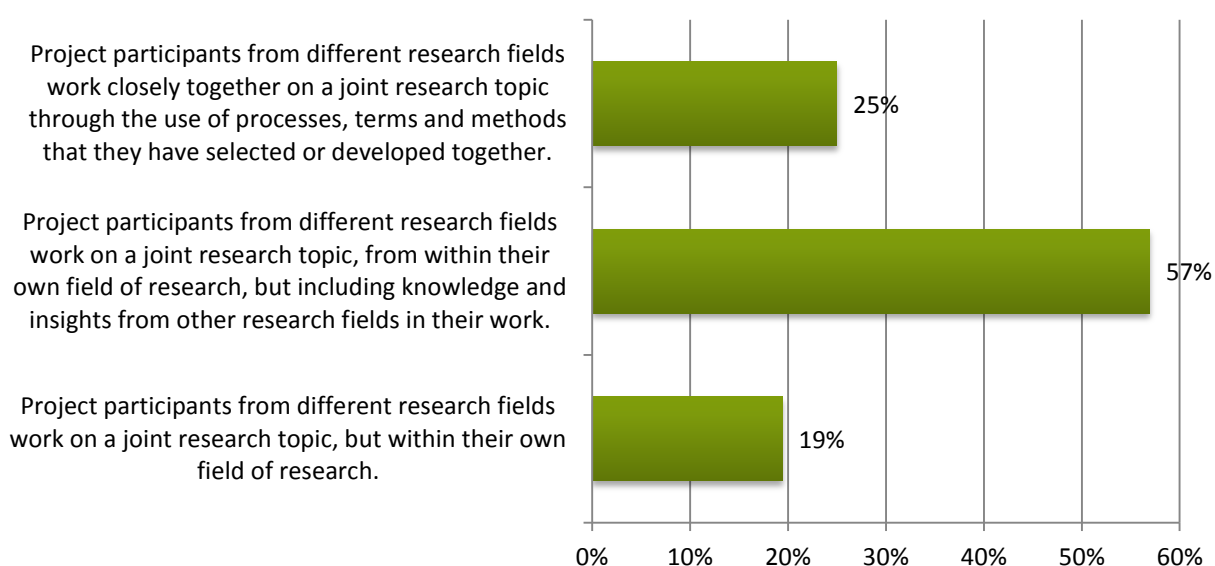
knowledge and insights from other fields.

Just over one fifth of academic respondents indicated that the different participants in the project engaged in *interdisciplinary collaboration* that is, worked closely together on a joint research topic through the use of processes and methods that they have selected and developed together.

Finally, one fifth of the respondents stated that participants from different research fields work on a joint research topic but within their own field of research, and thus engage in limited interaction between research fields.

These findings are similar to the results of an evaluation of interdisciplinarity in a broad selection of projects funded by the Council for Strategic Research undertaken in 2009: 33 percent of projects were, according to participants, characterised by interdisciplinary collaboration, while 48 percent were more aptly described as multidisciplinary collaborations. Finally, 19 percent of the projects ex-

Figure 8.1: The nature of interdisciplinary collaboration



Source: DAMVAD 2012. N (academic participants) = 72

amined involved little or no interaction between research fields.<sup>1</sup>

## 8.2 Achievements from interdisciplinary collaboration

The majority of respondents emphasise that the project could not have been completed without an interdisciplinary approach, as the project necessitated the combination of technologies. As such, respondents argue that a single research group could not have established the necessary background and knowledge to solve the problem.

A very large number of the respondents point to achievements from the interdisciplinary collaboration such as the ability to gain new insights knowledge of other scientists' approach to scientific challenges – including the development of new methods and learning about a new field. The combination of technologies provides a platform of learning across the different disciplines.

Respondents also stated that interdisciplinarity is strengthened by the greater degree of problem orientation, which comes from collaborating with company partners.

A few respondents did not find the questions to be relevant for their project.

Main findings and examples of respondents' statements have been summarised in the box on the right.

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<sup>1</sup> Please see DAMVAD 2012, "Tværfaglighed i strategisk forskning" ("Interdisciplinarity in strategic research"), The Danish Council for Strategic Research, 2009.

### Key achievements from interdisciplinary collaboration, according to academic participants

#### Insight into and knowledge of other scientists' approaches to scientific challenges

- Adaptation of methods from other scientific fields or development of new approaches
- Cross-fertilization of insights from different scientific fields
- Different analysis and synthesis techniques provide the opportunity to obtain complementary results, giving a more comprehensive approach

#### The project could not have been completed without the combination of technologies

- A platform for the technology needed to solve the problem could not have been established by one organisation alone
- It would be impossible to fulfil the objectives of the project without interdisciplinary collaboration
- All the published results derived from cooperation between different groups and could not have been obtained by ourselves
- The interdisciplinary approach was the start, the core and the end of the project

#### Access to data and technologies

- The existence of other kinds of data and technology through collaboration with other fields
- Ensuring critical mass

#### Problem orientation from collaborating with the industry

- Experiments with applying data in a real life context in a company
- Turning science into applications with the assistance and know-how of the industry partner
- The industry partner provided a concrete problem that could be used as benchmark for applicability of techniques and results from the scientific field

Source: DAMVAD 2012. Based on 67 respondents

## 9 Research funding

This chapter presents information on the role of the funding provided by NABIIT and on additional funding applied for by participants in NABIIT funded projects.

In addition to presenting results from the self-assessment survey, this chapter also presents additional data on other funding applications to both the Council for Strategic Research and the Council for Independent Research by participants in NABIIT funded projects.

### 9.1 Additionality of the funding provided by NABIIT

Both academic and company respondents were asked whether they would have sought funding elsewhere, had they not obtained funding from NABIIT.

As illustrated in figure 9.1, 15 and 13 percent of academic and company participants, respectively, would have sought funding for the same project elsewhere.

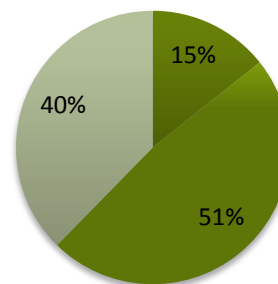
Meanwhile, 40 and 37 percent of academic and company participants, respectively, would have abandoned their project in the absence of funding from NABIIT.

Approximately half of both academic and industry participants would have sought alternative funding for a similar or related project elsewhere.

