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*Best practices to lower the barriers for commercialisation of nanotechnology research*

**NanoCom**

**Lowering Barriers for Nanotechnology Commercialisation**

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## Data reporting: Entrepreneurship patterns applicable to nanotechnology commercialisation

### Abstract

T2.2 focused on studying how research undertaken in large, collaborative, publicly-funded projects was being commercialised. The goal was to identify best practices as well as likely pitfalls. A parallel objective was to assess how private money was being engaged in the outcomes of such projects. To accomplish these targets we interviewed 26 researchers and entrepreneurs and 15 investors with experience in publicly-funded projects and their outcomes. The interviewees reflect a wide spread of geographies, technologies, markets, fund sizes, etc. We found that researchers and entrepreneurs generally have a very positive take on collaborative research projects, driven to participate in them by the opportunity for collaboration with other nanotechnology scientists and engineers and for working on next-generation technologies. As a consequence, the interviewees in this category stress the importance of finding the right partners and clarified that while outcomes of such projects were positive, they were pre-commercial – and this was perfectly acceptable to them. On the other hand, the interviewed investors are ambivalent about the value-add of investing in outcomes of publicly-funded projects. The metrics they use and the challenges they assess for nanotechnology innovations stemming from publicly-funded projects are the same as those used for emerging technology companies overall: investors are drawn to companies with a strong management team and a strong business model enabling a suitable exit. While a company's participation in a publicly-funded project does not influence their investment decision, positively or negatively, the investors stress how a start-up involved in such a project should use it to strategically improve its market position. All our interviewees – researchers, entrepreneurs, and investors – call out certain disconnect between the ways the project calls are conceived and the needs of the market or the business focus areas of the participants. They suggest methodologies ranging from training and mentorship, to alternate funding models, to increased stakeholder participation as tweaks to improve the process and make this vital source of funding, innovation, collaboration, and partnership work better for them.

# 1 Introduction

## 1.1 Objective of task T2.2

In T2.2, we analysed entrepreneurship patterns in different strategic industrial sectors to **identify common features for successful commercialisation of technology developed in large collaborative public funded projects**. Our analysis further took into account different regional elements in order to identify key enablers for wider engagement with investors and entrepreneurs.

## 1.2 Methodology

In order to accomplish the objectives outlined for T2.2 in the DoW, we approached T2.2 as follows:

### 1.2.1 Questionnaire design:

The questionnaire is the template used by the various T2.2 partners to conduct the necessary interviews with researchers, entrepreneurs, and investors. (A copy is attached in appendices A and B.)

We created two separate questionnaires – one for researchers/entrepreneurs, and one for investors. Each one had a set of questions with both an objective and a subjective component. These templates were then shared with the partners. Upon receiving their feedback, the questionnaires were appropriately modified and finalized.

### 1.2.2 Interviewee selection and targeting:

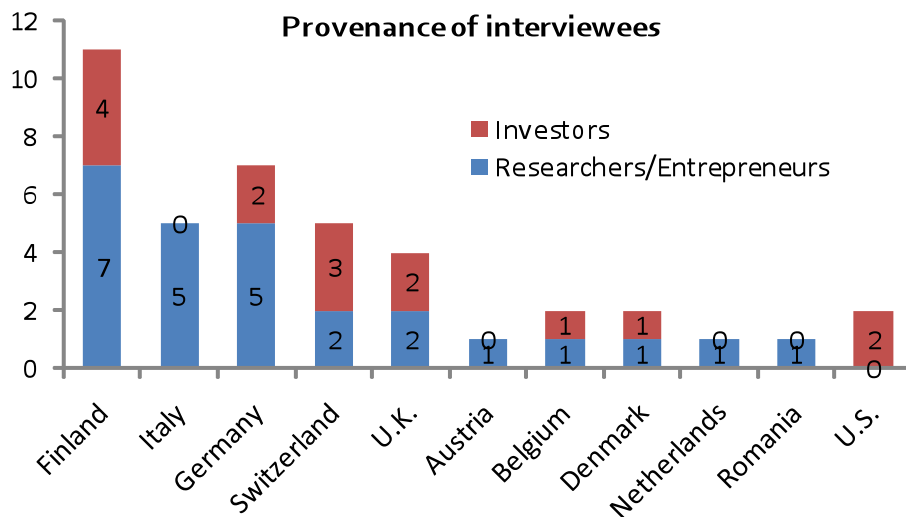
For the success of T2.2 a careful selection of the right interviewees was critical. We ensured this selection by considering various sources for appropriate candidates, including:

- Inputs from WP1 – successful T1.2 projects
- IoN/NanoTV list of publicly-funded projects with commercial outcomes
- Companies that responded to the T2.1 questionnaire that had a publicly-funded R&D background
- Other companies with similar R&D backgrounds in the professional networks of the T2.2 partners
- Venture capitalists with nanotechnology investment experience, that have funded the interviewee companies/projects

Together these approaches ensured that we were only targeting companies with publicly-funded R&D projects in their history, and when possible, the researchers and investors associated with that company. All the potential interviewees were contacted, and the willing ones were interviewed by a T2.2 partner.

### 1.3 Constituency of interviewees

For the researchers and entrepreneurs part of the task, we conducted a total of 26 interviews, whereas for the investors part we interviewed 15 entities. The interviewees were regionally distributed as follows:



Additionally, we ensured that the interviewees reflected a wide diversity in technical interest and expertise, organization or investment fund size, and target markets.

Altogether, the interviews yielded a comprehensive picture of the entrepreneurship dynamics involved in commercialising the research undertaken in large, collaborative, publicly-funded projects. They also provided an insight into the interconnect between such research and private money (see Appendices C and D.) Specifically, we found:

## 2 Researchers and entrepreneurs see value in publicly-funded projects

Of the 26 interviewees of this type, several reflected positively on their experiences in large, publicly funded projects, with varying degrees of enthusiasm and eagerness. Others took a more critical approach, pointing out shortcomings and suggesting improvements for future projects. However, despite the mix of criticism and praise for specific aspects of the process, an overwhelming majority of the interviewed entrepreneurs and researchers *will* participate in future European Commission-funded projects. To identify common themes among interview responses, we analysed the overall project experience in three different phases:

### 2.1 Project conceptualisation and design

This phase involves researchers and entrepreneurs developing a plan to address a European Commission call, deciding which partners to work with, and conceptualizing how those partners can develop a product or technology in a complementary manner using a set amount of funding. Respondents asserted that:

#### 2.1.1 Entrepreneurs sometimes struggle to design a project to fit the topics outlined by the Commission.

Our interviewees pointed to a level of detachment from the European Commission's (EC) process for deciding which topic areas merit funding for projects. Without any insight into the mechanics behind the choice of these topic areas, **entrepreneurs and researchers struggle to design project plans that satisfy the requirements of the funding call while staying within the parameters of their organisation's interest areas**; this situation was often said to cause mismatches in expectations. Additionally, entrepreneurs cited a difficulty in coming up with project ideas in several cases where there was an apparent redundancy in funding which addressed needs that were already being pursued through other calls. One entrepreneur asserted that, "In principle, we see EC calls coming by, where the calls are not very logical. You also see calls where the EC is funding things that have already been funded before."

### **2.1.2 Project funding is not a key attractant for entrepreneurs/ researchers**

Only 16% of the respondents claimed that the funding was a key attractant for participating in past EC projects. The majority (36%) claimed that **“Opportunity for collaboration with other nanotechnology scientists and engineers” was the key aspect of the project that attracted their teams**. Many SMEs or start-ups that participate in EC projects lack industry experience or connections. Thus, one of the aspects of large, publicly funded projects that they value most is the ability to network with other large companies or research institutes in their fields, enabling them to benefit from their partners’ knowledge and experience, to better know the exact requirements of the final customers and to get the visibility from the key players which may buy the developed technology/products. In fact, most entrepreneurs commented that networking emerged as a key benefit at the end of the project, as it often led to future commercial partnerships, projects, or business opportunities with other partners in the project team. One respondent explicitly said, “Money was definitely not the main driver to participate. Our key interest was to participate with a diverse consortium.” Entrepreneurs believe that building that network and exposing more mature partners to their own next-generation technology provides a level of industry validation that would otherwise take them many years to achieve. Furthermore, **some entrepreneurs cherished the opportunity to work with established players in a specific, conservative field**, asserting that, “We didn’t care about the money. Our area of activity is a very conservative field. Entering that consortium was priceless since it forced existing players to seriously consider our technology.” Across our sample set, it was clear that **funding is a necessary but not a sufficient driver for participation**.

### **2.1.3 Developers participate in collaborative projects to work on non-critical path technologies**

In addition to working with other nanotechnology scientists and engineers, 25% of respondents claimed that the “Ability to work on next generation (not immediate critical path) technologies” was a key motive

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for participating in publicly funded projects. In a resource-constrained environment, start-ups or SMEs are unable to pursue some high-risk-high-reward innovation paths while simultaneously maintaining focus on immediate or near-term commercially-relevant areas. An EC project provides them with an opportunity to do the former, while also receiving direction from the project coordinators in choosing the applications to pursue. According to the entrepreneurs interviewed, this combination of funding and commercial advice is a unique attribute of EC projects, and **the opportunity to work on cutting-edge technologies off their current commercialization path will continue to attract them going forward.**

#### **2.1.4 Finding the right partners is key**

All entrepreneurs and researchers interviewed reported that screening and identifying the right partners to engage with is a pivotal step in planning a successful project. However, **“finding the right partners” entails three distinct points of alignment between the expectations of the entrepreneur and its partners: a) number/size; b) shared goals; and c) role in value chain.**

The size of the partner is important since it speaks to the level of resources that the potential partner can bring to the project. Entrepreneurs reported that a partner that is too big is likely to contribute less to earlier stage research because the research is less relevant to their commercial efforts, and that a partner that is too small is likely to be overwhelmed with maintaining its current commercial activities while also participating in the project. Similarly, the type of partner, including where the partner falls in the value chain (i.e. university vs. service company vs. materials supplier etc.) is also an important consideration, depending on the work to be completed in the project. **Researchers and entrepreneurs believe that finding a group of complementary partners with as little overlap as possible in core expertise is extremely challenging, but necessary** to ensure that competition does not occur within the project team over the course of the work.

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Secondly, entrepreneurs believe that **finding partners with shared goals is paramount to ensuring a fruitful project**. According to most respondents, potential partners should have similar ideas of how to approach the research, how dedicated each team will be, what each team is expected to bring to the table, and most importantly, what each team expects to do with the results of the project. Several researchers and entrepreneurs reported that projects that were less than ideal typically resulted from a mismatch in end goals from partners involved in the project; one entrepreneur wanted to move towards commercialization of the research, whereas another was uninterested in moving the research further beyond EC funding.

Finally, entrepreneurs claimed that the **right partners needed to participate in an appropriate part of the value chain for successful collaboration**. This particular aspect affected researchers less, in that their main concern was in carrying out the research itself; however, one entrepreneur asserted that, “Finding the right partners in the right parts of the value chain was very difficult, this took a long time. Spending this time early on is worth the effort to avoid competition and ensure mutual participation.” Furthermore, bringing in partners at each link of the value chain ensures that each team is bringing a unique core expertise to contribute to the group.

