



> Driving German Innovation

The role of incubator organisations in
the promotion of high-tech academic spin-offs

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SUMMARY

Germany needs innovation. New high-tech solutions provide sustainable responses to fundamental changes in society such as an aging population, greater urbanisation, climate change and the evolution of renewable energies. They ensure prosperity and economic growth. Global competition also drives the demand for popular technological exports bearing the label "made in Germany". In addition, Germany's lack of natural resources has led to the development of a knowledge-driven economy with a high demand for continuous innovation.

Besides major companies carrying out research in Germany, high-tech spin-offs from the research community play a key role in transforming ideas into innovations. They are an important channel for successful technology transfer from universities and other research institutes to get new developments onto the commercial market. At the same time they drive competition in the quest to develop marketable innovations and motivate existing companies to increase their own levels of innovation.

GERMANY: IDEAS-RICH BUT LACKING IN INNOVATION

However, German levels of innovation currently lag behind those of other countries such as Switzerland or Sweden.¹ There is no lack of original ideas, yet the rich economic potential that lies dormant in German research institutes too rarely gets transformed into new products. There is a long list of German milestones in basic technical research, but far too often German researchers are overtaken on the home straight to the market by other industrial nations. A well-known example of this is the development of the MP3 format by researchers at the "Fraunhofer-Gesellschaft". However, it was Asian and American companies that captured the market with a concrete product in the form of an MP3 player.

This lack of technology transfer can also be seen from the number of business start-ups in Germany: according to data from 2009 collected by the German Institute of Economic Research (DIW),² Germany only ranks 12th out of 17 countries worldwide with Korea having the highest number of start-ups. The importance of establishing spin-offs and turning ideas into products does not get a lot of recognition in the German research community. Young entrepreneurs who nonetheless dare to step out of the research community and into the market face many obstacles there. Only a few spin-offs manage to meet the high growth expectations. They are hampered by a lack of market knowledge, industry experience, and financial and personnel resources, as well as concrete methods for applying their new ideas.

HIGH-TECH START-UPS NEED SUPPORT

The federal government wants to promote innovation and improve the success rate of German start-ups as part of its "High-Tech Strategy 2020" and the more recent "Technologie Offensive". It is supporting young entrepreneurs and technology transfer through the "EXIST" funding programme, by investing in the early-stage seed investor "High-Tech Gründerfonds", through the funding initiative "Validierung des Innovationspotentials wissenschaftlicher Forschung – VIP" and the "Zentrales Innovationsprogramm Mittelstand" (ZIM), which is a programme for promoting innovation in small and medium-sized companies.

One tool used increasingly over the last few years to improve a young company's prospects is the "incubator". These include start-up centres as well as technology transfer centres in universities and major research organisations. Incubators aim to support and encourage the development of business ideas and start-ups in the first few years of their existence. Support from an incubator contributes significantly to the economic success of academic spin-offs. There are

¹ Deutsche Telekom Stiftung/BDI 2011.

² DIW 2009, p. 315.

now several thousand incubator organisations worldwide, with several hundred of them based in Germany.

The incubators in Germany supply different services to spin-offs in order to identify any weaknesses in the young companies and support them with their market launch. However, upon closer inspection, German incubator services do not always meet their clients' demands.

ADVICE

The entrepreneurs behind academic spin-offs do not usually have any business know-how. Although German incubators offer courses in general business management, only rarely do they provide specific advice about the particular issues faced by young high-tech companies.

A spin-off company's capital lies in its exclusive technological knowledge which needs to be protected from competition by patents. This means that there is a high level of demand for legal advice in the early stages of the company's development. However, apart from the technology transfer centres at research institutes with their commercial focus, hardly any incubator organisations provide advice in this field.

NETWORKS

Entrepreneurs from the research community rarely have any market experience. In particular, many spin-offs experience difficulties in establishing a customer base. However, relatively few incubators provide assistance with this issue.

INFRASTRUCTURE

High-tech companies are reliant on having often very expensive technical equipment and laboratory facilities, which they cannot afford in the early stages of their development. However, very few incubators are in a position to be able to provide their spin-offs with this kind of infrastructure.

