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Open innovation in small and micro enterprises

Katja Hutter
Austria
Julia Hautz
Austria
Karina Repke
Germany
Kurt Matzler
Austria

Abstract

Open innovation has become a key strategic element to increase the generation and commercialization of innovations among big companies. Small and medium-sized firms (SMEs), that exhibit particular characteristics regarding organization, culture and strategy, have been more reluctant to adopt this approach. Thus little research exists on the adoption of open innovation among SMEs, and small and micro companies in particular. The paper presents the results of an explorative research design based upon semi-structured and narrative interviews that investigates particularities of small and micro firms regarding the sources of innovation, the strengths and weaknesses of their innovation process, and the potential of open innovation based on Web 2.0 technologies

Keywords: small and micro firms, Web 2.0, open innovation

Introduction

In the age of globalization, complex technologies (Nonaka, 2007), shortened product life cycles, and increasing interconnectedness of customers (Tidd and Bessant, 2005), companies depend on their ability to innovate in order to achieve competitive advantage and ensure survival. As a consequence of this intense competition, research on innovation management has proposed and described a shift from the traditional “closed” innovation model toward an “open innovation” paradigm (Chesbrough, 2003). The systematic opening of innovation processes thereby includes effectively exploiting external sources of knowledge (Chesbrough, 2003) and seeking new ways of commercially exploiting internal knowledge and intellectual property (Chesbrough and Crowther,2006). These in-bound and out-bound innovation processes are further supported by the rapid development and application of a variety of Web 2.0- based information and communication technologies that simplify the relationship with stakeholder groups and enable new ways of networked collaboration (Lagrosen, 2005). Many large firms such as IBM, Procter & Gamble or Eh Lilly have already successfully adopted the open innovation approach. The McKinsey Enterprise 2.0 study shows that in 2008, 60-70% of large, established companies were already using Web 2.0 technologies to integrate customers and external experts into their innovation processes (McKinsey, 2008). It has been suggested that this open innovation approach, especially supported through new Web-based technologies, might also offer benefits and advantages for SMEs to funded by the Regional Operational Programme for the Autonomous Province of Bolzano 2007-13 - Programme under the Regional Competitiveness and Employment Objective, co-funded by the European Regional Development Fund (ERDF). balance out prevailing size disadvantages toward large firms (Petersen et al., 2002). However, recent studies show that only 5-20% of SMEs actively engage in open innovation activities (OECD, 2008). Also, the majority of current academic research on open innovation focuses on large, multinational corporations mainly embedded in high-tech industries (van de Vrande et al., 2009). The limited number of recent studies on open innovation concerning SMEs are providing important insights, but they have been fragmented to date and still leave space for speculation and incongruence (Bianchi et al., 2010). Many of these studies focus on one type of open innovation activities (Bianchi et al.,

2010), mostly cover in-bound innovation activities (Parida et al., 2012; Lasagni, 2012) or do not consider small firms or “micro-firms” (van de Vrande et al., 2009; Parida et al., 2012), often radical innovators in their field. Furthermore, these previous studies on open innovation in SMEs have neglected the potential of Web 2.0 technologies and platforms and related concepts such as crowdsourcing (Howe, 2008), cocreation (Winsor, 2005), or user innovation communities (von Hippel, 2005). Therefore, even though previous studies have made important contributions to the literature and management practices alike, there is a need for additional work to advance the knowledge regarding open innovation activities in the SME context (Colombo et al., 2012).

Therefore, the main goal of this paper is to gain a deeper understanding of the current adoption of open innovation by SMEs and how open innovation might help overcome difficulties associated with the innovation process of these firms. In our paper, we will pay special attention to small and micro companies and their peculiarities as well as considering the potential opportunities provided through online Web 2.0 technologies. Our empirical analysis will address three research questions. First,
we will examine which priority open innovation processes are given among small and micro firms as well as the extent of adopting these concepts. Second, we will attempt to gain more accurate insight into what motivates and what hinders small and micro firms in adopting the open innovation approach, including both in-bound and out-bound aspects in our analysis. Finally, this study will assess how Web 2.0 technologies can serve as an intermediary in supporting small and micro firms in their open innovation activities.

In doing so, this paper is descriptive and explorative in nature. First, it gives an overview of the concept of open innovation and the differentiating characteristics of SMEs and micro companies with respect to how they engage in innovation activities. Second, we review the existing literature on open innovation activities in SMEs followed by an explanation of the qualitative approach applied in our study. Finally, we discuss the results in the fight of existing theory and summarize their theoretical and managerial implications.

1. Literature review

1.1. The concept of open innovation. Today, shortened product life cycles, constantly growing costs of technology development, more rapid information flows, and increasingly interconnected customers

(Tidd and Bessant, 2005; Chesbrough, 2007) have supported a paradigm shift toward an open approach to innovation which includes "[...] the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively" (Chesbrough, 2006, p. 2). Therefore, the innovation processes are opened up in two directions (Rufat- Latre et al., 2010; Lasagni, 2012), with the major goal of better exploring and exploiting innovation opportunities. In-bound open innovation refers to the practice of exploring and integrating external knowledge sources for technological development, while out-bound open innovation includes exploiting technology by also using external paths of commercialization (Chesbrough, 2003). A large number of studies that investigate different aspects of the open innovation paradigm and its favorable consequences - an increase in innovation profitability, growth, revenues or increased knowledge bases and customer satisfaction - are available in innovation literature (See e.g. Special Issues in Technovation, R&D Management or European Journal of Innovation Management). Also a variety of studies discuss many examples of almost exclusively large companies such as BASF, Eli Lilly and P&G that have successfully implemented the open innovation approach.