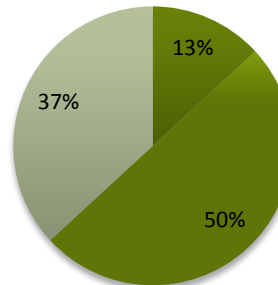
**Figure 9.1: Additionality of the NABIIT funding**

- The organization would have sought funding for the same project elsewhere
- The organization would have sought funding for a similar/related project elsewhere
- The organization would not have pursued similar research activities

#### Academic participants



#### Company participants



Source: DAMVAD 2012. N (academic participants) = 73, N (company participants) = 38

## 9.2 Alternative sources of funding

Those respondents who indicated that they would have sought alternative funding elsewhere had it not been financed by NABIIT were also asked to specify where they would have applied for funding.

Few respondents replied to this question. The funding sources they identified are summarised in the box below.

### Alternate possible sources of funding for projects not supported by NABIIT, according to both academic and company participants

#### Academic participants

- The Council for Independent Research, particularly from the research councils for the natural sciences (FNU) and for technology and production sciences (FTP)
- Advanced Technology Foundation
- Funding from the European union
- Private foundations (e.g. the Carlsberg Foundation, the Novo Nordisk Foundation)
- Proof-of-concept funding at DTU
- Danish in-kind contributions (e.g. from participating universities)

#### Company participants

- Advanced Technology Foundation
- Danish Council for Technology and Innovation
- Funding from the European Union
- Collaboration with another company or with industry associations

Source: DAMVAD 2012. Based on 37 academic participants and 21 company participants

Most academic participants highlighted other strategic research programmes or, alternatively, funding from The Council for Independent Research as the most likely alternatives to NABIIT. Meanwhile, company participants primarily referred to as the Advanced Technology Foundation as the main alternative source of funding.

## 9.3 Reasons for abandoning the project in the absence of NABIIT funding

Academic respondents who had indicated that they would not have sought alternative funding elsewhere were asked why they would have abandoned the project in the absence of funding from NABIIT.

The reasons given are summarised in the box below. The main reason is, according to respondents, that there are no other adequate sources of funding for interdisciplinary projects, particularly when these are large-scale projects and/pr involve company participants. Some respondents also mentioned that the particular interdisciplinary focus in NABIIT created the opportunity to pursue research projects that would not otherwise have been pursued.

### Reasons for abandoning the project, according to academic participants

- There are no other relevant sources of funding for interdisciplinarity, large scale projects undertaken in collaboration with industry
- NABIIT provided a special opportunity to pursue projects that would not otherwise have been pursued
- The decision to abandon the project or seek funding elsewhere is up to the lead investigator

Source: DAMVAD 2012. Based on 27 respondents

Company respondents were also asked why they would have abandoned the project had they not obtained funding from NABIIT; their statements are summarized in the box below. Most companies who replied to this question explained that the project did not lie within their primary research areas and therefore not something they would have pursued without targeted funding.

**Reasons for abandoning the project, according to company participants**

- The project was not within the company’s primary research areas and would therefore not be pursued without NABIIT funding
- The project was too heavily focused on basic research and therefore considered too risky
- Applying for alternative funding is considered to be a task for the university partner(s)

Source: DAMVAD 2012. Based on 14 respondents

**9.4 Spin-off projects requiring additional funding**

Respondents were asked to indicate whether their NABIIT funded project has resulted in spin-off projects requiring additional funding.

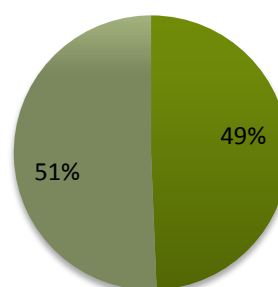
As illustrated in figure 9.2, 49 percent of academic respondents have developed spin-off projects as a result of their NABIIT funded research. The same holds true for just 18 percent of company respondents.

The scientists have specified from which sources they have sought additional funding for the spin-off projects.

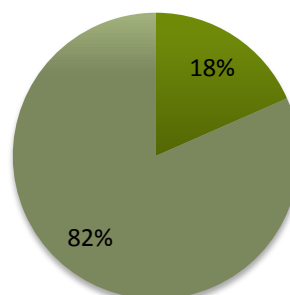
**Figure 9.2: Spin-off projects requiring additional funding**

- Yes - the project has resulted in spin-off projects requiring additional external funding
- No - the project has not resulted in spin-off projects requiring additional external funding

**Academic participants**



**Company participants**



Source: DAMVAD 2012. N (company participants) = 38, n (academic participants) = 77

Programmes under the Councils for Independent Research and Strategic Research are identified as primary sources of additional funding. Academic respondents also highlight proof-of-concept funding at DTU, as well as other kinds of finance at the universities. Funding sources also cover companies, private foundations as well as EU framework programme.



## 9.5 Additional funding applications and grants

This section presents an overview of the amount of funding applied for by NABIIT project participants from other programmes under the Council for Strategic Research and from the Council for Independent Research.

Data, which was provided by the Danish Agency for Science, Technology and Innovation, included information on all applications to and grants from the two Councils, where individual NABIIT project participants were listed as main applicant or grant holder, respectively.

It is important to emphasise that it is not possible to ascertain which of these applications and grants concern research which is related to the projects funded by NABIIT; these applications and grants may be completely unrelated to NABIIT research.

### Strategic research applications and grants

Individual participants in NABIIT funded projects have submitted 99 applications to the Council for Strategic Research during the period 2009-2011 with a total applied amount of nearly DKK 1.8 billion. The applications resulted in a total grant sum of DKK 539 million.

The application for the highest amount of funds was in excess of DKK 55 million, while the highest grant sum awarded was nearly DKK 37 million. The smallest amount of funding applied for – and also the smallest grant awarded – was just over DKK 500,000.

On average, individual participants in NABIIT funded projects submitted applications to the Council for Strategic Research for nearly DKK 18 million; the average grant size was nearly DKK 17

million respectively. However, there is great variation within applications and grants. Moreover, it should be noted that the average grant size is calculated based on just 32 observations.

**Table 9.1. Applications and grants to the Council for Strategic Research (2009-2011, both years included) by individual participants in NABIIT funded projects**

	Applications	Grants
<b>Number</b>	99	32
<b>Total amount</b>	1.769.533.005	539.702.419
<b>Smallest amount</b>	552.944	552.944
<b>Largest amount</b>	55.800.000	36.999.122
<b>Average amount</b>	17.874.071	16.865.701

*Source: DAMVAD 2012 based on data from the Danish Agency for Science, Technology and Innovation. These data include applications to NABIIT.*

### Independent research applications and grants

The Council for Independent Research has received 285 applications from individual participants in the NABIIT funded projects during the period 2009 to 2011. Based on available information, funding has been granted to 58 applications.