The provision of demand-based services by start-up and research centres and ideal political conditions for incubators and spin-offs are important elements in improving the support given to spin-offs.

FINANCING

Financing is crucial for the success of spin-offs. High-tech start-ups often have difficulties in seeking funds, loans or venture capital as a result of bureaucratic obstacles. However, incubators rarely supply any kind of support regarding the raising of capital beyond listing financing options and assisting with the completion of forms.

RECOMMENDATIONS

acatech recommends

1. improving legal and business advice for spin-offs.

A mentoring programme run by experienced entrepreneurs would support spin-offs with their individual challenges. Improvements are needed in setting up contacts with experts, for example patent lawyers. Providing vouchers for consultancy and paying trade-fair fees using current national funding programmes would contribute to this. The certification of experts across Germany would also guarantee the quality of advice.

2. **expanding the network of incubators.** Incubators and their young companies benefit from external expertise through contact with former spin-offs (alumni) and an advisory board. A greater emphasis needs to be placed on incubator organisations sharing their experiences.
3. **facilitating financing for spin-offs.** Incubators need to support entrepreneurs in looking for and negotiating with investors. Regional venture capital funds modelled on the "High-Tech Gründerfonds", the expansion of existing funding programmes and tax incentives for potential lenders would increase the financing options available to spin-offs.
4. **using the incubators' existing infrastructure for mutual benefit.** Incubators should put spin-offs in touch with those institutions which best suit the specific demands of the young company.
5. **improving motivation for business start-ups.** Incentive schemes for technology transfer provide encouragement for the heads of research institutes, while prizes and awards for successful business start-ups attract young researchers. Information about starting a business also needs to be taught early on at schools and universities.

PROJECT

This position paper was developed on the basis of the acatech STUDY *Mehr Innovationen für Deutschland - Wie Inkubatoren akademische Hightech-Ausgründungen besser fördern können* (Spath & Walter, 2012).

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1 INTRODUCTION

Young technology companies can make an important contribution to the creation of jobs and innovation. Spin-offs from universities and public or private research institutes, so-called academic spin-offs, are of particular interest here. These companies transform technology developed in a public research institute into a commercial application, thereby building an important bridge for technology transfer from publicly or privately funded research. These companies are therefore of great importance in the development of cutting-edge technology and in the promotion of growth and prosperity.³

However, positive economic effects only come about if the company manages to establish itself on the market successfully. For this to happen the technology transferred from the university or research institute needs to be converted into an application (product or service) that is in demand on the market. However, academic spin-offs have to overcome a whole range of obstacles in this context. Besides the typical lack of resources and market acceptance for many young technology companies, academic spin-offs often face the problem that they are dealing with relatively "raw" technology which may potentially be converted into different applications, but whose prospects of success are unknown.⁴ Studies also indicate that academic spin-offs often lack market knowledge and market-focused thinking, particularly as a result of the founder's technical and academic background.⁵ Accordingly, there is often no clear idea of a marketable product or suitable target market when the company is created.⁶

These obstacles can lead to academic spin-offs being hampered in their development or even failing. However, countries such as Germany, whose lack of natural resources has resulted in a high demand for technological innovation, depend heavily on successful technology transfer from uni-

versities and research institutes. Their knowledge-intensive economies depend for their existence in the international competitive environment, and for their long-term growth, on the production of a continuous stream of innovation. Currently, German levels of innovation are lagging behind other countries such as Switzerland or Sweden.⁷ There is no lack of original ideas, yet the rich economic potential that lies dormant in German research institutes too rarely gets transformed into new products. There is a long list of German milestones in basic technical research, but German researchers are overtaken far too often by other industrial nations on the home straight to the market. A well-known example of this is the development of the MP3 format by researchers at the "Fraunhofer-Gesellschaft". However, it was Asian and American companies that captured the market with a concrete product in the form of an MP3 player.

The federal government wants to promote innovation and improve the success rate of German startups as part of its "High-Tech Strategy 2020" and the more recent "Technologie Offensive". It is supporting young entrepreneurs and technology transfer through the "EXIST" funding programme, by investing in the early-stage seed investor "High-Tech Gründerfonds", through the funding initiative "Validierung des Innovationspotentials wissenschaftlicher Forschung – VIP" and the "Zentrales Innovationsprogramm Mittelstand" (ZIM), which is a programme for promoting innovation in small and medium-sized companies.