### **2.1.5 Preventative measures around IP ownership are viewed as tedious, but necessary**

Intellectual property and technology transfer are not seen as barriers but the process to get agreements in place is cited as long and tedious (but necessary). Most entrepreneurs and researchers claimed that IP and technology transfer were fairly smooth at the conclusion of the EC funded projects they worked on. 52% of respondents stated that the outcome of their respective projects resulted in a “new product,” with 50% stating that arranging a technology transfer at the end of a project was minimally challenging. Entrepreneurs explained that the EC has exceedingly detailed standard documents in place that all of the partners need to properly discuss prior to kicking off the project. **Respondents agreed that this set of negotiations and discussions**

were long and tedious, but necessary to avoid disagreements once the project is completed. Additionally, some entrepreneurs asserted that as well as having the standard EC IP contracts in place, they also “knew their partners quite well”, which prevented any misunderstandings or disagreements down the line. All parties involved expected to work together again in the future, which motivated them to cooperate.

## 2.2 Project execution

In this phase, the partners carry out tasks laid out in the project plan over months or years (depending on the project). The projects involving our interviewees involved as few as two and as many as twenty or thirty partners, with objectives ranging from assessment of toxicity of nanoparticles in manufacturing to development of a new nano-enabled intermediate material for enhanced properties. Respondents asserted that:

### 2.2.1 Logistical and administrative requirements put a heavy burden on SMEs

In large, publicly funded projects, one partner (usually an entrepreneur) will initiate coordination and organization by investing a significant amount of cash, time, and resources to bringing in the right partners and drawing up the legal documentation to apply for the project. However, some SMEs maintain that this task proves too daunting for a small company with limited resources, especially considering that upfront cash requirements can be as high as €90'000, according to one entrepreneur. In addition to the monetary outlay, the coordinator must screen potential partners, deal with legal issues, and still keep up with their own company's activities (given the fact that simply responding to a call does not ensure that the project will be funded). Entrepreneurs at start-ups and SMEs commented that these responsibilities are challenging for small companies, and that **often time and resources availability prevent them from applying for projects, even if these would have been highly relevant to their core expertise.**

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### 2.2.2 Project coordinators could benefit from additional training

Our interviewees saw the role of the project coordinator as extremely crucial for a smooth and productive operation of a project. The coordinator is typically tasked with ensuring that partners stay on schedule for the project, maintaining focus (rather than carrying out research for the sake of research), and conducting general administrative and coordination duties. However, according to most entrepreneurs, **project coordinators often end up being the bottlenecks in the process due to lack of training.** As one entrepreneur said, “they are in a position to help, but often don’t.” A likely reason for this proposed by some interviewees was that coordinators are often assigned to the role based on factors other than merit alone (for instance, to ensure regional diversity in representation). One interviewee stated, “The coordinator has the role of steering. He has to say what the important points are, where the priority should be, and he didn’t. Thus, the project was flowing without direction.” In some cases, entrepreneurs claimed that coordinators’ lack of training caused the group to stray from the core purpose of the project, which lead to delayed timelines and frustration from many team members. Other entrepreneurs claimed that their project coordinators did a poor job of ensuring that all partners contributed their fair shares of work to the project, which also caused frustration among participants. As an entrepreneur quipped, “The one thing that the consortium coordinator could have done for us is to ensure equal participation from all partners.” Most interviewees agreed that **choosing coordinators based purely on merit would have solved many of the workflow issues that arose over the course of the project**, including partner participation and course-correction on research, as well as administrative duties necessary for the smooth running of the project.

### 2.2.3 Networking, partnerships, and the ability to work on next generation technologies were the most valuable attributes of projects

While several researchers and entrepreneurs felt that the ability to collaborate with nanotechnology scientists and engineers was a key attractant for most projects, 36% of our interviewees agreed that this

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remained the key benefit at the conclusion of the project. However, 18% of respondents claimed that “ability to work on next generation (not critical path) technical innovations” became the biggest benefit to working in a large publicly funded project, while nearly every entrepreneur interviewed commented that the networking from the project and subsequent partnerships that emerged after the project concluded were the most valuable. Many even remarked that **the reason the networking was so valuable was not necessarily for ongoing collaborations, but for industry validation through the network**. Without their participation in the projects, many start-ups and SMEs would have to resort to seeking out partners on their own and proving their mettle to industry members one by one. Their participation in the publicly-funded project allowed them to profile their abilities and innovation broadly without an inordinate investment of time and money.

#### **2.2.4 Researchers and entrepreneurs struggle in meeting present EC goals and milestones**

The success of an EC project is typically measured by progress against milestones set at the beginning of the project which look at the overall accomplishments at preset checkpoints. However, most projects are early -to mid-stage research topics (where the outcomes are still largely unknown), which often run into significant unforeseen setbacks that are not accounted for in these checkpoints. These setbacks cause teams to miss deadlines and suffer in evaluations. Several entrepreneurs reported to have experienced these circumstances in multiple projects, citing “unrealistic milestones” as the cause for their delays or missed deadlines. They felt that the **rigidity of the milestones was inherently incompatible with the fluidity and uncertainty of the innovation process**. A few interviewees commented that constructing a timeline with numerous smaller “if-then” type milestones would help keep the project running smoothly while still allowing for setbacks and course modifications that are bound to occur with this type of research.

### **2.3 Activities following project completion**

Upon completion of the project, either immediately after or several months or years later, there are several indicators of long-term impact of the research

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conducted during the project. A prominent one is commercialisation of the research, and we uncovered a diverse set of opinions regarding these activities. Respondents asserted that:

### **2.3.1 Project outcomes are often satisfying but pre-commercial**

Researchers and entrepreneurs were generally pleased with their experiences in EC projects. In fact, a whole 78% of respondents rated their experiences as either “good” or “great,” with several interviewees claiming that they achieved the goals of the project in a shorter time than if they had done it on their own. In addition to achieving these goals, respondents pointed to successful applications development, constructive feedback from partners, and useful direction for future or ongoing research as aspects of projects that were beneficial to them. However, all but three interviewees firmly asserted that the projects in which they participated strictly resulted in early stage research, and many went so far as to say that, “commercialization was not the main goal of the project.” Proving feasibility, making a first generation prototype, or making the first sample of a specific material were cited as typical goals. **All the interviewees were in agreement that completion of the project did not put any of the partners in a position to actively go to market without supplemental investment and significant follow-on development of the product.** One interviewee even said, “Mostly these projects are led and defined by academia and there is no real interest from these to strive for rapid commercialization, if there is any interest for that at all.”

### **2.3.2 Public agency support is not specifically designed to aid commercialisation**

When asked what type of commercialisation support project members received from the EC, an overwhelming majority responded “none.” **Entrepreneurs claimed that the EC projects specifically fund earlier stage or developmental research, but “not much more than that.”** One interviewee even claimed that some of its proposals were turned down for funding *because* they were too “commercially-oriented.” Yet, 38% of researchers and entrepreneurs felt that they received an adequate level of commercial support through networking and

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introductions to relevant investors, buyers, or partners for follow-on projects, or never expected aid with commercialization in the first place. One respondent stated, “[through the project] we were connected with early stage VCs which ended up being interested in our work. Without these introductions, our company would have been stagnated.” However, these respondents admitted that the networking was something they proactively pursued, rather than something the project structure had specifically allowed for. In addition to the networking two respondents alluded to the Commission’s training programs for start-ups and SMEs looking to commercialize their research. One respondent said, “There is exploitation training from the EC which seems quite useful, but we have not explored it.”

### **2.3.3 None of the researchers or entrepreneurs would have actively pursued the specific technology or application outside of the project.**

When asked how they might have hypothetically developed the technology or application outside of the publicly-funded project, all the researchers and entrepreneurs responded that they “would not have involved themselves in these applications.” Across the board, **the interviewees called out the benefits of the type of funding that the EC provides, primarily the importance of working on next generation technologies with reputable partners in focused projects.** One entrepreneur responded, “No real alternative (to EC funding). Publicly funded projects are important to generate knowledge that can be exploited in industry projects.” A few entrepreneurs admitted that if they were to consider pursuing those applications outside of an EC project, the process would be slower, less focused and innovative, and unlikely to be fruitful. One researcher said, “Development would have been significantly slower, and we would have been forced to raise VC or alternate funds to get us going. In this climate, that would have been a disaster.”

### **2.3.4 Very few respondents actively sought out investors at the close of the project**

When asked how they attracted investors at the end of the project, the overwhelming majority of researchers and entrepreneurs claimed that

this was not a key focus for them. However, the reasons for this were twofold: one group of respondents claimed that the results of their projects were too early stage to attract most investors (even seed capital or angels) and were thus left in limbo about next steps in the commercialisation process. The second group of interviewees claimed that they were not interested in commercialisation from the start (but were instead interested in knowledge creation for internal use), and were thus not pursuing investors.

### **2.3.5 Entrepreneurs required more flexible, patient funding over a longer period of time to bridge the gap between “research” and “development”**

A constant topic of discussion during all the interviews was the disconnect between the outcomes of a publicly-funded project and something that would be ready for commercialisation. The researchers and entrepreneurs felt a clear need for one or more follow-on projects to take the research to its logical commercial outcome. But without any guarantees to that effect, **all of them felt that the public-funding agencies were not positioning themselves to see an idea through towards social and economic impact.** The interviewees were clear that they were not referring to “commercialization” funding per se, but to “development” funding – to take early-stage research through to the proof of concept stage where it could be successfully pitched to private investors. All the interviewees also pointed to nanotechnology’s long development timelines, asking the funding to match those ground realities when it comes to timelines and consistency. **A recurring recommendation was the awarding of multiple linked projects,** where a company that met all the milestones laid out in the first project would have guaranteed funding available to advance the product or technology further down the development path.

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### **3 Investors are ambivalent about value-add from publicly-funded projects**

Investors are more focused on products' added value for customers, rather than on the technologies used. Therefore, **a start-up's participation in a publicly-funded project is not a decisive criterion when deciding to invest.**

Nevertheless, investors are well aware of potential benefits and limitations of publicly-funded projects. They expect such a start-up to use this opportunity to increase its value, a) by proving the market interest (strong management team and judicious choice of the partners involved in the Consortium are critical) and b) by reducing the risks associated with emerging technologies. There are no significant differences in the answers from the investors operating in different regions (i.e. Europe or United States). That said, those looking for start-ups in a very early stage of development are keener to consider the benefits for a start-up to participate in a publicly-funded project. Here are the key points from the conducted interviews:

#### **3.1 All the interviewed investors are drawn to companies with a strong management team (and of course a strong business model enabling a suitable exit)**

This answer has been given by more than 90 percent of the interviewees, independently of their geographical presence and of the investments' size they are procuring. About 50 percent of the investors also favour a strong IP. Only investors looking for very early stage start-ups also expect a strong scientific team.

#### **3.2 Investors associate the following risks with nanotechnologies (or generally to emerging technologies):**

- I. Market acceptance, which refers to *perceived* risks from the customers to adopt a new technology. "Fears" are more difficult to manage than factual safety issues.
- II. Time to market could be longer, and size of investments larger. This makes the potential of return on investments uncertain.

- III. For investors looking for start-ups in very early stage of development, longer time to market and larger financial needs may also imply a greater dilution if more investment rounds are needed.

### **3.3 Investors have the same expectations for start-ups using nanotechnologies as for any other start-up in term of added value.**

This finding means that nanotechnology is just one way for the start-up to bring to market a product of interest for customers. **The investors are interested in the market potential of the product, and not in the technology itself.** But in the same time, investors are very well aware of the risks associated to emerging technologies-based products, and are expecting the start-up to be highly focused to reduce them.