A large share of research on the opening of the innovation process also highlights the important role of online information and communication technologies (ICTs) and Web 2.0-based applications. The rapid development of these technologies offers numerous interactive and inexpensive opportunities to facilitate the opening of the innovation process in both directions through supporting access to external ideas and the identification of new market opportunities for existing ideas. Depending on the individual business context, companies can make strategic use of social networks (Marandi et al., 2010), online communities (Spaulding, 2010; Dahlander et al., 2008), virtual worlds (Kaplan and Haenlein, 2010; Kohler et al.,2011), or idea and design contest and tournaments (Morgan and Wang, 2010) to support and open their innovation process. 70% of large corporations have been found to rely on forms of social technologies to implement the open innovation approach to developing new products and services (McKinsey,2008). The use of these new technologies is a particularly promising strategy in the idea generation stage of the innovation process, when firms seek first ideas and design concepts, aim to identify important trends, or get possible directions for future products (Morgan and Wang, 2010; Terwisch and Ulrich, 2009). Various online platforms have been

established which feature questions covering a wide variety of subjects and thereby aim to leverage the creativity, skills, insight and intelligence of billions of individuals on the Web (Terwiesch and Xu, 2008). For example, InnoCentive, an online innovation platform founded in 2001 by Eli Lilly, shows how online technologies successfully connect innovation seekers, companies, and potential solution providers such as creative individuals, designers, retired employees, scientists, suppliers, or other enterprises for new ways to generate idea, find solutions and integrate external knowledge with unconventional and creative results (Lagrosen, 2005). In addition, social technologies on the Web can support later stages of the innovation processes, help to identify new application opportunities or entire markets and support firms' marketing, sales or service activities (Bemoff and Li, 2008)

1.2. Innovation and company size. Despite anecdotal and empirical evidence of the effectiveness of the open innovation activities of large firms, these concepts cannot be transferred readily to micro, small and medium enterprises. SMEs are clearly different from larger firms with respect to how they innovate and consequently can use open innovation activities for innovation outcomes (Farida et al., 2012). A company's size and effect on innovation have been broadly discussed in the literature (Edwards et al., 2005; Plehn-Dujowich, 2009; Golovko and Valentini, 2011), where the assumption that research and development productivity declines with firm size still prevails (Arias-Aranda et al., 2001). The question of SMEs' innovativeness is particularly interesting because of the growing importance and the increasing contribution of SMEs to the global economy in promoting growth and employment opportunities (Bednarzik, 2000; Hoffman et al., 1998; Bianchi et al., 2010; Chesbrough, 2010; OECD, 2000; European Commission, 2005). "Micro, small and medium-sized enterprises (SMEs) are the engine of the European economy. They are an essential source of jobs, create entrepreneurial spirit and innovation in the EU and are thus crucial for fostering competitiveness and employment" (European Commission, 2005). In the European Union 99,8% (20,9 million) of enterprises active within the EU- 27's non-financial business economy in 2008 were SMEs (Eurostat, 2008). Together they accounted for two out of every three jobs (66,7%) and for 58.6% value added within the non-financial business economy (Eurostat, 2008). SMEs play an essential role in economic and technological development (Kaufmann and Tödtling, 2002). SMEs have been a source of successful innovation based mainly on their degree of

customer orientation (Rogers, 2004; Scozzi et al., 2005; Bianchi et al., 2010), flexibility (Narula, 2004) and ability to quickly detect innovation opportunities. Compared to large firms, these characteristics permit a more rapid response to market shifts and changes in demand (Scozzi et al., 2005). Moreover, SMEs enjoy the benefit of less bureaucracy, flat hierarchies and more efficient information exchanges, which in turn favor the creation of an innovation supporting culture (Laforet, 2008). Typically SMEs can rely on more specialized knowledge in a very certain industry or product range. Due to their restricted geographic reach, they are more locally embedded than their larger counterparts (Ereel, 2003). This enables them to adapt and specialize their products, services and innovation attempts perfectly to the markets they serve (Hausman, 2005; Madrid-Guijarro et al., 2009; Bianchi et al., 2010).

At the same time, innovation usually also bears risks and substantial challenges for SMEs because of their structural disadvantages based on their “liability of smallness” (Chesbrough, 2010). SMEs’ financial resources (Madrid-Guijarro et al., 2009; Ereel, 1999; Carpenter and Petersen, 2002) and opportunities to spread risk among their small portfolios are often limited (van de Vrande et al.,2009). Owing to a lack of economies of scale and scope (Nooteboom, 1994), small enterprises tend to keep a smaller part of R&D in-house than large firms (van de Vrande et al., 2009). Moreover, they rely on less human resources (Hausman, 2005) and therefore have to deal with a lack of a broad multidisciplinary competence base (De Toni and Nassimbeni, 2003; Cooper et al., 2003). These restricted internal resources reduce access to new technologies and the ability to engage in innovative efforts (European Commission, 2005; Pittaway et al., 2004). SMEs often lack structured internal knowledge sharing, gathering and utilization (Varis and Littunen, 2010), and the purposive establishment and fostering of an innovation culture (Terziovski, 2010). Innovation performance is negatively affected by the absence of sophisticated hierarchical structures (Jones and Tilley, 2003). Generally, SMEs lack sufficient capabilities and structures to fully implement and structurally manage the entire innovation process (Edwards et al., 2005; De Toni and Nassimbeni, 2003; Vossen, 1998). Only a small number of SMEs can profit from intellectual property in a sustainable way (Chesbrough, 2010). They experience more difficulty in the successful implementation of the innovation process, including successful comer- cialization, than in the invention or idea generation phase itself (Gans and Stem, 2003; Bianchi et al., 2010;

Hotho and Champion, 2011). SMEs do not possess complementary assets needed to market and commercialize innovations (Gans and Stem, 2003), which often leads to spontaneous, unstructured and ineffective market introductions and activities within small enterprises (O'Dwyer et al., 2009).