One tool used increasingly over the last few years to improve a young company's prospects is the incubator. These include startup centres as well as technology transfer centres at research institutes. According to estimates from the National Business Incubator Association (NBIA), there are roughly 7,000 incubators worldwide, with several hundred of them in Germany. Research into entrepreneurship has

³ Riesenhuber et al., 2006.

⁴ Jensen & Thursby, 2001; Shane, 2000.

⁵ Franklin et al., 2001.

⁶ Grandi & Grimaldi, 2005.

⁷ Deutsche Telekom Stiftung & BDI, 2011.

also played a vital role in making policy-makers, universities and businesses aware of the importance of incubators as a crucial driving force for the development of spin-offs.

Scientific studies into incubator organisations use a large number of different definitions. However, the different approaches have certain key elements in common which can be summarised as follows:⁸

An incubator is an organisation which provides researchers with substantial support in setting up a new business or achieving their goals, or which helps new companies in their commercial development. This supportive role involves pooling various services and management decisions and is geared towards improving the company's chances of survival and growth.

In short, just as a medical incubator helps a premature baby to develop, a business incubator helps young entrepreneurs get "on their feet" in the national economy. An incubator's basic aim is to provide support designed to develop and en-

courage business ideas and start-ups in the first few years of their existence. These organisations provide entrepreneurs with various degrees of infrastructure and advice on financing, corporate management and marketing issues, and support them in establishing contact with investors and potential customers. This position paper differentiates between three types of incubators in Germany based on how the organisation is funded (publicly or privately) and whether or not they focus on research:

1. Public start-up centres
2. Private start-up centres
3. Public research institutes

The acatech STUDY on which this position paper is based examines the question of whether the support services supplied by different types of incubators are reasonable, adequate and sufficient from the point of view of the spin-offs. The recommendations for action in this position paper are based on the findings from a wide-ranging survey of incubators and from interviews with incubators and spin-offs.

⁸ Hackett & Dilts, 2004; European Commission/CSES, 2002.

2 SUPPORT SUPPLIED BY INCUBATORS

Incubators support academic spin-offs in a variety of ways. Research into this area differentiates between the different services provided, which are briefly described below:⁹

1. Advice and support
2. Access to the incubator's network
3. Provision of infrastructure

ADVICE

The incubator organisation is able to support tenant spin-offs with a variety of advisory services. These frequently extend to compiling the business plan and giving financial and marketing advice. Companies which receive external business advice are particularly successful.

NETWORKING

Companies often find it difficult to establish a network of customers, suppliers or investors in their start-up phase. Potential network partners are often sceptical towards young high-tech companies because they do not have a track record to prove their credibility and reliability. Providing access to networks in order to overcome this lack of market acceptance is therefore an important component of the services supplied by incubators. At the same time, it is important that the incubator organisation itself has a diverse network that it can make available to its clients. This should ideally include experts in fields of technology and business, financial advisors, business angels and other investors, and lawyers and other qualified advisors. Links with universities

are particularly important as they can, for example, enhance the reputation of a young technology company by association, or provide them with the opportunity to use laboratory facilities and equipment and to recruit students.¹⁰

INFRASTRUCTURE

The provision of an infrastructure that can be jointly used by all the companies based at the incubator enables each individual company to make a whole range of cost savings. These include conference rooms, office machinery and other equipment, as well as communal facilities such as an admin office and cafeteria.

Admittedly, empirical studies have so far been unable to prove that individual infrastructure components make more than just a small contribution to success. Nevertheless, it can be presumed that they are an essential service supplied by the incubator without which the spin-offs' ability to function would be significantly restricted.¹¹

This summary has already made it clear that incubators can have a major influence on the development of young companies. However, the actual contribution to success made by the individual services supplied is not the focus of this study. Instead it is concerned with how well these services correspond to the demand for support, i.e. the cooperation that exists between incubators and spin-offs which also has an effect on the success of both the young company and the incubator organisation. The other support services to be considered include advice, access to networks and the provision of infrastructure.

