NANORA
Nano Regions Alliance

Investing in Opportunities
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Starting a company in the nanotechnology sector: development pathways of nano businesses

Preamble

This working paper addresses the process of formation and further circumstances of companies formed out of universities (i.e. university spin-offs). It is presumed that in these cases the professors as the principal investigators are participating in the technological developments and patents relevant for the company. Furthermore, the working paper focusses on the formation of new companies from scratch. Spin-Offs by established companies (either directly or with high degrees of support by those), i.e. the simple separation of single products or product groups, are not considered here given the significantly different underlying conditions in such cases. Additionally, it is presumed that the intended company formations are innovative, i.e. application-oriented, and that patentable inventions are underlying. This includes start-ups with services like coating of components to alter or functionalize the surface. In contrast, companies with services like measurements, consulting or planning are not considered in this working paper.

1. Introduction

Transforming innovative technologies into marketable products is a task often performed by new and young companies, i.e. start-ups. Newly formed companies typically focus on specialized products based on innovative technologies, thus becoming drivers for the whole economy. Universities, as an important source of invention of new technologies, can adapt the important role of transferring inventions made in their laboratories into innovative companies. This holds also true for their attached technology transfer offices. To succeed, it is crucial to identify the critical success factors for the founding process and to investigate which impact different courses of action by the universities have on these factors and the founding process itself.

2. Influencing factors

Start-ups are influenced multidimensionally by various factors and at different points in their formation and early phase. In the following, the most important questions and their impacts in respect to the formation of nanotech companies are discussed.

2.1 Is the invention closer to research or application?

One central question for the long-term success of a start-up is whether the underlying invention is closer to research or already has a high degree of applicability. This entails a time factor for the market introduction of products. Generally, it is to be said that the probability of success is higher with closer applicability of the invention that grants a faster market entry.

At this point, the orientation of the respective university or its technology transfer office plays an important role. Supporting the patenting of an invention usually meets the interests of both the university and the inventors. The next steps, though, can differ significantly. Here, two basic scenarios are thinkable:

Scenario 1 – Licensing or sell-off: The university or technology transfer office are looking as soon as possible to find an established company willing to buy a license of the patent to further develop the technology and later launch a product. Alternatively, the whole patent or patent family is sold. This way, the universities immediately raise money. But patents at this early stage are usually closer to research with respect to a final product, so the achievable rates of return are quite low.

Scenario 2 – Formation of a company: The university supports the inventors in founding a start-up company by supplying the patents. In this case, usually advanced cooperation agreements are formed between university and start-up to further promote the development of the technology and/or application. In this scenario, the university still has a financial risk as a later sale of the patents might become much more difficult. If the company's formation is done too early, the development gap to the market is great and the financial needs are difficult to cover – a failure becomes more likely. In contrast, if the start-up performs well, a later exit by the university promises high returns on investment. Nevertheless, it should be noted that a start-up with a completely finished product is seldom found.

Both the university and the inventors are implicated in this area of conflict between valorization of the intellectual property and the identification of the perfect time to found a company. Only a shared strategy and inclusion of all stakeholders can lead to success.

2.2 How high is the invention's degree of innovation?

The invention's degree of innovation influences the probability of success of the planned start-up in multiple ways. Basically, the assumption applies that highly innovative inventions do have better chances to succeed than me-too-products just using a nanotech label (e.g. adding nanomaterial to a product rather than conventional materials). This is due to the fact that innovative processes and products can usually be better protected by patents, thus giving the start-up an advantage at the market (so-called first mover potential). Also, such start-ups generally do have better chances to find investors in early phases of the company.

At the same time, a highly innovative product might be an additional challenge to market launch and fund raising if the invention needs extensive explanation thus being time consuming to present and difficult to understand.

Here it falls to the universities to procure access to grants and qualified start-up consultancy for their employees. The most promising way in this respect is to approach the inventors in an individualized way.

2.3 Is it a one purpose application or is the invention multifunctional?

What does the targeted market look like? Especially with cross-sectional technologies the answer to this question influences the probability of success for the start-up significantly. If the invention addresses a single market or is a highly specialized application for a few customers, it might lower the chances to succeed. A strong coupling of its business leaves the company vulnerable to market fluctuations and changes in competition.