1.3. Open innovation in SMEs. Successful innovation raises the chances of SMEs' survival by 22% (Golovko and Valentini, 2011; Cefis and Marsili, 2006). Therefore, it is essential for SMEs to overcome the "liability of smallness" that restricts their ability to innovate successfully. Previous studies support the idea that the open innovation approach can offer promising ways for small firms to overcome their difficulties and increase their innovation success and profitability, and therefore ensure their competitiveness and survival (Gass- mann et al., 2010; Hotho and Champion, 2011; Chesbrough, 2010; van de Vrande et al., 2009). However, despite extensive research in the field of SMEs innovation (Hotho and Champion, 2011) and explicit differences between larger and small firms, only a few studies have focused on a more open- oriented innovation concept in small and mediumsized companies (Colombo et al., 2012).

Recently, research interest has grown regarding the adoption of open innovation in small and medium sized firms. According to Parida et al. (2012), SMEs could gain greater benefits from open innovation than larger enterprises due to characteristics such as less bureaucracy, increased willingness to take risks, and faster ability to react to changing environments. However, van de Vrande et al. (2009) confirm that large firms still embrace and use open innovation activities to a larger extent than small firms. Van de Vrande et al. (2009) conclude that the bigger the firm, the more likely open innovation practices are applied. In their sample, medium-sized firms were found to apply open innovation practices significantly more often than small enterprises. Furthermore, a recent study conducted by Ebersberger et al. (2010) provides evidence that the probability of open innovation implementation in SMEs is lower than in large enterprises. In relation to the amount of external collaboration, SMEs tend to engage in fewer strategic alliances with other firms (Narula, 2004). This is in line with the findings of Ebersberger et al. (forthcoming) who found a lower propensity of SMEs to collaborate with any type of external collaboration partner. A possible explanation for these findings could be the "liability of smallness" related to the limited internal resources that can be dedicated to open innovation efforts and even limited management knowledge of the open innovation paradigm.

Taken in light of previous research by Keupp and Gassmann (2009), it can be inferred that firm size does matter in terms of open innovation adoption and implementation. Van de Vrande et al. (2009) suggest the great barriers for adopting open innovation practices are related to organizational and cultural issues.

Regardless of corporate size, the not-invented-here (NIH) syndrome and lack of internal commitment might be substantial factors that hamper open innovation (Chesbrough and Crowther, 2006; Lasagni, 2012; van de Vrande et al., 2009). One crucial challenge to implementing the open innovation approach in SMEs is insufficient knowledge and awareness of managers or owners (Parida et al., 2012), the usual decision makers in SMEs, who usually have a technological background (Bougrain and Haudeville, 2002). Due to their restricted abilities to spread risk, SMEs cannot afford to experiment with open innovation activities (Parida et al., 2012). In addition, complementary resources and a certain level of inhouse capacity are essential to using external sources beneficially (Narula, 2004). Extemalization of R&D brings along codified results. Therefore a minimum level of in-house capacity is essential to decipher and use the knowledge gathered (Narula, 2004). Before SMEs incorporate external knowledge, they need to develop and structure their own capacities (Bougrain and Haudeville, 2002).

Previous studies have found that the reduction of time-to-market and costs and risk, and the acquisition of missing knowledge are among the main motives for SMEs to apply an open innovation process (van de Vrande et al., 2009). Also, the SMEs that are successfully applying open innovation activities are mostly firms that are inclined toward in-bound or technology exploration aspects of open innovation (Bianchi et al., 2010; Chesbrough and Crowther, 2006). Therefore, customer involvement, user innovation, external networking and outsourcing of R&D tools are among the most frequently applied open innovation practices in SMEs (van de Vrande et al., 2009). Furthermore, Lasgni (2012) and Parida et al. (2012) show that in-bound activities such as the use of external relationships with suppliers, customers, universities and R&D labs for technology scouting and idea sourcing show a higher innovation performance. While SMEs tend to open up their innovation processes in the exploration stage, current literature shows that out-bound processes and the use of open innovation approaches at later stages in the innovation process are scarce (Lee et al., 2010). This is partly because the out-bound processes do not necessarily require financial investments and are less risky for the organization (van de

Vrande et al., 2009; Chesbrough, 2010). SMEs that are successfully engaged in venture activities, external participation or effective in licensing intellectual property tend to be the exception (van de Vrande et al., 2009). One of a very few studies, Bianchi et al. (2010) focus on outbound activities and provide a quick and easy-to-use methodology to identify viable opportunities for outlicensing technology. However, there is a need for more studies focusing on the out-bound dimension of open innovation in SMEs.

Previous studies also show that SMEs lag behind in the implementation of open innovation (Narula, 2004; Lee, 2007; Lee et al., 2010), especially when it includes collaborations with more powerful partners (Narula, 2004) or when small firms face a lack of capacity for the full implementation of the innovation process (Lee, 2007; Lee et al., 2010). Therefore, Lee et al. (2010) highlight the role of an intermediate organization in supporting SMEs innovation activities, where an intermediary assumes research activities, the creation of adequate collaboration structures, consulting services and targeted marketing support.

One recent study focused on the application of social technologies of the Web 2.0 as tools to open up the innovation process of SMEs (Piva et al., 2012). They investigate how collaborating with open source software communities on the Web can help SMEs overcome financial constraints and access external competencies and valuable complementary assets (e.g., complementary applications, distribution channels). However, potential of Web 2.0 innovation platforms and communities to support the open innovation activities of SMEs outside the special case of the software industry.