⁹ The selection of spin-offs to be supported comes before the provision of these support services and is therefore not the focus of this observation.

¹⁰ Bollingtoft & Ulhoi, 2005; Bergek & Norrman, 2008; Peters et al, 2004; Rice, 2002; Mian, 1996.

¹¹ Kim & Ames, 2006; Aerts et al., 2007; Peña, 2004.

3 COMPARISON BETWEEN THE SUPPORT ON OFFER AND THE REQUIREMENTS OF THE SPIN-OFFS

The importance of high-tech spin-offs from public and private research institutes as a driving force for economic development is undisputed today. Promoting the development of these spin-offs in the best way possible requires an understanding of the support they need to start up successfully and get established on the market. Research has highlighted various obstacles in the different development stages of spin-offs which incubators can help start-up teams and their organisations to overcome (cf. Table 1).

The acatech STUDY which this position paper is based on shows that in reality the services provided by German incubators do not always meet the demands of young high-tech companies.¹² A wide-ranging survey of incubators and interviews with both academic spin-offs and incubators were used to assess the extent to which the literature-based systemisation of requirements (advice, networks, infrastructure; cf. Section 2) actually addresses the key problems facing spin-offs and also what support services are on offer. The

study reveals shortcomings in this system and conclusions are drawn regarding more effective ways of supporting academic spin-offs. The following comparison also considers other central findings from the interviews about financing, organisational processes and start-up culture.

3.1 ADVICE

BUSINESS KNOWLEDGE

Requirements

Academic spin-offs are by definition founded by (former) researchers from public research institutes who generally have sound technological knowledge but often lack sufficient business know-how,¹³ particularly when it comes to spin-offs not originating from business schools. This shortcoming was also frequently referred to in the interviews with heads of different incubator organisations.

Table 1: Academic spin-off demands derived from the literature¹⁴

AREA	PHASE	IDEA	MARKET ENTRY AND ADJUSTMENT	GROWTH AND EXPANSION
START-UP TEAM		<ul style="list-style-type: none"> – Industrial experience and market knowledge – Access to market information 	<ul style="list-style-type: none"> – Team cohesion and conflict management – Business knowledge 	<ul style="list-style-type: none"> – Management skills – Coaching
ORGANISATION		<ul style="list-style-type: none"> – Skills in turning knowledge into marketable products – Investor networks 	<ul style="list-style-type: none"> – Social capital and networking skills – Property rights and property rights agreements – Access to resources (equipment, technological knowledge, personnel) 	<ul style="list-style-type: none"> – Entrepreneurial spirit

¹² Detailed consolidated reports on the case studies can be derived from the relevant acatech STUDY (Spath & Walter, 2012).

¹³ Radosevich, 1995.

¹⁴ The acatech STUDY that this position paper is based on systematically considers the demand profiles of spin-offs as described in the literature (Spath & Walter, 2012).

In interviews with start-up teams from academic spin-offs, it became clear that their founders are very aware of their lack of business knowledge but are often confronted with specific questions that cannot be answered by general business courses. In particular, a lack of knowledge in sales was often mentioned as a critical shortcoming.

Provision

Although many of the heads of incubator organisations interviewed are very much aware that academic spin-offs have shortcomings regarding their business knowledge, the training supplied is largely very general and is often carried out by external providers. The empirical analysis showed that less than half of all incubators provide any advice at all relating to company and personnel management and the compiling of market analyses.

Conclusion

It is important to attract mentors and coaches who can provide companies with practical support on an individual basis and can be consulted when required. These can be experienced entrepreneurs and experts in the business sector from the region. It is crucial that events are organised in the form of industry-specific networking platforms and that links from the incubator's own network are created and passed on.

More extensive business advice addressing the specific issues of academic spin-offs as well as basic business topics would also be desirable. The importance of this support has already been empirically proven by Peña (2004). This could be realised for example by a mini-MBA lasting two to five working days to support the start-up. The course would include topics relevant to start-ups such as team building and development, strategy development (including different functions such as sales and marketing), production, drawing up action plans, financing etc. Regular presentations by experienced entrepreneurs would also be a useful addition here.