In contrast, if the invention entails the potential for broad applications, the company can diversify on a mid- to long-term scale – an entrepreneurial success becomes more likely. At the same time, this aspect requires a much more focused planning to keep the start-up target-oriented. Here, universities can offer important support for the founding team with consulting options or the access to such by external experts.

2.4 Is a high-priced niche application addressed or is a mass product produced?

The question of whether the invention is a product that enables marketing as a high-priced niche application or constitutes a down-market product is also of relevance for the success of a start-up. A potential new cancer treatment promises high revenues with good patent protection, thus raising the probability to acquire venture or debt capital. Additionally, this way the newly formed company would get access to a certain degree of entrepreneurial knowledge, support and networks. In contrast, a new more scratch-resisting car paint will have significantly more problems to achieve high revenues at the market. Consequently, finding investors becomes a more difficult task and success rates might go down.

In all cases, universities can support their spin-offs by offering them adequate training opportunities, especially with respect to marketing and how to address investors. Collaborations across the departments might be a solution, e.g., members of the economic science department could be advisors for their natural scientific colleagues.

2.5 What is the idea generators'/inventors' degree of involvement in the start-up?

At the beginning, a start-up is always just an idea or invention. Here it is of lesser concern whether that idea comes from a single person or a team. In contrast, the degree of involvement of the inventors in the soon-to-be company is essential. Here, three cases are imaginable:

The professor – usually the most recognized expert – in whose work group the invention has been made

1) directly participates in the start-up (personal and personnel involvement).
2) becomes a member of the scientific advisory board (consulting/advising involvement).
3) is only a silent partner, e.g., by granting access to his patents or as a worst case even only as licensor (no involvement).

Case 1 – the Best Case: The active involvement of all inventors heightens the authenticity of the start-up and has positive effects on the perception by outsiders. Furthermore, important know-how is directly accessible for the new company at nearly any time.

Case 2 – the Mid Case: This is the most likely option. The professor stays at the university but is available with his expertise and knowledge, e.g., as a scientific advisor. His personal involvement is lower than in case 1, but most of his positive effect on the authenticity and perception of the company can be preserved.

Case 3 – the Worst Case: A lack of participation of one or more inventors – i.e., especially the principal investigator – demonstrates disinterest, or – even worse – the expectation of failure by one of the central characters behind the invention. The start-up's perception by outsiders is likely to suffer. Furthermore, important knowledge is not accessible to the company.

By maintaining an intense dialogue with the professor, universities can significantly influence the tendencies towards cases 1 and 2. Furthermore, the universities should search for possible compensation in case the professor is not involved. The degree of activity in these respects has a direct influence on the probability of success of the start-up.

2.6 How was the spin-off prepared and what kind of further partnership is planned?

Besides all addressed aspects, the preparation of the planned spin-off is essential. Successful formations of a company are based nearly without exception on a team with complementary

competences. Internal structures and responsibilities are clearly defined. The new company's present needs (e.g. rooms, production facilities, financial requirements, etc.) are known and there is a plan for the next five years – typically validated by persons experienced in founding processes. Parallel to this, available start-up support schemes (like in Germany the KfW-Gründercoaching or EXIST proposals) are exhaustively used. Accompanying actions like coaching are pursued after the successful formation of the company in the ideal case.
Universities and technology transfer offices have to facilitate this process with their expertise and networks. Furthermore, external offers have to be communicated and promoted to enable the best start-up formation possible. If the founders are left to their own devices the company's formation process continues to suffer from the poor starting position even when the business comes to live. The formation of the company can fail early on because of real or perceived obstacles. In any case, valuable time is lost that the start-up could invest more productively in other tasks.

2.7 Which factors influence the success of a start-up further?

Besides the factors discussed in items 2.1 to 2.6, the formation of a company is influenced by various other factors, though to a lesser extent. These can be, e.g., necessary authorization processes, the need for expensive production facilities, usage of cost-intensive raw materials / production processes or the dependence on certain suppliers. The impact of these factors can be decreased by a good planning and preparation of the founding process (see 2.6).