### **3.4 Participation in publicly-funded projects did not influence investment decisions.**

All the interviewed investors are focused on the market potential of the product, and **whether the start-up participated in a publicly-funded or not is therefore not decisive.** Nevertheless, investors looking for very early stage of development are giving more importance to that point, considering that the participation to this project:

- a. is a confirmation of the potential of the technology,
- b. helps the start-up to focus on industrial needs and,
- c. allows the company to have a part of its development financed by non-dilutionary public money

Another advantage for a start-up to participate in such a project is the potential to increase its network and to become known by key players in their domain of activity.

On the other side, some drawbacks are also identified:

- a. lower efficiency due to too big consortiums,
- b. loss of focus from the start-up on adding consumer value,
- c. potential loss of IP protection due to the number of involved partners and due to confidentiality issues.

Most of the investors see the IP situation somehow complicated by the start-up's participation in a publicly funded project, but investors from the U.S. seem less concerned by this point.

### **3.5 Investors are unanimous in expecting a start-up participating in a publicly funded project to use this**

**opportunity to increase its market value.**

There are a lot of different ways to achieve this, for instance a) by leading the project in order to have more weight on the strategic decisions, b) by developing a demonstrator, c) by getting collaboration contracts and generating some revenues with a key player, or d) by confirming the market potential of the technology.

**3.6 Investors feel disconnected from the EU's process of determining which focus areas the public research shall fund.**

Several investors mentioned they would be glad to help EU in the key decisions (like framework programs' definition) in order to make the developments more oriented towards market needs.

## 4 Implications

Our findings from the interviews with a diverse set of researchers, entrepreneurs, and investors, all having experience with publicly-funded research, have several implications as follows:

### 4.1 Public funding should link the process from discovery to commercialisation

There appears to be a disconnect, at least one of perception, between the projects being funded by the EC and what the market is willing to invest private money into. Even the few EC-funded programs that support proof-of-concept or prototype development activities are not widely known and are viewed as too logistically complex for SMEs to access. To ensure that public money investments in nanotechnology research yield commercial outcomes, **there is a need to introduce development stage funding that can kick in at the end of the current funded projects** and take them down the commercialisation path.

### 4.2 EC should institute mentorship programs for project coordinators

Such programs could have a two-pronged approach to meet the two needs highlighted by the project participants: 1) *training*, to ensure that the coordinators are able to leverage all the tools at their disposal to facilitate the project most effectively and provide the necessary focus and assistance, and 2) *networking*, to allow coordinators from different ongoing projects to meet at regular intervals to share notes, learn from each other's experiences, and **ensure a standardization of approach and quality across all ongoing EC-funded projects**.

### 4.3 Train entrepreneurs using experienced coaches and apprenticeship programs

Investors repeatedly stressed on the criticality of the management team strength in their decision to invest in a particular business idea. With the current demand-supply dynamic in the venture capital domain, **there is a marked need for skilled entrepreneurs who can package and pitch the research produced in publicly-funded projects appropriately in order to attract the**

**scarce seed and venture capital.** There are several programs around the world that provide training to first-time entrepreneurs using experienced serial entrepreneurs as coaches which could serve as a model for the EC.

#### **4.4 Include investors in the project conceptualisation and market focus identification process**

All the investors we interviewed were eager and willing to participate in the wider discussion regarding the direction of public funding, but felt disconnected from the process. Given how vital private money is in the eventual commercialisation of publicly-funded research and the fact that the investors are able to bring a unique market focus and insight to the table, **there is a case to be made regarding incorporating their inputs in the call design, project conceptualisation, and market assessment.**

#### **4.5 Evaluate projects not only at the end, but also 3-5 years after the project is completed to get a better idea on long-term success**

All the interviewees called out long development paths with inherent lack of clarity and comparables as a key facet of nanotechnology research. Several of them stated that often **the real benefits of the work conducted during a publicly-funded project only became evident after three to five years.** To accurately assess the impact that public support has had on advancing scientific knowhow and commercial activities, a more accurate frame of analysis could widen the assessment window to also measure benefits after this time has passed.

#### **4.6 Educate and encourage entrepreneurs to participate in relevant programs**

As the entrepreneurs we interviewed called out their needs, they also often referred to specific EC-funded programs that could help meet them. However, the general perception was that the requirements that they would need to satisfy in order to access these programs was a large time-money-paperwork burden that was beyond the reach of an SME. **There is a clear and present need to convince SMEs that availing the EC support mechanisms will not hinder their progress as a commercial entity and to institute mentorship and facilitation processes that can guide them through the steps easily.**



## 5 Appendix

### 5.1 Copy of blank researcher/entrepreneur questionnaire

#### Commercializing Nanotechnology Innovations from Publicly Funded Projects

This questionnaire is designed to identify key benefits and setbacks for an entrepreneur/researcher participating in a large government-funded nanotechnology project.

#### Respondent information:

**Affiliation:** [Click here to enter text.](#)

**Name:** [Click here to enter text.](#)

**Phone Number: +** [Click here to enter text.](#)

**Email:** [Click here to enter text.](#)

**Anonymous?** [Choose an item.](#)

**Wants summary doc?** [Choose an item.](#)

**Date interview conducted:** [Click here to enter a date.](#)

**Interview key takeaways:** [Click here to enter text.](#)

#### QUESTIONNAIRE

1. **What was the main objective of the project?**

[Click here to enter text.](#)

2. **What was the overall size of the project (in €)?**

[Click here to enter text.](#)

3. **How many partners were involved?**

[Click here to enter text.](#)

4. **What role did your firm play?**

[Click here to enter text.](#)

5. **What was your firm's share of the funding?**

[Click here to enter text.](#)

6. **What most attracted your firm or research group to the consortium or large publicly funded project versus developing the technology in house?**

Choose an item. [Click here to enter text.](#)

7. **What became the biggest benefit to working in a large collaborative publicly funded project?**

[Choose an item. Click here to enter text.](#)

8. **What was the nature of the commercial outcome of the work conducted during this project?**

[Choose an item. Click here to enter text.](#)

9. **How would you rate your overall experience in being involved with this project?**

[Choose an item.](#)

10. **On a scale of 1 to 5, with 5 being the most challenging, please rank the difficulty in arranging a tech transfer at the end of the project.**

[Choose an item.](#)

11. **What was the key challenge in arranging a tech transfer?**

[Choose an item. Click here to enter text.](#)

12. **Were there any major challenges in sharing IP with other members of the project? Please be specific.**

[Click here to enter text.](#)

13. **How did you attract investors to the outcomes of this project?**

[Click here to enter text.](#)

14. **How would you have done this differently had you not participated in the project?** [Click here to enter text.](#)

15. **What incentives were put in place for you to participate in the project?**

Tax breaks

Direct funding

Access to trained staff

Guarantee on IP ownership

Guarantee in help finding C-level management

Other (please explain) [Click here to enter text.](#)

16. **In your opinion, what is the key challenge to commercializing a nano-enabled technology developed as a part of a publicly-funded collaborative project? (Please be specific.)**

[Click here to enter text.](#)

17. **What type of *commercialization support* did you receive from the government and your partners during the course and upon completion of this project?**

[Click here to enter text.](#)

18. **How adequate was this support for your needs?**

[Choose an item. Click here to enter text.](#)

**19. What were some of the things that worked very well with the project and its eventual commercialization?**

[Click here to enter text.](#)

**20. What were some of the things that could have gone better with the project and its eventual commercialization?**

[Click here to enter text.](#)

**21. Would you participate in such a (publicly-funded, collaborative) research project again?**

[Choose an item.](#) [Click here to enter text.](#)

## 5.2 Copy of blank investor questionnaire

### Commercializing Nanotechnology Innovations from Publicly Funded Projects

This questionnaire is designed to identify key benefits and setbacks for an investor investing in a company that is participating or previously participated in a large government-funded nanotechnology project. Additionally, it aims to determine what key factors investors consider before investing in a nanotechnology venture, and whether or not those factors would be affected by a start-up taking part in a large publicly funded project.

#### Respondent information:

**Affiliation:** [Click here to enter text.](#)

**Name:** [Click here to enter text.](#)

**Phone Number:** + [Click here to enter text.](#)

**Email:** [Click here to enter text.](#)

**Anonymous?** [Choose an item.](#)

**Wants summary doc?** [Choose an item.](#)

**Date interview conducted** [Click here to enter a date.:](#)

**Interview key takeaways:** [Click here to enter text.](#)

#### QUESTIONNAIRE

1. What are the key qualities a company must display to merit an investment?

- Strong IP
- Strong management team
- Strong scientific team
- History of successful collaboration
- Other (please explain)

[Click here to enter text.](#)

2. Do you look for different qualities in a nanotechnology company versus a different type of technology provider?

[Choose an item.](#) [Click here to enter text.](#)

3. What are some key risks in investing in a nanotechnology start-up? Are these risks different from investing in other technology start-ups?

[Click here to enter text.](#)

- 4. Would a company's current or former participation in a large publicly funded project help convince you to invest? Why?**

Choose an item. [Click here to enter text.](#)

- 5. What are the key benefits to investing in a company involved in a large publicly funded project? (Please explain)**

[Click here to enter text.](#)

- 6. What are the key setbacks to investing in a company involved in large publicly funded project? (Please explain)**

[Click here to enter text.](#)

- 7. What should a company do or accomplish in a large publicly funded project to make itself more attractive to you as an investor? (Please explain)**

[Click here to enter text.](#)

- 8. Did the company's participation complicate the resulting IP's ownership?**

Choose an item.

- 9. Would you actively target companies that have participated in large publicly funded projects? Please explain.**

[Click here to enter text.](#)

- 10. Additional comments:**

[Click here to enter text.](#)

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## 5.3 Completed Researchers and Entrepreneurs interview reporting documents

# Part I: Respondent information

**Number of respondents:** 26

### Interview key takeaways:

- An entrepreneur from a nanomaterial start-up:
  - Choose the right partners if you want your project to be successful. Governmental agencies could be helpful in promoting innovative products and nanotechnologies to end users that a small company might not have access to as easily, so it is important to take full advantage of the team including the facilitators.
- A researcher involved with a carbon nanotube equipment producer:
  - The choice of the partner is what determines the success of the project
- An entrepreneur involved in developing CNT-based medical devices:
  - Participation in this project gave us the chance to be involved with other tech entrepreneurs. Problem right now is that there is no demand and no finished product. Everything is in research. When we can collaborate with other EU companies, it's a great way to brainstorm on new products without having to finance R&D all on our own. We participated in another project with just one other company – the other company didn't go too much into the research – the research team they had working on it doesn't put enough time into it – we're waiting to see how the results are. They've never worked with nanotubes before. Thus it is also important to choose the right partners who want what you want.
- An researcher investigating the toxicology profile associated with nanoparticles:
  - “[Company X] fully supports the goal of the project to lowering the barriers and contributing towards the rapid commercialisation of innovative nanotechnology driven products. Our perception is that policy makers currently work in the opposite direction. There is almost a race going on to regulate each area of nanotechnology based on the assumptions that all nanomaterials pose a risk to men and the environment. The markets already react to that development by rather avoiding nanomaterials instead of using nanomaterials. This is very much in contradiction to the expenses of DG Research into nanotechnology research. To my opinion this is or will become one of the biggest barriers for the commercialisation of nanoproducts.”
- An entrepreneur at a start-up supplying high quality carbon nanotubes:
  - Several of [Company Y]'s projects are very exploratory of nature and if about 3 out of 10 reach the market that would be a high percentage – commercialization takes a lot of time even when the projects are over – 3 to

5 years is seen as a normal minimal period afterwards to get to market. And several of these projects are not expected to become marketable since it is more about idea testing in the hope that something practical comes out.