LEGAL EXPERTISE

Requirements

The exclusivity of technologies being employed by academic spin-offs gives them the potential to develop sustainable competitive advantage.¹⁵ Formal protection mechanisms prevent competitors from imitating products and can therefore contribute to the company's success.¹⁶ Many companies find it very difficult to assert themselves in a competitive environment without strong patent protection. Correspondingly, it is crucial to have adequate legal advice, for example on the registration of patents or granting of licences.

Legal expertise is only mentioned as an area of support by public research centres, but significant shortcomings were revealed in terms of legal support in interviews with academic spin-offs. Knowledge of general contract law is important throughout the whole start-up process. In addition, companies lack expertise in the field of patent law at the "ideas phase" in particular, whilst legal advice in international law is a priority at the later growth phase.

Provision

In the survey of 98 German incubators, it became clear that public research institutes provide advice about patent and licensing strategies far more frequently than start-up centres. These organisations do so particularly out of self-interest as part of their technology transfer management strategy in order to earn income from the sale of patents and the issuing of licences.

Conclusion

Start-up centres should expand their advice services for academic spin-offs to include legal advice about patent law, contract law and similar topics.

¹⁵ Kaiser, 2009.

¹⁶ Shane & Stuart, 2002; Nerkar & Shane, 2003; Niosi, 2006.

ADVISOR AND LAWYER QUALIFICATIONS

Requirements

It is crucial that a spin-off selects the right advisor for its start-up phase. The lack of transparency regarding advisor and lawyer expertise was addressed in the interviews. Vouchers for consultants are provided by public authorities, but they are not an adequate solution to this problem.

Provision

In a few isolated cases, certification is required and supplied, for example in the case of start-up advisors for the "EXIST" funding programme. Other organisations also occasionally supply certification for business start-up advisors. However, there is a lack of uniform standards, and in particular a lack of suitable lawyers, patent lawyers and tax advisors.

Conclusion

We propose that nationwide certification for advisors and lawyers should be devised in order to create uniform quality standards. This should include minimum qualifications for advising start-ups, such as a sufficient degree of experience. This certification would help spin-offs in their search for suitable support and guarantee the effective use of vouchers for consultants. Incubators would be able to benefit from this by including only certified advisors and lawyers in their network. The certification could be issued, for example, by selected incubators or an independent organisation.

3.2 NETWORKS

CONTACT WITH INDUSTRY EXPERTS THROUGH ALUMNI AND ADVISORY BOARDS

Requirements

Academic spin-offs do not only lack commercial knowledge. In the initial stages, there is usually also a lack of profound industry or market experience (e.g. finding and dealing with partners, customers, suppliers, knowledge about market regulations) and no clear idea of what makes a marketable product and suitable target market.¹⁷ However, these factors have been identified in various studies as impacting on the success of a business.

These findings regarding the lack of market and industry experience were gained from an analysis of the literature, but were then confirmed several times over in the interviews conducted with incubators and academic spin-offs. In particular, building up contacts with their first customers causes difficulties for many academic spin-offs as does adapting their first product to meet market needs.¹⁸

Provision

More than 80 percent of all three types of incubators offer support in establishing links with technology experts. Some of the incubators interviewed are already setting a good example and regularly organise events at which the supported companies present their products and can exchange ideas with external companies from the industry. However, very few incubators provide help with customer acquisition. This kind of support is supplied by only half of all private start-up centres, and the percentage is even lower for public institutions.

¹⁷ Franklin et al., 2001; Heirman & Clarysse, 2004; Grandi & Grimaldi, 2005.

¹⁸ acatech, 2010.

Conclusion

Customers play a crucial role in a company's ability to recognise market demands and develop products in line with the market.¹⁹ Academic spin-offs lacking industry and market experience must be given better support in building up contacts with customers and other market participants, in particular. One possible starting point would be to use the incubator's alumni network. Another option would be to set up an experienced advisory board. In this way, relevant experience and networks of experts, for example from companies from that particular industry, industry associations and investors, could be made available to start-ups right from the start.