2. Empirical study

2.1. Research method and sample. An exploratory qualitative research design was adopted to investigate our research questions. This approach is particularly appropriate for research areas where only limited empirical evidence is available concerning the identified research question (Briisenmeister, 2000; Denzin and Lincoln, 1994; Eisenhardt, 1989). Qualitative research cases are not selected based on statistical issues but according to theoretical considerations (Glaser and Strauss, 1967; Eisenhardt, 1989). Therefore, we carried out an exploratory qualitative study among fifteen SMEs from South Tyrol (Northern Italy), mainly including small and micro firms from the craftsmen business sector. Fifteen in-depth personal interviews using a semi-structured interview guideline were conducted over two

weeks. According to the definition of the European Commission, SMEs can be assigned into three subgroups: medium-sized, small and micro enterprises, based on staff headcount, annual turnover and annual balance sheet (European Commission, 2005). As financial data is rarely available for SMEs, we relied on the number of employees when selecting our interview partners. Five of our selected companies represent micro firms with less than 10 employees, while ten of them employ between 10 and 50 employees. The sample of interviewees was selected in a way to provide a broad range of work fields in the area of craftsmen businesses including carpenters, mechanical engineers, metal workers, footwear producers, sports equipment technicians, electrical engineers, bricklayers and manufacturers of refrigeration. Twelve of the interview partners are also the owners of the respective firms, and only three were CEOs that did not own the company.

The interviewees were notified via phone and an appointment was made in advance in order to guarantee that the interviews could be conducted over the full length of 30 to 40 minutes. An interview guideline was prepared in advance based on the theoretical findings and the resulting research questions presented above. The guideline included questions concerning the main sources of innovation in their firms, the most prevalent problems within their innovation processes, and their experiences with new media, social technologies and open innovation tools. The semi-structured interviews were conducted in accordance with suggestions of empirical social research and study design (Denzin and Lincoln, 1994; Eisenhardt, 1989; Yin, 2003). The average duration of the interviews was 35 minutes and all the interviews were recorded. The empirical analysis of the interviews was consisted of four steps conducted by a research team of three people. The first three steps were done by two coders - one was the interviewer and the other was an expert in open innovation studies. To ensure that the insider’s perspective did not bias the results, the fourth step of the content analysis was conducted by an independent person.

First, the interviews were carefully perused and the collected data broadly categorized according to our three research questions. Within the first round of content analysis, meaningful sections of the interviews were highlighted, thematically structured and transferred to the next phase of analysis. In the second phase, the coder developed a variety of relevant subcategories (insight categories) for each research question and on the basis of first cognitions from the first phase. For example, for the second research question,

categories such as “extensive bureaucracy”, “missing working time”, and “lack of experience in marketing and sales” and others were defined. Then the coder analyzed the interviews again and filtered out statements, matching to these categories. The result from phase two was a comprehensive overview of more than 60 insight categories, along with their frequency. In phase three of the content analysis, categories were thematically summarized and the coders reworked the data searching for significant quotations, which are presented below. Another goal of the third step was to filter out the most essential and topic-related findings among a variety of interesting ideas. The fourth phase of analysis was realized by an independent person, who examined all findings again. The independent coder was to review the findings on a random basis and try to comprehend the data as well as the most important findings. Next, the results are presented with meaningful statements from the interviews.

3. Results

3.1. Current sources of innovation in SMEs. Concerning the main sources of innovation in small and micro firms, the interviews show that the entrepreneur/owner him/herself is still the main driving force behind technological development and very often the main source of new product ideas or the adoption of new technologies.

Interviewee 7: “Innovation is internally advanced and encouraged by the owner. ”

Also, internal sources such as employees are still considered important sources of innovation:

> Interviewee 8: “You have to consider that the majority of the ideas are generated by our employees, who are working on the front line and who have gathered a tremendous amount of experience within their specific area of expertise. Those people are the ones who come up with the most excellent ideas […]”
>
> Interviewee 12: “[…] our employees are actively involved in the development process of new ideas. I am the one responsible for condensing and implementing the best ones. Most of the decisions are made in collaboration with our employees, because without their involvement it is difficult to consequently succeed. ”

However, many small and micro businesses are making products and services with a very high consumer involvement. Therefore, in the investigated firms, there is often a very close relationship with the final customer, who is frequently a source of new ideas and stimulates the companies' idea generation process.

> Interviewee 11: "Often customers come to us with a specific problem and we find an adequate solution for them. "
>
> Interviewee 14: "Our customers have a lot of good ideas, which is why most of the time they take action when it comes to the realization of inventions. Usually we are not the initiators but we try to find adequate solutions that match our customers' ideas. "

However, as a consequence of their very customercentered approach, these small and micro firms often develop only one product prototype for a specific customer and his/her needs and requirements. The firms have difficulty assessing and recognizing whether these new prototype solutions could have potential for a broader customer base, and instead turn back to the next customer and daily business, often overlooking innovation opportunities.

Within the small and micro firms surveyed, other external sources for ideas, inventions and inspiration are mainly other corporations and partner firms.

> Interviewee 5: "When it comes to exchanging ideas and experiences with external partners, we already foster co-operations with various associated companies in Austria and Germany. On one hand, we regularly meet with them in order to discuss certain topics. On the other hand, we are able to consult them spontaneously in case of a specific problem or question. I know some other firms which are collaborating in the same way. In my opinion, such collaborations only make sense if both parties are spatially separated. A direct transfer of knowhow and certain skills between us and a direct competitor bears too much risk. "
>
> Interviewee 3: "We are meeting on a monthly basis in order to exchange our experiences and point of views. Our discussions are about the latest technologies and solutions for everyday problems. I think that there are not so many initiatives like ours in South Tyrol, because

> competitive thinking prevents firms from collaborating with other firms. In my opinion, that way of thinking is not beneficial because we all struggle with the same difficulties and together it is often much easier to find practical solutions. ”

These statements also show that small and micro firms are often confronted with a lack of experience and various uncertainties concerning the effective implementation of innovation that have negative effects on the whole innovation process. However, all the interviewees agreed that active, external support for daily questions concerning their innovation processes would enhance their innovation performance.

