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Companies in High-Technology Industries**

Gabriele Beibst, Heiko Haase und Arndt Lautenschläger

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Herausgeber:

Fachhochschule Jena
Carl-Zeiss-Promenade 2
Postfach 10 03 14
07745 Jena

Schriftleitung:

Prof. Dr. Gabriele Beibst
gabriele.beibst@fh-jena.de
Dipl.-Volkswirt Arndt Lautenschläger
arndt.lautenschlaeger@fh-jena.de

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The Internationalization of Thuringian Start-up Companies in High-Technology Industries

Gabriele Beibst*, Heiko Haase und Arndt Lautenschläger***

*Fachhochschule Jena
Carl-Zeiss-Promenade 2, 07745 Jena
E-Mail: arndt.lautenschlaeger@fh-jena, Tel. : +49 3641 205591

**Technische Universität Ilmenau
Ehrenbergstraße 29 (Ernst-Abbe-Zentrum), 98693 Ilmenau
E-Mail: heiko.haase@tu-ilmenau.de, Tel.: +49 3677 694023

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Abstract

In 2002 a survey conducted by the University of Applied Sciences Jena pointed out that many young technology-based firms in the Free State of Thuringia in Germany strive for international contacts. 50% of the enterprises that have been surveyed operated internationally, 40 % intends to establish inter-national business contacts. The export of goods and services was the most specified activity, followed by the implementation of joint research & development projects with foreign partners. Based on this survey the entrepreneurs of several firms were chosen for an oral interview with the intention to receive detailed information about why and how they strive for international contacts.

The present article presents the results of this investigation and draws conclusions in order to make a contribution to the development of an integrated theory of International Entrepreneurship and to give recommendations to managers of SMEs as well as to entrepreneurs. It has four parts. The first part gives an overview of existing explanations and theories on the internationalization of SMEs. The second part describes three cases of international-oriented start-up companies from Thuringia. In the third part the authors draw conclusions from their investigation and try to give an answer on how the presented cases fit into existing theories of the internationalization of start-up companies and on whether these explanations have to be adjusted and extended. Finally some aspects that companies should take into account when going global are discussed.

Key words

university-based start-ups, university spin-off companies, international entrepreneurship, case studies

1. TECHNOLOGY-BASED START-UPS IN THURINGIA

Thuringia is one of the sixteen Federal States of Germany. Since the Reunification of Germany in 1990 the region has been affected by radical structural changes. Traditional industries and large companies have collapsed. The existing economic links disintegrated and many jobs have been lost.

During the past ten years, the industrial basis of Thuringia has been renewed almost completely. Many productive and competitive companies there were established. Business life in this Federal State today is marked essentially by small and medium-sized companies.

Research institutes as well as universities mainly had driven this process of renewal. Science, economy and politics in Thuringia have established a dense network enabling research institutes, universities and companies to work together intensively as partners. Thuringia has thereby created a very innovative climate for young entrepreneurs, who benefit from the excellent infrastructure of pure and applied research that has been developed during the previous 10 years. Scientific results rapidly become innovative products and often serve as a basis for business start-ups.

A survey conducted by the University of Applied Sciences Jena in 2002 pointed out that many of the young technology-based firms in Thuringia strive for international contacts. 50% of the enterprises that have been surveyed operated internationally, 40 % intends to establish international business contacts. The export of goods and services was the most specified activity, followed by the implementation of joint research & development projects with foreign partners. (Beibst and Lautenschläger, 2002)

Based on this survey the entrepreneurs of several firms were chosen for an oral interview with the intention to receive detailed information about why and how they strive for international contacts. The interviews took place in 2003.

The purpose of this paper is to present the results of our investigation and to draw conclusions in order to make a contribution to the development of an integrated theory of International Entrepreneurship and to give recommendations to managers of SMEs as well as to entrepreneurs.