3.3 INFRASTRUCTURE

SPECIALISED EQUIPMENT AND LABORATORY FACILITIES

Requirements

As academic spin-offs frequently use radical technologies which are still at a very early development stage, many of these companies depend on specialised laboratory facilities or large and expensive equipment which they cannot afford to buy themselves due to insufficient capital.

Provision

Whilst public research centres in particular often have specialised technical equipment that can be made available to academic spin-offs, start-up centres are less often able to provide this kind of infrastructure. It became clear in face-to-face interviews that this is only possible in exceptional cases. As the equipment required depends heavily on the type of industry, it is not worth acquiring specialised, expensive equipment for individual companies, especially in the case of start-up centres with no particular industry focus. It is also often the case that there are no standardised procedures for using infrastructure.

Conclusion

During the selection process, incubators should consider whether they can actually meet the demands of the spin-off looking to them for support. If this is not the case, they should refer them to more appropriate organisations. If they have suitable equipment, this should be provided for use with due consideration of the legal limits, particularly in the case of young companies who cannot afford to purchase such equipment themselves. One obstacle to the provision of equipment for start-up projects is the high initial administrative costs. This can be reduced considerably by using standardised procedures. For example, a university-wide standardised academic "sponsorship agreement" can be used, in which the framework conditions for funding start-up projects are defined.

3.4 FINANCING

INVESTOR NETWORKING

Requirements

In the case of academic spin-offs, it has been shown that direct contact with venture capitalists has a positive effect on the amount of external financing received as well as on the probability of company survival.²⁰

In the interviews, academic spin-offs often complained about their financial insecurity, saying that the bureaucratic obstacles and amount of time associated with acquiring credit or funds were sometimes unacceptable. Several of the spin-offs interviewed also felt overextended when choosing suitable financing and expressed dissatisfaction regarding support from their incubator organisation in this respect.

Provision

Roughly half of all the incubators surveyed stated that they offered support with acquiring financing. In the one-to-one interviews conducted, however, it became clear that this

¹⁹ Bollingtoft & Ulhøj, 2005; Bergek & Norrman, 2008; Peters et al., 2004.

²⁰ Shane & Stuart, 2002.

support is predominantly restricted to providing a list of sources of funding or to explaining how to complete certain forms. One incubator organisation did provide financial support in the form of a special technology transfer fund, although this required companies to go through an application process.

Conclusion

Support with financing issues should form part of the services supplied by all incubator organisations. However, this support should go beyond merely highlighting individual financing options and include actively putting spin-offs in touch with suitable funding programmes and credit institutes as well as accompanying entrepreneurs to meetings with possible sources of finance. The incubator's reputation can open more doors by actively setting up contacts.

In addition, venture capitalists could be a suitable source of funding for spin-offs through public-private partnerships. Plus, tax incentives for investments in spin-offs must be designed to promote innovation.

3.5 START-UP CULTURE AND ORGANISATION

The following findings do not relate directly to the incubator support services being analysed and are therefore listed separately. They refer to both the incubators' organisational processes and to start-up culture itself.

MANAGEMENT ROLES IN INCUBATOR ORGANISATIONS

One problem facing the heads of technology transfer units in public research centres is the resentment felt by heads of department about the development of academic spin-offs from these centres. They sometimes even attempt to

prevent spin-offs from being created, fearing that there will be an exodus of capable researchers and the loss of the research findings they have worked on over many years. The heads of technology transfer units are therefore required to work diplomatically to reduce this kind of resentment that might otherwise put the emergence and development of academic spin-offs at serious risk.

During personal interviews with managing directors from different incubators it became clear that there are huge variations in the commitment they show towards the companies they support. Whilst some respondents gave the impression that they tend to see themselves as administrators and only become active if the entrepreneur approaches them, others always made every effort to liaise closely with the companies in order to provide them with the best possible support.

Being proactive should be seen as an important requirement in the appointment of managing directors of incubator organisations and heads of technology transfer centres. The support provided by incubators goes beyond quantifiable individual services and also takes place on a personal level. The attitude of the heads of these organisations is a crucial factor in this regard.

Performance indicators for incubators could be set up for the issuing of funds. These would need to go beyond the prevailing key indicator – the number of start-ups – and could for example include relevant economic performance indicators.