3.2. Barriers and problems in the innovation process. Questions concerning the main problems and barriers in the innovation process in small and micro firms revealed six main problem areas. These problems include lack of time, absence of complementary assets in the areas of marketing, distribution and sales, lack of a multi-disciplinary, broad knowledge and competence base, limited financial resources, high bureaucracy associated with innovation efforts due to complex institutional processes and policies, and risk avoidance.

3.2.1. Time. The majority of survey participants identified a lack of time as one of the main barriers to successful innovation. In order to survive, small and micro firms have to give precedence to day-to- day business, and little or no time is left for innovation projects with uncertain outcomes. In other words, the high workload and competitive pressures prevent a successful realization of innovative ideas and new products.

> Interviewee 10: “[...] alongside daily business is no time left for such projects. ”
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> Interviewee 8: “In my experience, SMEs have a lot of good and innovative ideas, but they have no time to work on them. ”

3.2.2. Complementary assets. In addition to time constraints, limited marketing knowledge and a lack of marketing strategies could be substantial barriers to successful completion of innovation projects in small and micro firms. They lag far behind medium and large competitors when it comes to a well- structured, planned and adequately supported commercialization phase of the innovation process. This limitation becomes even more prevalent when small

and micro firms have to launch new products outside their existing core markets and core customer segments and are suddenly confronted with new market conditions. With regard to the innovation process, the search for suitable markets, adequate determination of the appropriated pricing strategies and selection of marketing tools for effective communication have been identified as obstacles.

> Interviewee 6: “The difficulty is to find the right customer for a new product. In my opinion, this is one of the most important steps within the innovation process but within our firm adequate knowledge for this phase is missing. ”
>
> Interviewee 2: “The main problem is to position our product in the market and to find the right arguments for its high price. ”

3.2.3. Multi-disciplinary knowledge base. Many small and micro firms do not actively pursue innovation projects after the initial idea generation because of the difficulty of activating adequate knowledge-carriers with whom the firms otherwise would be able to compensate for their lack of knowhow. However, the limited transfer of know-how between companies is the result of regional- and business-related thinking. More than half of the firms surveyed criticized small and micro firms’ competitiveness, which renders cooperation nearly impossible.

> Interviewee 6: “[...] there exist many firms which fear direct competition. In my opinion, they have to overcome their worry and they have to think in a global way. ”
>
> Interviewee 8: “At this point of the innovation process, I would need the support of large companies, especially for technical and very detailed questions. I do not have the adequate knowhow for such details, but I don’t know who to ask. ”

Moreover, this demonstrates that the market does not always offer qualified staff, and because of limited resources, there is no possibility to train the staff within the firm.

3.2.4. The interviews also revealed that the high costs of technological development and limited financial resources are challenging the innovation efforts of small and micro firms. The decision makers in SMEs, who have a technological rather than an

economic background, often have difficulty analyzing project-related risks and the realization of future-related investments. These problems lead to a high level of insecurity and skepticism.

> Interviewee 2: “The financial part is a huge problem for us. Up to now, we have raised all financial means by our own and we don’t know if the final profit of the new product will be high enough to compensate for these investments. ”

3.2.5. Public funding and bureaucracy. Since governments have recognized the essential role small and micro firms play in future economic and technological development, particularly in mature Western economies, encouraging and improving the innovative potential of small and micro firms remains at the heart of policy initiatives that provide a wide range of financial support for innovative projects (Edwards et al., 2005). However, the application processes for this financial support are complicated by extensive bureaucracy that results in long processing times.

> Interviewee 4: “[...] we have an office that deals with the allocation of public funding for innovative projects. The problem is that the applicant has to be aware of a waiting time of 1 to 3 years for the actual payment of the money. This is a huge problem for small businesses. ”

Most of the interviewees also identified public and institutional bureaucracy associated with projects as one of the main obstacles in their innovation process. The interviewees from small and micro firms criticized the working methods of existing institutions that are, for example, supposed to support businesses in their innovation process in order to reduce the burden of bureaucracy and to create the necessary scope for other projects.

> Interviewee 10: “The bureaucracy is a huge problem. We would have a lot of good ideas, but a successful realization is nearly impossible. ”
>
> Interviewee 3: “With their bureaucracy, the local policy and the state leave little or no scope for new ideas. ”

3.2.6. Risk avoidance. Some of the respondents state that they are afraid to realize innovative projects and are aware that the same situation persists in other businesses, too. In their opinion, the main

rea-son for this problem is the prevailing “think local, act local” mentality of many SME business owners.

3.3. The potential of open innovation practices based on Web 2.0 and social technologies. Many of the problem areas identified could be eased and supported through the adoption of open innovation practices based on Web 2.0 and social technologies. Therefore, in the course of the interviews, decision makers in small and micro firms were asked to provide information about their perceptions, attitudes toward and actual use of these new forms of media. Furthermore, the open innovation platforms and idea and design contests as well as their strategic uses and possibilities were introduced to the interview partner based on the best practice example of InnoCentive, the SPAR Bag Design Contest and the Swarovski Jewelry Design Contest. The results show huge differences between the companies surveyed in term of active use, acceptance and curiosity toward new technologies.

It is obvious that the Internet already plays an important role in the small and micro firms investigated in the study, because they are using it to inform themselves about new technologies, products and competitors. However, corporate Web sites are mainly used for a fast information exchange and for promotions aimed at targeted customers.

> Interviewee 1: “We are actively using our home page to illustrate our products and to inform potential customers about our services. We are very happy about the results we achieve with this tool. ”
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> Interviewee 2: “The Internet is essential for us, because it offers a huge amount of specific information that is needed to offer even better solutions for our clients and to stay up to date. ”
>
> Interviewee 5: “We are trying to use the Internet in the best possible way. [...] If necessary we are also open for new ideas and we are willing to try new things. ”

Based on the best practice example of InnoCentive (Eli Lilly and Company), the interviewees were introduced to the strategic use of online platforms in the innovation process. This kind of tools was mostly unknown to them but they showed great interest in this topic and could identify potential areas of support and advancement. More than half of the managers surveyed said they would participate in such a know-how transfer.