Therefore, the paper has four parts. The first part that follows the introduction gives an overview of existing explanations and theories on the internationalization of SMEs. The second part describes three cases of international-oriented start-up companies from Thuringia. In the third part we will draw conclusions from our investigation and try to give an answer on how the presented cases fit into existing theories of the internationalization of start-up companies and on whether these explanations have to be adjusted and extended. Finally we discuss some aspects that companies should take into account when going global.

2. INTERNATIONAL ENTREPRENEURSHIP AS A SUBJECT OF STUDIES

2.1 Definition and Domain of International Entrepreneurship

The phenomenon of International Entrepreneurship has come to academic awareness within the last decade. McDougall (1989) defined in her study International Entrepreneurship "... as the development of international new ventures or start-ups that, from their inception, engage in international business, thus viewing their operation domain as international from the initial stages of the firms operation." Since that time literature on International Entrepreneurship has been growing. Coviella and Jones (2002) for example give a good overview on empirical research in the emerging field of International Entrepreneurship.

Past research was to a large extent focused on studying the internationalization of new ventures. But recently several authors argue that "companies of different age and size often

engage in international entrepreneurship activities as they venture into international markets and these firms should be included in the study of international entrepreneurship” (Zahra and George, 2002: 6). Also established companies are worth to study as various members of a small or medium business company’s top management team can be engaged in entrepreneurial activities across borders.

In their more recent article McDougall and Oviatt (2000) suggested a broader definition of the international phenomenon: “A combination of innovative, proactive, and risk-seeking behavior that crosses or is compared across national borders and is intended to create value in business organizations.”

International Entrepreneurship is defined in this study as an issue that describes transnational business activities carried out by a single person (entrepreneur) or an entrepreneurial acting group of persons in order to manage and to develop their own company. With other words, our attention is on entrepreneurs that are able to link resources from multiple countries and/or sell their products or services to international costumers.

In difference to McDougall’s first definition of international entrepreneurship we not focus solely on “born globals”. However, entrepreneurial acting managers of SMEs that are not the owners of these firms are excluded from our investigation. To be contrary to Wright and Ricks (1994) we don’t regard International Entrepreneurship as firm-level activity.

2.2 Explanatory Approaches of International Entrepreneurship

McDougall et al. (1994) argued that traditional international business theories are not applicable to “born global ventures”. According to these authors each of the traditional theories has several assumptions about the nature of the market or the sources of competitive advantages to be derived within certain market structures. Many of these assumptions do not match the characteristics of “born international” new ventures.

Bürgel (2000: 54) states that international activities of start-ups are not incompatible with theories of international business per se. The extent to which start-ups compete internationally has to be the starting point of any evaluation of these theories. Schmidt-Buchholz (2001: 269) found that established theories could only explain several aspects of why young firms rapidly internationalize. However, often several persons in start-ups companies are the driving force behind internationalization. Their behavior, background and intentions, are not part of traditional internationalization theories.

We suggest that an integrated framework of International Entrepreneurship should take into account international business theory as well as intra-personal factors that bear international new ventures. Following a feasible framework is presented. For other framework suggestion see for example Oviatt and McDougall (1994), Schmidt-Buchholz (2001), Zahra and George (2002) or Yeung (2002).

2.3 Factors Influencing Transnational Activities of Entrepreneurs

Transnational activities of firms range from exports through licensing, contracts, franchising to foreign direct investment. They represent alternative strategies to enter and serve foreign markets or to provide a firm with resources. They vary in respect to resource commitment, level of perceived business control and involved risks.

On the one hand, the causes of international commitments can be found in the nature of the business itself. Factors are for example: the need for special resources and inputs, limited domestic demand, the intensity of domestic competition and so on. Finally they result in the realization of competition advantages.

On the other hand, there are factors that are situated in the entrepreneur's person itself, such as knowledge and experiences, intentions, characteristics. The entrepreneur's background and his intra-personal skills are important when explaining international entrepreneurship. Further factors that influence decisions on how, when and where the firm should engage across borders can be located in the respective environment. All factors within the suggested framework are presented in figure 1.