3. Fundamental questions regarding the formation of a company

3.1 Does the formation of a nanotech company follow the same logic present in traditional branches of industry?

The basic logic of a company formation holds true for nanotech companies: An invention should be transferred into a marketable product, thus bringing financial success for the company.
Therefore, a good team with complementary competences, clearly defined products (one or more) and a solid and comprehensible planning and strategy are of key importance.
Starting as they do from an enabling technology, nanotech start-ups can usually address very diverse markets. That is why a thorough analysis of the markets, the related opportunities and risks and how they influence the formation and further development of the company is necessary before commencing the start-up process. At this point, universities can significantly support the planning process.

3.2 What are the success/failure rates?

Following the opinions of market observers (e.g., Nanostart, Creathor Ventures), success and failure rates in the area of the formation of nanotechnological companies are comparable to those of other innovative industries. The – in some way controversially discussed – rule of thumb is that only one out of ten start-ups performs successfully. Six to seven are considered to fail completely and the remaining two to three are developing very slowly. But it has to be noted that these numbers usually derive from a venture capitalist's point of view for whom success only sets in once the invested capital has increased tenfold. In this respect, the real success rate might be significantly higher from the company's point of view, only with a lower performance.

Universities can influence this aspect only at very early stages by thoroughly preparing the founding process and accompanying the entrepreneurial actions. It is primarily the company itself and its activities with respect to investors and customers that influence the success.

3.3 What are the main reasons for the failure or success of company formations?

A study conducted by the German federal state of Hessen in 2012 showed that various factors are significantly influencing the formation of a company in the forefront. The appeal of established employers (i.e., big companies with relevant research activities) and the related financial security of the potential founders is a relevant factor to prevent their final step into entrepreneurial independence. Besides, especially in the university sector a lack of knowledge of existing support schemes was identified. This is where technology transfer offices and universities have the highest leverage to take positive influence on the realization of a start-up formation. Another aspect is that often not all inventors participate in the planned founding or that personal differences and conflicts with respect to the allocation of shares, tasks and competences arise, leading to a split-up of the team.

If these factors do not come into effect, start-ups still often fail due to a lack of funding. Opinions vary as to whether there is not enough venture capital available at the market or whether insufficient business plans are the main reason, but the outcome is in the first approximation similar.

But even with successful funding, bad planning of the business development like badly constructed timelines and development milestones, a fundamentally wrong market estimation or too optimistic sales forecasts can lead to the failure of the newly founded company.

Consequently, a nanotechnology start-up will only be successful with profound and realistic planning that takes into account deviations and setbacks and with a team that is confident and manages to convince others of its potentials.

4. Summary

Nanotechnology is an enabling technology and as such cannot be clearly differentiated from other industry sectors in the sense of being a distinct industry branch or addressing a single precise market. On the contrary, its principles and product innovations influence a great number of established industries and address numerous markets. Given that, it is not really surprising that there is no nanotech-specific way of company formation – the preconditions and influencing factors are too diverse. Nevertheless, the success of a nanotechnology start-up, like everywhere, becomes more likely the better defined the strategy (i.e. business plan) for the company is and the better the founding team harmonizes.

Universities can assume an active role as catalysts to support and enable the spin-offs. This not only translates into giving potential founders enough time to conduct their research, but also into offering training, coaching – especially while writing the business plan – or access to networks and administrative assistance. While a lack of support does not necessarily equal a programmed failure, important and valuable chances to raise the probability of success are squandered. But if a university actively supports the inventors, especially in the run-up to the founding and in the early stages, it can significantly contribute to the success.

As illustrated and detailed in the report, universities, particularly university-owned technology transfer offices, but also related actors involved in technology transfer and business funding, play a crucial role in influencing the success of nanotechnology start-ups that have emerged from academic research activities. Start-ups need support in matters of handling intellectual property, conducting sound market analysis, establishing sound mid- and long-term business plans, undertaking successful marketing campaigns and addressing investors. In short, they need access to funding and qualified start-up consultancy in order to flourish. And they need to know where to get this kind of support. That is why it is important to have an overview of support schemes on offer in their regions.

NANORA has collected suitable support schemes on offer inside and outside academic institutions in various regions throughout the Alliance. Please see table in the annex for an overview:

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Decision matrix regarding factors influencing the formation of a company in the nanotechnology sector

Preamble

The following matrix can be used to identify the important factors with respect to the formation of a company in the nanotechnology sector.