The overall satisfaction with these projects is good. Working with several partners is not always easy and it takes time to adapt to the different ways of working and cultural differences of the partners.

- A researcher at a science park foundation:
  - Three main barriers in nanotechnology. 1. Regulation: Especially for products that are directed to the final user it is difficult to have no single standard in Europe. 2. Financing: Nanotechnology results are often still at a more research level. And it is difficult to raise private additional money with no clear application in mind, in particular as nanotechnology is very complex. 3. Research is too much science based and not application based (in biotechnology, which is more mature research now often starts from a problem). So there are wonderful solutions in nanotechnology without a market or even a problem
- An entrepreneur at a start-up developing nano-enabled contrast agents:
  - The key issue in commercialization is timing. Therefore, it is important to make funds available fast and allow partners to use it flexible and non bureaucratic. If there is a result that is ready to commercialize, the effort to apply for funds and the time required is too high. Therefore the commercialization potential is not used to the full extent.
- An entrepreneur at a start-up developing innovative ceramic filter elements:
  - It is important that the funding agency and the leading partner are committed to the project to motivate everyone in the project to collaborate and work hard. A diverse project team can be helpful but must again be coordinated efficiently. For SMEs, such projects offer the chance to operate on a larger scale (both concerning financial issues and infrastructure).
- An entrepreneur developing sensors for the aviation industry:
  - For this company, the project served as an entry ticket to a certain field of technology. This was mentioned again and again as the major benefit. The interviewee further emphasized the importance of trust and reliability of partners as a success factor. In particular, the dependence on other firms'/ researchers' can lead to problems if people are not fully committed to the project and willing to help out in case of difficulties.
- An entrepreneur at a firm studying toxicity of nanoparticles:
  - The key issue of such a project is to get the right people to work together. Funding is not the main concern, however, it facilitates collaboration as people do not have to neglect other tasks.
- A researcher at a firm studying toxicity of nanoparticles:
  - For all projects we have been involved in, there were big tech transfer issues. But, collaboration and new knowledge creation is the major benefit of such projects for [Company B].
- An entrepreneur at a company developing nanoimprint lithography stamps:

- 
- A clear gap (particularly in funding) lies between basic research and potential applications. Further, mutual trust and satisfactory agreements are very helpful for successful projects. Therefore, it is important to know and trust your partners involved in the project
  - A researcher at a multi-disciplinary nanotechnology research center:
    - Large publicly funded projects are absolutely needed to show the feasibility of products based on nanotechnologies
  - A leading authority in energy consulting, testing & certification:
    - EC funding allowed us to apply a lot of prior work that we had done for our technology's application in one domain (separating evaporated water from industrial flue gas streams) to its application in a completely new and promising domain (CO<sub>2</sub> capture and separation)
    - In principle, we see EC calls coming by, where the calls are not very logical. You also see calls where the EC is funding stuff that has already been funded before. Many projects have a far smaller budget than would be required to take the work to its logical conclusion. Overall, I have seen many EC projects that do not have a commercial outcome – maybe this is because the goal is R&D?
    - It would help if there were a coordinators' meeting between the coordinators from different projects. It would be valuable for us to see how the other coordinators are doing this and learn from each other. It would also help to have a project leader meeting and experience exchange between different projects' leaders. I am sure it would improve the process for everyone concerned
    - Ours was a complicated project with many (26) partners. It is challenging because of technical complexity as well as value chain complexity. Each partner has its own preferences and agenda. The end user partners want to have durable materials with low-pressure drop and this puts pressure on the university partners. For us, as coordinators, the challenge becomes how to make people choose and draft combined consortium goals
    - Another challenge is also to find/draft a project that fits the call text (in addition to satisfying the partners' agendas). We are gravitating to projects where each work package could be a mini project of its own with the only constant being the project coordinator or facilitator
    - The project complexity is not a bad thing because the technical content itself is very complex and you need partners from all parts of the value chain to cover all those aspects. If you reduce complexity, you reduce coherence.
  - An entrepreneur developing high-power semiconductor lasers:
    - Large collaborative projects with other companies are sort of challenging, since nobody uses exactly the same technology. However, our R&D projects that involved one company and some university groups worked quite well. In such cases, the original R&D collaboration and partnerships that were established are still of great value

- 
- R&D funding should be very patient. In our case, the original research project took 10 years of work and 10 years of losses. With impatient funding the technologies are sold abroad while still at an immature phase and the foreign investor will “gather the fruits”
  - Seeing the project as having a phased lifecycle. In the first phase, a sort of daredevil, reckless and open attitude is of benefit and it demands a very multidisciplinary team with scientists from many different fields. However, within 2-3 years these have to be replaced with people who can turn the experiments phase into a business. The different phases of commercialization just demand different skills and personality types
  - An entrepreneur developing Atomic Layer Deposition (ALD) systems for research and production
    - The critical benefit of the EU projects for an SME is that they allow the company to increase R&D without engaging more capital
    - From the CEO’s point of view a good project provides
      - development in the topics which are of core interest to the company (this is not always the case in publicly funded projects)
      - funding for the company’s R&D personnel costs
      - work that includes a clear business vision for the company
      - ability to ensure that core know-how remains in the company – including the IP
    - Large collaborative projects are also beneficial as they allow networking at the European level (easier to start business discussion with the experts you already know from joint projects) and as the feedback from the project partners (future customers) is very open and direct
  - An entrepreneur involved with a nano-instrumentation company spun out from two publicly-funded research projects
    - It would also be beneficial if after a 3-year FP7 project, the gap to commercialization is assessed and specific funding is made available for prototype development with limited partnership. Current, such funding, even it is €100000, does not exist within the EC set-up
    - Finding a good FP7 project is not easy: one needs to look for partners that are not competing in some way. Key criteria for participating would be to get access to new technology, to be able to prove own technology, and to be able to develop new partnerships. Currently, this is not happening enough with the FP7 projects
    - Funding for nanoinstrumentation is very difficult and a huge hurdle for start-ups and SMEs, and is complicated by the fact that often nano-instruments are so new that only a few academics understand the application and have any idea how to evaluate and co-develop it
    - Nanoinstrumentation is also more of a problem to go to the market since a working prototype needs to be built and that costs money that is not easy to find. Developing such instruments involves long-term projects needing many steps

- Good nanoinstrumentation ideas are often developed at universities but the university is happy with the publications. When the researcher wants to build a working instrument, he/she is rarely supported by the university and has to step outside for funding or create his/her own company

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## Part I: Respondent information

**Number of respondents:** 26

**Interview key takeaways:**

- An entrepreneur from a nanomaterial start-up:
  - Choose the right partners if you want your project to be successful. Governmental agencies could be helpful in promoting innovative products and nanotechnologies to end users that a small company might not have access to as easily, so it is important to take full advantage of the team including the facilitators.
- A researcher involved with a carbon nanotube equipment producer:
  - The choice of the partner is what determines the success of the project
- An entrepreneur involved in developing CNT-based medical devices:
  - Participation in this project gave us the chance to be involved with other tech entrepreneurs. Problem right now is that there is no demand and no finished product. Everything is in research. When we can collaborate with other EU companies, it's a great way to brainstorm on new products without having to finance R&D all on our own. We participated in another project with just one other company – the other company didn't go too much into the research – the research team they had working on it doesn't put enough time into it – we're waiting to see how the results are. They've never worked with nanotubes before. Thus it is also important to choose the right partners who want what you want.
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  - “[Company X] fully supports the goal of the project to lowering the barriers and contributing towards the rapid commercialisation of innovative nanotechnology driven products. Our perception is that policy makers currently work in the opposite direction. There is almost a race going on to regulate each area of nanotechnology based on the assumptions that all nanomaterials pose a risk to men and the environment. The markets already react to that development by rather avoiding nanomaterials instead of using nanomaterials. This is very much in contradiction to the expenses of DG Research into nanotechnology research. To my opinion this is or will become one of the biggest barriers for the commercialisation of nanoproducs.”
- An entrepreneur at a start-up supplying high quality carbon nanotubes:
  - Several of [Company Y]'s projects are very exploratory of nature and if about 3 out of 10 reach the market that would be a high percentage – commercialization takes a lot of time even when the projects are over – 3 to 5 years is seen as a normal minimal period afterwards to get to market. And several of these projects are not expected to become marketable since it is more about idea testing in the hope that something practical comes out. The overall satisfaction with these projects is good. Working with several

partners is not always easy and it takes time to adapt to the different ways of working and cultural differences of the partners.

- 
- A researcher at a science park foundation:
    - Three main barriers in nanotechnology. 1. Regulation: Especially for products that are directed to the final user it is difficult to have no single standard in Europe. 2. Financing: Nanotechnology results are often still at a more research level. And it is difficult to raise private additional money with no clear application in mind, in particular as nanotechnology is very complex. 3. Research is too much science based and not application based (in biotechnology, which is more mature research now often starts from a problem). So there are wonderful solutions in nanotechnology without a market or even a problem
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    - For all projects we have been involved in, there were big tech transfer issues. But, collaboration and new knowledge creation is the major benefit of such projects for [Company B].
  - An entrepreneur at a company developing nanoimprint lithography stamps:
    - A clear gap (particularly in funding) lies between basic research and potential applications. Further, mutual trust and satisfactory agreements are very helpful for successful projects. Therefore, it is important to know and trust your partners involved in the project
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    - Large publicly funded projects are absolutely needed to show the feasibility of products based on nanotechnologies

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    - EC funding allowed us to apply a lot of prior work that we had done for our technology's application in one domain (separating evaporated water from industrial flue gas streams) to its application in a completely new and promising domain (CO<sub>2</sub> capture and separation)
    - In principle, we see EC calls coming by, where the calls are not very logical. You also see calls where the EC is funding stuff that has already been funded before. Many projects have a far smaller budget than would be required to take the work to its logical conclusion. Overall, I have seen many EC projects that do not have a commercial outcome – maybe this is because the goal is R&D?
    - It would help if there were a coordinators' meeting between the coordinators from different projects. It would be valuable for us to see how the other coordinators are doing this and learn from each other. It would also help to have a project leader meeting and experience exchange between different projects' leaders. I am sure it would improve the process for everyone concerned
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    - The project complexity is not a bad thing because the technical content itself is very complex and you need partners from all parts of the value chain to cover all those aspects. If you reduce complexity, you reduce coherence.
  - An entrepreneur developing high-power semiconductor lasers:
    - Large collaborative projects with other companies are sort of challenging, since nobody uses exactly the same technology. However, our R&D projects that involved one company and some university groups worked quite well. In such cases, the original R&D collaboration and partnerships that were established are still of great value
    - R&D funding should be very patient. In our case, the original research project took 10 years of work and 10 years of losses. With impatient funding the technologies are sold abroad while still at an immature phase and the foreign investor will “gather the fruits”
    - Seeing the project as having a phased lifecycle. In the first phase, a sort of daredevil, reckless and open attitude is of benefit and it demands a very multidisciplinary team with scientists from many different fields. However, within 2-3 years these have to be replaced with people who can turn the