The total amount of funding applied for exceeds DKK 1.2 billion; nearly DKK 275 million has been granted. The smallest application was for nearly 84,000 and the smallest grant was 155,000.

The largest application was more than DKK 20 million, which was also the largest grant. The average amount applied for was in excess of DKK 4.4 million, while the average grant sum was nearly DKK 4.7 million. Again, average values should be treated with caution due to the relatively small number of grant observations and the high degree of variation in both application and grant sums.

**Table 9.2. Applications and grants to the Council for Independent Research (2009-2011, both years included) by individual participants in NABIIT funded projects**

	Applications	Grants
<b>Number</b>	285	58
<b>Total amount</b>	1.264.221.640	274.543.900
<b>Smallest amount</b>	83.855	154.650
<b>Largest amount</b>	20.112.517	20.112.521
<b>Average amount</b>	4.435.865	4.733.516

Source: DAMVAD 2012 based on data from the Danish Agency for Science, Technology and Innovation.

### Detailed insight into applications and grants

Overall, the data indicate that participants in NABIIT funded projects apply for funding and receive grants from a broad range of programme committees and research councils under the Councils for Strategic and Independent Research, suggesting that their research is not narrowly confined to nanotechnology, biotechnology and ICT but feeds into a wide variety of research topics.

Table 9.3 shows the distribution of applications to specific committees or programmes under the Councils for Strategic and Independent Research. Not surprisingly, two thirds of the applications to the Council for Strategic Research have been submitted to the Programme Commission on Strategic Growth Technologies (which includes the NABIIT programme). The remaining applications were evenly distributed between the other programme committees.

**Table 9.3. Where have individual participants in NABIIT funded projects applied for funding?**

Committee/programme	No. of applications
<b>Council for Strategic Research</b>	
Programme Commission on Sustainable Energy and Environment	14
Programme Commission on Strategic Growth Technologies	65
Programme Commission on Health, Food and Welfare	10
Programme Commission on Individuals, Disease and Society	8
Programme Commission on Health, Safety and Environment	2
<b>Total</b>	<b>99</b>
<b>Council for Independent Research</b>	
Humanities	3
Natural Sciences	114
Social Sciences	1
Medical Sciences	42
Technology and Production Sciences	125
<b>Total</b>	<b>285</b>

Source: DAMVAD 2012 based on data from the Danish Agency for Science, Technology and Innovation

Similarly, table 9.4 shows the distribution of grants to specific committees or programmes under the Councils for Strategic and Independent Research.

Again, more than 70 percent of the grants from the Council for Strategic Research to participants in NABIIT funded projects were awarded under the Programme Commission on Strategic Growth Technologies (which includes the NABIIT programme).

More than 50 percent of the grants from the Council for Independent Research to individuals also participating in NABIIT funded projects were awarded within the area of natural sciences. Nearly one third of the grants were awarded from the council for technology and production sciences.

**Table 9.4. Where have individual participants in NABIIT funded projects been granted funding?**

Committee/programme	No. of grants
<b>Council for Strategic Research</b>	
Programme Commission on Sustainable Energy and Environment	6
Programme Commission on Strategic Growth Technologies	23
Programme Commission on Health, Food and Welfare	2
Programme commission on health, safety and environment	2
<b>Total</b>	<b>99</b>
<b>Council for Independent Research</b>	
Natural Sciences	<b>30</b>
Medical Sciences	<b>8</b>
Technology and Production Sciences	<b>20</b>
<b>Total</b>	<b>58</b>

*Source: DAMVAD 2012 based on data from the Danish Agency for Science, Technology and Innovation*

## 10 Research infrastructure

This section focuses on the use of and investments in infrastructure in the projects funded by NABIIT.

### 10.1 The use of the existing capital base

Academic respondents were asked to describe to what extent and how their project made use of the existing capital base, that is, existing research facilities and equipment.

The vast majority of respondents indicated that they make extensive use of existing research infrastructures. Several participants stated that the use of lab facilities and other infrastructure built up over the years has been central to their project.

Examples of research infrastructure used in the projects are presented in the box below.

#### Examples of existing research infrastructure used in the projects, according to academic participants

##### Research infrastructure in Denmark

- Examples: SDU, DTU/ DANCHIP, iNANO, Risoe, Danish Center for Scientific Computing

##### International research infrastructure

- Examples: large scale synchrotron radiation sources, such as ESRF and MAXLAB, access to large (US based) supercomputers

Source: DAMVAD 2012. Based on 48 respondents

A small number of respondents mentioned that they only make limited use of existing research infrastructure, typically because their projects do not make use of laboratory facilities.

### 10.2 Investments in new infrastructure

Academic respondents were also asked whether they have invested in infrastructure in connection with the NABIIT funded project. The 38 replies to this question indicated that about half of the academic participants have invested in new research infrastructure; however the degree to which they have done so differs significantly from project to project. Of those academic respondents that had indicated they had used the grant to invest in research infrastructure most indicated that they had invested in standard equipment such as computers, database servers, digital cameras, microscope lenses etc. However, some academic respondents also indicated that they had invested in more advanced equipment such as XPS equipment for surface analysis, facilities for experiments in vitro, in ova and in vivo or NMR probe used to image mice.

## 11 Dissemination activities

This chapter presents information on non-academic dissemination activities in NABIIT funded projects.

### 11.1 Project webpage

Respondents were asked to indicate whether they have developed webpages to present the NABIIT funded project and its results. Respondents were also requested to provide the URL for the webpage and information on the amounts and origin of visits to their webpages.

About half of the respondents chose not to answer this question.

The 30 respondents who did answer the question provided links to the webpage in question, but only one project could provide information on the number of visits to the webpage.

### 11.2 Dissemination to industry

The majority of academic participants argued that talks and non-academic conferences constituted their main channel of communication to industry. Some respondents also pointed to academic conferences or journals, collaboration in connection with the project or commercialisation of the results of the project as means of communicating with industry.

The box below summarizes the responses from academic participants.

#### Examples of dissemination activities directed at industry, according to academic participants

- Talks and non-academic conferences etc.
- Academic (journal and conference) publications
- Collaboration within the project
- Commercialisation of research results
- Courses and education programmes
- “Popular science” dissemination
- Project webpage
- Direct dialogue with potential users; face-to-face visits etc.

*Source: DAMVAD 2012. Based on 52 respondents*

### 11.3 Dissemination to the general public

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Finally, academic scientists were asked to indicate how they have disseminated results of the project to the greater public. The majority of the respondents answered that they have disseminated research findings through articles in newspapers and trade (i.e. non-academic) journals, but also through appearances on television (e.g. on *Danskernes Akademi*).