Insert figure 1 here.

3. INTERNATIONAL ENTREPRENEURSHIP: THREE CASES FROM THURINGIA

In June 2003 we interviewed six young entrepreneurs from international active start-up companies in Thuringia. Three studies out of these six had been chosen for presentation as case studies in this article.

One of the cases refers to the entrepreneur Jörg Schilling and his firm **Schilling Spezialbeschichtungen GmbH** (Schilling Special Surface Treatments Ltd.). This company deals with special surface treatments like color case hardening which is a process to change iron surfaces to steel. By the very quick cooling, the steel becomes harder and gets also during the cooling process the special marble colors.

Jörg Schilling studied precision mechanics at the University of Jena. From 1993 to 1998 he worked as an engineer for a small company in Thuringia that produced hunting and sport guns. In 1998 he decided to join a research project with special emphasis to color case hardening. Within the scope of this project he established contacts to the University of Chicago. Here he found a mentor and a laboratory where he analyzed his research results.

In the year 2000 the research project was finished. Because of his desire for self-realization and his professional and personal intentions Schilling decided to become an entrepreneur on the basis of his research results. He applied in Thuringia for a start-up program and received support by the Thuringian Government for two years. During this time he undertook some further research in the process of color case hardening and developed a business plan.

The initial idea of his business was to deal with color case hardening for iron parts of hunting and sporting rifles and shotguns. However, because of the very limited market volume, a short time after Schilling started his company in 2000 he strived for a diversification of his business. He attempted efforts to enter the market of the automotive supply industry and the consumption and luxury good industry like jewelry and clock production. And he succeeded. At the same time he became aware of the opportunity to sell his products und services also to costumers abroad.

Nowadays his firm has 5 employees. Only 3 years after starting the company Jörg Schilling is able to acquire customers from the UK, Norway, Austria, France, Italy, the USA, Argentina, Chile and South Africa. He regularly attends international trade fairs or visits potential business partners abroad. And he is still in contact with his mentor at the University of Chicago.

The second case study deals with the company **WERNER BioAgents** that was founded by Gisela Werner in Jena-Cospeda on January 15th, 2000 as a spin off of the Hans Knöll Research Institute. Dr. Walter Werner, husband of the entrepreneur, worked as a chemist in the institute until his retirement and supports Gisela Werner in all their activities. Depending of the economic situation there is planned to engage a second employee in the firm.

The objective of WERNER BioAgents is to pursue a mail-order business for a worldwide sale of selected natural products and biologically active compounds that are used in the Biotechnology and Gene technology as well as for Pharmaceutical and Molecular Biological Research. Regarding the number of sales between the ten chemical products the main focus is on “clonNAT”, the trade name of the antibiotic nourseothricin. This substance was developed in the former GDR by Hans Knöll Research Institute and it was used to increase the flesh production in livestock breeding.

After the Reunification of Germany “clonNAT” was forbidden as a drug in human and veterinary medicine. Dr. Werner discovered a new application using the broad activity spectrum of this natural product that also inhibits bacteria, mykobacteria, yeasts, fungi, viruses and plants.

Together with resistance genes “clonNAT” can be used as an alternative selection system for microbial applications and for modern plant cultivations. After offering the product free of charge at international trade fairs and congresses between 1992 and 1998 a Canadian client places the first order in 1999. The way into self-employment for the married couple was opened by an exclusive contract with Hans Knöll Research Institute that ensures the production, marketing, and exclusive worldwide sale of “clonNAT”.