- 
- experiments phase into a business. The different phases of commercialization just demand different skills and personality types
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    - The critical benefit of the EU projects for an SME is that they allow the company to increase R&D without engaging more capital
    - From the CEO's point of view a good project provides
      - development in the topics which are of core interest to the company (this is not always the case in publicly funded projects)
      - funding for the company's R&D personnel costs
      - work that includes a clear business vision for the company
      - ability to ensure that core know-how remains in the company – including the IP
    - Large collaborative projects are also beneficial as they allow networking at the European level (easier to start business discussion with the experts you already know from joint projects) and as the feedback from the project partners (future customers) is very open and direct
  - An entrepreneur involved with a nanoinstrumentation company spun out from two publicly-funded research projects
    - It would also be beneficial if after a 3-year FP7 project, the gap to commercialization is assessed and specific funding is made available for prototype development with limited partnership. Current, such funding, even it is €100000, does not exist within the EC set-up
    - Finding a good FP7 project is not easy: one needs to look for partners that are not competing in some way. Key criteria for participating would be to get access to new technology, to be able to prove own technology, and to be able to develop new partnerships. Currently, this is not happening enough with the FP7 projects
    - Funding for nanoinstrumentation is very difficult and a huge hurdle for start-ups and SMEs, and is complicated by the fact that often nanoinstruments are so new that only a few academics understand the application and have any idea how to evaluate and co-develop it
    - Nanoinstrumentation is also more of a problem to go to the market since a working prototype needs to be built and that costs money that is not easy to find. Developing such instruments involves long-term projects needing many steps
    - Good nanoinstrumentation ideas are often developed at universities but the university is happy with the publications. When the researcher wants to build a working instrument, he/she is rarely supported by the university and has to step outside for funding or create his/her own company

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## Part II: Questions' answers

### Question 1: What was the main objective of the project?

- Develop new tools, processes, or instrumentation to facilitate manufacturing of nano-enabled products :
  - Mechanical alloying for production of metal nanoparticles.
  - Development of positioning and analyzing devices.
  - Develop different approach to the nanoimprint lithography process. There was a basic idea but this idea was definitely not ready for commercialisation. The aim of the project was to fill this gap.
  - Process and product development of the ALD technology.
  - High-power lasers for production of semiconductors.
  - Tools for Nanotechnology (TNT) and Nanoresolution tools for interdisciplinary applications (NRT).
  - The objective of the first project (1) was to find a less expensive technology for tableware glass coloring. Thus a 'bottom-up' scheme was planned, i.e. to grown nanoparticles through vapour-solid route. The objective of the second project (2) was similar, i.e. glass matrix doping with colouring (i.e. absorbing) ions, but at this time the glass matrix was the one used in active optical fibers (used i.e. in optical fiber telecommunications and fiber lasers). So, in both cases the objective was glass doping, but in the first case the glass price (in the final product) is roughly 50 €/kg (for premium tableware) as in the second case the price is roughly 200 000 €/kg.
- Develop nanointermediates to be incorporated into various end products:
  - To develop new diagnostic tools, to search for therapeutic applications, to assess technological, human, environmental consequences of using nanoparticles.
  - To create a nanotube-enabled medical device/drug combination.
  - Create vials made of dense aligned CNT (carbon nanotube) arrays for microelectronic interconnection.
  - Develop new generation of contrast agent for magnetic resonance imaging.
  - Develop laser-treated microelectronics array.
  - Application of nanostructured membranes for CO<sub>2</sub> capture and separation (nanoGLOWA)
  - Pressure sensors for aviation (follow up project: First was also for sensors, but for a different industry).
  - OLEDs and organic electronics
  - Developing immunosensor platform
  - Smart packaging
- Address or study nanotoxicity :
  - Risk Assessment of nanomaterials and nanoparticles in the production process to determine the toxicological impacts of these nanoparticles. The project was not designed to test these materials on a small scale but in real production.

- Nanoparticles risk assessment, interaction of nanoparticles inside a cell of an organism.
- To design special masks to protect people exposed to nanoparticles.

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**Question 2: What was the overall size of the project (in €)?**

<b>Respondent</b>	<b>Size of project (€)</b>
1	2,500,000
2	11,000,000
3	1,000,000
4	2,000,000
5	6,500,000
6	5,000,000
7	2,500,000
8	6,400,000
9	2,000,000
10	1,000,000
11	2,750,000
12	1,500,000
13	5,000,000
14	5,000,000
15	3,000,000
16	2,000,000
17	1,000,000
18	2,400,000
19	1,000,000
20	No response
21	No response
22	No response
23	No response
24	No response
25	3,000,000
26	16,000,000

**Question 3: How many partners were involved?**

<b>Respondent</b>	<b>No. of partners</b>
1	3
2	12
3	10
4	6
5	8
6	4
7	6
8	6
9	4
10	2
11	9
12	3
13	10
14	10
15	4
16	4
17	4
18	2
19	3
20	No response
21	No response
22	No response
23	No response
24	No response
25	4
26	26

**Question 4: What role did your firm play?****➤ Leader/coordinator**

- Coordinator/management – in our case, the budget for management is separate from the rest of the budget.
- Connecting and information interchange management between other partners.
- [Company F's] role was a bit of everything. In addition to being the project coordinator, we also functioned as an integrator. We know quite some things about the industry and end users. In addition, coordinating the project was a natural decision for us since we owned some of the basic patents around the nanostructured membranes. Moreover, the EC is one of our key accounts and we have done over a 100 EC projects, and are now involved in our 2<sup>nd</sup> Framework.
- The firm acted as coordinator as well as a regular partner.

**➤ Regular partner**

- Manufactured nanoparticles according to the specs provided by our partners.
- Materials development.
- Making prototypes using our laser equipment and technology knowhow.
- Developed the nanotube material, and others functionalized it and targeted its application.
- Synthesis of CNT arrays, CNT characterization and metallic/semi conduction single-wall enrichment or separation.
- Production of particles and modifications.
- Industrial partner.
- A lot of the company's R&D was based on private funding. While publicly funded research was being carried out by the local universities, the company participated actively in these research groups' guidance and funding, also supporting identification of the research topics. Both the company and the research groups had time to develop the process, test numerous applications and make numerous mistakes. Basically the company is now based on all the expertise gathered during these years.

**Question 5: What was your firm's share of the funding?**

<b>Respondent</b>	<b>Share of funding (€)</b>
<b>1</b>	<b>300,000</b>
<b>2</b>	<b>600,000</b>
<b>3</b>	<b>100,000</b>
<b>4</b>	<b>300,000</b>
<b>5</b>	<b>650,000</b>
<b>6</b>	<b>650,000</b>
<b>7</b>	<b>220,000</b>
<b>8</b>	<b>448,000</b>
<b>9</b>	<b>1,300,000</b>
<b>10</b>	<b>500,000</b>
<b>11</b>	<b>178,750</b>
<b>12</b>	<b>200,000</b>
<b>13</b>	<b>400,000</b>
<b>14</b>	<b>150,000</b>
<b>15</b>	<b>500,000</b>
<b>16</b>	<b>500,000</b>
<b>17</b>	<b>300,000</b>
<b>18</b>	<b>1,200,000</b>
<b>19</b>	<b>500,000</b>
<b>20</b>	<b>No response</b>
<b>21</b>	<b>No response</b>
<b>22</b>	<b>No response</b>
<b>23</b>	<b>No response</b>
<b>24</b>	<b>No response</b>
<b>25</b>	<b>400,000</b>
<b>26</b>	<b>7% of total funding</b>

**Question 6: What most attracted your firm or research group to the consortium or large publicly funded project versus developing the technology in house?**

- *Funding itself:* 4 answers
- *Ability to work on next generation (not immediate critical path) technical innovations:* 7 answers
- *Opportunity for collaboration with other nanotech scientists and engineers:* 9 answers
- *Access to strategic partners for future business collaboration:* 3 answers
- *Opportunity to increase your project's visibility:* 1 answer
- *Opportunity to attract additional investors:* 1 answer

**Comments:**

- **The importance/unimportance of funding:**
  - Money was definitely not the main driver to participate. Our key interest was to participate with a diverse consortium (big companies, research institutes, SMEs). Especially as an SME that works with nanoparticles, it was of our interest to know if these particles endanger workers in our company.
  - We didn't care about the money, we were very happy to be in the consortium. Airfield activity is a very conservative field, you cannot enter easily. Entering that consortium was priceless since it forced existing players to seriously consider our technology.
  - Funding itself not a major incentive to participate in such a project.
  - Allowed us to increase R&D activities without engaging more capital.
- **Industry exposure:**
  - The types of other partners present in the consortium improved the chances of transferring the technology into a commercial setting.
  - Our main goal was to show industrial feasibility.
- **Access to emerging technologies:**
  - We seek public investment in areas we don't know yet – once we have developed internal know-how about the topic area, we can then do commercial consultancy externally.
  - Key criteria for participating would be to get access to new technology, to be able to prove our own technology, and to be able to develop new partnerships as a result.
  - Get to know more about the life-cycle of nano-products by interacting with developers working directly with these particles. This helps us to begin to imagine how these particles could potentially be harmful.

**Question 7: What became the biggest benefit to working in a large collaborative publicly funded project?**

- *Funding itself:* 6 answers
- *Ability to work on next generation (not immediate critical path) technical innovations:* 5 answers
- *Opportunity for collaboration with other nanotech scientists and engineers:* 10 answers
- *Access to strategic partners for future business collaboration:* 6 answers
- *Opportunity to increase your project's visibility:* 0 answers
- *Opportunity to attract additional investors:* 1 answers

**Comments:**

- **Networking and partnerships emerge as a key benefit**
  - Projects often serve as a basis for future industrial projects (knowledge generated and network)
  - Partners are interesting too – since they later became customers (Customers are water and energy intensive industry)
  - Original R&D collaboration and partnerships that were established are still of great value
  - Allow networking in European level (easier to start business discussion with the experts you already know from joint projects) and as the feedback from the project partners (future customers) is very open and direct
  - We were able to show industrial feasibility through working with some of the partners in the project – once your network believes you have a good product or concept, your progress can accelerate.
- **The knowhow emerging from this process is invaluable**
  - New Knowledge, especially knowledge they did not expect to get out of these kinds of projects, is another major benefit.
  - Working knowledge of how to handle, produce, deal with your technology (not a new product or license that can help to improve existing products) is often undervalued. So we're not talking about specific products of [Company B] but knowhow that you shouldn't necessarily try to protect with patents.

**Question 8: What was the nature of the commercial outcome of the work conducted during this project?**

- *New product:* 12 answers
- *Modification or improvement to existing product:* 5 answers
- *Spin-out or similar form of technology transfer:* 3 answers
- *Licensing revenue:* 1 answers
- *Other:* 2 answers

**Comments:**

- **Several respondents were confused about next steps towards commercialization**
  - Goal rather to show proof of concept than to have the final application ready.
  - Tests of nanomaterials, focus on products that are really used in industry. Outcome should have been a table that classifies nanomaterials with respect to their toxicological impact.
  - Project started in Dec 2006 and ends in Dec 2011. On technical parameters, some things are doing very well, but others are taking far longer than we thought. Commercial outcome, as of now, is unclear
  - We are planning demonstration tests in the next 2-3 years. That said, we have little experience that will help us commercialize this. We sell consultancy hours and our business model is getting ourselves enough work to keep busy. Only twice in our history have we licensed patents. We will obviously not be producing any products on our own.