Respondents also indicated considerable overlap between dissemination activities directed at industry and dissemination targeted at the general public. This overlap is also reflected in the examples listed in the box below.

#### Examples of dissemination activities directed at the general public, according to academic participants

- Blogs and popular science webpages (e.g. *videnskab.dk*)
- TV shows (such as *Danskernes Akademi*)
- Press releases and articles in popular press (e.g. in *Ingeniøren*)
- Courses and public lectures
- Exhibitions or lectures at “*Experimentarium*” (a Copenhagen-based science centre)

Source: DAMVAD 2012. Based on 41 respondents

## 12 Overall assessment of results and outcomes of the projects

This chapter presents results regarding both academic and company participants' overall assessment of the results or outcomes that they have experienced at the time of evaluation from their participation in a NABIIT funded project.

### 12.1 Results of project participation

Both academic and company participants were asked to indicate which results their organisation has achieved (so far) as a result of participating in the project (cf. figure 12.1).

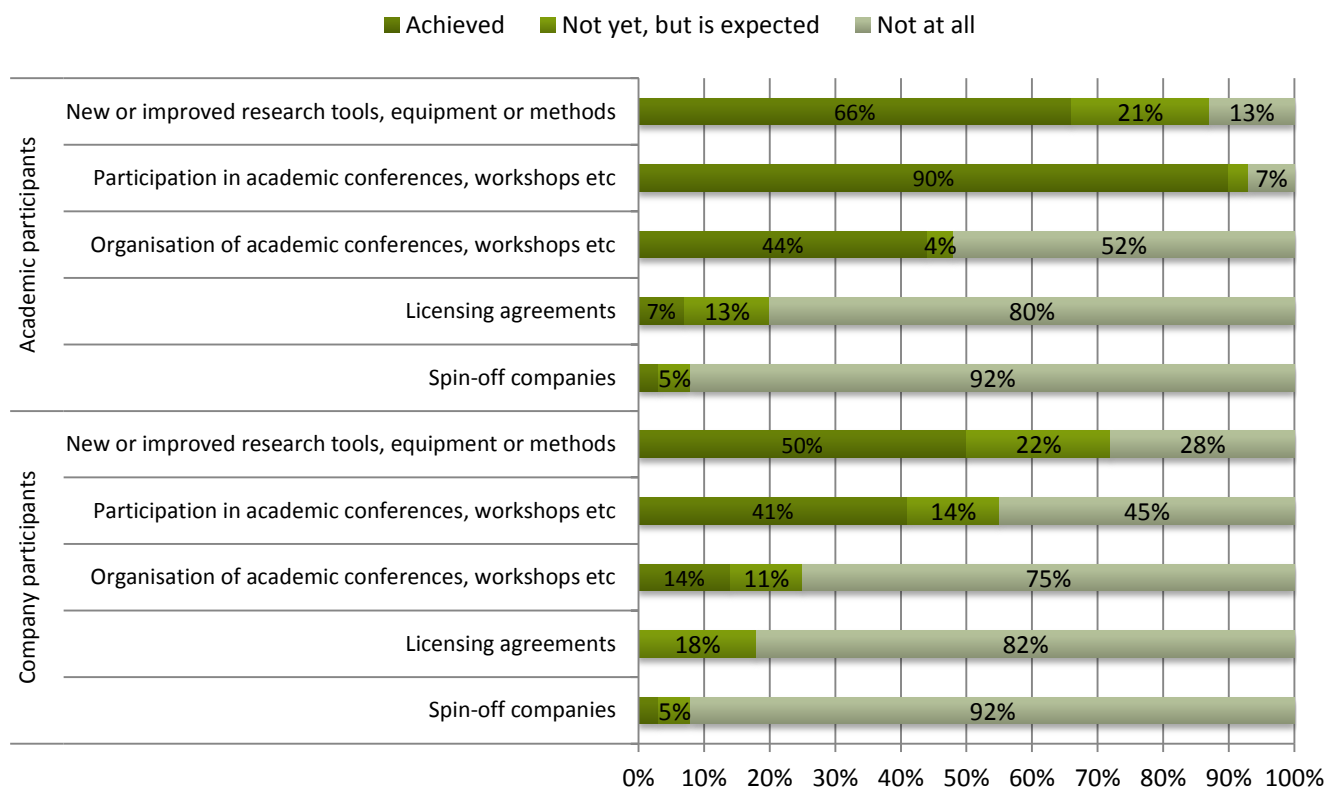
90 percent of academic participants had participated in academic conferences or workshops as a result of participating in the project, while 44 percent had themselves organised an academic con-

ference or workshop. In addition, 66 percent of academic participants had developed or gained access to new or improved research tools, equipment or methods through the project.

Company respondents had primarily gained new or improved research tools and methods (50 percent), while 41 percent had participated in academic conferences and workshops.

Only 5 percent of both respondent groups (amounting to two academic respondents and 1 company respondent) have started spin-off companies as a result of the NABIIT funded project. Moreover, less than 20 percent of all respondents had achieved or expected to achieve licensing agreements as a direct result of their project.

**Figure 12.1: Results achieved as a result of participating in the project (multiple answers possible)**



Source: DAMVAD 2012. N (academic participants) = 77, N (company participants) = 38