Another possible measure would be to create start-up officers at universities to actively shape and support the issue of start-ups. They would need to liaise closely with start-up centres and would thus form a link between the university and the incubator organisation. They would be both supporters and the first point of contact for potential spin-offs.

ORGANISATION OF INCUBATORS IN RESEARCH INSTITUTES

Organisational structure and strategic focus were considered by international incubators in particular as important factors in their success. This made it clear that incubators should not aim to put profit first and foremost, but rather technology transfer. This leads to decisions being made that can have a positive effect on the promotion of spin-offs. Furthermore, sustainable schemes should be given preference.

The application of ideas and the creation of spin-offs are given a higher profile by directly involving the technology transfer centre in the management of the research institute. This means that relevant internal processes can be more easily influenced, for example the establishment of a systematic process to identify, analyse and support exploitable ideas or cooperation between the offices responsible for patents and spin-offs. Other processes, for example the co-ordination of implementation agencies with institutes and heads of institutes, can also be promoted and controlled better by senior management. In addition, implementation activities can be taken into consideration in management decisions relevant to the institute.

The application of knowledge often comes into conflict with a researcher's professional career. However, incentive systems, such as pay-related incentives, can be created to encourage implementation. In this way, successful transfer can become one of the goals of an institute.

THE TECHNOLOGY CENTRE AS AN UMBRELLA ORGANISATION FOR START-UP PROJECTS

In order to reduce risk and insecurity, entrepreneurs can carry out a start-up project as part of a start-up centre company, instead of starting their own company straight away. This does not merely involve coaching, as the start-up project

acts in the name of and on account of the start-up centre. The advantage for entrepreneurs is that they can operate close to the market as part of a limited company or GmbH, but still benefit from the security and positive visibility of an established player. The transfer of knowledge and cooperation can be organised simply by creating a cooperation agreement between the start-up centre and the local university. In addition, entrepreneurs can for a time enjoy the protection of a young company which has already been successful.

MAXIMUM LENGTH OF STAY

Besides the conclusions already discussed, it became clear during interviews with different incubators that a statutory limit restricting companies to a maximum of five years involvement with a public start-up centre should be reconsidered, particularly in the case of centres in rural areas. A limit which primarily serves to free up space in the centres for new companies only makes sense, if it can be said to make sense at all, if space is generally lacking. However, as centres in rural areas are already having to deal with the problem of uptake levels that are too low, they would lose additional income as a result of this kind of statutory regulation. Older, experienced companies also often act as advisors for younger companies in incubator organisations and therefore make an important contribution to their support. A graduated lease linked to the length of stay, as was suggested by different heads of incubator organisations, would be an appropriate means of regulating the length of stay.

CAMPAIGNS AND A CULTURE PROMOTING START-UPS AND INNOVATION

The subject of business start-ups must be systematically communicated and adapted in order to establish a start-up culture. The target groups for this are companies, research organisations and researchers as well as schools

					Comparison		

and universities. A comprehensive campaign might be a suitable approach. German media companies have already carried out a wide-scale media campaign ("Du bist Deutschland") to promote a culture of innovation. The extent to which these kinds of broad concepts can be transferred to a start-up culture needs to be investigated. Plus, regional approaches that improve mutual understanding and a sense of belonging might also be suitable.

There also needs to be greater integration of entrepreneurial skills into the curriculum in schools, colleges and universities. This would require the involvement of politicians in drawing up and implementing appropriate schemes.

4 RECOMMENDATIONS

The following recommendations are largely derived from the interviews with the heads of incubator organisations and academic spin-offs that were carried out as part of the acatech project. Expert opinions developed during an expert workshop have also been incorporated.²¹

The recommendations below are aimed at eradicating the discrepancies between the incubator support on offer and

the requirements of the spin-offs and include concrete proposals for the implementation and structuring of framework conditions.

These recommendations are directed at the heads of incubator organisations and political stakeholders, and unless stated otherwise, at all three types of incubators identified.