**Question 9: How would you rate your overall experience in being involved with this project?**

- *Great:* *8 answers*
- *Good:* *10 answers*
- *OK:* *5 answers*
- *Bad:* *0 answers*
- *Terrible:* *0 answers*

**Question 10: On a scale of 1 to 5, with 5 being the most challenging, please rank the difficulty in arranging a tech transfer at the end of the project?**

- *1:* *12 answers*
- *2:* *4 answers*
- *3:* *2 answers*
- *4:* *2 answers*
- *5:* *2 answers*

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**Question 11: What was the key challenge in arranging a tech transfer?**

- *Agreeing on value of IP:* 1 answers
- *Agreeing on eventual IP ownership:* 3 answers
- *Process logistics:* 8 answers
- *Agreeing on financial terms including commercial fees or equity stake holdings* 2 answers
- *Other:* 9 answers

**Comments:**

- **IP and ownership issues**
  - Standard EU IP contract drafts are helpful but IP ownership is still a big issue in almost every project.
  - It took a very long time to sort out who owned what part of the invention, but this all happened before any work started.
  - No issues with IP, but mainly because we knew our partner quite well.
  - Agreement on publication rights (not patents but rather scientific publications) was a key issue and frankly slowed our progress. Generally knowledge exchange worked well via a new designed internet platform and meetings of the consortium.
  - No issues because no IP came out of this project
  - No challenges thanks to CSEM experience to find win-win agreement
  - If you ask me, “What could be done better?” I would have to say, “Do you have a book, because I have enough things that went wrong to fill it!” With our project, there were no legal officers available – IP discussions and legal paperwork took months, and that was not my idea of having fun. Also very little information was available for international partners.
  - From the CEO’s point of view a good project ensures that the core know-how remains in the company – including the IP. This causes problems with researchers sometimes, but this is usually discussed and solved before the project work begins.
- **Post-project challenges**
  - Deciding on if and how to spin out a company from the project work is also a major challenge.
  - In a low risk society like ours, getting talented people who would like to join a start up, knowing that the company – and the job – might not exist in 2-3 years is a huge challenge. This is probably one of the reasons that the team is quite international.
  - Linear flow of the project, dependency on the results of other partners, creates a high risk: If anybody fails, the whole project fails. But a firm who may not have pulled its weight throughout the project could still be owed partial ownership of the IP based on discussions early on.

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**Question 12: Were there any major challenges in sharing IP with other members of the project?****➤ No major challenges**

- None
- No major challenges, just had to be discussed and settled
- Not that much of a challenge, because there were no competitors in the project
- No, no competitors involved
- Sorted before the project started
- Only challenge was to be able to produce the product that they needed and do all the tasks on time – but we synced ourselves. At the beginning, each company put down how much they wanted \$\$ for their part of the 3 yr project, and we all decided who would own what. All the partners had done this before which expedited the project logistics.
- No challenges, because this was agreed upon at the beginning of the project
- No major issues – built the consortium around the inventor – The IP that went into [Company Z] – there was other IP that wasn't really relevant to [Company Z] so they took the leftover and made a side product out of it.
- No issues with IP due to good agreements and because they both know they will work together in future.
- No challenges thanks to CSEM experience to find win-win agreement
- We usually have a standard consortium agreement in place helped by our own legal office. Some parties read it carefully while others do not. Nevertheless, that process goes very well. A frequent point of discussion is co-financing. A typical project costs the project coordinator between EUR 30000 and EUR 90000 to prepare and make. This is an upfront, out-of-pocket investment from us, even before project starts and mechanisms to alleviate this burden or make it more manageable to speed up the process and improve it for us

**➤ Some challenges**

- Patent belongs to the researcher, not to the University. That makes it difficult to exploit the technology as researchers are often not business experts.
- A major problem is the trade-off between publication of results (typically desired by universities) and the desire to patent and commercialize (companies).

**Question 13: How did you attract investors to the outcomes of this project?**

- Not relevant
  - NA – this was not our goal – we were looking for customers
  - This was not our main goal – our main goal was to get a working part and test it in the full machine at the end of the project
  - We did not try to attract investors because the project was still in need of significant development
  - Not relevant as the project did not become commercial
  - It is very difficult to attract VCs or other private investors in nanotechnology. The reason is that nanotechnology is very complex and investors are most of the time not able to understand the technology. Unless there is an application (but then again there is not that much need for additional money) it is very hard to raise funds, and funding an outcome of a project like this is no exception.
  - No venture capitalists are involved in these projects. One reason is the big time lag. If a venture capitalists has to wait for project applications and the review process (usually several months), investment is no longer attractive.
  - No VC or private funding was involved right after the project
  - No other investors apart from the project partners involved
  - This was not a main focus for us – plus it happened during the recession so we didn't have high hopes.
  - Did not try.
- Investors attracted by partners, the market, or the application focus resulting from the project
  - Collaboration with key players already going on.
  - The market for this product is sufficiently high to generate enough earnings.
  - The project is oriented towards customer's needs.
  - In y2000 this was easy: we just asked an old friend (who had just IPO'ed his previous company) and explained the situation. He answered: "How much money do you want?"

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**Question 14: How would you have done this differently had you not participated in the project?****➤ No other way**

- We would not have involved ourselves in these applications –we may have gone a different route, say rather than aviation and automotive materials, we may have looked at building materials
- It would not have been possible without such a project
- We would not have explored that field of applications
- We would not have been able to develop the application we did without the public funding, so the company would not have existed
- We would not have done it at all.
- No real alternative. Publicly funded projects are important to generate knowledge that can be exploited in industry projects.
- Without public funding they wouldn't have had the capabilities to conduct such a project.
- We would not have pursued these applications – or KNOWN to pursue these applications alone.
- We would not have done this project without EC funding. This technology is so radical/new that it is a classic chicken-and-egg situation. The customer response is always “demonstrate it at a higher integrated level or commercial ready stage first”. On the other side, systems integrators are unwilling to take it on since it is out-of-the-box. The EC subsidy helps act like a carrot to bring them to the table.
- As the aviation industry is very difficult to enter, we would not have carried out a similar project without the aid of the other partners.
- We would not have engaged in this area of research without such a project
- There was no chance of conducting this project otherwise

**➤ Delays and focus issues**

- We would have directly approached the key players for partnership, though this approach has very low chances of success and would have taken us much longer to prove ourselves.
- It would have been much slower, and less innovative with very little direction.
- We would have developed the product much more slowly and without an application focus, which would have lengthened our development cycles.
- Development would have been much slower and we would have been forced to raise VC or some other funds to get us going. In this climate, that would have been a disaster.
- We might have looked for alternate sources of funding – bank loans or small business loans, though it would have taken a lot longer.
- We would have been a lot less focused on the required specs.

**Question 15: What incentives were put in place for you to participate in the project?**

- *Tax breaks:* *0 answers*
- *Direct funding:* *23 answers*
- *Access to trained staff:* *7 answers*
- *Guarantee on IP ownership:* *0 answers*
- *Guarantee in help finding C-level management:* *0 answers*
- *Other:* *2 answers*

**Comments:**

- Help with applications development was also a big draw for us. Also, our product was validated by having several partners working with us
- Access to new field of technology and to a very exclusive industry

**Question 16: In your opinion, what is the key challenge to commercializing a nano-enabled technology developed as a part of a publicly-funded collaborative project?**

➤ **Finding the right partners**

- The challenge is to gain visibility while not compromising your key goals as a company. There is often sacrifice involved in partnerships, but you have to strike a balance.
- Finding the right partners in the right parts of the value chain was very difficult – we were the first ones to find the project, and we tried to find relevant partners – this took a long time. It is worth it to spend this time early on, though, to avoid clashes later on.
- Getting the right partners together within the project. Have the project designed in the right way
- For FP7 type of projects, a hurdle is the number of participants needed. For a company working on nano-instrumentation it would be more logical to step into a project with one university partner and perhaps one other complementary company. That way the work can be more easily defined (testing, experiments by university, instrument development by the company). FP7 does not accept such projects – they want many partners from different regions and a mix of academia and industry.
- The one thing that the consortium could have done for us is to ensure equal participation from all partners.
- To fully use the knowledge available in the consortium, especially if there is a large variety of partners. One must use the available resources efficiently and allocate work to the right partner. This depends a lot on the leading partner in such a project. If coordination is not efficient and doesn't motivate partners, the whole project struggles.
- Making a strong consortium agreement with definitions of IP and end-use property.

➤ **Commercialization aid**

- The project was not long enough – it only covered 3 out of 5 steps required to get us near commercialization. We needed more time and more money. Or more time and more strategic money.
- The projects usually stop at too early stage, so there is little understanding on needs of commercialization. The researchers value their results, including possible PR too much.
- Overcoming the gap between the research findings and a final application is a big challenge.
- Finding the right timing for your product, for your project, for the funding is tough.
- Getting reproducibility is key for progress after the consortium ends, and most of the time, there isn't enough funding or resources to make that happen. Other organizations like the NIHR in the UK fund towards scale up

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of technologies so they become usable within the NHS or health sciences, but sometimes they are oddly administered and not fairly distributed.

- Identifying needs for the final products is not something we as a small company are suited to do. In this project “guaranteed” by the other partners involved in the project. For [Company A] the big chance was not to commercialize something directly out of that project but to have access to this part of the industry for future (own) ideas.
- Unknown results, lots of basic research, therefore commercialization possibilities are difficult to foresee
- Lack of business knowledge and awareness of the end markets
- Competition with incumbent technologies, and making the market aware of the benefits you bring to it – this is hard to do at the stage of development we achieve by the end of these projects.
- Generally speaking, commercialization of products based on nanotechnologies lead to perturbances in the market (new players, substitution, resistance), and there are also informal barriers (adapting your marketing and your distribution channels). EC projects rarely help us with dealing with or foreseeing these issues.
- Mostly these projects are led and defined by academia and there is no real interest from these to strive for rapid commercialization, if there is any interest for that at all
- For [Project A], we did not include scale-up and module development in our work-plan since it was not in the call. End user demonstration and production of fibers at full scale was needed (for commercialization) but not included. When the EC makes a call text, they should look at value chain and see who/what is needed to complete the end-to-end, idea-to-product commercialization.
- The funding. Getting 3 years of funding is not enough; the actual need is for, like, 10 years of funding. A bad deal with a VC can also result in a lot of losses and problems. A much longer public funding would protect a start up from these kinds of problems – but of course real checkpoints are needed
- At the level of a large multi-partner project, you’re doing RESEARCH and development...after the consortium ends, you switch to DEVELOPMENT and research. Now you’re at a phase where you’re seeking the next level of funding and support to scale up with no real direction to do so in a long project.

**Question 17: What type of *commercialization support* did you receive from the government and your partners during the course and upon completion of this project?**

➤ **Little to no commercialization support**

- None
- No commercialization support, but then again, we didn't expect any.
- Not much by way of commercialization support, mostly funded developmental research.
- We had no support after developing the product.
- Not relevant for this project.
- None, but maybe none of the partners was aware of possible business support.
- None really, other than exposure to our partners.
- The EU funded research, not more than that.
- No special commercialization support apart from the funding of the project "The EU funds the project, but they don't take care."
- Not really, our university served as the partner for commercialization support.