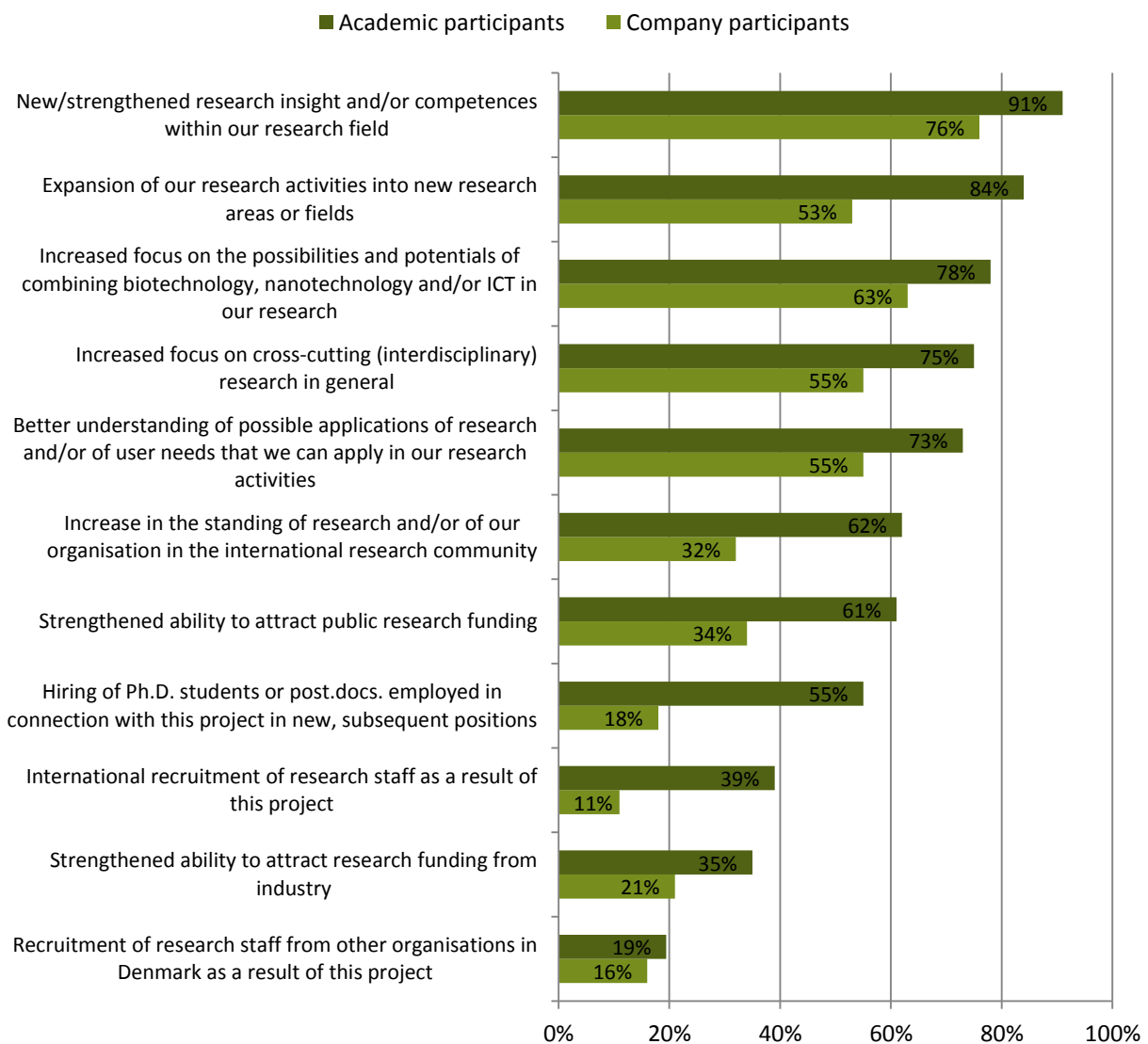
## 12.2 Research activities

Respondents were asked to indicate which outcomes their organisation had experienced on its research activities as a result of participating in the project under NABIIT (cf. figure 12.2).

Overall, figure 12.2 shows that more academic participants than company participants experienced outcomes on their research activities.

The main outcomes experienced by academic participants were: new or strengthened research insight and/or competences in their field (91 percent of academic respondents), expansion of research activities into new research areas or fields (84 percent) and increased focus on the possibilities or potentials of combining biotechnology, nanotechnology and/or ICT (78 percent).

**Figure 12.2: Outcomes on the organisation's research activities from participating in the project (multiple answers possible)**



Source: DAMVAD 2012. N (academic participants) = 77, N (company participants) = 38



76 percent of company participants also developed new or strengthened research insight and/or competences in their field, while 63 percent gained an increased focus on the possibilities or potentials of combining biotechnology, nanotechnology and/or ICT.

they had improved their ability to participate in interdisciplinary research collaboration and that they were more motivated to engage in such collaborations as a result of participating in the NABIIT funded project.

**12.3 Research collaboration**

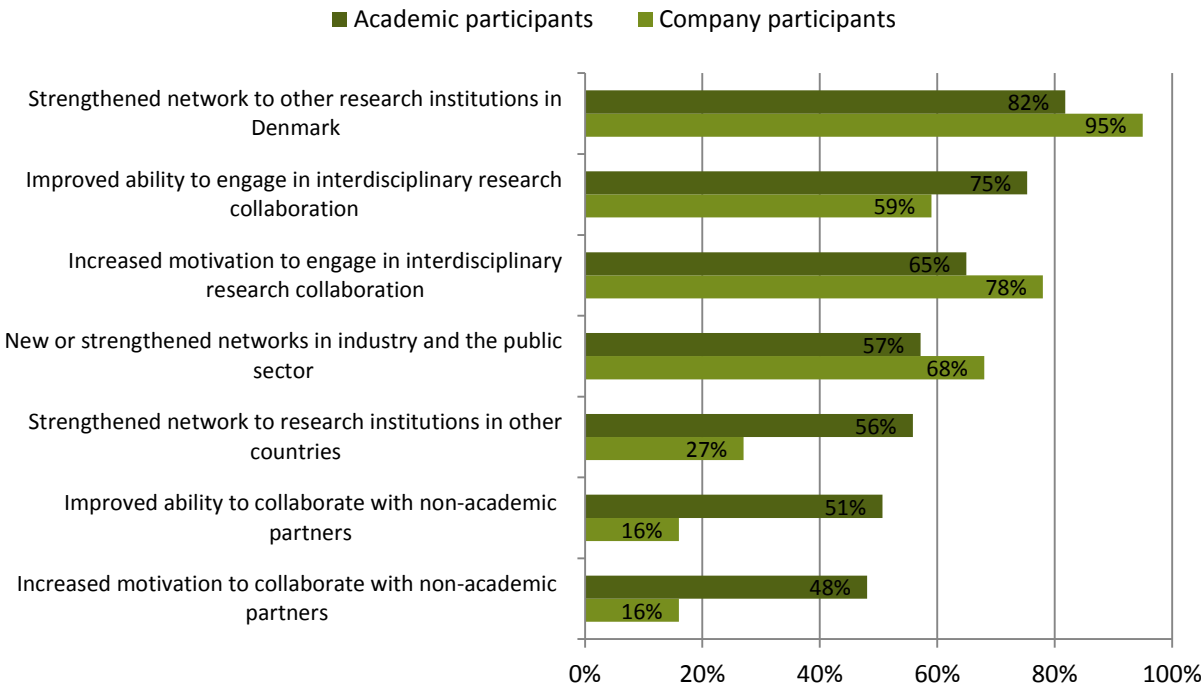
Respondents were also asked to indicate the outcomes of participating in the project on their R&D collaboration. Results are presented in figure 12.3.

Moreover, 56 percent of the academic respondents indicated that the project has strengthened their network to research institutions in other countries.

Both academic and company respondents answered that they have improved their network to other research institutions in Denmark (82 percent and 95 percent, respectively).