> Interviewee 9: “This could be very interesting for all of us, especially when it offers the possibility to get trustful partners and to develop long-term collaborations with other firms. ”
>
> Interviewee 15: “That would save us a lot of time. Also in the case of questions concerning commercialization and marketing...so that we could have support along the whole process. I think this is a great idea. ”
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> Interviewee 11: “I think many firms have great ideas, but they have no clue what to do with them to transfer them to successful products here. Such a project could help. ”

Also tools such as idea and design contests were introduced to the interviewees by presenting best practice cases such as the SPAR Bag Design Contest or the Swarovski Jewelry Design Contest. The positive responses show that this kind of innovation tool has a great potential to find wide acceptance among the small and micro firms.

> Interviewee 4: “I like this idea! This could be an interesting tool for future projects!”
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> However, the need of an intermediary role of the platform used becomes apparent.
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> Interviewee 14: “I am skeptical. Small firms will not invest a lot of time to establish and manage online platforms. I am reserved as such a tool has to be managed and cannot run on itself. ”

Discussion and conclusions

Drawing on the empirical study it can be concluded that small and micro firms encounter various problems within the frame of realizing innovation processes. In particular, limited financial resources, a lack of time as well as knowledge may cause disadvantages with respect to larger firms. Furthermore, huge difficulties concerning capabilities in the areas of marketing, distribution and sales, could be identified, which may increase the risk of innovation failure dramatically. According to existing literature also structural disadvantages (van de Vrande et al., 2009), missing economies of scale and scope (Nooteboom, 1994), difficulties in networking, inadequate capacities and their specialized knowledge basis (Bianchi

et al., 2010) can have negative effects on the innovation capability of small and micro firms.

The surveyed small and micro firms may have the prerequisites for the adoption of a more open- oriented innovation process. They are already strongly customer-oriented as they often provide unique products, which require high customer participation. Hence, unlike their larger counterparts they are used to collaborate directly with their customers and to perfectly respond to their needs. Not only managers are the driving forces behind the generation and development of new ideas, but also customers, employees and other corporations are accepted as sources for invention. This study supports theoretical assumptions, which point out that small and micro firms have recognized the importance of innovation and as a result are willing to overcome their difficulties within the innovation process (Bianchi et al., 2010; Cefis and Marsili, 2006). In the procedure of finding more adequate and open workflows and processes, they are even willing to test and if necessary, to follow latest technology and Internet trends.

Furthermore, the prerequisites of the surveyed firms are very good for the strategic application of new open innovation tools which can help them in overcoming some of their natural limitations and therefore increase their significance in the competitive landscape (Hamill and Gregory, 1997). Moreover, via the application of external knowledge sources the entire innovation process can be accelerated and improved and missing competencies and knowledge can be compensated.

However, our findings also highlight that despite their superiority regarding invention and idea generation, SMEs are often stretched to their limits at the commercialization stage. Consequently, SMEs should attach importance to the latter phased of the open innovation model (Lee et al., 2010) and focus more on either brining some of their new ideas successfully to the market or finding new markets for exiting products and technologies. Out-bound open innovation activities could offer new possibilities to apply and market inventions and good ideas effectively, even if they cannot be realized internally. Through the use of online initiatives and platforms small and micro firm might be further able to get help and support in solving their marketing and sales problems, as these initiatives represent cost-effective possibilities for strengthening this knowledge-base and capabilities (Howe, 2008). Through using the support of Web 2.0 technologies in applying open innovation practices information generation can be simplified and market and trend research

effectiveness can be increased, for companies of all sizes. Even if small and micro firms still do not make full use of these social technologies, the investigated firms demonstrate a positive attitude concerning these tools and are willing to adapt them in future if necessary.

Additionally, our empirical study confirms the assumption that small and micro firms should be actively supported by an intermediary - e.g. an agency, public institution..., in adopting openinnovation practices, like detecting potential external partners and sources for innovation, creating a company's network or establishing and managing Web 2.0 based initiatives. Thereby, strong competitive thinking as well as a focus on selfinterests can be an obstacle for collaborations and partnerships. In this context, small and micro firms have to learn how to establish adequate win-win situations for all parties involved and how to exploit external knowledge sources effectively.

Despite the insights generated, our study also has some limitations. Larger scale quantitative studies are needed to validate the results and to investigate if small and micro firms from other sectors and countries also experience comparable problems concerning their innovation processes. Further, it might be interesting to explore if small and micro firms increase their ability to successfully realize and launch new products when receiving external support. Finally, research should investigate in more detail how Web 2.0 based technology like online idea and design contests, innovation platforms and other open innovation tools, which can serve the roles of intermediaries, have to be adapted in order to especially serve the needs and questions of small and micro enterprises and enhance their innovation productivity.

References

1. Arias-Aranda D., Minguela-Rata B. and Rodnguez-Duarte A. (2001). Innovation and firm size: an empirical study for Spanish engineering consulting companies, European Journal of Innovation Management, 4 (3), pp. 133-141.
2. Bednarzik R.W. (2000). The role of entrepreneurship in U.S. and European job growth, Monthly Labor Review, 123 (7), p. 3.
3. Bemoff J. and Li C. (2008). Harnessing the Power of the Oh-So-Social Web, MIT Sloan Management Review, 49 (3), pp. 36-42.