➤ **Sufficient support through networking**

- We were connected with early stage VCs who ended up being interested in our work. Without those intros, our company would have been stagnated. Also, the angel investor provided a list of organizations who would help start ups. However, at the first phase it was not really utilized, though we got there eventually.
- Other partners in the consortium helped us find partners to contract with; the standard contracts we then had were tens of thousands running on 500-600 thousand Euros. We needed that scale to get something concrete done.
- There is exploitation training from the EU which seems quite useful.
- Does not really apply, as the output was rather a recommendation for companies working with nanoparticles. However, support for dissemination was good (arrangement of conferences, contact to NGOs etc.).
- At the end, a special project was arranged in which the ministry of war became a direct recipient of the final product.

**Question 18: How adequate was this support for your needs?**

- *Completely inadequate:* 4 answers
- *Somewhat inadequate:* 9 answers
- *Adequate:* 8 answers
- *Somewhat generous:* 0 answers
- *Generous:* 0 answers

**Comments:**

- **Funding**
  - We eventually needed more money a few months after the project ended
  - We need money for a certain machine, or a certain hire, and we specifically don't get it because it's too "close to commercialization"
- **Training programs**
  - The problem is that funding agencies do not know enough about nanotechnology to really help. They are too general. Trainings etc. could be (and are in some other projects) provided and are somewhat helpful.
  - Should be better focused on added value, commercialization. Facilitating the industrialization, the development/growth of start-ups, the commercialization through the promotion of innovating products.
  - Consortium might be able to help by informing partners better about training possibilities etc.

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**Question 19: What were some of the things that worked very well with the project and its eventual commercialization?****➤ Constituency of partners**

- The partners we had worked very well with us, the funding was good
- Profile of the partners: they were interested and collaboration was effective
- Having the right partners around the table
- Outset of the project and the final results worked well, mostly because of the great partners we had.
- We established clear roles for each of the partners. This facilitated research, gave clear competencies and tasks and avoided missing opportunities.
- Team work within the company and among project partners. Everyone involved appreciated this chance to work among leaders in the field. Collaboration with high potential partners with good, futuristic projects. The network established by the project helped to overcome problems during the worldwide financial crisis.
- Collaboration with partners made it possible to get unexpected results. “When I started this project I had no idea about the incredible results I obtained now.”
- Good partnership with the University, mutual trust, especially knowing that future projects will be conducted together.
- We could assess the real needs from the industry through feedback from our partners.
- Having the right partners around the table made the project successful.

**➤ Execution of the project**

- We saw the project as having a phased lifecycle. In the first phase, a sort of daredevil, reckless and open attitude was of benefit and demanded a multidisciplinary team with scientists from many different fields. However, within 2-3 years these need to be replaced with people who can turn the “experiments” phase into a business. The different phases of commercialization just demand different skills and personality types, which our group understood well.
- The EU-funding is more beneficial for an SME than for example our own national funding, because an SME gets 75% funding with flat rate 1.6 for overheads. The critical benefit of the EU projects for an SME is that they allow the company to increase R&D without engaging more capital.

**➤ Achieving goals of the project**

- We did accomplish the goals of the project, and in shorter time than we would have done it alone
- Applications development, direction for our research, good internal feedback from partners on our prototypes, etc
- Huge number of publications that came out of it, which was good for raising awareness about our project.
- The projects we work with usually come as joint project, where basic /university research and application is combined. This is useful, as a topic is

to be researched from several perspectives. This makes it easier for basic researchers to see potential applications.

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- **Potential for future progress through funding or commercial partnerships**
    - Early investors' (business angels') very positive and risk-sharing attitude to the project.
    - The first angel investor is very important! A bad deal would have killed the company by now.
    - Open discussion and networking played the key role in getting funding – numerous presentations and finally the right person heard it, which led to introduction to the first angel investor (Finnish). People are afraid that someone's gonna steal your idea but that's not gonna happen, people are too busy with their own projects.
    - The sponsor had a high interest in this project. Therefore, they offered a lot of support and forced the consortium to work together and share knowledge with other related projects. In other projects support was often missing and the budget was not flexible to adapt to changing needs of these projects
    - Large collaborative projects are also beneficial as they allow networking at the European level (easier to start business discussion with the experts you already know from joint projects) and as the feedback from the project partners (future customers) is very open and direct.

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**Question 20: What were some of the things that could have gone better with the project and its eventual commercialization?**

- Project coordination
  - Despite there being only 3 partners, the organisation was really a nightmare with the management of the members. Each partner had about 15 people working, so getting everyone on the same page was difficult.
  - Some of the partners weren't engaging as strongly as they could have – overall management was horrible – coordination was lacking. Coordinator has the role of steering. He has to say what the important points are, where should priority be, and he didn't. Thus, the project was flowing without direction. The problem is that EU puts too much priority on attracting partners from all different countries, so the coordinator role is not a merit-based position.
  - Administrative interactions with EC are often laborious and slow. Quite often these are frustrating.
  - The EC pressures you to submit things on time but then seems to have no urgency or concept of time on its end.
  - Sometimes they are unclear messages from the EC – you hear from one department that some paperwork has been approved and but there is still a delay and you do not know where exactly the holdup is – the process is very non-transparent
  - Clarity and speed of communication are really the big issues with the EC. That said, we have been seeing some improvements on the EC side – the reporting time, the problems of financial documentations have improved
  - EC coordinators – contact persons – are quite busy. They do not really get involved and are merely checking up on things. They have possibility to help you out but they do not take a proactive involvement stance.
  - The overall organization of the project was completely lacking. Project coordination was horrible, and this could have been avoided by a merit-based appointment for the role.
  - The organization of the project was a bit messy. The project coordinator was too busy to pay enough attention to the management of the project, but the rest of the partners organized themselves.
  - In general, the effort required for fulfilling administrative duties is very high, and too big for an SME.
  - Administration and application effort is very high, especially for EU funded projects.
- Objectives were too challenging
  - The project was really challenging with a quite difficult to achieve target and even when the target was achieved the end-users were probably not ready to integrate such technology. It was more 'a blue sky project.'
  - A lot of research found dead ends, expensive market research was carried out on the wrong topics. It took a lot of time to analyze different markets where the

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- technology could be utilized: how big is the market, how fast you could get there, does it lead to other markets.
- Difficult to know what kind of tests are really needed to show non toxicity of product especially for different countries. Clear regulation needed. Administrative effort is often too high, especially for SMEs. The companies can solve administration problems with regional authorities but with EU funded project it is very difficult.
  - Make smaller milestones with less challenging objectives – it was difficult to coordinate that many people in a consortium setting
- Dissemination and flexibility of allocated funds
- Once the project is successful, they should have additional funding to finish up the research – it won't be finished in 3 yrs. It's very hard to attract investors for any company – they're all short on cash. Also, if we buy instruments for the project – we can't buy expensive instruments – normally 75% is paid by the EU, and 25% by us – but when it comes to instruments, it's much less because they take the value of the instruments for 3 years only. Some projects don't even provide funding for any instruments – the only thing you can buy is a computer. We are a spin-off of a research institute. For some instruments, we were charged to use them, and we couldn't use subcontractors in the process, and we had to make appointments, and it just caused delays. In the third year, we only got 30% of what we were supposed to get – at the end we were audited, and then we received the rest of the money several months later. We had to pay the overhead each month (20%) including healthcare etc.
  - Stage 2 funding. There was opportunity to help the funders/researchers much more, but somehow it didn't happen.
  - Looking back, if something could have been different, it would have been beneficial to start utilizing the training support for the start ups earlier.
  - Perhaps some bridge funding between commercialization and basic research would have made the transition easier for us.
  - A big issue is speed of projects and flexibility of funding. If one has to wait too long for follow-up financing, there is a great chance that recognized business opportunities are gone. There is a need for flexible funding to fill this gap.
  - There is not a need for more (although more is appreciated) money, but for more flexible funds. Additionally, it would help to train researchers, and, more importantly, technology transfer offices and also funding agencies, to help in commercialization issues.
  - Nothing specific, although more generous funding would help to have more researchers and commercially focused research involved in the project.
- Resource support
- Dissemination of our research, committed partners whose researchers put in as much time as our own.

- Any upgrade of human resources is helpful. Training of employees, in particular business skills.
- One needs many resources to do R&D and process development. The customers are in their R&D phase too and always demand more, even though we are just entering the production phase. On the other hand, when the customer ramp-up realizes, the orders could increase by a factor of 10 at once, which is very challenging on the production, yield and capacity point of view
- Miscellaneous
  - The project went very well, no particular needs in this case. However, for general support of SMEs, it would be helpful to specifically address their needs: Some (but only a very small percentage) want to grow, the rest of SMEs just want to survive. This should be considered in such projects.
  - If the public funding allows the company to make less profit on sales, the effect is actually negative in the end – it could even distort the competition and destroy the whole industry.
  - At the moment the validation of new nanoinstruments needs to be done by universities and they charge too much for that type of work

**Question 21: Would you participate in such a (publicly-funded, collaborative) research project again?**

- Yes: *21 answers*
- No: *1 answers*

## 5.4 Completed Investors interview reporting documents

# Part 1: Respondent information

**Number of answers considered:** 15

### Interview keys takeaways

- Participating in a large publicly funded project maybe bring value, but the choice of the partners and of the objectives is critical.
- The important point is the potential of return on investment. Unless the partners of the project are very well chosen, a big publicly funded project will not help the company to increase its value
- Ideally, a publicly funded project would enable the start-up to create value by realizing some first revenues or a collaboration contract with a key player.
- Start-ups participating in large publicly funded projects should always have in mind to increase their value
- Commercialization of a product based on nanotechnologies is long and difficult, it requires the collaboration with different partners
- There are plenty of interesting technologies, the difficult thing is to find to which application one will bring a superior solution
- The company does not favor/unfavor projects where public investment is involved
- We don't view companies that have participated in government funded projects any differently from the way we view companies that have simply collaborated with other companies. The fact is, most of these projects are so early stage that successful commercialization isn't guaranteed, so the risks aren't any less
- Investors prime question: What are the fundable opportunities? Who/where are the entrepreneurs who can take IP/company forward? IP alone does not a business make. If people ask me the question about VC in EU, my primary response is, "where are the entrepreneurs in the EU?" We in the VC community see fundable opportunities in the EU when an entrepreneur brings them to us. It is not my job to do the heavy lifting. In deciding what to fund and how, Government has a role to play, but so does the investor/entrepreneur.

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We don't see IP as an issue. Assumption is that there is no ownership of the startup's IP by consortium partners. Lawyers are experienced and smart and know what to look for before entering such agreements

- One of the things that I have never understood in the context of the framework programs: How European agenda setting works. HOW do they pick the areas that they support – how do they manage the monitoring of the projects and control etc etc. It is my impression that this is very academically and corporate bias – the insiders decide on these things – ZERO INPUT from the VCs who fund commercialization of the technology. There WOULD be significant willingness to share our views, and the companies would benefit from this. It is our daily business to benchmark EU tech in the global market – that kind of expertise we have built is TOTALLY untapped
- The large publicly funded projects' biggest problem is that all the competitors are in and thus the investor is actually more interested when the project is finished.

When the project is finished its details and outcomes become irrelevant. From investors' point of view it is irrelevant where the IP has originated, the decision is made based on the idea and the team.

However, the public funding for a start up's R&D and product development plays a crucial role and thus interest of the main public funding organization for research, development and innovation in a Nordic country in the project/idea is of great value in decision making. The investor would recommend redirecting more public funding for the public funding organization in question and its product development funding instruments and take it away from general funding for "networking" etc activities

- I think that there should be more public financing after a completed R&D project. Especially loan instrument for net working capital. Why finance a project if then the company aren't able manufacture and sell the product?