Similarly, both groups of respondents stated that

**Figure 12.3: Outcomes on the organisations’ research collaboration from participating in the project (multiple answers possible)**



Source: DAMVAD 2012.. N (academic participants) = 77, N (company participants) = 38

## 12.4 Research management

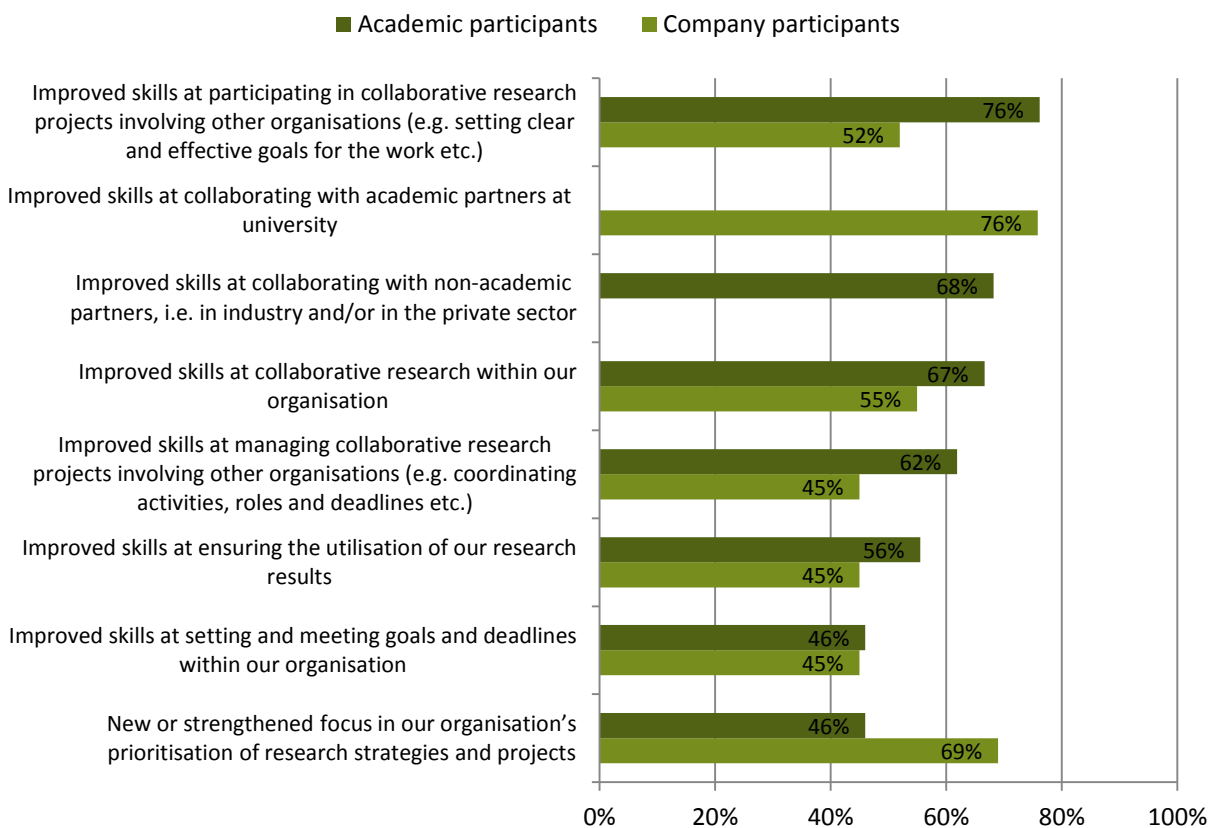
Finally, respondents were asked a question regarding the impact that their participating in a NABIIT funded project had on their research management skills (cf. figure 12.4).

Academic participants indicated that they had improved their skills in collaborating with other organisations regarding research projects (76 percents).

In addition, more than two thirds of academic respondents stated that their organisation has become more skilled both at collaborating with both industry and at collaborative research *within* the organisation.

76 percent of company respondents stated that they had improved their skills at collaborating with academic partners, while 69 percent had gained a new or strengthened focus in their prioritisation of research strategies and projects.

**Figure 12.4: Outcomes on the organisations' research management from participating in the project (multiple answers possible)**



Source: DAMVAD 2012. N (academic participants) = 75, N (company participants) = 38. Please note that the second and third question were only been directed at one of the groups of respondents which is why there is only one bar in the graph for each question

## 13 Reflections and recommendations from participants

The final two questions in the self-assessment directed at allowed respondents to reflect on the NABIIT programme or the evaluation and to make recommendations to the Council for Strategic Research or to the Programme Commission responsible for the NABIIT programme. Not surprisingly, these questions yielded a broad variety of responses.

### 13.1 Reflections

In their reflections, a few academic scientists mentioned that possibilities for following-up on the results of NABIIT projects (e.g. with regards to implementation and product development) should be improved; many of these respondents also considered the project period to be too short in view of the level of ambition of the programme and the lack of possibilities to get additional funding for the same project.

Some reflections concerned difficulties of getting industry partners involved with the project, while other respondents emphasised that the NABIIT programme filled an important gap in research funding. Recommendations are summarised in the box below.

#### Reflections from academic participants

- Important to maintain international peer-review of applications
- Difficult to adequately involve industrial partners
- Programme “fills a gap” in research funding
- Possibilities for following up on project results (e.g. through implementation and product development) should be improved

*Source: DAMVAD 2012. Based on 23 respondents*

Company participants provided relatively few reflections, with only 11 company respondents answering the question. Some argued that the overall outcome for their company of participating in the project was very low, while others expressed great enthusiasm about their project.

A few company respondents' pointed out that the collaboration between their company and the participating public research institutions has been disappointing and cited differences in goals and interests as a key reason for the lack of successful collaboration.

## 13.2 Recommendations

A summary of the recommendations provided by academic participants to the Council for Strategic Research or to the Programme Commission responsible for the NABIIT programme are presented in the box below.

### Recommendations from academic participants

- To continue providing similar funding. The size and format of the small NABIIT programs were very appropriate and also offered good opportunities for young, upcoming scientists
- Focus on the science quality and fundamental insight; commercialisation and patenting which is “mostly a waste of time”
- Provide flexibility and room for high-risk projects, which is particularly important to promote interdisciplinary projects
- More flexible and lighter administrative burdens on researchers and project managers
- Increase focus on and funding of projects in the 10-15 million DKK range
- Consider providing follow-up funding for interdisciplinary and innovative high-risk projects
- Check which participants actually contribute to the project
- All home pages of individual projects ought to be presented/linked to on the Council’s webpage

Source: DAMVAD 2012. Based on 30 respondents

Nine company respondents also offered recommendations. Some respondents stressed the importance of ensuring that the collaborating parties in a project complement each other and that they have the same (or at least compatible) goals for the joint project. On a related note, some respondents requested clearer milestones for projects and clearly defined responsibilities among project participants.