After this first order the sales of “clonNAT” rose up steeply, especially in the USA and Canada which are still the main zone of distribution. Meanwhile WERNER BioAgents is exporting in all over the world, the customers are universities, research institutes and pharmaceutical enterprises. In March 2003 the internationalization of WERNER BioAgents suffered a serious crisis caused by the political attitude of the business partners. Due to the Iraq war the main market USA failed, the turnover dropped extremely. The efforts in other markets couldn't compensate this downward trend. Recently, because of the end of the Iraq war, the demand is coming up slowly. The exchange rate alteration of the Euro is another concern expressed by the international orientated entrepreneurs: A strong value of the Euro endangers the sales numbers in markets outside the Euro zone.

The arrangement and extension of international contacts are effected mostly at trade fairs, meetings, conferences and congresses as well as throughout personnel contacts. Since famous scientists of the field support “clonNAT” in publications the international reputation of the product is growing and increases the demand. Because of the uniqueness of “clonNAT” in many cases potential clients addresses themselves to WERNER BioAgents.

The third case presented in this paper is **LightTrans GmbH**. That company was founded by Petra Wyrowsky in January 13th, 1999 as an university spin off with two computers and two students. Her husband, Frank Wyrowsky, is Professor in the field of technical physics at the University of Jena since 1997. He worked with students in different research projects on „optical engineering“ and „software development“ and realized several projects in co-operation with SMEs. Because of the increasing number of inquiries for research and for results thereof on the part of international acting enterprises Petra Wyrowsky decided to start their business on that. Nowadays LightTrans GmbH has five full-time employees and three students, which will be taken over after the end of their studies.

The mission of the entrepreneurs was to develop and commercialize a virtual optics laboratory, specialized on wave-optical engineering, since there was no competitive product in the German market and only one big optical center in Finland. The outcome was a software package called “VirtualLab“, the new version VOL4® VirtualLab will be released in summer 2003. Other production lines are Beamshaping, Beamsplitting and Light Diffusing, which are internationally in demand. Beyond it LightTrans GmbH offers individual services in the field of optical design and analyses as well as software training courses for customers.

As LightTrans GmbH does not have at his disposal a manufacturing plant for moduls of light variation it joined the “Jena Photonics Fabrication Network“. This network of SMEs presents

flexible and unified production capacities and clean room facilities. Other fabrication partners are from Finland and Russia.

The world-wide demand for Professor Wyrowsky's optical engineering services and products actually was the reason for the creation of LightTrans GmbH. Therefore it already entered into the market as an international operating firm. First customer was a Philips spin off from the Netherlands, pursued by inquiries for service modules from Finland and Switzerland. Meanwhile LightTrans GmbH has a wide-ranged spectrum of clients in Europe, USA and Japan. A financial subvention of the German Chamber of Commerce made possible the entrance in the Asian markets. Throughout a commercial travel, personal contacts and an agent in the place many Japanese firms became customers, for example Canon, Ricoh and Fuji. Also the growing Indian market is opened up by means of an commercial agent.

Beside the production and exportation LightTrans GmbH researches abroad on new designs and manufacturing processes for optical elements. With the financial aid of a European Union project the University Joensuu in Finland is a permanent research partner since the creation of the firm. In R&D there is also a co-operation with a Swiss enterprise.

Managing Director Petra Wyrowsky is convinced of the advantages that offer the international orientation of her firm. Except some difficulties with customs clearance or transport damages there never have been doubts about this strategy. Trade fairs and conferences are the main source of contacts, frequently potential clients addresses themselves to LightTrans GmbH. The German Chamber of Commerce, other public and private foundations as well as the Thuringian network "Optonet" provide the necessary information about the characteristics of the foreign markets.

4. CONTRIBUTIONS TO AN INTERNATIONAL ENTREPRENEURSHIP THEORY

Our investigation supports the importance of the entrepreneur itself in the internationalization of his firm. He is the driving force behind the internationalization process. Thus, he had to become the center of the international entrepreneurship research.

All of the interviewed entrepreneurs their selves were responsible for the contact to costumers and partners abroad and they had initialized the internationalization of their firm. However, all of the firms were small and usually there were no other persons responsible for management tasks. Nevertheless, the role of the entrepreneurs seems under-evaluated in academic literature. We suggest that further research in International Entrepreneurship should focus stronger on the person of the entrepreneur.