## Part II: Questions' answers

**Question 1: What are the key qualities a company must display to merit an investment?**

- *Strong IP: 5 answers*
- *Strong management team: 9 answers*
- Mandate is to invest in companies that have differentiated science and technology but that is just means to an end – which is to make investment that can be a successful business. Primary indicator of future success is strong management team – even if one thing fails they have the ability/experience to do something else
- From the investor's point of view the technology has to be needed and protectable. The most important issue however is the management team: in many cases there are too many R&D people in the management
- *Strong scientific team: 2 answers*
- *History of successful collaboration: 1 answers*
- *Other: 2 answers*
- Disruptive technology
- Business model should be attractive

**Question 2: Do you look for different qualities in a nanotechnology company versus a different type of technology provider?**

**Yes: 5 answers**

- We are specifically assessing if the technology can be realistically used at an industrial levels
- There has to be applications with an important added value and no competition from other, better mastered technologies
- Safety
- Big production facilities needed?
- Potential to build a consortium of investors (big amounts needed)
- Because the commercialization of a product based on nanotechnologies is long and complex, the start-up will have to deal with other partners. We are interested in knowing how the start-up see this process, and how it is positioned in the value chain of the commercialization
- Nanotechnology is more scientifically intensive and hence you need someone who is more scientifically competent. Possibly development path will be longer and hence we need to believe that the end commercial outcome is even more promising than usual. EHS is also a consideration but it's more of an afterthought to some of the other considerations that we use to evaluate – EHS is more on diligence side than a driver to our decision

**No: 5 answers**

- Nanotechnologies are emerging technologies. In that way, they have the same constraints as all other emerging technologies
- For all projects criteria are similar The idea is to reach new markets with whatever technology available
- The qualities required in a nanotech company versus another emerging tech company are the same, and they're more or less going to face the same commercialization hurdles
- From the investor's point of view there's nothing really specific in nanotech: nanotechnology is a lot of different things, different technologies can't really be compared

**Question 3: What are some key risks in investing in a nanotechnology start-up?****Are these risks different from investing in other technology start-ups?**

- Market acceptance, proved added value, ROI sufficient (high amount of investment needed)
- The way to the commercialization of a product could be longer and more difficult
- Market acceptance
- Safety
- Size of overall investments
- Time to market, how many rounds of financing will be necessary before the exit, Difficult to explain the value to the next investors
- It is often difficult in nanotechnology to communicate everything in the right way to the public. Some results/ products are seen in a critical way, just because it involves nanotechnology, although they are not more dangerous at all for the environment/health of people. (Example: Sunscreen Lotion used to contain nanoparticles for years, but only recently that came to the attention of the media). It could therefore be helpful for the whole nanotechnology industry to have a better public management/communication
- Risks aren't different, except for the hype associated with nanotech, which I think has died down. Its challenging to figure out which company's stories are true and which are not
- Biggest risk is also biggest opportunity – initial obstacles to getting widespread commercial adoptions. They have to convince end customers to make new broad platform bets (Molecular Imprints – convincing semiconductor industry to invest in a totally new platform; same with Nanosys)
- Two main camps: “internet” side – reasonable investment in short periods of time – risk is in copycats  
“Nano” – long development times to get tech right – long development cycles – huge investments, which make this game much more difficult to play – much better barriers to entry because IP is actually protected
- The problem could however be that before really commercializing it is highly unpredictable and thus difficult to estimate how much money is actually needed. This leads to situation where is it difficult to estimate a fair market value when selling



**Question 4: Would a company's current or former participation in a large publicly funded project help convince you to invest? Why?**

***No, this doesn't weight into our decision at all 7 answers***

- What is interesting us is the future of the company, not its past
- All companies have key technologies and know very well about this technology. The key issue is to convince customers that there might be a benefit in changing their products and use this new technology. The investors do not care about how this knowledge was developed ("Whether it was funded by the king of Saudi Arabia or public funding, doesn't matter"), but to bring a project further into the development phase. They main concern of investors is the market potential of a new technology
- Most of the companies we invest in have already participated in consortiums but we don't specifically look at that as a guidepost on whether or not to invest
- We don't consider it, but 9 out of 10 companies we invest in happen to have such a project in their past
- No it did not, large public project fail many times due to too many players and non focus on getting real business. In some cases there is even potential competitors joining the project and this should not happen , but it does happen time after time
- The research projects played no role in investment decisions: only the technology and know-how was relevant, independently from where it originated.  
However, the research projects the company participated after the investment play an important role when evaluating the current value of the company. I.e., they have brought a lot of added value

***We consider it, but don't give it much weight: 2 answers***

- Anything that helps bring down expected risk or investment is a plus. Most companies, even after our funding, have applied for external, non-dilutive funding. This is essential for us
- we invested before the company had a large project. Our investments enabled the large publicly funded project



***Yes, participation adds significantly to their merit: 5 answers***

- This mean that at least part of the R&D has already been paid
- Public money for part of the development, recognition, opportunity to get in touch with market needs
- Focus on industrial needs
- It helps to the valuation of the company
- yes, usually framework programs are based on tight selection process, so definitely positive thing. Question mark is whether all activities in the project are based on business requirement or are part of the activities being done, because the program settings require.

***Yes, if they did not participate, we would not invest: 0 answer***

**Question 5: What are the key benefits to investing in a company involved in a large publicly funded project? (Please explain)**

- Public money for the research
- No benefits, unless it helps it to better understand the market needs
- Being in contact with industrial needs
- They learned PM skills, showed collaboration aptitudes and increased their network
- Validation, recognition
- Training of nanotechnology people in possible application fields outside their core technology could be helpful. Public funding itself is not a blue stamp. It does not help an investor to identify a company, which is better suited for investment. The reason is that the investor cannot see the full reason, why this company received funding. They are all at the technological edge, but it is hard to find out whether they are doing more basic or more applied (desired by the investor) research. A public grant is not helpful in solving that information problem. Also, a lot of investors do not trust funding agencies that much, so they are not sure whether funding agencies identify good projects
- We do not differentiate between firms involved in publicly or privately funded projects. They do not see any difference. It is only important to see a potential result / application
- None that we see. I suppose it is good that they have worked with partners, but there's no way to tell if the project was a success or not
- Molecular Imprints participated in program in Texas with support from industrial partners. We see it as a huge accelerator to pace of business development activity and adoption. Helps them gauge how to manage relationships going forward. The consortium partners haven't typically been the long term partners, but that's not necessarily a bad thing
- We are not in a position to fund basic R&D because the funding cycle is too long. That part of the funding trajectory has to be in public hands because we don't have the structure to finance these things. If you want deep IP based on long basic R&D, then we're reliant on those institutions to fund them. Its not the amount of money but the time to fruition

- There was not too many benefit, one of the benefits is if interviewee (the main public funding organization for research, development and innovation in a Nordic country) is involved and if it has allocated money to the large project
- usually the company can double the money received from investor
- it is an advantage if the project and the partners show that there is already commercial interest for the technology being developed
- Usually these projects also involve a ready network of different type of competencies that can be used also at commercial phase

**Question 6: What are the key setbacks to investing in a company involved in a large publicly funded project? (Please explain)**

- Quiet often (too) big consortiums with not everybody bringing value to the project
- Less flexibility on timing and tasks. Unless all partners are subcontracting to the start-up
- Too many partners with different agenda & objectives
- Less flexibility, less focus
- Choice of partners depends sometimes on political criteria, not always the best ones
- IP ownership unclear, not focused on commercialization
- No drawbacks
- Maybe the obligation to make results public
- None that we see, though again, we don't look at these companies separately
- While I don't agree with this viewpoint, some people think such participation is distracting – since you are focusing on what the government wants you to do than what market wants you to do. But I see it as a net positive if you manage potential downsides
- IP ownership – question of does the entity that I fund OWN the IP that it is based on or are there 17 licensees that will make it hard for our company to have an edge against other companies out there
- The investment had nothing to do with the public project , the public project was a part of many other things in the company development
- the focus on the company can be too much on the R&D project, and the company's strategy can be hard to change due to an ongoing project
- Refunding or imbursements from the public programs are usually slow and they might burden working capital – this is a major concern in start-ups. Also IPR due diligence needs to be done extra carefully to be sure who owns them

**Question 7: What should a company do or accomplish in a large publicly funded project to make itself more attractive to you as an investor? (please explain)**

- Develop a demonstrator or a prototype
- Be in charge of the project and choose only partners needed for the objectives
- Getting collaboration contracts with key players, generating some revenues with a first customer
- Reach the milestones, Conclude collaboration agreements, in a general way create value
- Clear the situation regarding IP ownership, define a business model acceptable for the investors as well (allowing an exit)
- It is an interactive process between the advisor, the nanotechnology company, the customer and investors. There is a need to train nanotechnology people outside their own field in order to make it easier to identify other potential applications
- It may be more difficult to find investors when results have to be made public
- Find a strong management team, and have a clear path to commercialization
- Be selective about what you work on or at least be prepared to not attract more investors. When our portfolio companies do this, we are not anticipating attracting more new investors. See it as a means to an end. Such projects should be one more circle around the track, but that's not a destination in and of itself
- Prove that the technology works, and that SOMEONE is interested in it
- Quicker execution i.e. sometimes waiting for partners is understandable from the projects perspective, but not necessarily from business perspective



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**Question 9: Would you actively target companies that have participated in large publicly funded projects? Please explain**

- The point is not that it participated or not in a large publicly funded project, it is how much value has been created during this project
- No
- No, it has advantages and setbacks. Each case has to be analyzed
- No, it is not part of the decisive criteria
- No. We already have many business opportunities coming to us, and we look for spunout companies
- No
- No, that doesn't align with our thesis
- Overall it is difficult for funding agency to decide what is important for market. Such projects are good only so long as government focuses on advanced technology development that is critical for company regardless of what application the startup selects. The startup should then be responsible for selecting applications and market needs. Seems to me like government is looking for people to tell them what they want to hear when they ask them to submit a proposal. If government is doing economic development funding where the government should absolutely take inputs from VCs and corporations on which applications to fund. But if the goal is to encourage proliferation of bright minds in a particular area, you don't need inputs from industry Inspiring bright minds vs. creating jobs in local regions
- We do not actively target companies that have participated in such projects, again, but there are clear commercial benefits. Industry exposure is a HUGE benefit – ability to work with big guys like BASF, Infineon, etc – who in Europe who are really bad at open innovation otherwise. These interactions that surface through the projects could be very helpful
- No, investment has close to zero to do with the public project, the company, its management and end customer are the drivers for the investor.

**Question 10: Additional comments**

- The business model should be kept in mind during all the development, already during the research phase, in order to allow for a sufficient return on investment for the investor(s). Confrontation as early as possible with industry is also important (more industrial partners in the research projects)
- Ideal scenario: inspire entrepreneurs with incentive structures so that they want to go out and build businesses in nanotech – for example, an EU IdeaLab. Alternate scenario: Incentivize corporations to go out there and pursue development efforts in focus areas. Like ARPA-E grants – where they brought in corporations and start-ups to work with PIs – so that there is some market oversight of the research – where DOE had defined basic areas which it considered important
- In Europe we have probably 30-50 individuals like myself who do nothing but look for new tech in cleantech domain – all these folks could be tapped into for the decision making process