## 14 International participants in NABIIT projects

12 international partners have been direct participants in a project funded by NABIIT. These partners include both research organisations and private companies.

As described in chapter 3, these international partners received a short series of questions in lieu of a full self-assessment survey. The aim of this small, separate survey was to gain an international perspective on the NABIIT research programme.

This chapter presents the results from the 10 international participants that contributed to the survey.

### 14.1 Staff assigned to the project

On average, the international participants have three employees assigned to the project supported by NABIIT, cf. table 14.1. This corresponded to an average of 1.75 persons, measured as full-time equivalent staff. In connection to this, it should be noted that international participants may also finance their part in the NABIIT projects through partners' own contribution.

**Table 14.1: Staff assigned to the NABIIT project by international participants**

	International participants			
	Total	Min.	Max.	Ave.
Members of staff in the organisation funded by the grant from NABIIT	27	1	10	3
Full-time equivalent of all staff members (including Ph.D. students)	15,8	0,5	5	1,75

Source: DAMVAD 2012, N = 9

### 14.2 The role of international participants

The international participants were asked to describe their role in the project and comment on how they contributed to the project supported by NABIIT. Examples of their responses are summarised in the box below.

The vast majority of the international participants stated that their role in the project was primarily related to participating in core research activities (e.g. performing tests), development of new methods or models, and optimisation, fabrication, and delivery of specific materials. A few participants also acted as Ph.D. supervisors, while others mentioned that they participated in the preparation of joint articles and presentations with other project partners.

#### Examples of the role of international participants

##### Supervisor of Ph.Ds.

##### Participating in core research activities

- Responsible for planning and carrying out experiments
- Development of logic-based probabilistic modelling language as a research tool
- Involved with the linking to materials surfaces of molecules provided by other partners and with relevant characterization,
- Delivered technology, optimization, fabrication, and Highly Non Linear Fibers (HNLF) to the project

##### Preparation of articles and presentations

Source: DAMVAD 2012. Based on 9 respondents

### 14.3 Contribution to solving societal challenges

International participants were asked to contribute with examples to how the research funded by NABIIT has helped address societal challenges. Their replies are summarised in the box below.

The majority of the international participants mentioned challenges within healthcare as those their project has helped provide solutions to. There are also examples of environmental concerns, primarily related to homeland security; finally, a few scientists refer to the health of farm animals as a contribution from the project.

#### Societal challenges addressed by NABIIT funded projects, according to international participants

##### Healthcare

- Diagnosis or treatment of disease, (i.e. application of nano-structures in cancer therapy)
- Drug discovery and development (i.e. more bio-compatible or effective implant devices)

##### Environmental concerns

- Safety and homeland security (prevention of acts of terror using explosives)

##### Food quality and safety

- Health of farm animals

Source: DAMVAD 2012. Based on 8 respondents

### 14.4 Research quality

International participants were also asked to assess the academic level of the research undertaken in connection with the project supported by NABIIT relative to international research within their field. All ten international participants an-

swered that academic level in the project, they participated in, was “very good, top level” and “of high international standard” or “the leading edge of international research in the field”.

### 14.5 Recommendations

Finally, the international participants were asked if they – based on their international experiences – had advice or recommendations for the Council for Strategic Research. Overall, the international participants seemed pleased with the administration of the NABIIT programme and with the research activities that they have participated in. Their recommendations directed towards future improvements can be found in the box below.

#### Key reflections and recommendations from international participants

- The great advantage in this collaboration has been working interdisciplinarily and towards a common goal. All parts have contributed with funding that has boosted the project to a higher level.
- I think that for a small country like Denmark it has been a very wise decision to make international collaborations possible, as all expertise may not be available within the country.
- The program is working well - to try to maintain the current level
- Clear targets and dedicated research parameters are most important
- Perhaps organising the NABIIT-funded projects as formal centres of research could be useful

Source: DAMVAD 2012. Based on 7 respondents

## 15 Methodology

### 15.1 Purpose

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The purpose of the self-assessment survey was to yield data on a broad range of evaluation components and evaluation themes, including:

- The resources that have been invested in NABIIT-supported activities by NABIIT but also from other sources (including e.g. number of staff and additional funding)
- The actual behaviour and activities that occur and create value in the projects supported by NABIIT (e.g. collaboration among project participants or research management)
- The measurable results of investments under the NABIIT (including e.g. new knowledge, scientific publications, doctoral graduates, etc.)
- Indications of the immediate outcomes and long-term effects of the programme.

It is important to stress that the above can only to a very limited extent be assessed at this point in time, as less than half the NABIIT projects are completed at the time of evaluation.

### 15.2 Data

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The report was based on data collected through three separate surveys:

- An extended self-assessment was conducted among academic participants, i.e. university research departments or centres at Danish universities. This group of respondents also included two university hospitals in Denmark.
- A shorter self-assessment questionnaire was sent to company participants in companies in Denmark (including authorised technological services institutes, also known as GTS institutes).

- A short list of questions was sent to international participants including both academic and company participants.

The surveys are described in more detail in section 15.3.

In addition, section 9.5 presents an analysis data on individual NABIIT project participants' funding applications and grants from the Councils for Strategic and Independent Research. These data were provided by the Agency for Science, Technology and Innovation.

### 15.3 Method

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This section describes how the self-assessment questionnaires were designed, how the survey was administered, and how results were analysed and reported.

#### Tailored self-assessment questionnaires

As mentioned above, the self-assessment questionnaire was tailored to each of the three main groups of participants in NABIIT funded projects: academic participants (including university hospitals), company participants (including GTS institutes) and international participants.

This choice was made for two reasons. First, the three groups of participants differ in the aims, activities and research objectives that their organisations pursue. As such, they were expected to have different perceptions of and insights into the NABIIT projects in which they have participated.

Second, experience show that organisations also differ in their willingness to contribute to such surveys. Academic researchers are generally willing to fill out more extensive questionnaires, partly because they are very dependent on research coun-

oil funding and partly because they often take a genuine and personal interest in many of the issues raised in this type of survey. In contrast, respondents from private firms are less dependent on research council funding for their research activities; they are therefore prone to disregard or abandon surveys if they are too lengthy or if they do not perceive them to be relevant and to the point. As such, a shorter version of the self-assessment questionnaire was adapted for company participants.