Its two axes are the complexity to achieve the optimum for the specific factor (x-axis) and the relevance of the specific factor for the founding process (y-axis). The scale ranges from 1 to 10, with 10 equaling highest relevance (x) or highest complexity (y).

Based on this, the matrix can be split up into four different sectors:

1) Must-have factors (easy to optimize; important for the foundation)
2) Factors that should be invested in to accomplish (difficult to optimize; important for the foundation)
3) Nice to have factors (easy to optimize; not too important for the foundation)
4) Factors that can be – to a certain degree – neglected (difficult to optimize; not too important for the foundation)

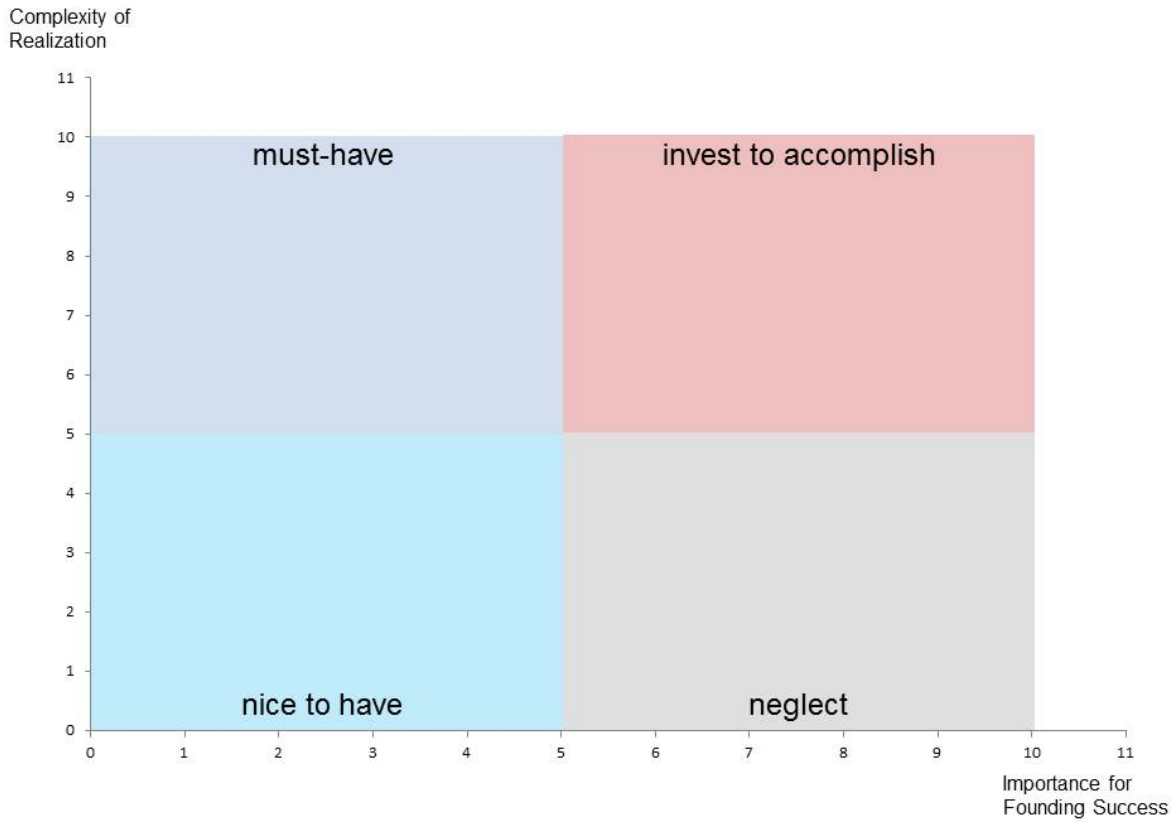


Fig. 1 – Decision matrix to evaluate the relevance of specific factors on the founding process

By assigning degrees of complexity and relevance to a specific factor for a planned company formation, one can easily identify whether this factor is a must-have, whether time should be invested to get the optimum, whether it would merely be nice to it or can even be neglected.

The influencing factors might vary for different companies and depend on the respective point of view (i.e., depending on whether is a venture capitalist or an experienced founding coach), though some are regarded as important be everyone.