4. Bianchi M., CampodaU'orto S., Frattini F. and Vercesi P. (2010). Enabling open innovation in small- and mediumsized enterprises: how to find alternative applications for your technologies, R&D Management, 40 (4), pp. 414-431.
5. Bougrain F. and Haudeville B. (2002). Innovation, collaboration and SMEs internal research capacities, Research Policy, 31 (5), p. 735.
6. Brüsenmeister T. (2000). Qualitative Forschung - Ein Überblick, Germany, Westdeutscher Verlag.
7. Carpenter R.E. and Petersen B.C. (2002). Is the growth of small firms constrained by internal finance? Review of Economics & Statistics, 84 (2), pp. 298-309.
8. Cefis E. and Marsili O. (2006). Survivor: The role of innovation in firms' survival, Research Policy, 35 (5), pp. 626-641.
9. Chesbrough H. (2006). Open Innovation: A New Paradigm for Understanding Industrial Innovation, Open Innovation'. Researching a New Paradigm, Oxford: Oxford University Press.
10. Chesbrough H. (2010). How Smaller Companies Can Benefit form Open Innovation, Economy, Culture & History Japan Spotlight, 29 (I), pp. 13-15.
11. Chesbrough H. and Crowther A.K. (2006). Beyond high tech: early adopters of open innovation in other industries, R&D Management, 36 (3), pp. 229-236.
12. Chesbrough H.W. (2003). A Better Way to Innovate, Harvard Business Review, 81 (7), pp. 12-13.
13. Chesbrough H.W. (2007). Why Companies Should Have Open Business Models, MIT Sloan Management Review, 48 (2), pp. 22-28.
14. Colombo M.G., Laursen K., Magnusson M. and Rossi-Lamastra C. (2012). Introduction: Small Business and Networked Innovation: Organizational and Managerial Challenges, Journal of Small Business Management, 50 (2), pp. 181-190.
15. Cooper R.G., Edgett S.J. and Kleinschmidt E.J. (2003). Best Practices in Product Innovation: What Distinguishes Top Performers, Ancaster, State-Gate, Inc.
16. Dahlander L., Frederiksen L. and Rullani F. (2008). Online Communities and Open Innovation: Governance and Symbolic Value Creation, Industry & Innovation, 15 (2), pp. 115-123.

17. De Toni A. and Nassimbeni G. (2003). Small and medium district enterprises and the new product development challenge: evidence from Italian eyewear district, International Journal of Operations & Production Management, 23 (6), pp. 678-697.
18. Denzin N.K. and Lincoln S.Y. (1994). Entering the Field of Qualitative Research. In: Denzin, N.K. and Lincoln, S.Y. (eds.) Handbook of Qualitative Research, Thousand Oaks: SAGE Publications Inc.
19. Ebersberger B., Bloch C., Herstad S.J. and Van De Velde E. (forthcoming). Open innovation practices and their effect on innovation performance, International Journal of Innovation and Technology Management.
20. Ebersberger B., Marsili O., Reichstein T. and Salter A. (2010). Into thin air: using a quantile regression approach to explore the relationship between R&D and innovation, International Review of Applied Economics, 24 (1), pp. 95-102.
21. Edwards T., Delbridge R. and Munday M. (2005). Understanding innovation in small and medium-sized enterprises: a process manifest, Technovation, 25, pp. 1119-1127.
22. Eisenhardt M.K. (1989). Building Theories from Case-Study Research, Academy of Management Review, 14, pp. 532-550.
23. European Commission (2005). The new SME definition - User Guide and Model Declaration, Enterprise and Industry Publication.
24. Freel M.S. (1999). Where Are the Skills Gaps in Innovative Small Firms? International Journal of Entrepreneurial Behaviour and Research, 5 (3), p. 10.
25. Freel MS. (2003). Sectoral patterns of small firm innovation, networking and proximity, Research Policy, 32 (5), p. 751.
26. Gans J.S. and Stem S. (2003). The product market and the market for “ideas”: commercialization strategies for technology entrepreneurs, Research Policy, 32 (2), p. 333.
27. Gassmann O., Enkel E. and Chesbrough H. (2010). The future of open innovation, R&D Management, 40 (3). pp. 213-221.
28. Glaser G.B. and Strauss L.A. (1967). The Discovery of Grounded Theory: Strategies for Qualitative Research, New York, De Gruyter.

29. Golovko E. and Valentin! G. (2011). Exploring the complementarity between innovation and export for SMEs' growth, Journal of International Business Studies, 42 (3), pp. 362-380.
30. Hamill J. and Gregory K. (1997). Internet Marketing in the Internationalisation of UK SMEs, Journal of Marketing Management, 13 (1-3), pp. 9-28.
31. Hausman A. (2005). Innovativeness among small businesses: Theory and propositions for future research, Industrial Marketing Management, 34 (8), pp. 773-782.
32. Hoffman K., Parejo M., Bessant J. and Perren L. (1998). Small firms, R&D, technology and innovation in the UK: A literature review, Technovation, 18 (1), p. 39.
33. Hotho S. and Champion K. (2011). Small businesses in the new creative industries: innovation as a people management challenge, Management Decision, 49 (1), pp. 29-54.
34. Howe J. (2008a). Crowdsourcing - How the Power of the Crowd is Driving the Future of Business, Crown Business.
35. Howe J. (2008b). Crowdsourcing: How the Power of the Crowd is Driving the Future of Business, New York, The Crown Publishing Group.
36. Jones O. and Tilley F. (2003). Competitive Advantage in SMEs: Organising for Innovation and Change, USA, John Wiley & Sons Inc.
37. Kaplan A.M. and Haenlein M. (2010). Users of the world, unite! The challenges and opportunities of Social Media, Business Horizons, 53 (1), pp. 59-68.
38. Kaufmann A. and Tödtling F. (2002). How effective is innovation support for SMEs? An analysis of the region of Upper Austria, Technovation, 22 (3), p. 147.
39. Keupp M.M. and Grassmann O. (2009). Determinants and archetype users of open innovation, R&D Management, 39 (4), pp. 331-341.
40. Kohler T., Fueller J., Matzler K. and Stieger D. (2011). Co-creation in virtual worlds: the design of the user experience, MIS Quarterly, 35 (3), pp. 773-788.
41. Kozinets R.V., Hemetsberger A. and Schau H.J. (2008). The Wisdom of Consumer Crowds: Collective Innovation in the Age

of Networked Marketing, Journal of Macromarketing, 28 (4), pp. 339-354.