Efforts were however made to maintain as much similarity between the questionnaires sent to academic and company participants, to allow for more precise and efficient subsequent comparison and analysis of results.

Where relevant, questions were however tailored to the particular organisation type. For example, university researchers and firms typically have different motivations for participating in public-private research collaborations; the answers that survey respondents could choose from were therefore customised to ensure a high degree of relevance for all respondent groups.

Finally, a short questionnaire was tailored to the international project partners and designed with the aim of providing valuable insight into international partners' contribution to and perception of activities and collaboration in the projects.

### **Development of the questionnaires**

A draft version of the three self-assessment questionnaires was developed by DAMVAD. The draft questionnaires were revised based on comments from the evaluation panel.

The questionnaires contained both open-ended and closed-ended questions. Closed-ended questions, i.e. questions that ask the respondent to

choose from a range of possible choices in answering the question, were used whenever relevant to allow for subsequent statistical analysis of responses.

Based on the inputs from the evaluation panel, however, the majority of questions were formulated as open-ended questions where the respondents were encouraged to state their own views, reflect upon her subjective experiences and assessments, or simply answer questions using their own words. Responses to these questions were analysed qualitatively, using simple text coding to identify key themes or patterns in the responses.

A key challenge in the evaluation and therefore also in the design of the self-assessment questionnaire is the aforementioned fact that less than half the funded projects had been completed at the time the evaluation was initiated. As such, projects will greatly differ in the extent to which results have been achieved and the extent to which broader effects of the project can be estimated.

This issue was addressed by formulating questions so that they were relevant whether or not a project had been completed. Moreover, emphasis was placed on assess the additionality (of inputs, behaviour or outputs) created by the programme.

All three surveys were conducted in English.

### **Pilot testing**

Before launching the survey, all questionnaires were subject to pilot testing. The pilot test was performed by three DAMVAD employees (one for each group of partners, i.e. academic participants and university hospitals, company participants and GTS institutions and international participants) who are not otherwise affiliated with the evaluation.



In addition, one grant holder<sup>2</sup> was selected by the Council for Strategic Research and requested to participate in the pilot test of the survey questionnaire. The grant holder received the survey by e-mail and was asked to complete the questionnaire. The grant holder's completion of the survey was followed up with an interview session where the grant holder was asked to express his opinion on the quality of the questions, his ability to infer the meaning, and whether there were uncertainties connected to his completion of the survey.

The pilot tests resulted in several minor revisions primarily regarding the framing of the questions and whether a few examples could be included. Thus the comments enhanced the overall quality of the surveys. Based on the feedback from the pilot test the amount of time that was spent on completing the questionnaire was adjusted.

All three surveys were hereafter sent to the evaluation panel and Council for Strategic Research for comments.

### **Administration of the survey**

The self-assessment surveys were administered as online survey and carried out using the survey tool Analyzer.

Invitations to participate in the survey were sent to the contact person in each *organisation* that participated or is participating in a NABIIT funded project, and not to all *individual* participants. This is because experience indicates that sending surveys to all participants greatly increases complexity in the analysis while providing only marginal added value in an overall evaluation of a research programme (this is a more valuable approach in eval-

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<sup>2</sup> Three other grant holders were approached as potential participants in the pilot survey. Two of them did not respond to e-mail or telephone requests; one was willing but unable to participate due to time constraints.

uations of individual projects). In addition, asking all participants to contribute to the survey would constitute a substantial imposition on project partners.

Contact information for the 154 participants in 36 projects was provided by the Council for Strategic Research.

Individuals listed as contact persons on more than one project were requested to complete the survey for all projects that they participated in and were listed as a contact person for.

### **Survey launch and non-respondent analyses**

Invitations to participate in the survey were sent out via e-mail, along with a direct link to the online questionnaire. The invitation to participate in the survey specified the aims of the survey and thus provided essential background information for the respondents. It also specified that responses would be treated and presented anonymously.

The survey was launched on the 18<sup>th</sup> of May 2012. Following the launch, weekly non-respondent analyses were conducted to ensure representative coverage. To improve the response rate, a reminder was sent by e-mail to respondents who had not responded to the survey. A first reminder was sent on the 1<sup>st</sup> of June 2012, and a second reminder on the 11<sup>th</sup> of June.

To further improve the response rate, a process to call non-respondents and kindly remind them to contribute to the survey was initiated on June 12<sup>th</sup>. To ensure representative coverage, the telephone reminders were guided by the non-respondent analysis. The telephone reminders yielded an additional 32 survey responses.

Figure 15.1 presents the number of invited participants, how many completed the survey and the

response rate. The total response rate was 81 percent.

### Concluding non-respondent analysis

To ensure representative coverage of the project participants among survey respondents, a final non-respondent analysis was conducted, focusing on two dimensions: that participants from all three main respondent groups were represented, and that participants from all 36 NABIIT funded projects were represented.

For all 36 projects, there is a response rate of at least 50 percent from the academic participants.

Of the 36 projects, there were company participants represented in 31 of these projects. In four of those projects – all of which contained one company participant – it has not been possible to obtain answers for the survey. In the remaining 27 projects, at least 50 percent of the company participants contributed to the survey.

In 12 of the 36 projects, one international participant has been involved. Of those, answers have been obtained from 10 participants, whereas two participants have not responded to the survey.

Finally, 35 out of the 36 grant holders (or principal investigators) have completed the survey.

Three academic participants have been taken out of the survey: two because a more relevant col-

league responded on their behalf, and one because the participant – according to himself – lacked insight into the project. Moreover, one company participant was taken out of the survey, as he was no longer with the company described and no other contact information was available.

### Supplementary data on research funding applications and grants

The additional funding analysis presented in section 9.5 of this report is based on data from the Danish Agency for Science, Technology and Innovation. The data covers the period 2009-2011 for the Council for Strategic Research and the Council for Independent Research.

The funding information is linked to individual researchers associated with NABIIT projects and not to the projects themselves. As a consequence, no reliable connection can be established between the NABIIT project and other applications and/or grants. The “impact” of the NABIIT funding as such can therefore not be estimated based on these data. Hence the applications and grants should only be regarded as specific to the individuals involved in NABIIT projects.

**Table 15.1: Response rate (same as Table 3.1)**

Questionnaire	No. of invitations	No. of respondents	Response rate
Academic participants *	96	77	80 %
Company participants **	46	38	83 %
International participants	12	10	83 %
<b>Total</b>	<b>154</b>	<b>125</b>	<b>81 %</b>

*Source: DAMVAD 2012. \* Includes two university hospitals. \*\* Includes eight GTS institutes.*