The following factors are frequently addressed:

- Analysis of competition
- Analysis of financial demand
- Cooperations
- Degree of Innovation
- Development of 1st product
- Involvement of Inventors
- IP analysis / Freedom-to-operate (external)

- Knowing Investors and their demands
- Market analysis
- Marketing material
- Marketing strategy
- Milestone planning
- Preparation of Foundation
- Relevant network in research organization
- Relevant network to industry
- Sales knowledge
- Site analysis
- Support after Foundation (Coaching, Training, ...)
- Team Competences

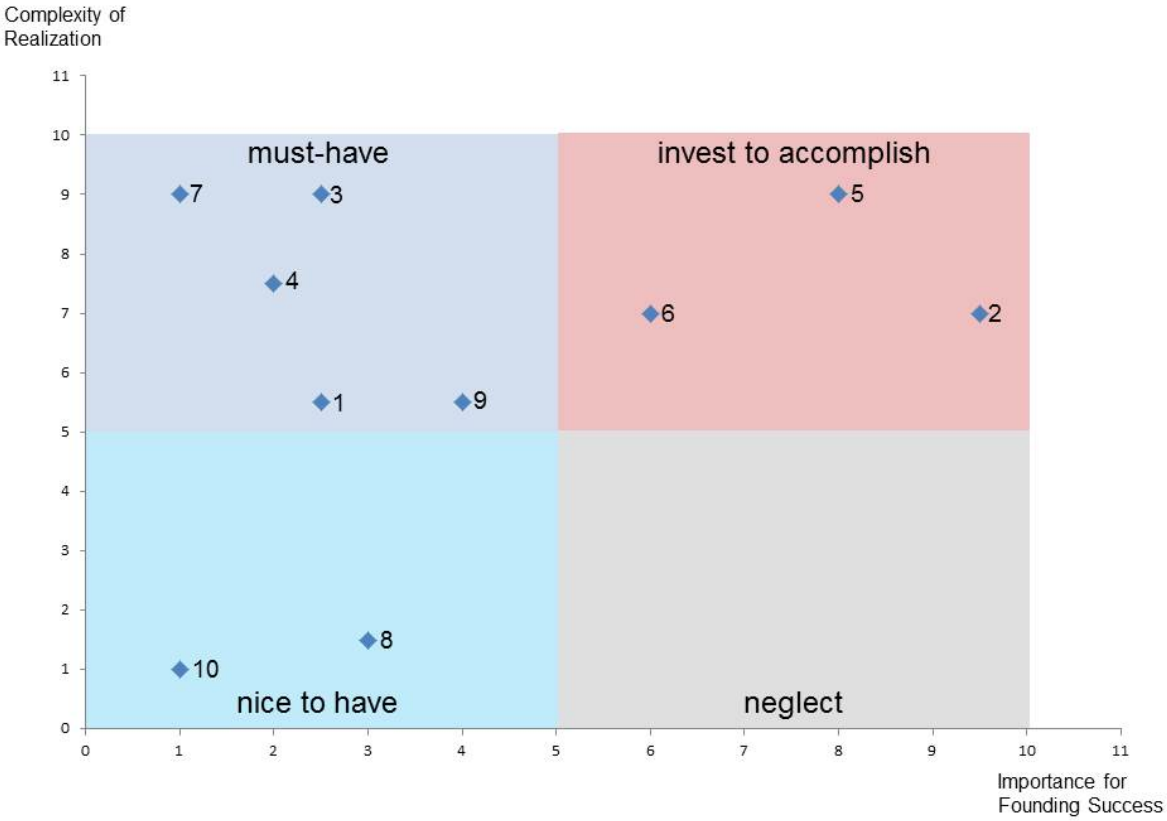
Example

The following example gives an impression on how to use this tool:

Key Factor	ID	Complexity of Realization (x)	Importance for Founding Success (y)
Analysis of financial demand	1	2,5	5,5
Involvement of Inventors	2	9,5	7
Preparation of Foundation	3	2,5	9
Support after Foundation (Coaching, Training, ...)	4	2	7,5
Team Competences	5	8	9
Market analysis	6	6	7
IP analysis / Freedom-to-operate (external)	7	1	9
Site analysis	8	3	1,5
Marketing strategy	9	4	5,5
Marketing material	10	1	1

Table 1 – Some relevant factors with respect to the formation of a company and their weighting with respect to the complexity to realize the factor and its importance for the founding process.