4.1 ADVICE

"Entrepreneurs coach entrepreneurs"

acatech recommends incubator organisations implement a practical "mentoring programme" in which experienced entrepreneurs teach academic spin-offs targeted business knowledge for start-ups (developing sales, financing etc.) and advise them on their individual challenges. Managers who have recently left an active career, and successful entrepreneurs, are particularly suitable for the role of mentors. Mutual support from tenant spin-offs, in particular information about successful advisory services, helps young entrepreneurs take their first steps towards independence.

Linking up with legal expertise

acatech recommends that incubator organisations strengthen the understanding amongst spin-offs of legal issues by improving the help they provide in establishing links with

specialist lawyers and patenting experts. Legal information about patenting and licensing must be provided when the spin-off is still at the "ideas phase" and has not yet developed the final end product. Training in contract law is also important, including answering questions about liability and providing sample contracts, for example for licences.

Customising funding programmes

acatech recommends supporting spin-offs in a more targeted manner, i.e. by focusing on each case individually, within existing funding programmes, for example by using vouchers for consultants to subsidise high-quality start-up advice. In terms of customer acquisition, the initial participation of start-ups in major trade fairs should also be subsidised. Plus, the nationwide certification of patent lawyers would guarantee an effective and efficient use of public funds.

²¹ An expert workshop took place on 9th June 2011, attended by representatives from academic organisations and other spin-off experts.

4.2 NETWORKS

Using alumni networks to establish industry connections

acatech recommends using existing links with the incubator's former spin-offs or setting up special alumni organisations in order to acquire mentors, advisors and investors. Many of these alumni have solid, long-standing relationships with the incubator organisation, which allows cooperation based on trust.

Expanding the incubator network

acatech recommends incubators establish an advisory board with permanent members from the research commu-

nity, investor groups, industry and politics. Board members would then advise the incubator and its spin-offs, act as mentors and provide contacts with other experts. The incubator would benefit from consistently up-to-date, external expertise and align itself more closely with industry and current practice.

Strengthening networking between incubator organisations

acatech recommends creating stronger links between incubator organisations. In this way they can regularly share experiences, specific industry knowledge and best practice or organise joint events with their respective spin-offs.

4.3 INFRASTRUCTURE

Finding incubators

Incubators should put spin-offs in touch with those institutions which can provide an infrastructure and advice appropriate to the specific demands of the young company.

Policy-makers need to offer incubators incentives to promote this kind of specialisation. In particular, any assessment of start-up centres should take into account whether they only support spin-offs which match the incubator's strategic focus.

4.4 FINANCING

Procuring investors

acatech recommends that incubators support spin-offs individually in making contact with **investors**. Incubators should also support the subsequent negotiations. This would help the young company to be more successful in

acquiring financial means, for example for seeing it through from development to the finished product or for building up its sales department. Tools for procuring investor contacts include **start-up trade** fairs and "investor days" on which spin-offs present their patented product ideas to potential investors.

Setting up regional capital funds

acatech recommends setting up regional **venture capital funds** in the form of public-private partnerships. The new funds are predominantly provided by interest groups from the fields of industry and politics. They are based on the model of the "High-Tech Gründerfonds" and aim to provide sustainable development and long-term investment in spin-offs. They also finance spin-offs at the pre-seed stage. In addition, existing funding programmes need to be expanded to national and EU level.

Creating tax incentives

acatech recommends looking into tax regulations relating to the remuneration of employees for their inventions and to investments which are not relevant to tax law, and adjusting these regulations in the spirit of promoting innovation and spin-offs.

4.5 MOTIVATION AND ACKNOWLEDGEMENT FOR BUSINESS START-UPS

Acknowledging successful technology transfer

acatech recommends creating an incentive system in line with current funding programmes such as "EXIST Gründungskultur" to motivate heads of university and non-university research institutes to promote spin-offs. The number of spin-offs should be included as a key performance indicator in the assessment of research institutes.

Furthermore, prizes and awards for particularly successful technology transfer would encourage young academics to start up a business.

Extending teaching on start-ups

acatech recommends a stronger focus on start-ups in school and university education. The possibilities, requirements, opportunities and risks of entrepreneurship need to form part of the curriculum at an early stage in schools. Plus, specific and more comprehensive information on how to start up a business needs to become a permanent component of degree courses in the natural sciences and of supervision during postgraduate studies.

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