The kind of transnational activities varied between the respective firms. In the case of research-intensive products and services there is often cooperation with foreign universities or research institutions. The majority of surveyed firms export goods and services. The reason therefore can be reduced to the unique product of the firm that is not available elsewhere and to the restricted national demand for a very specialized product.

Three firms of the sample of six were established since there was a strong demand from abroad for a special technological solution. These firms can be considered as "born global". Other three firms initially were founded to supply national markets.

When trying to explain the internationalization of small entrepreneurial firms we suggest to tell apart between "born globals" and firms that became global during its developing process ("made globals"). As "born globals" are international active from inception the internationalization process is different from those firms that increased their involvement in international operations over a certain period of time. Also motivations to internationalize may differ.

Table 1 gives an overview on the reasons and factors responsible for the internationalization of all firms interviewed.

Insert table 1 here.

The example of Jörg Schilling reflects the relevance of the internationalization process theory (Johanson and Vahlne 1977) that predicts that technology-based start-ups are oriented to the domestic market until a certain degree of market penetration is reached. After a certain time, when the growth potential in the home market has been realized, the firm might turn its attention towards expanding into foreign markets (Bürgel 2000: p. 39). However, in the case of Schilling Spezialbeschichtungen GmbH the entrepreneur has considered internationalization at the very beginning.

The Johanson and Vahlne's model fails to explain the internationalization behavior of WERNER BioAgents and LightTrans GmbH. These cases can be explained to some extent by firm specific advantages, in special by the resource-based view and unique assets (Collis 1991). Young, highly specialized companies offer an innovative solution that no competitor can match. Both firms were established because entrepreneurs took the opportunity to bridge a gap in the (international) market. They only could do this because of their background and specific knowledge. And from inception they regarded the global market as their relevant market.

In addition, the case of LightTrans GmbH match the conditions described by transaction cost economics (Williamson 1981). In transaction cost economics, the emphasis is placed on finding the most efficient institutional or contractual arrangement for economic transactions (Bürgel 2000, p. 42). LightTrans GmbH took use of several cross-boarder networks to produce modules (because it has no proper production plant) and it is engaged in research with foreign partners. Thus, internationalization helped to lower costs by running some transactions externalized.

In accordance with other authors (e.g. Bürgel 2000, Schmidt-Buchholz 2001) we support the conclusion that existing theories of international business can explain specific aspects of the internationalization of young firms. But these theories only give an explication of several aspects. Thus, the integration and a comprehensive view is necessary to achieve an integrated theory of International Entrepreneurship.

5. MANAGERIAL AND POLICY IMPLICATIONS

Our research within the scope of International Entrepreneurship has shown that the majority of technology-based start-ups in Thuringia strive for international business contacts. Some firms had been international from inception; other firm had become international a short time after doing business in domestic markets. We found that in any cases the entrepreneurs were the driving force behind internationalization strategies.

Unfortunately, on the base of the surveyed cases we are not able to make general suggestions for the management of young enterprises. It is difficult to give a statement on whether firms that follow a rapid internationalization strategy have a better performance than others. Further research must be done in this direction. Not only for managers but also for policy makers it would be interesting to know if there is a correlation between internationalization and the growth rate of the firms. Several studies indicate that early-internationalized companies are not more successful than others per se. (McDougall and Oviatt 1996; Knight 1997)

However, we suggest entrepreneurs and managers to check the following questions:

- Does there exist a demand for the company's products in foreign markets? Does the company have a unique product without any or only some competitors from abroad?
- How big is the national market for the company's product? Will the company sell enough products to compensate the high investments in R&D?
- What are the advantages of going global? Are there any risks in doing business abroad?
- Do I have international experience? How can I bring in this experience to build up international contacts and to sell my products internationally?
- Are there any possibilities offered by local universities or research institutions to find research partners abroad for joint research and development projects?