Fig. 2 – Decision matrix for ten selected key factors in respect to the foundation of a company.


Complexity of Realization
must-have
invest to accomplish
nice to have
neglect
7
3
5
4
6
2
1
9
8
10
Importance for Founding Success

Annex:

Support Schemes for nano-companies[1]

Name of the institution offering start-up support	Type of assistance provided	Region	Link for further information	Contact details (E-Mail, Phone number etc.)
BEFORE CREATION				
AST (Agence de Stimulation technologique)	support, coaching, financial funding (via Bourse Innovation)	Wallonia	Link 1 Link 2	+32 (0) 4 220.16.00 info@stimtech.be
Picarré ASBL (intellectual property)	support, coaching	Wallonia	Link	Tél : 04/349.84.00 Fax : 04/349.84.19 picarre@picarre.be
DGO6 (First spin-off programme)	financial funding, coacing, support	Wallonia	Link	N° général : +32 (0)81 33 40 79 N° général : +32 (0)81 33 31 14
LME (La maison de l'entreprise)	financial funding, coaching, support	Wallonia	Link	Tel : +32 65 / 32 15 11 Fax : +32 65 / 36 17 46 E-mail : projets@lme.be
WSL	Incubator	Wallonia	Link	Tel : +32 (0)4 367 30 63 Fax : +32 (0)4 365 23 46 E-mail: info@wsl.be
CAP INNOVE	Incubator	Wallonia	Link	Tel: +32 (0) 67 88 36 11 e-mail: info@capinnove.be
MecaTech Competiveness Cluster	Funding, market studies, intellectual property, communication, …	Wallonia	Link	Tel: +32 81 20 68 50 Fax: +32 81 20 68 59 e-mail: info@polemecatech.be
Cluster Photonique	Coaching	Wallonia	Link	
Sowalfin	funding	Wallonia	www.sowalfin.be	B-4000 Liège Tel: +32 (0)4 237 07 70 e-mail: info@sowalfin.be

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Interface Entreprises-Université de Liège	Intellectual property, coaching, communication, …	Wallonia	http://www.interface.ulg.ac.be/	Tel: +32 (0)4 349 85 10 E-mail: interface@ulg.ac.be
AVRE Umons (administration et valorisation de la recherche)	Funding, intellectual property, coaching, communication, research, advising…	Wallonia	http://portail.umons.ac.be/fr/universite/admin/dar/pages/productionrecherche.aspx	Tel: +32 (0)65 37 47 94 E-mail: pierre.cornut@umons.ac.be
CCAN	Coachiing, financial funding, technology search and general guidance on how to establish in Ireland.	All Ireland	www.ccan.ie	victor.acinas@ccan.ie
Enterprise Ireland	Supports available include: Start-your-own-business training courses. Market research information. Business planning advice and templates. Access to experienced business mentors. Feasibility grants and co-investment for your plans. Mentor grant Innovation Voucher	All Ireland	http://www.enterprise-ireland.com	
UNiKasselTransfer (UNIKAT)	Coaching, training	Hessen	www.uni-kassel.de/ukt/startseite.html	Jörg Froharth Telefon +49 561 804-2498 froharth@uni-kassel.de Gabriele Hennemuth-Tilschner Telefon +49 561 804-1859 hennemuth@uni-kassel.de