42. Laforet S. (2008). Size, strategic, and market orientation affects on innovation, Journal of Business Research, 61 (7), pp. 753-764.
43. Lagrosen S. (2005). Effects of the Internet on the marketing communication of service companies, Journal of Services Marketing, 19 (2), pp. 63-69.
44. Lasagni A. (2012). How Can External Relationships Enhance Innovation in SMEs? New Evidence for Europe, Journal of Small Business Management, 50 (2), pp. 310-339.
45. Lee C.-W. (2007). Strategic alliances influence on small and medium firm performance, Journal of Business Research, 60 (7), pp. 731-741.
46. Lee S., Park G., Yoon B. and Park J. (2010). Open innovation in SMEs - An intermediated network model, Research Policy, 39 (2), pp. 290-300.
47. Madrid-Guijarro A., Garcia D. and Van Auken H. (2009). Barriers to Innovation among Spanish Manufacturing SMEs, Journal of Small Business Management, 47 (4), pp. 465-488.
48. Marandi E., Little E. and Hughes T. (2010). Innovation and the children of the revolution: Facebook and value cocreation, Marketing Review, 10 (2), pp. 169-183.
49. Mckinsey (2008). Building the Web 2.0 Enterprise.
50. Morgan J. and Wang R. (2010). Tournaments for Ideas, California Management Review, 52 (2), pp. 77-97.
51. Narula R. (2004). R&D collaboration by SMEs: new opportunities and limitations in the face of globalisation, Technovation, 24 (2), pp. 153.
52. Nonaka I. (2007). The Knowledge-Creating Company, Harvard Business Review, 85 (7/8), pp. 162-171.
53. Nooteboom B. (1994). Innovation and Diffusion in Small Firms: Theory and Evidence, Small Business Economics, 6, pp. 327-347.
54. O'dwyer M., Gilmore A. and Carson D. (2009). Innovative marketing in SMEs: an empirical study, Journal of Strategic Marketing, 17 (5), pp. 383-396.

55. OECD (2000). The measurement of scientific and technological activities. In: Manual, O. (ed.), OECD Publishing.
56. OECD (2008). Open Innovation in Global Networks. Organization for Economic Co-operation and Development.
57. Parida V., Westerberg M. and Frishammar J. (2012). Inbound Open Innovation Activities in High-Tech SMEs: The Impact on Innovation Performance, Journal of Small Business Management, 50 (2), pp. 283-309.
58. Petersen B., Welch L.S. and Liesch P. (2002). The Internet and Foreign Market Expansion by Firms, Management International Review, 42 (2), pp. 207-221.
59. Pittaway L., Robertson M., Munir K., Denyer D. and Neely A. (2004). Networking and innovation: a systematic review of the evidence, International Journal of Management Reviews, 5/6 (3/4), pp. 137-168.
60. Piva E., Rentocchini F. and Rossi-Lamastra C. (2012). Is Open Source Software about Innovation? Collaborations with the Open Source Community and Innovation Performance of Software Entrepreneurial Ventures, Journal of Small Business Management, 50 (2), pp. 340-364.
61. Plehn-Dujowich J.M. (2009). Firm size and types of innovation, Economics of Innovation & New Technology, 18 (3), pp. 205-223.
62. Rogers M. (2004). Networks, Firm Size and Innovation, Small Business Economics, 22 (2), pp. 141-153.
63. Rufat-Latre J., Muller A. and Jones D. (2010). Delivering on the promise of open innovation, Strategy & Leadership, 38 (6), pp. 23-28.
64. Scozzi B., Garavelli C. and Crowston K. (2005). Methods for modeling and supporting innovation processes in SMEs, European Journal of Innovation Management, 8 (1), pp. 120-137.
65. Spaulding T.J. (2010). How can virtual communities create value for business? Electronic Commerce Research & Applications, 9 (1), pp. 38-49.
66. Terwiesch C. and Xu Y. (2008). Innovation Contests, Open Innovation, and Multiagent Problem Solving, Management Science, 54 (9), pp. 1529-1543.

67. Terwisch C. and Ulrich K.T. (2009). Innovation Tournaments: Creating and Selecting Exceptional Opportunities, Harvard Business School Press.
68. Terziovski M. (2010). Innovation practice and its performance implications in small and medium enterprises (SMEs) in the manufacturing sector: a resource-based view, Strategic Management Journal, 31 (8), pp. 892-902.
69. Tidd J. and Bessant J. (2005). Key Issues in Innovation Management Managing Innovation: Integrating Technological, Market and Organizational Change, John Wiley & Sons.
70. Van De Vrande V., De Jong J.P.J., Vanhaverbeke W. and De Rochemont M. (2009). Open innovation in SMEs: Trends, motives and management challenges, Technovation, 29 (6/7), pp. 423-437.
71. Varis M. and Littunen H. (2010). Types of innovation, sources of information and performance in entrepreneurial SMEs, European Journal of Innovation Management, 13 (2), pp. 128-154.
72. Von Hippel E. (2005). Democratizing Innovation, The MΓΓ Press.
73. Vossen R.W. (1998). Relative strengths and weaknesses of small firms in innovation, International Small Business Journal, 16 (3), p. 88.
74. Winsor J. (2005). SPARK: Be More Innovative Through Co-Creation, Agate Publishing.
75. Yin K.R. (2003). Case Study Research: Design and Methods, Newbury Park, Sage Publication Inc.

Footnotes

1. See e.g. Special Issues in Technovation, R&D Management or European Journal of Innovation Management