Policy makers and promoters of new enterprises, especially of technology-based firms, should be aware of the importance of international activities for young innovative firms. Entrepreneurs can provide their venture with resources that are not available in the home country, look for research partners to solve special technical problems, sell their products to the global market to realize economies of scale, and finally gain competitive advantages.

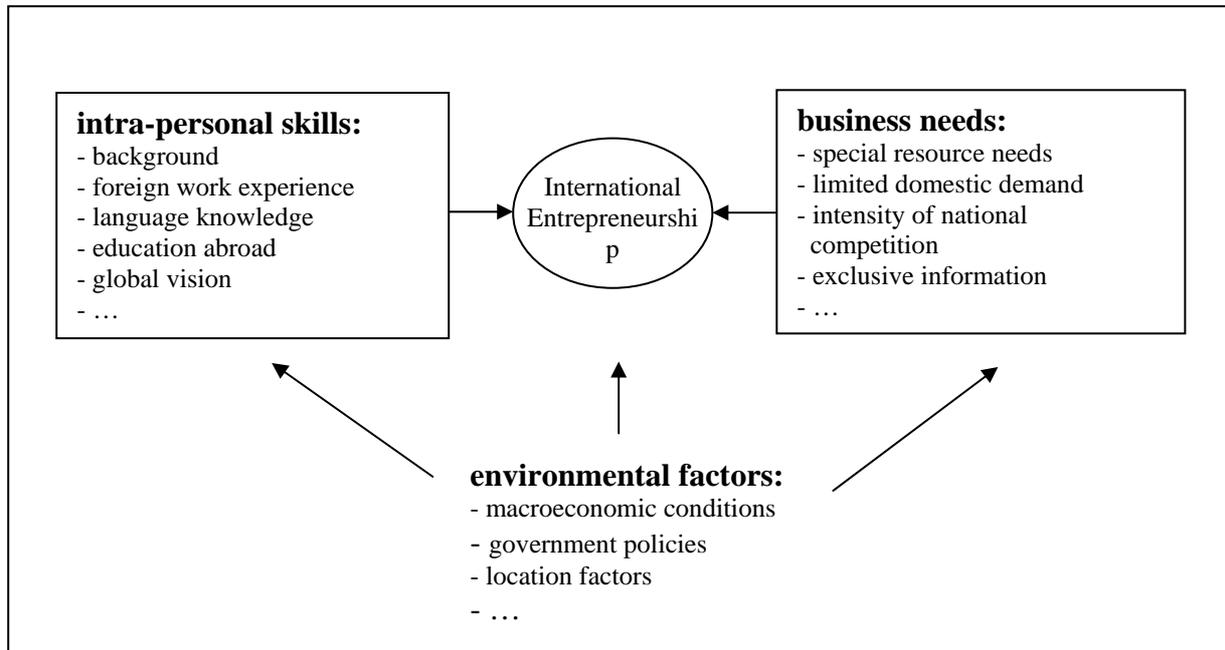
To support young entrepreneurs in doing so a suitable infrastructure and a network of professionals across boundaries is helpful. For that reason Thuringia is also exerted to support regional networks as well as the creation of international networks of universities, politics, industry and the start-up community.

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FIGURES

Figure 1: Factors influencing internationalization decisions of entrepreneurs



TABLES

Table 1: Main reasons for Internationalization

| The company is international... | Reasons for Internationalization (multiple entries possible) |
|---------------------------------|--|
| - from inception (3 firms) | - international demand for a specific technical solution or a specific product (3 firms) - cooperation within a network of foreign partners in the supply of goods and services (2 firms) |
| - not from inception (3 firms) | - company was established to serve national demand; because of reputation or unique products and services customers from abroad could be acquired (2 firms) - company acquires costumers from abroad to raise their sales because of the limited national demand (1 firm) |