Steinbeis-Transferzentrum Nordhessen	Coaching, training	Hessen	www.stw-nordhessen.de	Steinbeis Zentrum Nordhessen Fon: 05631 92 06 95 ax: 05631 92 06 94 E-Mail: info@stw-nordhessen.de
Zentrum für High Tech und Kultur	Coaching, incubator	Hessen	www.zhtk.de	Telefon :06441 - 9 24 70 - 0 Telefax:06441 - 9 24 70 - 22 E-Mail:info@zhtk.de
Science4Life	competiton, financial funding, coaching, training	Hessen	www.science4life.de	Science4life e.V. Telefon: 069 / 30 55 50 50 Fax: 069 / 30 52 70 21 E-Mail: info@science4life.de
	AFTER CREATION			
Innovatech	Coaching	Wallonia	www.innovatech.be	Tel: +32 (0) 71 91 98 60 Fax: +32 (0) 71 91 98 69 E-mail: info@innovatech.be
Agoria	Coaching, policy units, consultancy, development, communication, support	Wallonia	www.agoria.be	Tel: +32 2 706 78 00
UWE (Union Wallonne des Entreprises	Promotion, support,…	Wallonia	www.uwe.be	Tel: +32 10 47 19 40 e-mail: info@uwe.be
BMBF (German Federal Ministry of Education and Research)	Funding	Germany	http://www.bmbf.de/foerderungen/10758.php nano@kmu-innovativ.de.	+49(0)211 6214-586; Phone:+49(0)2461 61-1823;
BMBF (German Federal Ministry of Education and Research)	Funding	Germany	http://www.bmbf.de/foerderungen/10758.php nano@kmu-innovativ.de	Phone: +49(0)211 6214-586; Phone: 02461 61-1823;

Uni Kassel Inkubator	Incubator	Hessen	www.uni-kassel.de/ukt/startseite.html	Jörg Froharth Telefon +49 561 804-2498 froharth@uni-kassel.de Gabriele Hennemuth-Tilschner Telefon +49 561 804-1859 hennemuth@uni-kassel.de
FiDT Technologie- und Gründerzentrums Kassel	Incubator	Hessen	www.fidt.de	Ludwig-Erhard-Straße 2-12 34131 Kassel Telefon: 0561-93897-0 Fax: 0561-93897-11 E-Mail: info@fidt.de
GZM - Gründerzentrum Marburg	Incubator	Hessen	www.gruenderzentrum-marburg.de	Tel.: (06421) 205- 163 Fax: (06421) 205- 169 immobilienverwaltung@swmr.de
Technologie- und Innovationszentrum Gießen GmbH (TIG)	Coaching, incubator	Hessen	www.tig-gmbh.de	info@tig-gmbh.de Telefon: 0641/9482260 Fax: 0641/94822629
Frankfurter Innovationszentrum Biotechnologie FIZ Biotechnologie GmbH	Incubator	Hessen	www.fiz-biotech.de	Telefon: +49 (0) 69 800 865 0 info@fiz-biotech.de
TIZ Darmstadt GmbH	Incubator	Hessen	www.tiz-darmstadt.de	verwaltung@tiz-darmstadt.de Karin Rech Tel.: +49 (0) 6151 - 39786 – 0 Mobil: +49 (0) 173 - 2 64 54 97
LIFE-Gründerzentrum im Industriepark Kalle Albert	Incubator	Hessen	www.life-gruenderzentrum.de	T +49 (0)611-962-01 E info@infraserv-wi.de
Hessischer Gründerpreis	competiton, financial funding	Hessen	www.gruendertage-hessen.de/gruenderpreis/hessischer-gruenderpreis.html	k.A.
promotion Nordhessen	competiton, financial funding	Hessen	www.promotion-nordhessen.de	k.A.

AURELIA Private Equity GmbH	Capital investment	Hessen	www.aurelia-pe.de	Tel: 069 8090-0 Fax: 069 8090-109 E-Mail: info@aurelia-pe.de
BMH Beteiligungs-Managementgesellschaft Hessen mbH	Capital investment, coaching	Hessen	www.bmh-hessen.de	Telefon (0 69) 13 38 50-78 40 info@bmh-hessen.de
Creathor Venture Management GmbH	Capital investment	Hessen	www.creathor.de	Tel: +49 6172 13 97 20 E-Mail: creathor@creathor.de
MBG H Mittelständische Beteiligungsgesellschaft Hessen mbH	Capital investment	Hessen	www.mbg-hessen.de	Telefon (0 69) 13 38 50-78 41 E-Mail info@mbg-hessen.de
Nanostart AG	Capital investment	Hessen	www.nanostart.de	Tel +49 (0)69-2193 96 00 info@nanostart.de
Sirius Venture Partners GmbH	Capital investment	Hessen	www.sirius-venture.com	Fon +49 (0)611 69 66 99 – 0 E-Mail: info@sirius-venture.com

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